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Annotated Bibliography of the Genus Sebastes (Family Scorpaenidae).

by

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Preface

This bibliography consists of 1,258 references on members of the genus Sebastes (family Scorpaenidae). It contains published material on the taxonomy, distribution, abundance, life history, fisheries management, and ecology of North Atlantic redfishes and Pacific rockfishes. References on the technical aspects of the fishery and fish processing industry in regards to Sebastes are also included because of the commercial value of redfish and rockfish. In addition, administrative reports, stock assessment reports, doctoral dissertations, and master's thesis are included. Materials dating from the eighteenth century to the end of 1987 are cited.

The bibliography is based on records which have been downloaded from literature searches done on a variety of online databases including Aquatic Sciences and Fisheries Abstracts, NTIS, and BIOSIS. References were gathered from sources such as Canada's Fisheries and Oceans, Waves database, Northwest and Alaska Fisheries Center, NWAFC Technical Memorandums and Processed Reports, and G. I. McT Cowan 's Author-Subject Index to Fisheries Research Board of Canada Translation Series. World Bibliography of Redfishes and Rockfishes (Sebastinae, Scorpaenidae) by D. Clay and T. J. Kenchington, 1986 was the most comprehensive source encountered.

English translations of articles appearing in a foreign language are cited in the bibliography whenever possible. Titles of references in foreign languages appear translated into English. References to the original source from which an English translation was made generally do not appear in the bibliography. When a reference has been published more that once, the English translation is cited.

The bibliography is limited to the characters available on an IBM standard computer terminal. Therefore there are no accents, italics or underlines. Abstracts accompany many citations. This bibliography was completed in February, 1988 and there are plans for annual updates of the text. The bibliography has also been provided on floppy disks for use with Sci-Mate Software System* (produced and registered by the Institute for Scientific Information) on IBM-PC compatible computers. In this format the bibliography can be searched, sorted and citations can be retrieved by author, date, species names, and key words. A machine readable version of the bibliography is also available as an ASCII or text file on floppy disk. For those who use the text format, we suggest using LIST, a "shareware" program, to scan and extract information.

*Mention of trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

A disk version of the Sebastes bibliography is being distributed by American Fisheries Society Computer User Section, Anthony Frank, AFSCUS Librarian, 1451 Green Road, Ann Arbor, MI 48105. 313-994-3331. Paper copies of this document are available from Pacific Marine Fisheries Commission, Metro Center Suite 70, 2000 SW 1st Street, Portland, Oregon.

I would like thank Pacific Marine Fisheries Commission for the publication and distribution of this document. I would like to acknowledge the assistance of Ann McBride and Rahel Fischer in the preparation of this publication. It's been fun.

Maureen Leet
Librarian

Abstract

This bibliography on genus Sebastes (family Scorpaenidae) contains 1,258 references on the taxonomy, distribution, abundance, life history, fisheries management, and ecology of North Atlantic redfishes and Pacific rockfishes. The purpose of the project is to coordinate and organize the scientific literature on Sebastes and make a useful bibliography available to researchers working on rockfish. It is based on records downloaded from literature searches done on a variety of online databases and references gathered from bibliographic sources. Materials dating from the eighteenth century to the end of 1987 are cited. Abstracts accompany many citations. This bibliography was completed in February, 1988.

A disk version of the Sebastes bibliography is being distributed by American Fisheries Society Computer User Section, Anthony Frank, AFSCUS Librarian, 1451 Green Rd. Ann Arbor, MI 48105, 313-994-3331. Paper copies of this document are available from Pacific Marine Fisheries Commission, Metro Center Suite 70, 2000 SW 1st Street, Portland, Oregon.

Abascal, M. E., and M. San Martin. 1979. Evaluation of bottom fish from the Flemish Cap Bank. 5 Evento Cientifico, Instituto de Oceanologia, La Habana, Cuba No. 3.

Schaefer's (1954) production model modified by Gulland (1961) was used to evaluate the Sebastes sp. and Gadus morhua populations from the Flemish Cap Bank, located northeast of the Terranova Bank in the northwestern Atlantic. The effect of the increase in efficiency of the production system was analyzed. Maximum permissible catch was determined at 51,874, 47,926 and 47,846 tons averaging the fishing effort for 10, 11 and 12 years respectively. Fishing effort should be reduced to the level of the effort for maximum sustainable yield.

Adams, Peter B. 1980. Morphology and distribution patterns of several important species of rockfish (genus Sebastes). Mar. Fish. Rev. 42(3-4):80-82

On the basis of morphometrics, several species pairs of rockfish are suggested. Members of the species pairs are found to be spatially segregated. It is suggested that certain types of adaptive strategies are very important in terms of species that can support commercial fisheries.

Adams, Peter B. 1987. The diet of widow rockfish Sebastes entomelas in northern California. In W. H. Lenarz and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 37-41. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Adams, Peter B., and Constance J. Ryan. 1982. Morphology and growth of a pugheaded brown rockfish, Sebastes auriculatus. Calif. Fish Game 68(1):54-57.

Adu, G. A., J. K. Rabbitt, and D. L. Crawford. 1983. Effect of washing on the nutritional and quality characteristics of dried minced rockfish flesh. J. Food Sci. 48(4):1053-1055.

Yield and nutritional characteristics of unwashed and washed minced rockfish (Sebastes melanops, S. flavidus, S. rubrivinctus, S. pinniger, S. proriger, flesh and fillets were determined. The yield of fillets from whole fish was 26% compared to 43% for minced flesh. Washing minced flesh resulted in a 37% loss of solids. The greatest reductions were found in the ash (80%) and lipid (65%) levels in the washed flesh. Most of the sarcoplasmic proteins were lost during washing, but 77% of the total protein (N x 6.25) was recovered in the washed fraction. Washing minced flesh did not affect the amino acid composition, and PER values for all three fish treatments were higher than the casein reference. The rapid formation of trimethylamine and dimethylamine in the dried fillets and dried minced unwashed flesh may explain the development of off-flavors in wafers

containing 10% dried fish after 8 wk of storage at 30 degree C.

Agnello, R. J., and L. G. Anderson. 1981. Production responses for multi-species fisheries. Can. J. Fish. Aquat. Sci. 38(11):1393-1404.

Production equations are estimated for 5 major species of fish harvested in the Northwest Atlantic including Atlantic cod (Gadus morhua), haddock (Melanogrammus aeglefinus), flounder (Pleuronectiformes), redfish (Sebastes marinus) and herring (Clupea harengus) using data collected by the International Commission for the Northeast Atlantic Fisheries from 1960-1974. A log-linear regression specification is used in which the relationship between catch of a vessel and several factors including days fished, and vessel characteristics is estimated simultaneously. Vessel characteristics are represented as (0,1) categorical variables, and include a variable indicating the target species designated by the caption. Various settings for the target species variables allow the estimated equation to represent either a by-catch or target catch equation. The production parameters estimated by the regressions are used to analyze the effects of current quotas set by the New England [USA] Fisheries Management Council. For some fleets there is a likelihood of idle capacity given the current quotas.

Ahlstrom, E. H. 1959. Vertical distribution of pelagic fish eggs and larvae off California and Baja California. Fish. Bull., U.S. 60:107-146.

Redfish larvae belong to the large group of fish larvae that occurs in the upper mixed layers or within the thermocline but not below it. Most are taken between 10.2 degrees C and 16.1 degrees C.

Ahlstrom, E. H. 1961. Distribution and relative abundance of rockfish (Sebastes spp.) larvae off California and Baja California. Rapp. P.-V. Reun. Cons. Int. Explor. Mer 150:169-176.

The information in this paper concerns the distribution and abundance of Sebastes larvae in the area off California and Baja California that is surveyed by agencies participating in the California Cooperative Oceanic Fisheries Investigations. The pelagic distribution of rockfish larvae, especially their presence at considerable distances offshore, should be of interest, since it parallels, in part at least, the widespread oceanic distribution of Sebastes larvae in the North Atlantic.

Ahlstrom, E. H. 1965. Kinds and abundance of fishes in the California Current region based on egg and larval surveys. Calif. Coop. Oceanic Fish. Invest. Rep. 10:31-52.

Ahlstrom, E. H., H. Geoffrey Moser, and Elaine M. Sandknop. 1978. Distributional atlas of fish larvae in the California Current region: Rockfishes, Sebastes spp., 1950 through 1975. Calif. Coop. Oceanic Fish. Invest. Atlas 26, 178 p.

Larvae of Sebastes are among the more common taken on CCOFI cruises, usually exceeded only by the larvae of the northern anchovy and the Pacific hake. The genus Sebastes is represented by 69 species in the eastern North Pacific. Some 40 species of rockfish are taken by commercial and sport fishermen off California. The important constituents of the commercial catch are S. paucispinis, S. goodei, S. miniatus, and S. pinniger. The commercial catch and partyboat sport catch rockfishes from 1950-1977 is tabulated. Brief information is given on S. paucispinis, S. macdonaldi, S. jordani, and S. levis. The bulk of the work is taken up with distribution tables.

Ainley, David G., Daniel Anderson, and Paul R. Kelly. 1981. Feeding ecology of marine cormorants in southwestern North America. Condor 83:120-131.

Aldunate, R., and B. Dyer. 1981. Gastric epithelium structure in two bony fishes. Arch. Biol. Med. Exp. 14(3):246.

The general organization of the gastric epithelium of 2 bony fishes from different habitats and diets was studied. Sebastes oculatus lives near the coast among rocks and its diet is mainly carnivorous. The gastric epithelium has glands constituted by characteristic oxyintic-peptic cells and very organized tubular-vesicular system that occupies the major part of the apical end. Cheirodon pisciculus lives in freshwater ponds and river edges with a diet consisting mainly of algae and arthropod larvae. No glands could be detected in the anatomic area corresponding to the stomach.

Allen, M. James, and R. Voglin. 1976. Regional and local variation of bottom fish and invertebrate populations. South. Calif. Coastal Water Res. Proj. Annu. Rep. 1976:217-221.

Allen, W. F. 1905. The blood-vascular system of the Loricati, the mail-cheeked fishes. Proc. Wash. Acad. Sci. 7:27-157.

First description of the unusual vasculature associated with the ovary in Sebastes.

Alton, M. S. 1972. Characteristics of the demersal fish fauna inhabiting the outer continental shelf and slope off the northern Oregon coast. In A. T. Pruter and D. L. Alverson (editors), The Columbia River estuary and adjacent ocean waters, p. 583-634. Univ. Wash. Press, Seattle.

Altukhov, Yu. P. 1977. Problems of populational genetic organization of species in fishes. Zh. Obshch. Biol. 38(6):893-907.

A systematic approach to the study of genetics and the biology of the historically-formed isolated populations (so-called local stocks) of fish, Sebastes mentella, Engraulis encrasicholus, Oncorhynchus nerka and O. keta are proposed. The conservation of the genetic diversity of a population system makes it stable in time and space under commercial exploitation. The same principle must be considered when fishes are artificially bred.

Altukhov, Yu. P., and G. N. Nefyodov. 1968. A study of blood serum protein compositions by agar-gel electrophoresis in types of redfish (genus Sebastes). Int. Comm. Northwest Atl. Fish. Res. Bull. 5:86-90.

Altukhov, Yu. P., G. N. Nefyodov, and A. N. Payusova. 1968. Cytophysiological analysis of the golden redfish, Sebastes marinus and deepwater redfish, Sebastes mentella, of the northwestern Atlantic. In USSR Acad. Sci. Council on Cytology Problems. Variations in thermal stability of animal cells in ontogeny and phylogeny, p. 82-97. Science Publishing House, Leningrad.

Altukhov, Yu. P., G. N. Nefyodov, and A. N. Payusova. 1968. Thermostability of isolated muscle in determining the taxonomic relationship of the marinus- and mentella-types of the redfish (Sebastes). Int. Comm. Northwest Atl. Fish. Res. Bull. 5:130-136.

Altukhov, Yu. P., and E. A. Salmenkova. 1981. Applications of the stock concepts to fish populations in the USSR. Can. J. Fish. Aquat. Sci. 38(12):1591-1600.

Alveal, R. E., and P. R. Quintana. 1985. Seasonal reproduction cycle of Sebastes capensis (Pisces: Scorpaenidae) from San Vicente Bay, Chile. Bol. Soc. Biol. Concepcion 56:213-224.

The "cabrilla espanola", chilean rockfish, Sebastes capensis Gmelin, 1829 from San Vicente Bay (Chile) had internal fertilization. Females give birth to free swimming larvae. This species shows an annual reproductive cycle. Males have a high gonadic index between February and April, and females give birth to larvae between October and February. Ovaries and testes were studied through the year beginning in August 1983 based on the gonadic index and histological diagnostic.

Alverson, D. L. 1951. Deep water trawling survey off the coast of Washington (Aug.27-Oct.19, 1951). Commer. Fish. Rev. 13(11):1-16.

Alverson, D. L. 1953. Deep water trawling survey off the Oregon and Washington coasts (Aug.25-Oct.3, 1952). Commer. Fish. Rev. 15(10):5-15.

Alverson, D. L. 1953. Notes on the Pacific ocean perch. Wash. Dep. Fish. Fish. Res. Pap. 1(1):22-24.

Alverson, D. L. 1954. How high can perch climb? Pac. Fish. 52:25-28.

Alverson, D. L. 1967. A study of demersal fishes and fisheries of the northeastern Pacific Ocean. Ph.D. Thesis, Univ. Wash., Seattle, 286 p.

Alverson, D. L., and W. T. Pereyra. 1969. Demersal fish explorations in the northeastern Pacific Ocean--an evaluation of exploratory fishing methods and analytical approaches to stock size and yield forecasts. J. Fish. Res. Board Can. 26(8):1985-2001.

Alverson, D. L., and D. E. Powell. 1955. The open ocean. Pac. Fisherman 53(11):25-29.

Possible bathypelagic existence of Sebastes alutus is mentioned.

Alverson, D. L., A. T. Pruter, and L. L. Ronholt. 1964. A study of demersal fishes and fisheries of the northeastern Pacific Ocean. H. R. MacMillan Lectures in Fisheries. Inst. Fish., Univ. B. C., Vancouver, 190 p.

Alverson, D. L., and A. D. Welander. 1952. Notes on the scorpaenid fishes of Washington and adjacent areas, with a key for their identification. Copeia 3:138-143.

The authors have been gathering material during the past two years for a study of the rockfishes of the genus Sebastodes and present the following notes and key in an attempt to facilitate the identification of the scorpaenids of Washington, British Columbia and nearby regions. New records were obtained that extend the known range of S. aleutianus and S. crameri. S. columbianus was made a subspecies of S. melanops, and S. babcocki was synonymized with S. rubrivinctus. Because of the expanding rockfish fishery on the Pacific Coast, further additions to our knowledge of Sebastodes are to be expected. At present a rapid, reliable method of identification of the species is a real need.

Alverson, D. L., and S. J. Westrheim. 1961. A review of the taxonomy and biology of the Pacific ocean perch and its fishery. Rapp. P.-V. Reun. Cons. Int. Explor. Mer 150:12-27.

The development of a fishery for Pacific ocean perch, Sebastodes alutus, along the west coast of the United States and Canada has stimulated interest in the biological and taxonomic relationships which may exist between this species and the Atlantic species of redfish, Sebastes marinus. To aid fisheries workers in current or future comparative studies of the differences between the commercially-exploited scorpaenids of the Atlantic and the Pacific Oceans, the authors have reviewed and abstracted the more important publications relating to the biology and the taxonomy of the Pacific ocean perch and its fishery.

Amidei, Rosemary (editor). 1986. Rockfish: A focus for research? Proceedings of a California Sea Grant Workshop, Held at the Univ. of California, Davis on April 4, 1986. Calif. Sea Grant Coll. Program, La Jolla, T-CSGCP-015, 71 p.

On April 3-4, 1986, the California Sea Grant College Program sponsored a comprehensive Fisheries Workshop at the University of California, Davis. A discussion of the recommendation by the California Sea Grant Advisory Committee on Fisheries and Aquaculture that the program begin to orient its research more strongly toward specific fisheries. Specifically, the advisory committee had suggested that rockfish would make an appropriate choice for an intensive research effort in cooperation with state and federal agencies and recommended that this idea be offered for discussion to a larger and more diverse group of fisheries experts. The publication presents only that portion of the meeting that dealt with the third agenda item.

Anderson, J. T. 1981. Larval fish surveys on Flemish Cap. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/9/116, 14 p.

Anderson, J. T. 1982. Distribution, abundance and growth of cod (Gadua morhua) and redfish (Sebastes spp.) larvae on Flemish Cap, 1981. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 82/6/37, 11 p.

Anderson, J. T. 1982. Size and condition of larval Sebastes spp. on Flemish Cap during spring 1980. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 82/6/38, 12 p.

Anderson, J. T. 1983. Early life history aspects of redfish (Sebastes sp.) on Flemish Cap. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 83/6/34, 23 p.

Anderson, John T. 1984. Early life history of redfish (Sebastes spp.) on Flemish Cap. Can. J. Fish. Aquat. Sci. 41(7):1106-1116.

Studies were carried out on Flemish Cap [North Atlantic], 1978-1982, to assess fish spawning cycles, the distribution, abundance, and growth of early life stages, and their relationship to environmental factors. Redfish larvae (Sebastes spp.) were the most abundant fish larvae found on Flemish Cap. Redfish began releasing larvae during March, reaching an abrupt peak in late April. Larval abundances of 733 larvae .cntdot. m2 were observed during the late week of April 1979, with highest sampled larval abundance for the study area being 6.8 .times. 1012 larvae. Redfish larvae first appeared in the southwest corner of Flemish Cap and within 3 wk were found in waters throughout the area over depths > 200 m. In July, the survivors were concentrated over the Cap supporting the concept that Flemish Cap redfish constitute a distinct group. Larval growth for redfish was exponential through the periods sampled. In 1981, growth rate ranged from 0.40-1.66%/day. While larval growth was significantly correlated with average surface water temperature, high temperatures appeared to reduce larval growth. Slow growth during warm years appeared to be related to increased larval mortalities.

Anderson, Karen L. 1979. A karyological investigation of the systematics of Sebastes (subgenus Pteropodus). M.S. Thesis, Calif. State Univ., San Jose, 34 p.

Karyotypes were prepared from the gill epithelium of S. carnatus, S. Chrysomelas, S. Cuarinus, S. Vexillaris, S. nebulosus, S. maliger, S. atrovirens and S. rastrelliger. The chromosome types and arm lengths indicate that: S. carnatus, S. chrysomelas, S. caurinus and S. vexillaris are all valid species. S. carnatus, S chrysomelas, S. caurinus, S. vexillaris, S. nebulosus and S. maliger are closely related. S. atrovirens may not and S. rastrelliger does not belong to the subgenus Pteropodus. The diploid number of all species is 28.

Anderson, M. E. 1977. Range extension of two marine fishes to the Monterey Bay area. Calif. Fish Game 63(2):132-133.

Anderson, Paul M. 1980. Glutamine- and n-acetylglutamate-dependent carbamoyl phosphate synthetase in elasmobranchs. Science 208(4441):291-293.

Anderson, Todd W. 1983. Identification and development of nearshore juvenile rockfishes (genus Sebastes) in central California kelp forests. M.A. Thesis, Calif. State Univ., Fresno. 216 p.

Anonymous. 1983. Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1983. In Proc. Int. Counc. Explor. Sea, Gothenburg, Sweden, 10 October 1983. ICES-CM-1983/G:35, 27 p.

Anonymous. 1987. Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska. Univ. of Alaska, Alaska Sea Grant Rep. 87-2, 393 p.

Arai, Hisao P. 1969. Preliminary report on the parasites of certain marine fishes of British Columbia. J. Fish. Res. Board Can. 26(9):2319-2337.

The results of a study to assess the kinds and degrees of parasitism that exist in or on inshore fishes of British Columbia are presented. The report contains a listing of 68 taxa of parasites recovered from a total of 814 host specimens representing 61 species. Observations on host-parasite relationships made during the course of the study are discussed.

Archibald, Chris P., David Fournier, and Bruce M. Leaman. 1983. Reconstruction of stock history and development of rehabilitation strategies for Pacific ocean perch in Queen Charlotte Sound, Canada. N. Am. J. Fish. Manage. 3(3):283-294.

Pacific ocean perch (Sebastes alutus) have undergone considerable over-exploitation in Queen Charlotte Sound, British Columbia, largely as a result of excessive removals by foreign fleets in the 1965-1974 period. A new catch-at-age model is used to reconstruct the history of this stock through simultaneous analysis for all cohorts present in the time series of catch data. The reconstruction extends from 1963-1977 and estimates that intensive fishing pressure reduced the stock from an initial size of 82,000 t to only 13,000 t by 1977. Numbers of fish at each age are estimated for the period of the data, together with estimates of fishing mortality. The reconstructed stock status and the stochastic stock-recruit relation estimated by this analysis are used as inputs for a model to simulate stock behaviour over 30-year periods, under various exploitation strategies. Results indicate that rehabilitation will be achieved only at fishing intensities about one-third of the terminal 1977 fishing mortality (F = 0.06).

Archibald, Chris P., W. Shaw, and Bruce M. Leaman. 1981. Growth and mortality estimates of rockfishes (Scorpaenidae) from B.C. coastal waters, 1977-1979. Can. Tech. Rep. Fish. Aquat. Sci. 1048, 57 p.

Estimated parameters of total and natural instantaneous mortality, as well as von Bertalanffy growth parameters were presented for 10 species of rockfish (Sebastes) from British Columbia coastal waters. These estimates were derived from analysis of aging data obtained by the application of new aging techniques. The estimated longevity of this species increased considerably as a result of this work. Estimates of instantaneous mortality were reduced substantially from previously published estimates. For unexploited or lightly exploited stocks estimates of Z ranged from 0.01-0.07, while for heavily exploited stocks the corresponding estimates ranged 0.09-0.18. Estimated parameters of growth changed little from published values, largely because increased longevity occurs after major inflections in linear growth. The extension of age compositions past the point of major decreases in linear growth implies that the use of age-length keys for rockfishes, in British Columbia waters at least, is invalid.

Arima, S., and S. Arima. 1985. Total mercury level of fish caught in the East China Sea. Mem. Fac. Fish. Kagoshima Univ. 34(1):1-6.

In order to estimate mercury background level of fish in East China Sea, total mercury concentration of muscles of nineteen fish species is analyzed. Highest value was 0.54 ppm in Sebastes inermis, and lowest one was 0.016 ppm in Pampus argenteus. Average of average mercury concentration of 19 species was 0.087 ppm. Among species Sebastes inermis has the highest average mercury concentration (0.32 ppm), and Psenopsis anomala has the lowest one (0.023 ppm). While seven carnivorous species have higher average mercury level than 0.1 ppm, five species of plankton feeders and jellyfish feeders have the average mercury level as low as 0.031 ppm. So it is likely that feeding habit plays an important role on mercury accumulation by fish.

Aron, W. 1960. The distribution of animals in the eastern North Pacific and its relationship to physical and chemical conditions. Univ. Wash. Dep. Oceanogr. Tech. Rep. 63: 56 p. + 156 p. appended tables.

Atkinson, D. B. 1983. Redfish in Division 3LN. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 83/6/36, 9 p.

Atkinson, D. B. 1983. 2 and 3K redfish. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 83/23, 19 p.

The standardized catch rate series has shown a gradual increase from 1976-1982 although the confidence interval is quite large. Results of research cruises suggest that the stock is stable and contains relatively numerous fish.

Atkinson, D. B. 1984. Discarding of small redfish in the shrimp fishery off Port au Choix, Newfoundland, 1976-1980. J. Northwest Atl. Fish. Sci. 5(1):99-102.

The quantities of small (.ltoreq. 25 cm) redfish Sebastes sp., caught and discarded off Port au Choix, Newfoundland, in 1976-1980 were estimated from monthly sampling at sea of the catches of Newfoundland trawlers engaged in this fishery to assess the impact of these discards on the redfish stock of the Gulf of St. Lawrence. Minimum estimates of population size of small redfish in the region were derived from stratified-random trawl surveys in the summers of 1976 and 1978-1980. Although the quantities of small redfish discarded by shrimp-fishing vessels may have been visibly alarming, the analysis indicated that the quantities of redfish discarded annually represented less than 3.4% by number and 2.0% by weight of the estimated population of small redfish in the northeastern region of the Gulf of St. Lawrence, implying that recruitment to the exploitable stock would not be seriously affected by the discarding practices evident in 1976-1980.

Atkinson, D. B. 1984. Distribution and abundance of beaked redfish in the Gulf of St. Lawrence, 1976-81. J. Northwest Atl. Fish. Sci. 5(2):189-197.

The distribution of beaked redfishes of the genus Sebastes in the Gulf of St. Lawrence was determined from bottom-trawl surveys in summer, autumn and winter during 1976-81. Redfish were found in depths greater than 180 m where bottom temperatures ranged from 2 degree to 7 degree C. They were distributed throughout the deepwater areas of the Gulf during summer and early autumn but migrated southward and eastward during autumn and early winter to become concentrated in the southeastern region of the Gulf. Juvenile redfish tended to prefer somewhat shallower depths than adults. Small redfish (less than or equal to 15 cm), indicative of successful year-classes, were found to be concentrated mainly in the nursery area in the northern part of the Esquiman Channel in summer, but, as they became older, they were more dispersed throughout the Gulf.

Atkinson, D. B. 1984. The redfish in Div. 30 - an update. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 84/32, 7 p.

Atkinson, D. B. 1987. The redfish resources off Canada's east coast. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 15-33. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Atkinson, D. B., W. E. Legge, and P. Stead. 1981. The redfish stock in NAFO Division 3P. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 81/59, 21 p.

Atkinson, D. B., W. D. McKone, and W. E. Legge. 1980. 3P redfish assessment. Can. Atl. Fish. Sci. Advis. Comm. Res. Doc. 80/62, 29 p.

The TAC of 16,000 t in 1979 was not achieved, with only 11,000 t being landed. An analytical assessment of this stock was carried out and a number of regressions run in order to determine the best terminal F. Although no one regression series proved conclusive, the overall indication was that a terminal F of 0.10 was most appropriate. Projections suggested a TAC of 18,000 t in 1981 fishing at the FSUB-0.1 level of 0.146. Research surveys in 1979 indicated the higher than average abundance of several length groups that will be available to the commercial fishery in the near future.

Atkinson, D. B., and I-Hsun Ni. 1984. Division 3P redfish. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 84/31, 17 p.

Aurioles, D., C. Fox, F. Sinsel, and G. Tanos. 1984. Prey of the California sea lion, Zalophus californianus, in the Bay of La Paz, Baja California, sur Mexico. J. Mammal. 65(3):519-521.

Ayres, W. O. 1854. Description of new fishes from California. Proc. Calif. Acad. Nat. Sci. 1:3-32. (Reprinted 1873 in 2nd edition of Proc.)

Pages 5-8 give a description of S. nebulosus, S. paucispinis, S. ruber, S. ruber var parvus, S. variabilis.

Ayres, W. O. 1855. New species of California fishes. Proc. Boston Soc. Nat. Hist. 5(1854-1856):94-103.

Ayres, W. O. 1859. Description of new species of fishes. Proc. Calif. Acad. Sci. 2:25-32.

S. nigrocinctus, S. helvomaculatus, and S. elongatus are described.

Ayres, W. O. 1863. Description of Sebastodes flavidus and Sebastodes ovalis. Proc. Calif. Acad. Nat. Sci. 2:209-211, figs. 64-66.

Descriptions of species are given.

Ayres, W. O. 1863. Note on Sebastodes rosaceus and Sebastodes ruber. Proc. Calif. Acad. Sci. 2:207.

Descriptions of species are given.

Ayres, W. O. 1863. Notes on the Sebastoid fishes occurring on the coast of California. Proc. Zool. Soc. Lond. 26:390-402.

Ayres, W. O. 1863. Remarks in relation to the fishes of California which are included in Cuvier's genus Sebastes. Proc. Calif. Acad. Nat. Sci. 2:211-218, figs. 67-68.

S. melanops, S. paucispinis, S. elongatus, S. nebulosus, S. nigrocinctus, S. flavidus, S. ovalis, S. auriculatus, S. ruber, S. helvomaculatus, S. rosaceus in comparison of genus Sebastodes and Sebastes are referred to in article.

Ayres, W. O. 1864. Notes on Sebastoid fishes occurring on the coast of California. Ann. Mag. Nat. Hist. Ser. 3 13:330-342.

Babbitt, J. K., D. K. Law, and D. L. Crawford. 1976. Improved acceptance and shelf life of frozen minced fish with shrimp. J. Food Sci. 41(1):35-37.

Bagrov, A. A. 1982. Morphological variability of larvae of nematodes of the genus Anisakis (Nematoda: Anisakidae). Parazitologiya (Leningr.) 16(6):469-475.

Morphology of nematode larvae of the genus Anisakis dujardin, 1845 was studied. Larvae of this genus (260), from 8 spp. of fishes including Sebastes polyspinis from the Pacific, Caspian and North Seas were examined, using 7 characteristics. Anisakid larvae of different types had no stable morphometric characters. There was correlation between body length and length of esophagus and ventricle, and to a lesser extent, the caudal end. A new type of anisakid larvae, Anisakis type IA, was isolated; they are apparently larval forms of A. typica.

Bailey, R. M., J. E. Fitch, E. S. Herald, E. A. Lachner, C. C. Lindsey, C. R. Robins, and W. B. Scott. 1970. A list of common and scientific names of fishes from the United States and Canada. Am. Fish. Soc. Spec. Publ. (Third Ed.) 6, 150 p.

Bainbridge, V. 1964. A preliminary study of Sebastes larvae in relation to the planktonic environment of the Irminger Sea. Int. Comm. Northwest Atl. Fish. Spec. Publ. 6:303-308.

Bainbridge, V., and G. A. Cooper. 1968. Sebastes in continuous plankton records in 1968. Ann. Biol. 25:80-81.

Bainbridge, V., and G. A. Cooper. 1971. Populations of Sebastes larvae in the north Atlantic. Int. Comm. Northwest Atl. Fish. Res. Bull. 8:27-35.

Young Sebastes, principally S. mentella Travin, from the predominant group of fish larvae in the central and eastern regions of the North Atlantic sampled by the Continuous Plankton Recorder Survey at a depth of 10 m. Four populations of larvae could be distinguished on the basis of geographical distributions, patterns of pigmentation and the month of first extrusion. These included a vast oceanic population centered in the Irminger Sea and three separate populations over the North American Shelf and Slope between Labrador and the Gulf of Maine. The seasonal occurrence of the four populations of larvae can be linked to the periods when food organisms were most plentiful in the areas in which they live. (Author).

Bainbridge, V., and B. J. McKay. 1968. The feeding of cod and redfish larvae. Int. Comm. Northwest Atl. Fish. Spec. Publ. 7(1):187-217.

Baines, George W. 1973. Blood pH effects in eight fishes from the teleostean family Scorpaenidae. Ph.D. Thesis, Univ. California, Santa Barbara, 81 p.

Baines, George W. 1975. Blood pH effects in eight fishes from the teleostean family Scorpaenidae. Comp. Biochem. Physiol. A Comp. Physiol. 51(4):833-843.

The effects of changes in pH on the oxygen equilibria of erythrocytes of Scorpaena guttata and seven species of Sebastes (Teleostei: Scorpaenidae) from the coast of California were investigated. Erythrocyte suspensions were equilibrated with various concentrations of oxygen in a flowing gas tonometer and the per cent saturation was measured photometrically in the Soret band. Results show that the magnitude of the root effect varies consistently with the requirements of the swimbladder filling mechanism. Sedentary fish that live in shallow water have smaller pH effects whereas active forms from deeper water have greater pH effects. Scorpaena guttata, which lacks a swimbladder, has the smallest pH effect.

Bakkala, Richard, Wendy Hirschberger, and Katherine King. 1979. The groundfish resources of the eastern Bering Sea and Aleutian Islands regions. Mar. Fish. Rev. 41(11):1-24.

To describe the resources that will be available to the developing U.S. fishery, this article reviews the history of fisheries for groundfish in the eastern Bering Sea and Aleutian Islands regions to illustrate methods and areas of fishing, species taken and the magnitude of catches, and the current condition of the resource.

Bakunov, N. A. 1974. Cesium-137 level in food fish of the Atlantic Ocean and the Baltic Sea and Caspian Sea. Radiobiologiya 14(3):447-449.

Balaban, M., and G. M. Pigott. 1986. Shrinkage in fish muscle during drying. J. Food Sci. 51(2):510-511.

Shrinkage of rectangular slabs of ocean perch (Sebastes marinus) in all three dimensions during air drying at 24.5.degree. C, relative humidity 35% and velocity 35.6 m/min was determined. Percent change in dimensions with volume fraction of water was measured. It was observed that the dimension along the major axis of muscle fibers (length in this case) shrinks far less than the other two dimensions. Maximum shrinkage in length was 20%, while for width it was 50.5% and for thickness, 50.6%. At 95% confidence level, there was no significant difference between thickness and width shrinkage.

Balaban, Murat O. 1984. Mathematical model of air drying applied to fish. Ph.D. Thesis, Univ. Wash., Seattle, 437 p.

This study consists of four major sections. In the first section, the drying theories that can be applied to the drying of foods are reviewed. The bases and limitations of these theories are discussed. In the second section, a model was proposed to describe the drying behavior of slabs, taking into consideration the shrinkage of the slab while drying. In the third section, the model was applied to Ocean Perch (Sebastes marinus). The following physical properties of Ocean Perch were experimentally determined: thermal conductivity, heat capacity, isotherm relation, and shrinkage with changes in moisture content. Other transport parameters were found from the literature. In the last section, the partial differential equations of the model were expanded. The solution provided a prediction of moisture content, temperature and shrinkage values in a slab. These predictions were compared with the results of a drying experiment where shrinkage and moisture content of fish slabs were measured with drying time.

Balon, Eugene K. 1984. Reflections of some decisive events in the early life of fishes. Trans. Amer. Fish. Soc. 113:178-185.

Balsiger, J. W., D. H. Ito, D. K. Kimura, D. A. Somerton, and J. M. Terry. 1985. Biological and economic assessment of Pacific ocean perch, Sebastes alutus, in waters off Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/NWC-72.

The paper examines the depleted Pacific ocean perch, Sebastes alutus, stocks in waters off Alaska. The biology of the species is reviewed and the exploitation history recounted. A predictive model is used to estimate stock rebuilding rates under a range of fishing rates. Finally, long-term yields and profits are examined in an economic analysis and the effects reduced quotas would have on existing fisheries are studied.

Baranenkova, A. S., and N. S. Khokhlina. 1961. The distribution and size composition of larvae and young redfish of Norwegian and Barents Sea. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:177-187.

Bargmann, G. G. 1977. Instances of copper rockfish consuming a spiny dogfish shark. Calif. Fish Game 63(3):192.

Evidence is presented for predation on spiny dogfish shark Squalus acanthias by a copper rockfish, Sebastes caurinus.

Barham, E. G. 1957. The ecology of sonic scattering layers in the Monterey Bay area. Tech. Rept., Stanford Univ. 1:182 p.

Barker, M. W. 1979. Population and fishery dynamics of recreationally exploited marine bottomfish of northern Puget Sound. Ph.D. Thesis, Univ. Wash., Seattle, 135 p.

Barlow, G. W. 1961. Causes and significance of morphological variation in fishes. Sept. Zool. 10(3):105-117.

Barner, L. W., J. Selsby, and F. Mottl. 1978. Rockfish survey off the west coast of the Queen Charlotte Islands made on Arctic Harvester hydroacoustic Cruise 78-2, 1978. Can. Data Rep. Fish. Mar. Serv. 110, 89 p.

This report shows the catch tables, fishing positions, and survey tracklines for Arctic harvester cruise AH78-2 to west coast Queen Charlotte Islands. It also gives age, sex, and weight composition data for principal species of rockfish (Sebastes) captured and length sex data for other non-rockfish species.

Barner, L. W., F. H. C. Taylor, and A. Bennett. 1978. Midwater trawl tows and catches made on Arctic Harvester Cruise 78-1 and G. B. Reed Cruise 78-1 (January 24-February 10, 1978), Queen Charlotte Sound. Can. Data Rep. Fish. Mar. Serv. 106, 41 p.

This report shows catch tables, fishing positions, age and length distribution data for herring (Clupea harengus pallasi) and length-sex data for rockfish (Sebastes flavidus, Sebastes proriger, and Sebastes entomelas), and also length-sex data on dogfish (Squalus acanthias), and pollock (Theragra chalcogramma) and chinook salmon (Oncorhynchus tshawytscha).

Barner, L. W., F. H. C. Taylor, D. M. A. Bennett, and J. M. Thompson. 1979. Midwater and bottom trawl tows and catches made by M/V Nemesis No. 78-1, July 5-23, 1978, in Dixon Entrance. Can. Data Rep. Fish. Mar. Serv. 135, 108 p.

This report gives the midwater and bottom trawl catches, fishing positions and biological sampling data obtained during the M/V Nemesis cruise. The tows were made to identify the species encountered during an acoustical survey. The survey was made to determine the distribution and abundance of fish within the area. Sex and length data were obtained for Oncorhynchus tshawytscha, Squalus acanthias, Thaleichthys pacificus, Hippoglossus stenolepis, Ophiodon elongatus, Gadus macrocephalus, Theragra chalcogramma, Anopoploma fimbria, Pleuronectidae and Sebastes.

Barner, L. W., F. H. C. Taylor, and C. E. Turner. 1982. Midwater trawl tows and catches made on M/V Howe Bay Cruise HB80-1, southwest coast of Vancouver Island, November 3-21, 1980. Can. Data Rep. Fish. Aquat. Sci. 334, 71 p.

This report gives the midwater catches, fishing positions and biological sampling data obtained during M/V HOWE BAY Cruise HB80-1, November 3-21, off southwest coast of Vancouver Island. Tows were made to identify the species responsible for the fish concentration encountered during the hydroacoustic survey by the G.B. The latter cruise was undertaken to determine the distribution and abundance of herring (Clupea harengus pallasi) in the area. Age, sex, and length data were obtained for herring and sex and length data for chinook salmon (Oncorhynchus tshawytscha), dogfish (Squalus acanthias), hake (Merluccius productus), pollock (Theragra chalcogramma), sablefish (Anoplopoma fimbria), and four species of rockfish Sebastes spp.).

Barnhart, Percy S. 1936. Marine fishes of Southern California. Univ. Calif. Press, Berkeley. 209 p., 290 Figs.

Barnhart, Percy S., and Carl L. Hubbs. 1946. Pontinus vaughani, a new scorpaenid fish from Baja California. Bull. Scripps Inst. Oceanogr. Univ. Calif. 5(5):371-390.

Barrett, Izadore, James Joseph, and Geoffrey Moser. 1966. Electrophoretic analysis of hemoglobins of California rockfish (genus Sebastodes). Copeia 1966(3):489-494.

Barss, W. H., R. L. Demory, and N. TenEyck. 1977. Marine resource surveys on the continental shelf off Washington, 1975-76. Oregon Dept. of Fish and Wildl. Completion report. 34 p.

Barss, William H., and Tina W. Echeverria. 1987. Maturity of widow rockfish Sebastes entomelas from the northeastern Pacific, 1977-82. In W. H. Lenarz and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 13-18. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Barsukov, V. V. 1964. Interspecies variability in the Pacific rockfish (Sebastes alutus) Gilbert. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part II. U.S. Dep. Commer., Clearing House Fed. Sci. Tech. Inform., Springfield, VA., USA. TT 67-51204:241-267.

Barsukov, V. V. 1964. Key to the fishes of the family Scorpaenidae. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific, Part III. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA, USA. TT 67-51205:226-262.

Barsukov, V. V. 1968. Taxonomic relations of ocean perch of the genus Sebastes of the northwest Atlantic, Sebastes fasciatus and Sebastes mentella. Dokl. Akad. Nauk SSSR 183(2):479-482.

Barsukov, V. V. 1970. Species composition of the genus Sebastes in the North Pacific. Description of a new species. Dokl. Acad. Nauk SSSR Ser. Biol. 195(4):994-997.

Barsukov, V. V. 1971. Variability in the morphological features of Pacific ocean perch Sebastes alutus (Gilbert) and some observations concerning the intraspecies classification of fish. Fish. Res. Board Can. Transl. Ser. 2213.

Barsukov, V. V. 1972. Morphological and biological characteristics of the American redfish. Fish. Res. Board Can. Transl. Ser. 2488.

Barsukov, V. V. 1972. A systematic analysis of the group Sebastes wakiyai- Sebastes paradoxus- Sebastes steindachneri. Communication 1. Containing the description of a new species. J. Ichthyol. 12(4):576-585.

Barsukov, V. V. 1972. Systematics of the Atlantic redfishes. Fish. Res. Board Can. Transl. Ser. 2531.

Barsukov, V. V. 1973. A redescription of the type specimen of Sebastodes ruber Pavlenko, 1910. J. Ichthyol. 13(4):603-605.

Barsukov, V. V. 1973. The species composition of the Genus Helicolenus (Sebastinae, Scorpaenidae, Pisces) and a description of a new species. J. Ichthyol. 13(2):161-166.

Barsukov, V. V. 1973. A systematic analysis of the group Sebastes wakiyai-S. paradoxus-S.steindachneri. Communication 2 (containing a redescription of S. wakiyai). J. Ichthyol. 13(6):824-833.

Barsukov, V. V. 1974. A systematic analysis of the group Sebastes wakiyai - S. paradoxus - S. steindachneri; Report 2, with a redescription of S. wakiyai. Fish. Res. Board Can. Transl. Ser. 3165.

Barsukov, V. V. 1981. A brief review of the subfamily Sebastinae. J. Ichthyol. 21(1):1-26.

Data on the 1st reconstruction of the phylogenetic history of Sebastinae (Scorpaenidae) are presented. Seven cycles are outlined in the subfamily's evolution. Each cycle is characterized by ternate synchronous sympatric speciation due to incomplete (primarily, biotopic) isolation. The acquisition of more rapid movement as a result of more frequent ascent into the open water is linked to intermediate medium-depth taxa under pressure from whom borderline (as a rule, shallow) taxa retreat to their previous benthopelagic predatory mode of life, retaining some structural features acquired when their predecessors ascended into the open water. Complete geographic isolation of large parts of the previously unified area of distribution causes the allopatric formation of specific and superspecific taxa. Ternate synchronous sympatric speciation continues in these isolated parts. It ceases when a steady reduction in the population and area of distribution of the predecessor species occurs, as well as when its adaptation to broader environmental conditions takes place without disturbing species integrity. Data on the distribution times and tendencies of Hozukius, Helicolenus and Sebastes are presented.

Barsukov, V. V., and Lo-chai Chen. 1978. Review of the subgenus Sebastiscus (Sebastes, Scorpaenidae) with a description of a new species. J. Ichthyol. 18(2):179-193.

A detailed review of the systematic position of the genus Sebastiscus Jordan et Starks which is morphologically close to the genus Sebastes in its modern understanding was presented. A series of characteristics were isolated in the 2 genera which did not occur in other genera of the subfamily Sebastinae and the entire family Scorpaenidae. The status of the genus Sebastiscus was not verified and was lowered to subgenus. Differences between Sebastes and Sebastiscus were compared and discussed in detail. Differentiating morphological characteristics were presented for Sebastes marmoratus, S. albofasciatus and S. tertius sp. nov. S. tertius was described. The holotype Lithrichthys viviparus Schmidt (1931) was verified to be an example of Sebastes albofasciatus which developed some abnormal structures at an early stage of development.

Barsukov, V. V., and L. A. Lisovenko. 1965. On the northern limits of the ranges of some Pacific rockfish species. Fish. Res. Board Can. Transl. Ser. 711, 5 p.

Barsukov, V. V., N. I. Litvinenko, and V. P. Serebryakov. 1985. Manual for the identification of redfish species of the North Atlantic and adjacent areas. Can. Transl. Fish. Aquat. Sci. 5168, 25 p.

Baxter, J. L. 1960. Inshore fishes of California. Calif. Dept. Fish Game, Sacramento, California. 80 p.

Beam, J. 1973. An inventory of groundfish biological samples, including rockfish species composition catch estimates, taken in Washington during 1972. Wash. Dept. Fish. Groundfish Data Rep. Ser. 15, 28 p.

Beam, J. 1974. An inventory of groundfish biological samples, including rockfish species composition catch estimates, taken in Washington during 1973. Wash. Dept. Fish. Groundfish Data Rep. Ser. 19, 25 p.

Beam, J. 1975. An inventory of groundfish biological samples, including rockfish species composition catch estimates, taken in Washington during 1974. Wash. Dept. Fish. Groundfish Data Rep. Ser. 21, 28 p.

Beam, J., and N. Pasquale. 1969. An inventory of groundfish biological samples taken in Washington in 1968, including rockfish species composition samples, 1966-1968. Wash. Dept. Fish. Groundfish Data Rep. Ser. 4, 30 p.

Beam, J., and N. Pasquale. 1970. An inventory of groundfish biological samples, including rockfish species composition catch estimates, taken in Washington during 1969. Wash. Dept. Fish. Groundfish Data Rep. Ser. 8, 29 p.

Beam, J., and N. Pasquale. 1971. An inventory of groundfish biological samples, including rockfish species composition catch estimates, taken in Washington during 1970. Wash. Dept. Fish. Groundfish Data Rep. Ser. 11, 32 p.

Beam, J., and N. Pasquale. 1972. An inventory of groundfish biological samples, including rockfish species composition catch estimates, taken in Washington during 1971. Wash. Dept. Fish. Groundfish Data Rep. Ser. 13, 28 p.

Beamish, Richard J. 1979. New information on the longevity of Pacific ocean perch (Sebastes alutus). J. Fish. Res. Board Can. 36(11):1395-1400.

A comparison of ages determined from surfaces of otoliths and from sections of otoliths showed that ages were similar up to a section age of 22-24 yr. The growth pattern observed on thin sections of otoliths and from broken and burned otoliths from the region of the nucleus was interpreted to indicate that Pacific ocean perch probably live much longer than previously thought. Because the criteria used to identify annuli from otoliths sections appeared valid for younger fish, there was no justification to reject the application of these criteria for estimating ages of older fish and thus no reason to reject the possibility that Pacific ocean perch might live to be older than 70 yr. Ages determined from sections of otoliths from other rockfish species found off the west coast of Canada such as S. flavidus and S. brevispinis have ranged from 30 to 60 yr indicating that many species of rockfish may live longer than previously thought.

Bean, Tarleton H. 1890. New fishes collected off the coast of Alaska and adjacent region southward. Proc. U. S. Nat. Mus. 13:37-45.

The fishes herewith described were obtained by the U. S. Fish Commission steamer Albatross during the summer of 1888, chiefly in August, in the waters of Alaska. Eight of the genera are apparently new to science. (S. alascanus described).

Bean, Tarleton H. 1895. Description of a new species of rockfish, Sebastichthys brevispinis, from Alaska. Proc. U. S. Nat. Mus. 17:627-628.

Bello, R. A., and G. M. Pigott. 1979. A new approach to utilizing minced fish flesh in dried products. J. Food Sci. 44(2):355-358.

A dried fish product to be kept without refrigeration was developed, using the mixed, minced flesh from various fish species (lingcod, rockfish, herring, and Pacific cod). Modified tapioca starch, texturized soy fiber, and salt were required to enhance the binding and rehydration properties and sensory attributes of the product. Temperatures of 71-82 C during approximately 10 h were required to dry the patties to 5% moisture level 20 min submerged in water were enough to rehydrate the product. Physiochemical, microbiological, organoleptical, and histological tests were conducted during the development of the product.

Bennett, J. T., George W. Boehlert, and K. K. Turekian. 1982. Confirmation of longevity in Sebastes diploproa (Pisces: Scorpaenidae) from lead-210 and radium-228 measurements in otoliths. Mar. Biol. 71(2):209-215.

Fish ages are often estimated by assuming an annual frequency of the band-like, growth-zones recorded in the largest of their otoliths, the sagittae. The total number of growth-zones are normally determined either by counting external growth-zones (whole otolith technique) or by examining otolith cross-sections (otolith section technique). The 2 techniques do not always yield the same age, particularly in older specimens of certain fishes. To resolve this problem, otoliths of the splitnose rockfish S. diploproa were examined morphologically and were assayed for their natural radionuclide concentrations. Four age groups of otoliths were identified based on growth-zone counting; in the first 3, whole otolith and otolith section age estimates agreed, while in the 4th, the otolith section age substantially exceeded the whole otolith age.

Benson, H. G., T. J. Miller, H. M. Gottschalk, and P. S. Elias. 1980. Long term feeding studies in mice fed a diet containing irradiated fish. 2. Ninety day toxicity study. Toxicol. Lett. (Amst.) 7(2):103-106.

Three groups of mice (F2b generation of Part I study) were fed for 90 days, either stock ration or diets containing 45% fish, either non-irradiated or irradiated with 1.75 kilogray. Equal amounts of cod Gadus morhua morhua and redfish (ocean perch) Sebastes marinus constituted the fish portion of the diet. Hematological and clinical chemical examinations revealed no treatment-related effects. There were no untoward terminal gross or histopathological changes. An initial lag in weight gain of males fed fish diets was attributed to reduced food consumption, due to the difference in texture of the fish diets compared with the stock ration.

Berg, William J., and Donald G. Buth. 1984. Glucose dehydrogenase in teleosts: tissue distribution and proposed function. Comp. Biochem. Physiol. B Comp. Biochem. 77(2):285-288.

Tissue extracts of skeletal muscle, heart, eye, brain, liver, kidney, gill and stomach were electrophoretically examined for glucose dehydrogenase activity in 21 spp. of marine teleost fishes. Glucose dehydrogenase expression was detected only in liver extracts. Considerable interordinal variation was found in levels of enzymatic activity. Available data support the hypothesis that glucose dehydrogenase provides NADPH for the mixed-function oxidase system in teleosts.

Berger, T. S. 1968. Soviet investigations on young redfish (S. mentella and S. marinus) in the Barents Sea in 1966/67. Ann. Biol. 23:204-206.

Berger, T. S., and R. A. Cheremisina. 1968. Distribution of young redfish Sebastes mentella and Sebastes marinus in the Barents Sea in 1967. Ann. Biol. 24(1967):193-195.

Berger, T. S., and R. A. Cheremisina. 1972. Distribution and age of redfish fry Sebastes mentella and Sebastes marinus in autumn and winter 1971-1972 in the Barents Sea. Ann. Biol. 29(1972):174-175.

Berger, T. S., and R. A. Cheremisina. 1972. Distribution and age of young redfish Sebastes mentella and Sebastes marinus in the Bear Island Spitsbergen area in 1970. Ann. Biol. 27(1970):188-189.

Berger, T. S., and R. A. Cheremisina. 1973. Distribution and age of young redfish Sebastes mentella and Sebastes marinus in subarea I in 1971. Ann. Biol. 28(1971):209-210.

Bergeron, J. 1961. Redfish explorations in the Gulf of St. Lawrence, 1957. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:122-123.

Bernard, David. 1981. Multivariate analysis as a means of comparing growth in fish. Can. J. Fish. Aquat. Sci. 38(2):233-236.

The Hotelling's T2 is described as a test for differences between like von Bertalanffy growth parameters estimated from 2 fish groups when these parameters are correlated. Equations to calculate T2 are presented, as are equations to modify T2 to an F statistic for use in testing. Simultaneous confidence intervals and critical F values are described to separate effects of parameters on observed differences in growth. Assumptions made by the T2 is

technique are discussed, as are ways in which any bias caused by violating these assumptions is lessened. Two numerical examples concerning growth differences among groups of Pacific ocean perch (Sebastes alutus) are provided. Growth of male and of female perch captured off the Columbia River [USA] differs, with L.infin. being the most statistically significant parameter and to the least. Growth of male perch captured off Vancouver Island and off the Columbia River also differs, with only L.infin. statistically significant.

Berry, Frederick H., and Herbert C. Perkins. 1965. Survey of pelagic fishes of the California Current area. Fish. Bull., U.S. 65(3):625-682.

The pelagic fishes off central California to central Baja California were surveyed with four kinds of nekton-collecting nets. The survey was made during eight cruises between May 1961 and March 1963. More than 189 fish species and about 52,000 specimens were taken. Records of Scorpaenidae include Sebastolobus and Sebastes.

Besednov, L. N. 1973. Food fish of Sidimi Bay (an inlet of Peter the Great Bay) in the middle Holocene. J. Ichthyol. 13(1):33-36.

Best, E. A. 1961. The California animal food fishery, 1958-1960. Pac. Mar. Fish. Comm. Bull. 5:5-15.

Lists species considered food in California.

Best, E. A. 1961. Savings gear studies on Pacific Coast flatfish. Pacific Mar. Fish. Comm. Bull 5:25-48.

Best, E. A. 1964. Spawning of longspine channel rockfish, Sebastolobus altivelis Gilbert. Calif. Fish Game 50(4):265-267.

Best, E. A., and Peter J. Eldridge. 1969. Range extension of the flag rockfish (Sebastodes rubrivinctus) to Aleutian Islands. J. Fish. Res. Board Can. 26(7):1955-1956.

Beverley-Burton, M., T. E. McDonald, and D. Murith. 1986. Monogenea for some marine fishes taken off the Pacific Coast of Canada. J. Parasitol. 72(3):479-480.

Beverton, R. J. H., and S. J. Holt. 1957. On the dynamics of exploited fish populations. Fish. Invest. Ser. II Mar. Fish. G. B. Minist. Agric. Fish. Food 19:533.

Bingham, Alpheus, Jr., Donald W. Wilkie, and Harry S. Mosher. 1979. Tunaxanthin: occurrence and absolute stereochemistry. Comp. Biochem. Physiol. B Comp. Biochem. 62(4):489-495.

Three stereoisomeric carotenoids, IIIb, IVb and Vb, of the 3,3'-dihydroxy-.epsilon.,.epsilon.-carotene (tunaxanthin) constitution were identified from the skin of the Southern California fish, Oxyjulis californica; all 3 possess the unexpected 6S,6'S stereochemistry. One of these (Vb) was the enantiomer of chiriquixanthin A (Va) and another (IIIb) of chiriquixanthin B (IIIa) which was isolated from the skin of the yellow Costa Rican frog, Atelopus chiriquiensis. The major carotenoid pigment from Sebastes flavidus is the tunaxanthin stereoisomer identical to chiriquixanthin B (IIIa). The natural occurrence in fishes of these epimeric and enantiomeric carotenoid pigments, which are unknown in plants, is remarkable and provides a powerful means of investigating metabolic transformations of carotenoids.

Blacker, R. W. 1977. English observations on rare fish in 1975. Ann. Biol. 32:184-185.

The following records of rare or unusual fish were received at the Fisheries Laboratory, Lowestoft during 1975: Hexanchus griseus, Torpedo marmorrata, Acipenser sturio, Engralis encrasicolus, Alosa fallax, Argentina silus, Notacanthus chemnitzii, Entelurus aequoreus, Micromsistius poutassou, Phycis blennoides, Raniceps raninus, Beryx splendens, Zeus faber, Dicentrarchus labrax, Pterycombus brama, Brama brama, Mullus surmulletus, Boops boops, Spondyliosma cantharus, Labrus bergyla, Lycodes esmarkii, Centrolophus niger, Sebastes viviparus, Cyclopterus lumpus, Paraliparis bathybii, Zeugopterus punctatus, Phrynorhombus regius, Balistes carolinensis, Mola mola, Himantolophus groenlandicus.

Blaxter, J. H. S. 1969. Development: Eggs and larvae. In W. S. Hoar and D. J. Randall (editors), Fish Physiology, Vol. III, p. 177-252. New York, Academic Press, 1969. 485 p.

Blinov, V. V. 1985. Optimization of long-term exploitation of fish resources using mathematical models. In Theoretical aspects of commercial fishing gear, p.105-128. Sb. Nauch. Tr. Vniro.

Criteria of optimum long-term fish stock exploitation are considered and a mathematical model describing "stock-recruitment" relationships is constructed which allows for predicting prognostic characteristics of commercial stocks and catches. Retrospective and prognostic characteristics of stock and yield are estimated with reference to Arcto-Norwegian cod (Gadus morhua and Sebastes mentella) under conditions of varying fishing gear selectivity. The optimum codend mesh size in fishery for deepwater redfish is established.

Bodkin, J. L. 1986. Fish assemblages in Macrocystis and Nereocystis kelp forests off central California. Fish. Bull., U.S. 84(4):799-808.

The abundance and species composition of conspicuous fishes were compared within two canopy forming kelp forests (giant kelp, Macrocystis pyrifera, and bull kelp, Nereocystis luetkeana) in Central California. The primary investigative method was a subtidal belt transect, in which visual observation was used. The species composition of fish assemblages in the two canopy types was similar. Densities of fish were generally greater in Macrocystis than in Nereocystis forests. The major difference was the density of midwater species of the genus Sebastes. The blue rockfish, Sebastes mystinus, was the numerically dominant species in both canopy types. Estimates of the biomass of fish were about 2.4 times greater in Macrocystis beds than in Nereocystis beds.

Bodkin, J. L., G. R. Vanblaricom, and R. J. Jameson. 1987. Mortalities of kelp forest fishes associated with large oceanic waves off central California 1982-1983. Environ. Biol. Fishes 18(1):73-76.

Observations of three incidents of the mass mortality of nearshore fishes are reported; each corresponded to periods of high-amplitude, long-period swells during the 1982-1983 El Nino event along the coast of central California. Members of the nearshore kelp forest fish assemblage, primarily of the genus Sebastes, accounted for 96% of the observed mortalities and S. mystinus (blue rockfish) alone accounted for 72%.

Boehlert, George W. 1977. Physiological and morphological adaptations in the surface-to-benthic migration of Sebastes diploproa (Pisces:Scorpaenidae). Ph.D. Thesis, Univ. Calif.,San Diego, 173 p.

Boehlert, George W. 1977. Timing of the surface-to-benthic migration in juvenile rockfish, Sebastes diploproa, off southern California. Fish. Bull., U.S. 75(4):887-890.

Species of the genus Sebastes lead a pelagic existence as larvae, transforming to pelagic pre-juveniles and finally benthic juvenile stages at varying sizes. This paper provides information on the disappearance from surface waters and the appearance in the benthic habitat based on seasonal size distribution from the two habitats. Extension of the timing of emigration and subsequent appearance in the benthic habitat is probably a direct result of the long parturition season off California.

Boehlert, George W. 1978. Changes in the oxygen consumption of prejuvenile rockfish Sebastes diploproa prior to migration from the surface to deep water. Physiol. Zool. 51(1):56-67.

Prejuvenile S. diploproa migrate from temperate surface waters of the California current region Pacific Ocean to cold, relatively deep waters inhabited by juveniles and adults. Based on results from laboratory-acclimated prejuveniles, metabolic rates were proportional to test temperature, acclimation temperature and weight and inversely proportional to photoperiod. A multiple regression model was constructed using these factors to predict respiratory rates in field-acclimatized prejuveniles collected in monthly samples. During the migratory season (May-Sept.), respiratory rates measured at 10.degree.C were much higher than values predicted by the model. The Q10 values between respiratory rates measured at 10 and 20.degree.

Boehlert, George W. 1978. Intraspecific evidence for the function of single and double cones in the teleost retina. Science(Wash.) 202(4365):309-311.

Retinal growth in young Sebastes diploproa involved the succession of 3 distinct cone patterns. Development of the final pattern with the loss of single cones occurred in close temporal association with a permanent migration from the surface to deep water. Apparently loss of single cones depends upon the change in environment, and the loss occurs through fusion to double elements.

Boehlert, George W. 1979. Retinal development in postlarval through juvenile Sebastes diploproa: adaptation to a changing photic environment. Rev. Can. Biol. 38(4):265-280.

Boehlert, George W. 1980. Size composition, age composition, and growth of canary rockfish, Sebastes pinniger, and splitnose rockfish, S. diploproa, from the 1977 rockfish survey. Mar. Fish. Rev. 42(3-4):57-63.

Canary rockfish were taken predominantly in the Oregon-Washington region at depths of 50-149 fathoms (91-272 m). This species was considered as a single stock recruitment to the sampling gear and area was complete at ages of approximately 14-15 yrs and sizes of 51 cm (males) and 55 cm (females). Splitnose rockfish were taken in all areas, at depths of 50-260 fathoms (91-475 m) it was considered in 3 latitudinal strata (based on differences in growth) and 2 depth strata (based on differences in length-frequencies). Recruitment to the sampling gear and area was generally complete at ages 14-17 and sizes of 26 cm (males) and 29 cm (females). Fish in the shallow strata were

smaller than in the deep strata. In the deep strata there was a general trend of increasing mean size to the north. The size and age compositions in the northern stratum, when compared with historical data, suggest an impact of fishing pressure. It is suggested that the close ecological association of splitnose rockfish with Pacific ocean perch, S. alutus, may have resulted in a concomitant decline in stocks due to incidental catches of the former.

Boehlert, George W. 1981. The effects of photoperiod and temperature on laboratory growth of juvenile Sebastes diploproa and a comparison with growth in the field. Fish. Bull., U.S. 79(4):789-794.

Growth rates of fishes may act as sensitive indicators of environmental conditions. Variations in food supply, temperature, photoperiod, and other physical and biotic conditions may be reflected in the pattern of growth in a given species, yet the effect may vary depending upon the ontogenetic stage studied. The present study examines the effects of temperature and photoperiod on growth rate in juveniles of the splitnose rockfish, Sebastes diploproa,in the laboratory and compares these growth rates with growth in the field. Adults of this species are benthic in the northeastern Pacific Ocean. Sebastes larvae are pelagic and prejuveniles of this species remain pelagic for about 1 year, reaching maximum sizes near 55 mm standard length prior to migrating to the benthic habitat. The thermal regime of the surface waters differs greatly from that in the adult habitat, suggesting that temperature is an important factor in the life history of this species.

Boehlert, George W. 1981. The role of temperature and photoperiod in the ontogenetic migration of prejuvenile Sebastes diploproa (Pisces: Scorpaenidae). Calif. Fish Game 67(3):164-175.

Prejuvenile S. diploproa migrate from the seasonally warm surface waters of the northeast Pacific Ocean to depths of 200-500 m, encountering a major change in thermal environment. To better understand the factors important in initiation and timing of the migration, temperature tolerance and thyroid follicle cell height were monitored on a seasonal basis and in fish acclimated to 9 different photoperiod-temperature regimes. In field-acclimatized specimens, thyroid follicle cell height was negatively correlated and temperature tolerance was positively correlated with collection temperature; no changes were noted during the migratory season.

Boehlert, George W. 1985. Using objective criteria and multiple regression models for age determination in fishes. Fish. Bull., U.S. 83(2):103-118.

Analysis of the age structure of exploited fish populations is necessary for models upon which management decisions are made, but existing aging methodology for many species is hindered by subjective criteria used in age determination. A new technique is described in which age is estimated using multiple regression models based upon the measurable parameters otolith weight, otolith length, and otolith width in the splitnose rockfish, Sebastes diploproa, and the canary rockfish, S. pinniger. Models were calibrated using ages determined by interpretation of both whole otoliths and otolith sections which differ within these species, particularly at greater lengths. The models typically explained from 70 to 92% of the variability in age depending upon species, sex, and method of age analysis. In another sample used to verify the precision of the models, variability associated with model-estimated ages was generally less than that induced by variability in ages between different agencies. Based upon the pattern of otolith growth in length, width, and weight in these and other species, it is suggested that these methods would be applicable to a wide variety of fishes.

Boehlert, George W., W. H. Barss, and P. B. Lamberson. 1982. Fecundity of the widow rockfish, Sebastes entomelas, off the coast of Oregon. Fish. Bull., U.S. 80(4):881-884.

During the past several years a strong fishery has developed for the widow rockfish, Sebastes entomelas. Historical records and the trace amounts captured in early demersal fish surveys contrast sharply with recent catches. This note is intended to describe the fecundity of S. entomelas off Oregon as function of length and weight, adding to the limited information available from samples collected in 1957 through 1959 and described by Phillips (1964).

Boehlert, George W., and R. F. Kappenman. 1980. Variation of growth and latitude in two species of rockfish Sebastes pinniger and Sebastes diploproa from northeast Pacific Ocean. Mar. Ecol. Prog. Ser. 3(1):1-10.

Growth of 2 Sebastes spp. was measured as fish length vs. age, determined from otoliths. S. pinniger and S. diploproa were collected extensively over their wide latitudinal ranges in the northeast Pacific Ocean. In both species, females grew faster and larger than males. Growth of S. pinniger did not vary with latitude. For S. diploproa there was a cline of increasing growth with higher latitude. In the habitat of the adult fish, which are demersal on the continental shelf and upper slope, latitudinal variation in

environmental factors such as temperature and O2 concentration appears insufficient to account for the observed differences in growth. S. diploproa has been exploited by fisheries more in the north than in the south, possibly resulting in more available prey and increased growth in the north (short term density-dependent response).

Boehlert, George W., M. Kusakari, M. Shimizu, and J. Yamada. 1986. Energetics during embryonic development in Kurosoi Sebastes schlegeli. J. Exp. Mar. Biol. Ecol. 101(3):239-256.

Studies on the live-bearing scorpaenid genus Sebastes have recently shown that embryos of one species received nutrition in addition to that supplied in the yolk. In this large genus, however, reproductive characteristics may differ among species. Energetics of embryonic development in kurosoi, Sebastes schlegeli Hilgendorf, were analyzed to determine the patterns of embryonic nutrition. The egg of this species is larger and contains over the energy content of that in S. melanops, another species which has been studied. Catabolism during the 51 days of embryonic development required 88% of the original energy in the egg, but the embryo at birth contained 93% of the initial egg energy. Thus the total energy required for development from fertilization to birth requires .simeq. 1.8 times the initial, endogenous energy supply. Along with catabolism, this results in an overall decrease in the energy content of the ovaries during development, but the total amounts of protein and nitrogen remain nearly static. We thus suggest that resorption of unfertilized ova or early embryos which die may enrich the ovarian fluid and supply energy to be surviving embryos. This is a primitive form of embryonic nutrition in viviparous species and may be common in the genus Sebastes.

Boehlert, George W., Muneharu Kusakari, and Juro Yamada. 1987. Reproductive mode and energy costs of reproduction in the genus Sebastes. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 143-152. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Boehlert, George W., and Mary M. Yoklavich. 1983. Effects of temperature, ration, and fish size on growth of juvenile black rockfish, Sebastes melanops. Environ. Biol. Fish. 8(1):17-28.

Juveniles 35-93 mm standard length were acclimated to 7.degree., 12.degree and 18.degree. C and provided 4 daily rations (nominally 0, 25, 50 and 100% maximum ration); growth and food consumption were monitored over 57 days. Growth in length ranged from -0.023 to 0.314 mm/day,

relative growth in weight ranged from -0.689 to 1.495% body wt per day, and gross conversion efficiencies ranged from -13 to 21% among treatments. Under starvation conditions, weight loss increased with increasing with increasing temperature. At rations expressed as % maximum at a given temperature.

Boehlert, George W., and Mary M. Yoklavich. 1984. Reproductive embryonic energetics and the maternal-fetal relationship in the viviparous genus Sebastes (Pisces:Scorpaenidae). Biol. Bull. (Woods Hole) 167(2):354-370.

Reproduction in the scorpaenid genus Sebastes was characterized as primitive ovoviviparity. In the black rockfish, S. melanops, egg size is small (0.8 mm), but the gestation period is 37 days and larvae at birth are well developed, with a remnant of yolk and the ability to initiate feeding. To test the hypothesis that this species is viviparous with additional maternal nutrition, embryonic energetics and morphology were studied. Catabolism during development utilized 64% of the yolk energy, resulting in a maximum yolk utilization efficiency of 36%, similar to oviparous fishes. Calorimetry demonstrates that 81% of the initial yolk energy is present at birth. Thus approximately 70% of the catabolic energy is contributed by the maternal system during gestation. Histological observations reveal that the hindgut is functional approximately 22-25 days after fertilization.

Boehlert, George W., and Mary M. Yoklavich. 1984. Variability in age estimates in Sebastes as a function of methodology, different readers and different laboratories. Calif. Fish Game 70(4):210-224.

Age was determined in the fast growing canary rockfish, Sebastes pinniger, and the slow growing splitnose rockfish, S. diploproa, by different laboratories, techniques, and readers. Variability between agencies depended upon method and species. For S. pinniger age by both laboratories, whole otolith ages were similar, whereas the otolith section ages greatly exceeded those of whole otolith ages. Clear differences were noted for the slower growing S. diploproa: whole otolith ageing methods differed between the two laboratories, with much greater ages for larger specimens assigned by one laboratory. These older whole otolith ages showed similarities to the otolith section ages for this species, but still did not reveal the longevity noted with sections. The authors suggest two areas where improvement in precision of age determination is necessary.

Boehlert, George W., and Mary M. Yoklavich. 1987. Long-term cycles of growth in Sebastes: Extracting information from otoliths. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 197-207. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Bogason, Sigurdur G. 1984. Characterization of the intramuscular connective tissue collagen of three rockfish species (Sebastes). Ph.D. Thesis, Oregon State Univ., Corvallis, 80 p.

This investigation was carried out to characterize and quantitate the collagen of rockfish intramuscular connective tissue. Different species of rockfish were chosen to represent the range of product quality experienced by the fish processing industry. Species included widow, a rockfish noted for its soft flesh, yellowtail, a rockfish possessing flesh of intermediary texture and canary rockfish known for its firm flesh. The intramuscular connective tissue collagen was extracted from white muscle and total, salt, acid and insoluble collagen content was estimated by hydroxyproline analysis. No significant difference was observed among species with regard to all collagen fractions.

Bourgeois, C. E., and I-Hsun Ni. 1984. Metazoan parasites of northwest Atlantic redfishes, Sebastes spp. Can. J. Zool. 62(9):1879-1885.

443 specimens of 3 redfish species (209 S. fasciatus, 123 S. marinus and 111 S. mentella), were examined for metazoan parasites; 182 (87.1%) S. fasciatus, 120 (97.6%) S. marinus and 103 (92.8%) S. mentella were infected. Seventeen species of parasites Microcotyle sp., Brachyphallus crenatus, Derogenes varicus, Hemiurus sp., Lecithaster gibbosus, Lecithophyllum botryophorum, Podocotyle reflexa, Opecoelidae, Anisakis sp. Contracaecum sp., Hysterothylacium aduncum, Abothrium sp., Bothriocephalus scorpii, Scolex pleuronectis, Acanthocephala, Chondracanthus nodosus and Sphyrion lumpi were recovered (12 from S. fasciatus, 16 from S. marinus, and 11 from S. mentella), 22 of which were new host records. Quantitative data, including prevalence and intensity of infection, are given for each parasite by host species and NAFO division.

Bourne, Niel, and M. A. Pope. 1969. Deep-sea line fishing off British Columbia. J. Fish. Res. Board Can. 26(9):2527-2531.

Bracken, B. E., and V. M. O'Connell. 1986. Longline fisheries monitoring in the eastern Gulf of Alaska, 1980-1985. Alaska Dep. Fish Game Infor. Leaf. 258, 47 p.

This report summarizes the results of domestic longline fisheries monitoring in the eastern Gulf of Alaska from 1980 to 1985. It is comprised of two sections. Each section presents a detailed description of the monitoring activity of one of the primary groundfish fisheries in the region, the sablefish and the rockfish longline fisheries.

Bracken, Barry. 1987. The history of the rockfish fisheries in Alaskan waters. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 51-59. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Bratberg, E. 1956. On the interpretation of the opaque and hyaline zones in the otoliths of immature redfish (Sebastes marinus L.). J. Cons. Cons. Int. Explor. Mer 22(1):66-74.

Bratberg, E. 1984. Does the redfish grow slowly and is it possible to determine its age? Can. Transl. Fish. Aquat. Sci. 5100, 13 p.

On the basis of this study of the interpretation of the opaque and hyaline zones in scales and otoliths, growth studies of redfish (Sebastes marinus) show that they grow very slowly and that large fish must be quite old.

Brodeur, Richard D. 1982. Food habits, dietary overlap and gastric evacuation rates of rockfish (genus Sebastes). M.S. Thesis, Oregon State Univ., Corvallis, 98 p.

Brodeur, Richard D. 1984. Gastric evacuation rates for two foods in the black rockfish, Sebastes melanops Girard. J. Fish Biol. 24(3):287-298.

The rates of gastric evacuation of 2 food types, squid and fish, were measured in the laboratory for adult black rockfish, S. melanops, held nominally at 11.degree. C. Linear, logarithmic and square root regression models were applied to analyze the data expressed as both wet and dry weight proportions of the original meal. The linear model provided the best fit for the wet weight relationship of squid. The dry weight of squid and both the wet and dry weight of fish were best described by a logarithmic model, or by a square root model when the regressions were 'forced' through the original meal size. The instantaneous evacuation rates (.simeq. 6% h-1) and times to complete evacuation (.simeq. 76 h) were similar for all relations except those involving the wet weight of squid.

Brodeur, Richard D., and William G. Pearcy. 1984. Food habits and dietary overlap of some shelf rockfishes (genus Sebastes) from the northeastern Pacific Ocean. Fish. Bull., U.S. 82(2):269-294.

Euphausiids were the major food of 5 co-occurring species of rockfishes (Sebastes spp.) long the west coast of North America from Vancouver Island to northern California. Copepods, decapods, cephalopods, amphipods, fishes and other pelagic prey were also consumed but were less important to the overall diet. Two species, S. flavidus and S.diploproa, were relatively euryphagous, utilizing a high number of prey taxa. The other species, S. pinniger, S. alutus and S. crameri, had a more restricted diet comprised mostly of euphausiids. The numerical composition of prey in the diet of all species was similar due to the preponderance of the 2 dominant euphausiid species. Diet overlaps based on weight composition were high for S. pinniger, S. diploproa and S. alutus but were moderate for most comparisons involving S. flavidus and S. crameri.

Brown, W. D., M. Albright, D. A. Watts, B. Heyer, B. Spruce, and J. Price. 1980. Modified atmosphere storage of rockfish Sebastes miniatus and silver salmon Oncorhynchus kisutch. J. Food Sci. 45(1):93-96.

Rockfish (S. miniatus) fillets and salmon (O. kisutch) steaks were held in atmospheres containing 20 or 40% CO2, with or without Co. Controls were stored similarly in air. At intervals of refrigerated storage up to 14 days, samples were removed for sensory, chemical and microbiological analyses. At 7 days, all treatment groups were significantly different visually, with appearance of slime on the air controls, but not on samples in the gas treatments. Samples held in air were judged to have stronger aromas than others held under CO2 at either level. The higher level of CO2 was more effective. Values for thiobarbituric acid were low in all groups; hypoxanthine values varied widely, with no particular effect due to modified atmospheres. Storage under CO2 was effective in reducing the formation of trimethylamine and ammonia, and markedly inhibited microbial growth.

Browning, Robert J. 1980. Fisheries of the North Pacific: history, species gear and processes. Alaska Northwest Publishing Co., Edmonds, Washington. 423 p.

Bubier, J. L., and A. Riesner. 1986. USA and Canadian groundfish management in the Gulf of Maine Georges Bank region. Ocean Manage. 10(2):83-124.

Buchanan, Chester C. 1973. Occurrence of mature redfish, Sebastes marinus, in sport fishery of the New York Bight. Fish. Bull., U.S. 71(2):597-598.

The 1971 sport fishery survey of the New York Bight waters, reported catching redfish, Sebastes marinus, along the edges of the Hudson Canyon. Specimens obtained and examined later were found to be sexually mature fish. This is the first record of redfish being caught in the marine sport fishery off New York, and is a substantial extension of the southern and western breeding range for Sebastes in the north Atlantic.

Buckenhueskes, H., N. Antonacopoulos, and D. Riechers. 1983. Technology of fish processing. Z. Lebensm-Technol. Verfahrenstech. 34(4):307-311.

New fish species have increasingly joint the traditional species on the market. As a result the fish processing industry and marketing has to cope with considerable difficulties. This paper summarizes the common fish processing techniques in view of some important fish species and discusses their marketing strategies. (Sebastes marinus).

Buckley, R. M. 1970. 1967 bottom fish sport fishery. Wash Dept. Fish. Suppl. Progr. Rep. 42 p.

Bulgakova, T. I., and Yu. N. Efimov. 1982. A method for forecasting catch by consideration of the dependence of natural mortality upon age. J. Ichthyol. 22(2):24-32.

A new method is proposed for calculating the possible magnitude of fish catches taking into account the dependence of the instant coefficient of natural morality upon the age of the fish. The method has been tested with populations of Oregon hake, Merluccius productus, and Pacific Ocean perch, Sebastes alutus.

Burge, R. T., and S. A. Schultz. 1973. The marine environment in the vicinity of Diablo Cove with special reference to abalone and bony fishes. Calif. Dept. Fish Game Mar. Resour. Tech. Rep. 19.

Burreson, E. M. 1977. Two new marine leeches (Hirudinea: Piscicolidae) from the west coast of the United States. Univ. Nac. D. Mexico Inst. Biol. Special Publ. 4:503-511.

Two new species of marine leeches are described from the west coast of the United States and the internal anatomy of Ostreobdella is described for the first time. Orientobdella confluens has the following characteristics: body greatly elongated 14-annulate, with six large papillae dorsally and

eight or more ventrally on each annulus of the urosome two pairs of eyes 14 ocelli on posterior sucker pigmentation dark purple or brown with dark transverse bands ten pairs of pulsatile vesicles six pairs of testisacs terminal portions of male and female reproductive systems fused with common gonopore. Host: probably flatfishes or skates. Ostreobdella papillata has the following characteristics: body 14-annulate at least two rings of papillae on each segment of the urosome, most prominent on the ventral surface one pair of eyes 10-12 ocelli on the posterior sucker pigmentation uniformly light brown with segmental dark transverse bands most obvious near the posterior end of the body anterior sucker larger than posterior and wider than body six pairs of testisacs atrial cornua extremely muscular. Host: Sebastes melanops, Octopus dofleini.

Burreson, E. M. 1977. Two new species of Malmiana (Hirudinea:Piscicolidae) from Oregon coastal waters, USA. J. Parasitol. 63(1):130-136.

M. virida sp. nov., parasitic on buffalo sculpins, Enophrys bison, in Yaquina Bay estuary [Oregon, USA] and M. diminuta sp. nov., a parasite of rockfishes, Sebastes spp., and cabezon, Scorpaenichthys marmoratus, are described. M. virida reaches a length of 30 mm and resembles M. scorpii (Malm) except in structure of the male reproductive system. M. diminuta attains a length of only 15 mm and is usually reddish-brown with marginal, metameric clusters of yellow pigment granules. Cocoons of M. virida contain from 2-4 eggs, but those of M. diminuta contain only 1 egg.

Butler, P. A., and R. L. Schutzmann. 1979. Bioaccumulation of DDT and polychlorinated biphenyl in tissues of marine fishes. In L. L. Marking and R. A. Kimerle (editors), Aquatic toxicology: Proceedings of the second annual symposium, Cleveland, Ohio, USA, 31 Oct.-1 Nov. 1977. American Society for Testing and Materials. Spec. Publ. 667:212-220.

Butsuk, S. V., and B. I. Bessonov. 1981. Direct current electric field in some teleost species effect of medium salinity. J. Comp. Physiol. A Sens. Neural Behav. Physiol. 141(2):277-282.

A direct current electric field up to 3mV/cm was recorded in 33.permill. seawater around the fish Myoxocephalus brandi, Hexogrammos octogrammos, Enophrys diceraus, Pleuronectes stellatus, Bathimaster derjugini and Sebastes scorpaeniformis. The body surface potentials were positive in relation to the external and internal media; they attained 10 mV and slowly varied near the mean value at every point. The potentials at the surface points of individual skin sections adjoining the oral and bronchial

cavities, the anal orifice and peripheral fin sections were normally characterized by polarities opposite to those of body surface potentials (in seawater they were negative in relation to the external medium.

Cailliet, Gregor M., K. A. Karpov, and David A. Ambrose. 1979. Pelagic assemblages as determined from purse seine and large midwater trawl catches in Monterey Bay and their affinities with the market squid, Loligo opalescens. Calif. Coop. Oceanic Fish. Invest. 20:21-30.

71 samples, taken in the upper 50 fathoms using large midwater trawls were examined. From similar depths and locations in 1975 and 1976, 29 commercial anchovy hauls were subsampled as they were being unloaded in Moss Landing Harbor. Data for individual taxa are presented only as presence or absence, relative abundance, and frequency of occurrence. Catches were subjected to occurrent group analysis, and both methods showed similar assemblages. Catches taken over deeper water (>35 fathoms, or 64 m) were compared with those from shallower water, and the differences are discussed. In general, catches were dominated by Loligo opalescens and Engraulis mordax, but other frequently occurring organisms were Sebastes spp, Merluccius productus, scyphomedusae (Pelagia and Chrysaora), Torpedo californica, Citharichthys sordidus, Porichthys notatus, Genyonemus lineatus, Peprilus simillimus, and Clupea harengus pallasii. This paper presents preliminary studies on the biological ecosystem of the market squid population in Monterey Bay.

Carlisle, John G. 1969. Results of a six year trawl study in an area of heavy waste discharge: Santa Monica Bay, California. Calif. Fish Game 55(1):26-46.

Carlisle, John G., C. H. Turner, and E. E. Ehert. 1964. Artificial habitat in the marine environment. Calif. Fish Game Fish Bull. 124, 93 p.

It has long been known that greater numbers and kinds of fishes inhabit rocky coasts, reefs, and banks than smooth, unbroken sandy or muddy bottoms, and that shipwrecks provide excellent fishing in otherwise non-productive areas. On this basis, various state and private agencies have placed old automobile bodies and other objects in areas generally barren of sportfish. Reports have indicated greatly increased sportfish yields in these areas, but to our knowledge, no full-scale scientific evaluation of artificial reefs has been made. The Japanese have done some work in this field, but their results are unpublished. With these fact in mind, the California Department of Fish and Game instituted a study of artificial reefs in April 1958.

Carlson, H. Richard. 1986. Restricted year-class structure and recruitment lag within a discrete school of yellowtail rockfish. Trans. Am. Fish. Soc. 115(3)490-492.

Observations of a school of adult yellowtail rockfish Sebastes flavidus over an 11-year period in southeastern Alaska revealed negligible recruitment as the school dwindled in numbers and remaining individual fish grew in size. The recruitment observations described here are of a discrete school of yellowtail rockfish that occupied a sunken passenger liner at Point Lena, Lynn Canal, in southeastern Alaska.

Carlson, H. Richard. 1987. Restricted year-class structure and recruitment lag within a discrete school of yellowtail. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 329-331. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Carlson, H. Richard, and Louis Barr. 1977. Seasonal changes in spatial distribution and activity of two species of Pacific rockfishes, Sebastes flavidus and S. ciliatus, in Lynn Canal, southeastern Alaska. Mar. Fish. Rev. 39(3)23-24.

Mixed aggregations of rockfishes near Auke Bay, Alaska, were observed by divers over all the months of the year. The patterns of activity and distribution differed greatly between warmer months (May-October), when the fish were actively feeding and distributed above the substrate, and colder months (November-April), when the fish were partially or completely hidden between or beneath the substrate and were relatively sluggish and inactive. Selection probably favors this mode of behavior which renders the fish nearly inaccessible to predators when they would be most vulnerable and when food is scarce.

Carlson, H. Richard, and Richard E. Haight. 1972. Evidence for a home site and homing of adult yellowtail rockfish, Sebastes flavidus. J. Fish. Res. Board Can. 29(7):1011-1014.

Carlson, H. Richard, and Richard E. Haight. 1976. Juvenile life of Pacific ocean perch, Sebastes alutus, in coastal fjords of southeastern Alaska: their environment, growth, food habits, and schooling behavior. Trans. Am. Fish. Soc. 105(2):191-201.

Schools of juvenile Pacific ocean perch, S. alutus, at 4 coastal fiord sites in SE Alaska [USA] were sampled by trawling. Younger juveniles (ages I and II) were over rougher substrate than older juveniles (ages III-V); both age groups were at shallower depths than adults. Lengths of juvenile perch varied between and within geographic areas,

but the pattern of variation was not consistent. The most important food items were copepods and euphausiids; younger juveniles fed more on copepods and older juveniles more on euphausiids. Feeding activity was minimal in late winter and early spring. The relative strength of year classes fluctuated widely. Some juvenile perch become demersal by age I, and the hypothesis of a 2-3 yr early pelagic existence is rejected.

Carlson, H. Richard, R. E. Haight, and K. J. Kreiger. 1977. Species composition and relative abundance of demersal marine life in waters of southeastern Alaska, 1969-77. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 76, 69 p.

Carlson, H. Richard, R. E. Haight, and K. J. Krieger. 1982. Species composition and relative abundance of demersal marine life in waters of southeastern Alaska, 1969-81. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 191, 106 p.

Carlson, H. Richard, and Richard R. Straty. 1981. Habitat and nursery grounds of Pacific rockfish, Sebastes spp., in rocky coastal areas of southeastern Alaska. Mar. Fish. Rev. 43(7):13-19.

During late July 1978 we used a small submarine to explore the rugged rocky substrate along the coast of southeastern Alaska to depths of nearly 240 m (130 fathoms). The extensive boulder fields and pinnacle-studded bottom were populated mostly by rockfish, Sebastes spp., of several species and a wide range of sizes. This untrawlable zone is a nursery area for rockfish, and dense schools of thousands of small 6-8 cm (2.5-3 inch) red rockfish were sighted at 90-100 m (49-55 fathom) depths over crevices and cover. Fish were less abundant in similar surveys of protected waters of a bay and fiord adjacent to the coastal sites.

Carr, M. A. 1983. Spatial and temporal patterns of recruitment of young-of-the-year rockfishes (genus Sebastes) into Central California kelp forest. M.A. Thesis, Calif. State Univ., San Francisco, 104 p.

Carter, E. W., and B. M. Leaman. 1981. Exploratory fishing of Bowie Seamount by the automated longliner M/V Viking Star, August 28-September 12, 1980. Can. Data Rep. Fish. Aquat. Sci. 266, 34 p.

Bowie Seamount was explored using a vessel equipped with the Mustad autoline system. Rockfishes (Sebastes spp.) were the target species and were the dominant species in the catch. Sebastes aleutianus comprised 41% of the retained catch, followed by sablefish (Anoplopoma fimbria) with 11% and S.

ruberrimus with 10%. The primary species discarded was halibut (Hippoglossus stenolepis) (69% of discard). Total retained catch was 6819 kg while discards amounted to 2,404 kg. Catch rates at the Seamount during favourable weather were higher than at inshore localities. Two days were spent fishing in the Langara Island area, due to inclement weather at the Seamount. Biological characteristics of rockfishes at the Seamount suggest that they have undergone little, if any, exploitation. The commercial and scientific importance of rockfish stocks on the Seamount is briefly discussed.

Carter, E. W., and B. M. Leaman. 1982. Exploratory fishing of Bowie Seamount by the M/V Star Wars 2 , August 11-23, 1981. Can. Data Rep. Fish. Aquat. Sci. 331, 33 p.

This report presents the results of a second exploratory cruise to Bowie Seamount, to collect biological data on rockfish stocks present. Emphasis was placed on two species, the rougheye rockfish (Sebastes aleutianus) and the yelloweye rockfish or red snapper (S. ruberrimus). Catch rates for these species increased dramatically over those of the previous cruise. Use of gillnets in addition to the standard longline gear increased the number of species obtained from 12 on the 1980 cruise, to 20 in 1981. While catch rates for rockfishes at the seamount were higher in comparison with rates observed in inshore areas, the viability of commercial fishing at the seamount would be limited by the small amount of available fishing area.

Carter, E. W., D. A. Nagtegaal, and B. M. Leaman. 1982. Rockfish tagging off southwest Vancouver Island and off northwest Washington, M/V Sun Maiden, May 3-17, 1982. Can. Data Rep. Fish. Aquat. Sci. 349, 54 p.

In May, 1982, the Pacific Biological Station conducted a yellowtail rockfish (Sebastes flavidus) tagging cruise as part of an ongoing tagging program. The purposes of this tagging were to further investigate rockfish migration, abundance, growth, and aid in validating present aging techniques. A total of 3,272 S. flavidus were tagged and released after injection with oxytetracycline, at a dosage of 50 mg/kg of body weight. Tagging data, observations on pre- and post-tagging mortality, and records of injury and condition of the fish at time of release are presented in this report.

Carter, E. W., D. A. Nagtegaal, B. M. Leaman, C. P. Archibald, and B. J. Westman. 1982. Catches and trawl locations of M/V Tenacious during the rockfish biomass survey in southern Hecate Strait (Moresby Gully), June 1981. Can. Data Rep. Fish. Aquat. Sci. 321, 71 p.

Cass, A. J., L. J. Richards, and J. R. Selsby. 1986. A summary of rockfish samples collected from the commercial handline fishery in Statistical Area 13 between July 1984 and March 1985. Can. Manuscr. Rep. Fish. Aquat. Sci. 1881, 53 p.

A biological sampling program was initiated in 1984 to establish a catch-at-age data base for the commercial rockfish (Sebastes) fishery in the inside waters of Vancouver Island. Five commercial samples were collected from Statistical Area 13 between July 1984 and March 1985. These samples were supplemented by research samples collected within the same time period.

Chatwin, B. M. 1956. Further results from tagging experiments on lingcod. Fish. Res. Board Can. Pacific Prog. Rep. 107:19-21.

Chaussade, J. 1980. Bottom fishery in the maritime provinces of Canada. Peche Marit. 1230:513-518.

Five of these species represent 85% of the catches: Gadus morhua, Melanogrammus aeglefinus, Sebastes marinus, Sebastes marinus marinus and Hippoglossus hippoglossus. The author studies their geographical repartition, behaviour and migrations. He indicates the location of fishing harbours and of fishery industry plants in the west and the east of Nova Scotia and in the region of the St. Laurent Gulf.

Chekhova, V. A. 1972. Vertical distribution of beaked redfish (Sebastes mentella Travin) on the Flemish Cap Bank. Fish. Res. Board Can. Transl. Ser. 2504.

Chekhova, V. A., and K. G. Konstantinov. 1978. Characteristics of the beaked redfish, Sebastes mentella Travin, in bottom and midwater trawl catches on Flemish Cap. Int. Comm. Northwest Atl. Fish. Sel. Pap. 3:17-21.

Fishing for S.mentella has been carried out in the Flemish Cap area since 1972 by large USSR trawlers with midwater trawls. During the period of larval extrusion in the spring (March-June), mature females concentrate in the pelagic zone where midwater trawling is more effective than bottom trawling, and differences in such biological characteristics as length composition, stages of sexual maturity and feeding are evident in the redfish taken by the two types of gear. The mating of males and females occurs in the pelagic zone in October and November, and significant differences in the biological features of redfish in the bottom and midwater trawl catches are again evident. Such differences are not as apparent in fish taken in the near-bottom and pelagic zones during the winter. Diurnal and seasonal vertical migration between the near-bottom and pelagic zones is considered an important aspect of redfish distribution. Consequently, it

is concluded that a single population of beaked redfish inhabits the Flemish Cap area, differing components of which are exploited by bottom and midwater trawls at various times of the year.

Chen, Lo-Chai. 1969. Systematics, variation, distribution and biology of rockfish of the subgenus Sebastomus (Pisces, Scorpaenidae, Sebastes). Ph.D. Thesis, Univ. Calif., San Diego, 284 p.

Chen, Lo-Chai. 1971. Systematics, variation, distribution, and biology of the subgenus Sebastomus (Pisces, Scorpaenidae, Sebastes). Bull. Scripps Inst. Oceanogr. Univ. Calif. 18, 115 p.

Chen, Lo-Chai. 1975. The rockfishes, genus Sebastes (Scorpaenidae), of the Gulf of California, including three new species with a discussion of their origin. Proc. Calif. Acad. Sci. 4th Ser. 40(6):109-141.

Chen, Lo-Chai. 1981. Scorpaenid fishes of Taiwan. J. Taiwan Museum 34:1-60.

Chen, Lo-Chai. 1985. A study of the Sebastes inermis species complex with elimination of the subgenus mebarus (Pisces:Scorpaenidae). J. Taiwan Mus. 38(2)23-38.

Three meristic types are found in Sebastes inermis of authors. These three types are also different morphometrically. They are largely sympatric but not syntopic. They seem to represent three separate species of which one is new. Since no known features can clearly differentiate some of the specimens which are meristically intermediate, no name is proposed for the undescribed species. The subgenus Mebarus is defined, and is to include S. joyneri, S. thompsoni, S. atrovirens, and the S. inermis complex.

Chen, Lo-Chai. 1986. Meristic variation in 'Sebastes' (Scorpaenidae), with an analysis of character association and bilateral pattern and their significance in species separation. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 45, 25 p.

The report presents meristic data for nearly all of the known species of Sebastes. Rudimentary caudal ray counts tend to be higher in more active species. The number of caudal rays supported by the hypurals is consistently 14, whereas the number of branched caudal rays varies between 11 and 13. Vertebral counts and most fin-ray counts tend to be lower in species or populations in warmer latitudes, except for pectoral ray counts which tend to have an opposite geographic pattern. The author proposes that intrasample associations between meristic features are evidence of sampling heterogeneity.

Chen, Lo-Chai, and V. V. Barsukov. 1976. A study of the western north Pacific Sebastes vulpes species complex (Scorpaenidae) with description of a new species. Jpn. J. Ichthyol. 23(1):1-8.

Three western North Pacific scorpaenids, including a new species, Sebastes zonatus, and 2 closely related species, S. vulpes and S. ijimae, are described and compared. Their relationships to other species of Sebastes are discussed.

Cheremisina, R., and T. Berger. 1969. The distribution and age of young redfish, Sebastes mentella and Sebastes marinus in the Barents Sea in 1968. Ann. Biol. 25(1968):247-250.

Chernyshev, V. A. 1981. Characteristics of three modifications of the method of molecular hybridization of DNA on nitro cellulose filters. Biol. Nauki. (Mosc.) 1981:105-109.

Two systems of reference species were compared. In the 1st system, a methylated DNA preparation from Cottocomephorus grewingki, obtained with heterologous bacterial (EcoRII and E. coli dam) methylases, was used. In the 2nd system, a DNA preparation of the same species was obtained by direct exchange with tritiated water. The degree of homology of DNA sequences was determined in 19 species of scorpion fishes from the genera Cottocomephorus, myoxocephalus, Cottus, Paracottus, Batrachocottus, Abyssocottus, Procottus, Comephorus, Cyclopterus, Congiopodus, Scorpaena, Sebastes and Helicolenus and was compared with that of C. grewingki.

Chernyshev, V. A. 1981. Choice of the reper species in the molecular hybridization of DNA. Zh. Evol. Biokhim. Fiziol. 17(3):241-245.

DNA homologies were studied in 20 spp. of fishes from the order Scorpaeniformes Myoxocephalus polyacanthocephalus, M. jaok, M. scorpius, Cottus kessleri, Cottocomephorus grewingki, C. inermis, Paracottus kneri, Batrachocottus multyradiatus, B. baicalensis, Abyssocottus bergianus, Procottus jeittelesi major, Comephorus baicalensis, C. dybowskii, Cyclopter lumpus, Congiopodus leucopaecilus, C. peruvianus, Scorpaena cardinalis, Sebastes capensis, Helicolenus lengerichi, H. papillosus. DNA from 2 specialized (evolutionarily more advanced) and 1 generalized (evolutionarily less advanced) species were used as the radioactive marker (reper). Hybridization with the specialized reper shows gradient of the percentage of the homologies reflecting changes in the primary structure of DNA in the course of the evolution of species, while the generalized reper shows only its own point of the offshoot.

Chikuni, S. 1968. On the scale characters of the Pacific ocean perch in the Bering Sea. 1: Some scale characters and their variations by body regions. Bull. Jpn. Soc. Sci. Fish. 34(8):681-686.

Chikuni, S. 1968. On the scale characters of the Pacific ocean perch in the Bering Sea. 2: Formation of the resting zone on the scale, its time and periodicity. Bull. Jpn. Soc. Sci. Fish. 34(9):770-774.

Chikuni, S. 1971. On the age and size relationship of the Pacific ocean perch in the northeastern Pacific. Bull. Far Seas Fish. Res. Lab. 4:27-49.

In this paper, the age-length and the age-weight relationships of the Pacific ocean perch, Sebastodes alutus, in the northeastern Pacific were studied for the sample fish collected by Japanese trawl fishery form the Kodiak area in 1966 and 1967. The study was made by means of the analysis of age mark on the scale taken from the sample fish. The results obtained are summarized in English.

Chikuni, S. 1975. Biological study on the population of the Pacific ocean perch in the Bering Sea. Bull. Far Seas Fish. Res. Lab. 12:1-119.

The stock of the Pacific ocean perch in the North Pacific began to be utilized in 1946 by small trawl fishery in the coastal waters in the North America. In early 1960's deep sea trawl fisheries by USSR and Japan began to operate the Pacific ocean perch fishery on a large scale. The total amount of annual catch, after increasing up to 520 thousands of metric tons in 1965, decreased and is about 1/4 level of the peak in recent years. The status of the stock in recent years was supposed to be in bad condition. The scientific background of the species for management of the stock, however, has not been yet arranged enough because the history of the exploitation itself is rather new. In this report, the author presents the result of the study on biology of the Pacific ocean perch in the North Pacific, and also discusses some problems on the management of the stock and possibility of the future sustainable production by the fishery.

Chikuni, S., and K. Wakaboyoshi. 1970. On the scale characters of the Pacific ocean perch in the Bering Sea. Objectivity and accuracy of age determination by scale reading. Bull. Far Seas Fish. Res. Lab. 3:205-214.

The objectivity and the accuracy of age determination of the Pacific Ocean perch, Sebastodes alutus Gilbert, by means of scale reading was studied for 279 samples collected in the Bering Sea during the period from December 1965 to April

1966. The collation between the results of the two independent trials of scale reading carried out by the experienced reader showed an agreement of 75.6%. The rate of agreement declined in proportion to the number of resting zone. Stochastical test for the deviation did not show any significance. The results carried out by the inexperienced reader greatly differ at first from the determination by the experienced reader, gradually gain higher agreement in the course of repeated trials and collations. Though the second collation between the results of the two readers showed a high percentage agreement, the deviation caused by the tendency of over count was recognized in the results of the inexperienced reader. The tendency depended mainly upon the error of discrimination of simulated annulus.

Childs, E. A. 1974. Functionality of fish muscle emulsification capacity. J. Fish. Res. Board Can. 31(6):1142-1144.

Childs, E. A., and J. N. Gaffke. 1972. Mercury content of Oregon groundfish. Fish. Bull., U.S. 71(3):713-717.

The mercury content of Oregon groundfish was determined. The mercury content of rex sole, Glyptocephalus zachirus; Dover sole, Microstomus pacificus; petrale sole, Eopsetta jordani; English sole, Parophrys vetulus; sand sole, Psettichthys melanostictus; starry flounder, Platichthys stellatus; canary rockfish, Sebastes pinniger; flag rockfish, Sebastes rubrivinctus; yellowtail rockfish, Sebastes flavidus; rougheye rockfish, Sebastes aleutianus; sablefish, Anoplopoma fimbria; lingcod, Ophiodon elongatus; Pacific hake, Merluccius productus; and arrowtooth flounder, Atheresthes stomias; was significantly lower than 0.50 ppm mercury. All spiny dogfish, Squalus acanthias, samples contained greater than or equal to 0.50 ppm. No highly significant relationship in those species appropriately examined between catch location, time of catch, weight and length of fish, or sex and mercury content was observed.

Childs, E. A., and J. N. Gaffke. 1974. Lead and cadmium content of selected Oregon groundfish. J. Food Sci. 39(4):853-854.

Chilton, D. E., and R. J. Beamish. 1982. Age determination methods for fishes studied by the groundfish program at the Pacific Biological Station. Can. Spec. Publ. Fish. Aquat. Sci. 60, 102 p.

Christensen, J. M. 1964. Burning of otoliths, a technique for age determination of soles and other fish. J. Cons. Cons. Int. Explor. Mer 29:73-81.

Clark, F. N. 1935. Channel rockfish, Sebastolobus alascanus. Calif. Fish Game 21(1):85-86.

Clark, G. H. 1935. San Francisco trawl fishery. Calif. Fish Game 21(1):22-37.

Dragging for bottom fishes in the region of San Francisco originated about 1876, when a net operated between two boats was used. This same gear, "paranzella net", was later used in the waters to the south as were other types of drag nets operated by one boat. However, this article will deal with primarily with the drag net fishery of San Francisco, which industry has always caught the greatest poundage of bottom fishes.

Clay, D. 1980. Variability in abundance of Atlantic redfish derived from Canadian summer groundfish surveys on the Scotian Shelf (1970-1979). Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 80/31, 41 p.

Redfish (Sebastes marinus mentella) were shown to have had a variable catch history ranging from 84,000 tonnes in 1951 to 12,000 tonnes in 1979. Abundance (or catch rate) was affected by depth with peaks in catch rate at 150, 250 and 350 meters by bottom temperature with a peak at 5 C and by time of day with peaks at 1200 and 2130 hrs. Length frequencies from research vessel catches show small fish (<15 cm) to be very rare, although present in occasional catches (indicating their catchability). This lack of apparent recruitment over the last decade and the dependence of the fishery on 1 and 2 age groups (30% of catch made up of 15 and/or 16 year olds) indicates an unhealthy fishery which requires careful management. A summary of 10 years of R/V survey data is provided.

Clay, D., and T. J. Kenchington. 1986. World bibliography of the redfishes and rockfishes (Sebastinae, Scorpaenidae). Can. Tech. Rep. Fish. Aquat. Sci. 1429, 303 p.

Clay, H., and D. Clay. 1980. Age, growth and removals at age of Atlantic redfish (Sebastes marinus mentella) from the Scotian Shelf. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 80/32, 9 p.

Age and growth of redfish were read by counting the annual rings (dark bands under reflected light) on broken otoliths. The otolith length and otolith weight both gave good regressions with fish length. These two otolith parameters did not, however, give a better relationship with fish age than did fish length. Age length keys for 1977 and 1978 are included.

Cleaver, F. C. 1951. Rockfish. Fisheries statistics of Oregon. Oregon Fish Comm. Contrib. 16:15-16.

Clemens, W. A., and G. V. Wilby. 1946. Fishes of the Pacific Coast of Canada. Fish. Res. Board Can. Bull. 68:1-368.

The aim of the authors has been to provide a concise and generally useful publication for both scientific and non-scientific persons interested in the marine fishes of the Pacific coast of Canada.

Clothier, C. R. 1950. A key to some southern California fishes based on vertical characters. Calif. Fish Game Fish Bull. 79, 83 p.

The identification of larval forms of marine fishes, of fish fragments found in stomach contents and of fossil fish is often difficult. As a aid to such work a study is being made of the vertebral characteristics of adult marine fishes found off the coasts of Mexico, California, Oregon and Washington and a key based on these characteristics is being constructed.

Coleman, Brady A. 1986. Pacific west coast bottom trawl survey of groundfish resources, 1980: Estimates of distribution, abundance, length and age composition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/NWC-100, 186 p.

In 1980, the Northwest and Alaska Fisheries Center completed the second in a series of bottom trawl surveys to assess Pacific whiting (Merluccius productus) and rockfish (Sebastes spp.) resources off Washington, Oregon, and California. The survey encompassed the geographic/bathymetric region from Monterey Bay, California to the northern end of Vancouver Island, British Columbia. The report includes summaries of temperature (surface and bottom) data, catch composition, distribution and relative abundance of the major groundfish species, and rankings of fish species by international North Pacific Fisheries Commission (INPFC) statistical areas and depth strata by catch per unit effort.

Collins, Jeff, Kermit D. Reppond, and Fern A. Bullard. 1980. Black rockfish, Sebastes melanops: changes in physical, chemical, and sensory properties when held in ice and in carbon dioxide modified refrigerated sea water. Fish. Bull., U.S. 77(4):865-870.

The purpose of this study was to determine changes in various properties of fillets, minced flesh and washed minced flesh from black rockfish, S. melanops, as affected by time of holding in ice or CO2 modified refrigerated seawater and frozen storage at -18.degree. C. Fish were held up to 14 days in the holding mediums and removed periodically and analyzed for changes in physical, chemical and sensory properties. The yield of fillets calculated

from the initial whole weight was unaffected by time of holding in either system. Subjective observations made during the holding periods indicated that fillets of good quality could be prepared from rockfish held for 10 days in either system. These observations were confirmed in a later series by sensory evaluation of cooked portions from the frozen trimethylamine, total volatile acid and total volatile base were of no use to measure spoilage.

Conway, D. V. P. 1980. The food of larval blue whiting, Micromesistius poutassou (Risso) in the Rockall area. J. Fish. Biol. 16(6):709-723.

Larval blue whiting of 3-42 mm total length, taken in 1967 and 1968 in the Rockall Bank area, fed almost exclusively on various stages of small crustaceans; the eggs, nauplii and copepodites of copepods, along with fewer numbers of larval euphausiids and Evadne nordmanni, formed the major proportion of the diet. The guts of the larger larvae contained a greater number of, and larger organisms than those of the small larvae. Feeding incidence was generally lower at night. There was a general increase in the weight of the gut contents as the daylight hours progressed followed by a decrease during the night. Diurnal variation in the percentage composition of the food was also demonstrated. Comparisons of the diet in the 2 yr showed that more food was consumed by almost all sizes of larvae in 1968. Blue whiting larvae may find better feeding conditions on Rockall Bank than off the Bank.

Cooper, G. A. 1973. Sebastes in continuous plankton records in 1971. Ann. Biol. 28(1971):52-53.

Cooper, G. A. 1974. Sebastes in continuous plankton records in 1972. Ann. Biol. 29(1972):38-39.

Cooper, G. A. 1975. Sebastes in continuous plankton records in 1973. Ann. Biol. 30(1973)53-54.

Cooperrider, Candis L. 1987. Commercial passenger fishing vessel landings of widow rockfish Sebastes entomelas in central California. In W. H. Lenarz, and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 49-52. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Corlett, John. 1961. Distribution of redfish larvae in the Western Barents Sea. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:188-193.

The distribution of Sebastes larvae caught in various plankton nets between the Lofoten Islands and the Bear Island Bank in 1949, 1952, 1957, and 1958 is presented.

Corlett, John. 1961. Redfish larvae from Ocean Weather Station "A" in 62 N, 33 W. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:194.

Cramer, F. 1895. On the cranial characteristics of the genus Sebastodes (rockfish). Proc. Calif. Acad. Sci. Ser. 2 5:573-610.

Cross, J. N. 1985. Fin erosion among fishes collected near a southern California municipal wastewater outfall (1971-82). Fish. Bull., U.S. 83(2):195-206.

In the Southern California Bight fin erosion is most frequently encountered among fishes collected near municipal wastewater outfalls. This paper presents an analysis of the trends in the incidence of fin erosion among fishes collected by otter trawls near Los Angeles from 1971 through 1982. About 24% of the 122 species of fish and 9% of the more than 170,000 individuals collected had the disease. Flatfish (Pleuronectidae, Bothidae, and Cynoglossidae) and rockfish (Scorpaenidae) accounted for 66% of the affected species and 99% of the affected individuals. Dover sole (Pleuronectidae: Microstomus pacificus) accounted for 89% of the affected individuals. The incidence of fin erosion was highest close to the outfalls and declined with increasing distance. The number of species with the disease declined from 1971 to 1982. The incidence of the disease also declined in two of the three most affected species (Dover sole and rex sole, Glyptocephalus zachirus).

Crozier, G. F. 1967. Carotenoids of seven species of Sebastodes. Comp. Biochem. Physiol. 23:179-184.

Culver, Brian N. 1987. Results from tagging black rockfish (Sebastes melanops) off the Washington and northern Oregon coast. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 231-239. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Cushing, D. H., and J. K. G. Harris. 1973. Stock and recruitment and the problem of density dependence. Rapp. P. V. Reun. Cons. Int. Explor. Mer. 164:142-155.

Cutting, J. A., and T. F. Roth. 1973. Staining of phospho proteins on acrylamide gel electrophoregrams. Anal. Biochem. 54(2):386-394.

Dalen, J., and O. M. Smedstad. 1978. Investigations on demersal fish at Bear Island and West-Spitsbergen in autumn 1977. Fisken. Havet. 1978(3):1-14.

This report describes the results from a survey with R.V. G.O.Sars from 10 October to 5 November 1977 on demersal fish in the area off Bear Island and West-Spitsbergen. The most abundant species in the trawl catches were blue whiting, long rough dab, prawns, cod and redfish (Sebastes mentella), which respectively amounted to 31.5%, 19.2%, 15.1%, 13.4% and 9.9% of the catches. Compared with 1976 there were more prawns and less cod, haddock and redfish caught. The most numerous year class of cod were the 1973, 1975 and 1972 year classes. Haddock was very scarce. Redfish was abundant but specimens longer than 30 cm were few in the catches.

Danke, L. 1968. Comparative research on deepwater redfish (Sebastes mentella Travin) from different water depths. Fish. Res. Board Can. Transl. Ser. 1169.

Dark, T. A., M. E. Wilkins, and K. Edwards. 1983. Bottom trawl survey of canary rockfish, Sebastes pinniger, yellowtail rockfish, S. flavidus, bocaccio, S. paucispinis, and chilipepper, S. goodei off Washington-California, 1980. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-48, 40 p.

The Northwest and Alaska Fisheries Center conducted a bottom trawl survey during July-October, 1980 off Washington, Oregon, and California as the second in a series of triennial assessments of Pacific whiting and important shelf rockfish resources. Catch per unit effort data for canary rockfish (Sebastes pinniger), yellowtail rockfish (S. flavidus), bocaccio (S. paucispinis), and chilipepper (S. goodei) were compared with data from a 1977 survey and decreases in population densities were observed in most areas. Canary and yellowtail biomass estimates were greatest in the International North Pacific Fishery Commission (INPFC) Vancouver and Columbia area and about equally distributed between the two areas. Age and length frequencies are presented by INPFC area.

Dark, Thomas A., Herbert H. Shippen, and Kenneth D. Waldron. 1970. Pacific ocean perch and hake studies off the west coast. Comm. Fish. Rev. 32(3):25-30.

Davenport, D. 1966. Color variant of bocaccio (Sebastes paucispinis) in British Columbia waters. J. Fish. Res. Board Can. 23(12):1981.

Davenport, D. 1985. Biological observations of the foreign hake fishery for 1983. Can. Manuscr. Rep. Fish. Aquat. Sci. 1811, 20 p.

Non-North American fisheries off Canada's Pacific coast during 1983 were limited to a trawl fishery for Pacific hake (Merluccius productus) by Poland and a cooperative trawl fishery for hake by Poland and the U.S.S.R. Quotas were 12,500 t national and 12,500 t cooperative for Poland, and 17,000 cooperative for the U.S.S.R. Observer effort centered on total catch and species content estimation. In the combined fisheries, observer figures show hake accounting for 98.2% of the total catch of 40.9 thousand tonnes, of this, 12.6 thousand tonnes or 31% was monitored. Of secondary importance were rockfish (Sebastes sp.) 590 t, wallege pollock (Theragra chalcogramma) 31 t, spiny dogfish (Squalus acanthias) 173 t and Pacific salmon (Oncorhynchus sp.) 8358 pieces.

Davenport, D., W. R. Harling, M. S. Smith, and S. J. Westrheim. 1971. Age composition of Pacific Ocean perch (Sebastes alutus) in G. B. Reed trawl catches, 1963-1969. Fish. Res. Board Can. Manuscr. Rep. 1132, 54 p.

Davenport, D., M. S. Smith, O. B. G. Kristiansen, J. E. Peters, and S. J. Westrheim. 1971. G. B. Reed groundfish cruise no. 71-1, June 9 to 29, 1971. Fish. Res. Board Can. Tech. Rep. 269, 27 p.

Davis, Jackson, and Edwin B. Joseph. 1964. Southern record of Sebastes marinus, ocean perch. Chesapeake Sci. 5:212.

Day, D., and C. R. Forrester. 1971. A preliminary bibliography on the trawl fishery and groundfish of the Pacific coast of North America. Fish. Res. Board Can. Tech. Rep. 246, 91 p.

Day, Donald S., and William G. Pearcy. 1968. Species associations of benthic fishes on the continental shelf and slope off Oregon. J. Fish. Res. Board Can. 25(12)2665-2675.

Four species associations of benthic fishes found off the coast of Oregon within the depth interval from 40 to 1829 m were characterized by two or three most abundant species, depth range and average sediment type. Sixty-seven species of bottom fishes representing 21 families were collected, but 86% of the total number of fishes were from the families Pleuronectidae, Scorpaenidae, and Bothidae.

Day, L. R. 1961. Summer surface distribution of redfish larvae in ICNAF Subarea 4, 1954-1955. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:195-198.

Surveys for fish eggs and young fish were carried out in the Bay of Fundy, Scotian Shelf, and the Gulf of St. Lawrence areas of north-west Atlantic waters (ICNAF Subarea 4) in 1954 and 1955 from the Fisheries Research Board of Canada, Biological Station at St. Andrews, N.B. This paper is based on the collections of larvae of redfish (Sebastes marinus L.) and deals with their distribution, abundance, and size.

Debuen, F. 1960. Nota preliminar sobre los paces del genero Sebastodes en la fauna Chileno. Reuta Chil. Hist. Nat. 55:3-26.

De Groot, S. J. 1975. Dutch observations on rare fish in 1973. Ann. Biol. 30(1973):209-210.

DeLacy, A. C., B. S. Miller, and S. F. Borton. 1972. Checklist of Puget Sound fishes. Univ. Wash. Div. Mar. Resour. WSG 72-3, 47 p.

DeLacy, Allan C., and Robert L. Dryfoos. 1962. Maturation and the young of rockfishes (Sebastodes). Res. Fish. Annu. Rep. Coll. Fish. Univ. Wash. 139:22-23.

Observations on the stage of maturation and collections of larvae from within the adults were made on eighteen species of rockfish landed at the commercial fish markets in Seattle during July and August, 1961.

DeLacy, Allan C., Charles R. Hitz, and Robert L. Dryfoos. 1964. Maturation, gestation, and birth of rockfish (Sebastodes) from Washington and adjacent waters. Wash. Dep. Fish. Fish. Res. Pap. 2(3):51-67.

A study of the reproductive processes of female rockfish found in Puget Sound and along the coast of Washington and adjacent areas was conducted in winter of 1959, continues into late spring of 1960, and resumed during the summer of 1961 by the College of Fisheries, University of Washington. Objectives of this study were to determine the time the parents carried their young, to describe the young at birth, and to estimate the fecundity of species common to Port Orchard, Washington.

Demory, R. L., and H. A. Bailey. 1967. Length-frequency and age-length-frequency distributions for dover sole, english sole, petrale sole, and Pacific ocean perch landed in Oregon, 1948-1965. Oregon Fish Comm. Invest. Rept. 6:53.

Demory, R. L., M. J. Hosie, N. TenEyck, and B. O. Forsberg. 1975. Marine resources surveys on the continental shelf off Oregon, 1971-74. Oregon Dept. Fish. Wildlife Completion Rep., July 1, 1971 to June 30, 1975. 49 p.

Demory, Robert. 1987. The widow rockfish fishery in Oregon 1963-1980. In W. H. Lenarz, and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 9. U.S. Dep. Commer. NOAA Tech. Rep. NMFS 48.

Demory, Robert L., William H. Barss, J. T. Golden, and J. G. Robinson. 1980. Groundfish assessment, regional planning Pacific Ocean perch, other rockfish, lingcod and English sole tagging, and shrimp abundance by-catch studies. Oreg. Dep. Fish Wildlife Comp. Rep. Jun 1980, 94 p.

Major activities during October 1977 to October 1979 included participation and analysis in parts of two major rockfish surveys in cooperation with other State agencies and the National Marine Fisheries Service. English sole (Parophrys vetulus) and lingcod (Ophiodon elongatus) tagging in PMFC Areas 2B and 2C off Oregon, and pink shrimp (Pandalus jordani) abundance and bycatch work. Primary objective of rockfish surveys was stock assessment. Goals were to (1) assess abundance and distribution of rockfish species, especially Sebastes alutus in INPFC Columbia Vancouver areas. 2) determine change in precision of 1977 and 1979 biomass estimates caused by stratification of sampling units and allocations of sample stations (tows) and (3) to determine whether additional option tows based on vessel captains' experience and knowledge of grounds had any significant effect on the biomass estimate. Secondary objectives were to determine age and size composition of Pacific ocean perch and determine species composition of slope rockfish in the same area.

Dewees, Christopher M. 1970. Population dynamics and fishing success of an artificial reef in Humboldt Bay, California. M.S. Thesis, Humboldt State Univ., Arcata, Calif. 74 p.

Dewees, Christopher M., and Daniel W. Gotshall. 1974. An experimental artificial reef in Humboldt Bay, California. Calif. Fish Game 60(3):109-127.

In October 1968, an artificial reef constructed of used truck tires was placed in Southport Channel of Humboldt Bay, California. Studies were conducted to determine floral and faunal species composition and relative abundance, and to measure fishing success on the reef. Estimates of fish populations revealed that the most abundant fishes were kelp greenling, followed by copper and black rockfish.

DiDonato, Gene. 1969. The 1968 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 5, 43 p.

DiDonato, Gene. 1970. The 1969 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 9, 43 p.

DiDonato, Gene, and Brad Pattie. 1968. The 1965-1967 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 2, 111 p.

Dietrich, G., H. Aurich, and A. Kotthaus. 1961. On the relationship between the distribution of redfish and redfish larvae and the hydrographical conditions in the Irminger Sea. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:124-139.

Doboszynska, B., R. Otta, and E. Lipka. 1978. Influence of various forms of vitamin D isolated from fish oils on calcium metabolism in rats. Bull. Acad. Pol. Sci. Ser. Sci. Biol. 26(11):791-796.

From both cod-liver and Norway haddock Ocean perch [Sebastes marinus and S. marinus mentella] oils 2 substances similar to vitamin D were isolated by chromatographic methods and tested biologically on rats. The different influence of several substances on the increase of blood Ca level and on the calcification of bones was established.

Dobrovolov, I. S. 1986. Isoelectric focusing of the proteins of the north Atlantic rockfishes Sebastes marinus and Sebastes mentella Pisces Scorpaenidae. C. R. Acad. Bulg. Sci. 39(4):135-138.

Dojiri, Masahiro. 1981. Copepods of the families Lernaeopodidae and Naobranchiidae parasitic on fishes from southern California inshore waters. J. Crustacean Biol. 1(2):251-264.

Three morphological forms of the female of Neobrachiella robusta from 3 spp. of Sebastes [S. semicinctus, S. miniatus and S. dallii] are described along with the 1st description of the male. Three new species of parasitic copepods are described and illustrated, including Clavella embiotocae from the gill filaments of Embiotoca jacksoni, Rhacochilus vacca and Phanerodon furcatus; N. microsoma from the gill filaments of Genyonemus lineatus, Citharichthys stigmaeus, C. sordidus and C. xanthostigma; and N. scorpaenae from the gill filaments of Scorpaena gluttata. All copepods collected parasitized fishes caught in benthic trawls at the Orange County sewer outfall, California, between Oct. 1975 and Aug. 1976.

Dollfus, R. P. 1974. On a cestode pseudophyllid parasitizing Sebastes marinus teleost (Scorpaenidae) of the east coast of Greenland. Bull. Mus. Natl. Hist. Nat. Zool. 137:153-156.

Dorn, Philip, Llew Johnson, and Cheryl Darby. 1979. The swimming performance of nine species of common California inshore fishes. Trans. Am. Fish. Soc. 108(4):366-372.

The swimming performance of 9 spp. of southern California [USA] fish was tested in a flume at velocities of 42-117 cm/s. Genyonemus lineatus demonstrated the fastest continuous swimming ability of 61 cm/s, Hypsurus caryi the slowest, 42 cm/s. Embiotocids [5] tested demonstrated similar continuous swimming speeds ranging from 42-52 cm/s. Burst swimming abilities were in excess of 100 cm/s for 4 of 5 spp. tested; G. lineatus attained 137 cm/s. Chromis punctipinnis was the best swimmer relative to body length (BL), reaching 5.9 BL/s continuous and 11.1 BL/2nd burst swimming speeds. Gravid Hypsurus caryi had a lesser swimming ability than nongravid and male individuals of the species. Other taxa discussed include: Cymatogaster aggregata, Hyperprosopon argenteum, Phanerodon furcatus, Embiotica jacksoni, Sebastes serranoides and S. mystinus.

Doubleday, W. G., D. Rivard, and W. D. McKone. 1984. Estimation of partial recruitment and yield per recruit for an otter trawl fishery for deepwater redfish. N. Am. J. Fish. Manage. 4(1):15-31.

The Canadian deepwater redfish (Sebastes mentella) fishery in the Atlantic ocean tends to be concentrated in a limited depth range to maximize catch rates and optimize size composition of the catches that vary with depth. In this study, selectivity factors empirically determined for various bottom trawl mesh sizes and information from research vessel surveys on the composition of deepwater redfish catches in different depth zones were analysed to estimate partial recruitment factors for subsequent yield calculations.

Dunn, J. R., and C. R. Hitz. 1969. Oceanic occurrence of black rockfish (Sebastodes melanops) in the central North Pacific. J. Fish. Res. Board Can. 26(11):3094-3097.

Adult rockfish of the genus Sebastodes are generally considered to be demersal fish of the continental shelf. A pelagic existence has been suggested for the adult forms of certain dark rockfishes. A single spent Sebastodes melanops was captured in a surface gillnet on February 14, 1969, over 240 nautical miles south of the Alaska Peninsula. Other offshore captures of this species are reported and available evidence suggesting a pelagic existence for the black rockfish is examined.

Dushchenko, V. V. 1986. Polymorphism of NADP-dependent malate dehydrogenase in Sebastes mentella Travin (Scorpaenidae) from the Irminger Sea north Atlantic Ocean. Vopr. Ikhtiol. 26(3):522-524.

A series of muscle proteins and enzymes of deepwater redfish (Sebastes mentella) was studied by electrophoresis in poyacrylamid gel. Majority of proteins examined were monomorphic (myogens, non-specific esterases, alcohol dehydrogenase and glucosephosphate dehydrogenase). Significant polymorphism was revealed in the NADP-dependent malate dehydrogenase (malic enzyme). This locus included at least 2 alleles. No reliable differences in genetic-biochemical structure in 6 samples analyzed were recorded.

Dygert, Peter H. 1986. Management implications of variability in reproduction and growth of commercial marine fishes (rockfish, anchovy, sole). Ph.D. Thesis, Univ. Washington, Seattle, 275 p.

Ebeling, Alfred W., and Richard N. Bray. 1976. Day versus night activity of reef fishes in a kelp forest off Santa Barbara, California. Fish. Bull., U.S. 74(4):703-717.

Ebeling, Alfred W., Ralph J. Larson, William S. Alevizon, and Richard N. Bray. 1980. Annual variability of reef-fish assemblages in kelp forests off Santa Barbara, California. Fish. Bull., U.S. 78(2)361-377.

Echeverria, Tina. 1980. Sexual dimorphism in four species of rockfish. M.S. Thesis, Calif. State Univ., San Francisco, 70 p.

Echeverria, Tina Wyllie. 1986. Sexual dimorphism in four species of rockfish genus Sebastes (Scorpaenidae). Environ. Biol. Fishes 15(3):181-190.

Sexual dimorphisms, and factors influencing the evolution of these differences, have been investigated for four species of rockfish: Sebastes melanops, S. flavidus, S. mystinus, and S. serranoides. These four species, which have similar ecology, tend to aggregate by species with males and females staying together throughout the year. In all four species adult females reach larger sizes than males, which probably relates to their role in reproduction. The number of eggs produced increases with size, so that natural selection has favored larger females. It appears males were subjected to different selective pressures than females. It was more advantageous for males to mature quickly, to become reproductive, than to expend energy on growth. Other sexually dimorphic features include larger eyes in males of all four species and longer pectoral fin rays in males of the three piscivorous species: S. melanops, S. flavidus, and S. serranoides.

Echeverria, Tina, and William H. Lenarz. 1985. Conversions between total, fork, and standard lengths in 35 species of Sebastes from California. Fish. Bull., U.S. 82(1):249-251.

Efremenko, V. N., and L. A. Lisovenko. 1972. Morphological features of intraovarian and pelagic larvae of some Sebastodes species inhabiting the Gulf of Alaska. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeastern Pacific. Part V. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform. Serv., Springfield, VA, USA. TT 71-50127:267-286.

Ehrich, S. 1976. Investigations on productivity in the Pacific coastal waters of Mexico. Forschungsber. Bundesminist. Forsch. Technol. (Meeresforsch.) Feb 1976, (M76-02).

Investigations in the coastal waters of the northeast Pacific between 14 and 46N from 10.10.74 to 25.5.75 should give primarily information about the rentability of an operation of German trawlers in this area. At the same time the hydrography, the plankton, the fish stocks and the benthonic fauna of the region are studied in the interests of Mexican coastal fisheries. This paper reports about the activities at sea, about the hydrographic conditions during the expedition and about the growth of the hake Merluccius productus. Some parameters to describe the stock of hake and the first results of the investigation on the rockfish Sebastes entomelas are given. The planned investigations of the final part of this project are described.

Ehrlich, Karl F., J. Myron Hood, Gerald Muszynski, and Gerald E. McGowen. 1979. Thermal behavioral responses of selected California littoral fishes. Fish. Bull., U.S. 76(4):837-850.

Horizontal temperature gradients [2] were used to measure behavioral responses to temperature of various life stages of 16 spp. of temperate marine fish Cymatugaster aggregata, Damalichthys vacca, Embiotica jacksoni, Cheilotrema saturnum, Citharichthys stigmaeus, Oxyjulis californica, Paralabrax maculatofasciatus, Scorpaena guttata, Atherinops affinis, Leuresthes tenuis, Hypsoblennius gilberti, Oxylebius pictus, Paralabrax clathratus, Sebastes serranoides, Paralichythys californicus Pleuronichthys coenosus from southern California. Behavioral responses to thermal gradients were classified using 8 experimental parameters: initial, mean, modal and final selected temperatures; range of selected temperatures; skewness; kurtosis; and the degree of dispersion between individuals.

Eigenmann, C. H. 1892. On the viviparous fishes of Pacific coast of North America. Bull. U. S. Fish Comm. 12:381-478.

During a stay of nearly three years on the coast of California at San Francisco and San Diego, viviparous fishes were daily seen in the markets and a large amount of material illustrating their development was collected. Few adult specimens of Embiotocidae were preserved, since they were already well represented in most museums. The revision of this family is largely based on collections make by Drs. Jordan and Gilbert. Of the Scorpaenidae, more specimens were collected, since many new forms were discovered.

Eigenmann, C. H. 1893. The fishes of San Diego, California. Proc. U.S. Natl. Mus. 15:123-178.

Eigenmann, C. H., and C. H. Beeson. 1893. Preliminary note on the relationship of the species usually united under the generic name Sebastodes. Amer. Nat. 27:668-671.

Description of species is given.

Eigenmann, C. H., and C. H. Beeson. 1894. A revision of the fishes of the subfamily Sebastinae of the Pacific Coast of America. Proc. U.S. Natl. Mus. 17:375-407.

The primary object of the present paper is to present analytical keys, synonymy, and bibliography of the viviparous genera of Pacific Sebastinae. For the sake of convenience the oviparous genera of Sebastinae have also been added. The Scorpaenidae fall naturally into two groups or subfamilies: the tropical Scorpaenidae with twenty-four vertebrae, of which Scorpaena is found in all tropical seas; and the much more numerous Sebastinae inhabiting both of the temperate and both of the colder zones and which invariably have an increased number of vertebrae. While this subfamily has a wide distribution, the number of species found in the north temperate regions of the Pacific Ocean is much larger than that of all other regions combined.

Eigenmann, C. H., and R. S. Eigenmann. 1889. Notes from the San Diego Biological Laboratory. The fishes of Cortez Banks. West Amer. Sci. 6:123-132, 147-150.

Eigenmann, C. H., and R. S. Eigenmann. 1889. Notes of some California fishes, with descriptions of two new species. Proc. U.S. Nat. Mus. 11:463-466.

Description of species is given.

Eigenmann, C. H., and R. S. Eigenmann. 1890. Additions to the fauna of San Diego. Proc. Calif. Acad. Sci. Ser. 2. 3:1-24.

Eigenmann, C. H., and R. S. Eigenmann. 1890. Description of a new species of Sebastodes. Proc. Calif. Acad. Sci., Ser. 2, 3:36-38.

Sebastichthys flavidus is described.

Eigenmann, C. H., and R. S. Eigenmann. 1892. A catalog of the fishes of the Pacific coast of America north of Cerros Island. Ann. New York Acad. Sci. 6(6):349-358.

Einarsson, H. 1961. The fry of Sebastes in Icelandic waters and adjacent seas. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:199-200.

Einarsson, H. 1961. Larval studies and larval distribution. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:167-168.

Elliot, R. P., and K. L. Osterhaug. 1947. Palatability of Pacific rockfish fillets. U. S. Fish Wildlife Serv. Fish. Leaf. 264, 5 p.

Eschmeyer, William N. 1969. A systematic review of the Scorpionfishes of the Atlantic Ocean (Pisces: Scorpaenidae). Occas. Pap. Calif. Acad. Sci. 79:1-143.

Explains presence of Sebastes in extreme North Atlantic by a trans-artic movement.

Eschmeyer, William N., Earl S. Herald, and Howard Hammann. 1983. Field guide to Pacific Coast fishes of North America from the Gulf of Alaska to Baja California. Houghton Mifflin Co., Boston, MA 336 p.

Eschmeyer, William N., and J. C. Hureau. 1971. Sebastes mouchezi, a senior synonym of Helicolenus tristanensia, with comments on Sebastes capensis and zoo-geographical considerations. Copeia 1971(3):576-579.

Evermann, B. W., and E. L. Goldsborough. 1907. Description of a new rockfish of the genus Sebastodes from California. Proc. U. S. Nat. Mus. 31:651-652.

In connection with our recent studies of the fish fauna of Alaska and the geographic distribution of the species of fishes known to occur in the waters of that district, we examined and studied many specimens in various collections from the coasts of Washington, Oregon, and California. Among those from the California coast we find a species of Sebastodes which appears to us to be new. The description of the type is here given, together with a drawing by Mr. A. H. Baldwin.

Evermann, B. W., and E. L. Goldsborough. 1907. The fishes of Alaska. Bull. U.S. Bur. Fish. 26:219-360.

Faber, Daniel J. 1976. Hyponeustonic fish larvae in the Northumberland Strait during summer 1962. J. Fish. Res. Board Can. 33(5):1167-1174.

A neuston net with mesh openings of 1.3 mm was towed in the surface waters of the N basin of the Northumberland Strait at irregular intervals from mid-June-mid-Sept. 1962. Fifteen genera of teleost larvae belonging to 11 families were collected. Of these the following 8 spp. occurred in regular abundance and were termed abundant larvae: sand lance, Ammodytes americanus; radiated shanny, Ulvaria subbifurcata; lumpfish, Cyclopterus lumpus; fourbeard rockling, Enchelyopus cimbrius; Atlantic mackerel, Scomber scombrus; cunner, Tautogolabrus adspersus; white hake, Urophycis tenuis; and Atlantic herring, Clupea harengus harengus. Larvae were collected in variable numbers, with the sampling data suggesting they were aggregated in the water. The total abundance of all larvae was about 50 larvae/tow except for a peak in July. The regular appearance of the abundant larvae resulted in unique combinations of spawning and hatching times for each species. The larvae of spring spawners were present in June and were gradually replaced by the larvae of summer spawners. The remaining genera collected were Menidia, Scophthalmus, Lipaieis, Gadus, Hippoglossoides, Pseudopleureonectes and Sebastes.

Fadeev, N. S. 1968. Migration of Pacific ocean perch. Fish. Res. Board Can. Transl. Ser. 1447.

Feder, H. M., C. H. Turner, and C. Limbaugh. 1974. Observations on fishes associated with kelp beds in southern California. Calif. Fish Game Fish Bull. 160:1-140.

Feldman, Gene C., and Craig S. Rose. 1981. Trawl survey of groundfish resources in the Gulf of Alaska, summer 1978. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/NWC-13, 44 p.

The results of a resource assessment survey of groundfish in the eastern and central Gulf of Alaska are presented with emphasis on data most relevant to the needs of the commercial fishing industry. Species encountered in highest abundance include walleye pollock, Theragra chalcogramma, and Pacific cod, Gadus macrocephalus, in the vicinity of Kodiak Island, as well as several species of rockfish, Sebastes spp., off southeastern Alaska. Information on principal species occurring in the catches includes catch rates, depth distributions, size compositions, and locations of highest catch rates.

Field, Lawrence J. 1984. Bathymetric patterns of distribution and growth in three species of nearshore rockfish from the southeastern Gulf of Alaska. M.S. Thesis, Univ. Wash., Seattle, 88 p.

Finley, K. J., and E. J. Gibb. 1982. Summer diet of the narwhal (Monodon monoceros) in Pond Inlet, northern Baffin Island. Can. J. Zool. 60(12):3353-3363.

Stomach contents of 73 narwhals (M. monoceros) taken in Pond Inlet during June-Sept. 1978-1979 were examined. Arctic cod (Boreogadus saida) and Greenland habitat (Reinhardtius hippoglossoides) comprised 51 and 37%, respectively, of the diet by weight, Arctic cod contributed 57% in 1978 but only 29% in 1979. Squid (Gonatus fabricii) beaks were abundant but not representative of recent intake. Deeper fish (halibut, redfish (Sebastes marinus), and polar cod (Arctogadus glacialis)), found primarily in male narwhals, indicate a deep diving (> 500 m) capability.

Fiscus, Clifford H., and Hiroshi Kajimura. 1965. Pelagic fur seal investigations, 1964. U.S. Fish. Wildl. Serv., Spec. Sci. Rep. Fish. 522, 42 p.

Fitch, John E. 1964. The fish and fauna of the Playa del Rey locality, a southern California marine Pleistocene deposit. Los Ang. Cty. Mus. Contrib. Sci. 82, 35 p.

Reference includes Sebastes diploproa.

Fitch, John E. 1964. Sebastodes phillipsi, a new Scorpaenid fish from California waters. Copeia 1964(3):525-529.

A new California rockfish of the family Scorpaenidae is described as Sebastodes phillipsi. This little rockfish is found from Monterey Bay south to Santa Catalina Island, usually in water deeper that 800 ft (243 m.). Because of this habit of changing color when boated, it is given the common name of "chameleon rockfish.".

Fitch, John E. 1972. Fish remains, primarily otoliths, from a Coastal Indian midden (SLO-2) at Diablo Cove, San Luis Obispo County, California. San Luis Obispo Cty. Archaeol. Soc. Occas. Pap. 7:101-120.

Fitch, John E., and S. A. Schultz. 1978. Some rare and unusual occurrences of fishes off California and Baja California. Calif. Fish Game 64(2):73-92.

Nineteen fish species captured off California [USA] and Baja California [Mexico] were studied. Among these, 12 spp. (Benthodesmus eloncouesii, Epinephelus niveatus, Gadus macrocephalus, Lepidocybium flavobrunneum, Myliobatis longirostris, Pleurogrammus monopterygius, Pteraclis

aesticola, Ruvettus pretiosus and Taractichthys steindachneri) rarely have been seen in these waters, but only 7 of these 12 represent new locality records. Three are reported here because of their large size (Acipenser medirostris, Priacanthus cruentatus, and Zu cristatus), but Z. cristatus also is a rarely seen species. Two occurrences (Psettichthys melanostictus and Sebastes nebulosus) extended geographical ranges for commonly taken species. One fish (Elops affinis) was new to the outer coast of California and 1 (Paralabrax auroguttatus) was new to California's marine fauna.

Fitzpatrick, C., and R. J. Miller. 1979. Review of spawning times and locations for some commercial finfish on the Newfoundland and Labrador coasts. Can. Fish. Mar. Serv. Tech. Rep. 905, 20 p.

Literature on spawning times and locations was reviewed for seven important commercial finfish species. The offshore banks from northern Labrador (60N) to the southern Grand Bank (42N) and west to St. Pierre Bank are included. Only cod (Gadus morhua) and redfish (Sebastes marinus) spawning were noted north of Hamilton Bank, but extended over the full latitudinal range considered. In ICNAF Subarea 3 spawning is active earliest on the Flemish Cap with cod and redfish spawning by April. By June all seven species are spawning. Yellowtail peak spawning at the end of June is the latest of the seven species. The greatest concentration of spawning is south of 45N on the Grand Bank, Green Bank, and St. Pierre Bank.

Follett, W. I. 1952. Annotated list of fishes obtained by the California Academy of Sciences during six cruises of the U.S.S. Mulberry conducted by the United States Navy off central California in 1949 and 1950. Proc. Calif. Acad. Sci. Ser. 4. 27(16):399-432.

On August 19, 1949, the California Academy of Sciences and the United States Navy executed a contract (No.N9 onr 94400 of the Office of Naval Research) which provided for the joint participation the two institutions in a series of explorations of the waters adjacent to the coastline of central California. This paper deals with all the fishes obtained during the six cruises. The habitats explored were those from the surface, through intermediate stages, to the sea-bottom, in depths of 4.5 to 1100 fathoms, and at offshore distances of 0.7 to 46.6 miles, all within 60 miles of San Francisco.

Follett, W. I. 1970. Benthic fishes cast ashore by giant waves near Point Joe, Monterey County, California. Proc. Calif. Acad. Sci. 37(15):473-488.

Follett, W. I., and David G. Ainley. 1976. Fishes collected by pigeon guillemots, Cephus columba (Pallas), nesting on Southeast Farralon Island, California. Calif. Fish Game 62(1):28-31.

Twenty-four species of marine fishes obtained from nests of pigeon guillemots during 1971-1974 on Southeast Farallon Island, California, increase to 42 the number of species of fishes known as prey of pigeon guillemots. Five species of Sebastes are mentioned.

Follett, W. I., and L. J. Dempster. 1967. Partial melanabinism in a Scorpaenid fish, Sebastodes melanostomus eigemann and eigemann, from Monterey Bay, California, with selected references to melanism and albinism in fishes. Wasmann J. Biol. 24(2):189-198.

Forrester, C. R. 1969. Estimated annual catches of Pacific ocean perch, by nation, 1959-1968. Fish. Res. Board Can. Manuscr. Rep. 1069, 2 p.

Forrester, C. R., and M. S. Smith. 1973. Species composition of rockfish in catches by Canadian commercial and research vessels in Queen Charlotte Sound. Fish. Res. Board Can. Manuscr. Rep. 1258, 11 p.

Fowler, H. W. 1923. Records of West Coast Fishes. Acad. Nat. Sci. Philadelphia 75:279-301.

Fraidenburg, M. 1976. The 1974 recreational fisheries at four jetty and breakwater sites in the Gray's Harbor and Columbia River mouth areas. Wash. Dep. Fish. Tech. Rep. 18, 12 p.

During the summer and early fall of 1974, a study of selected jetty and breakwater fisheries in the Columbia River-Grays Harbor areas of Washington was completed. Objectives were to estimate total catch and effort levels and evaluate potential of a voluntary "self" creel census in this work. Fishing effort at four sites was estimated to total 38,475 angler trips in 1974 but total catches could not be accurately assessed. Surfperch and rockfish species were the primary components in the landings.

Fraidenburg, M. E., N. A. Lemberg, and D. K. Kimura. 1979. Factors influencing the availability of shelf rockfish (Sebastes sp.) to trawl and hydroacoustic gear. Wash. Dep. Fish. Prog. Rep. 79, 38 p.

As part of planning studies conducted prior to the comprehensive 1977 rockfish survey, the Washington State Department of Fisheries and the National Marine Fisheries Service conducted a joint research cruise to examine factors

influencing shelf rockfish availability. The experimental objectives were to: 1. examine diel availability to otter trawls; 2. examine diel availability of nekton to hydroacoustic sampling; and 3. compare density estimates from trawl and hydroacoustic sampling techniques.

Fraidenburg, Michael E. 1980. Biological statistics of yellowtail rockfish (Sebastes flavidus, Ayres) in the northeast Pacific. Wash. Dep. Fish. Tech. Rep. 55, 64 p.

Yellowtail rockfish (S. flavidus, Ayres) biological data collected from northern California [USA] to Queen Charlotte Sound, British Columbia [Canada] is summarized. Data on length-weight, age and length composition, growth, total and natural mortality, and size-related availability changes to trawls are presented and discussed. Age-related availability changes were demonstrated to exist with large individuals less available to trawl gear. The effects of such a change were greatest for females. The length-weight functions (in cm and kg) were calculated for males and females. The von Bertalanffy growth parameters were calculated. Size and age composition was observed to vary latitudinally with younger fish relatively more important in the southern areas. New exploitation of yellowtail rockfish in 1 area off the Washington [USA] coast afforded an opportunity to explore mortality estimates for this species. Although total instantaneous mortality estimates were difficult to interpret, instantaneous natural mortality was estimated to lie in the 0.2-0.3 range, and a preliminary point estimate is considered to be 0.25.

Fraidenburg, Michael E. 1980. Yellowtail rockfish, Sebastes flavidus, length and age composition off California, Oregon, and Washington in 1977. Mar. Fish. Rev. 42(3-4):54-56.

There was evidence of a north to south cline of decreasing size and age. Length composition data showed strong single modes for males and many modes over a broader size range for females. Age composition data showed two prominent modes at 8-10 and 13-14 yr old. No major differences in the age-length relationship were noted between areas using data from the survey and data from market samples from Washington's trawl fishery. Data for all areas were pooled to fit a common growth curve for the northern California to Queen Charlotte Sound, British Columbia, region.

Fraidenburg, Michael E. 1981. First estimates of natural mortality for yellowtail rockfish. Trans. Am. Fish. Soc. 110(4):551-553.

New exploitation of yellowtail rockfish, S. flavidus, in 1 area off the Washington [USA] coast allowed first estimates of instantaneous natural mortality rate to be made for this species. Most values calculated from catch curves and survival data fall in the 0.2-0.3 range; the best point estimate is 0.25.

Fraidenburg, Michael E., J. E. Smith, W. H. Barss, and T. Jow. 1977. Minimum estimates of the all nation removals North American trawl species composition and catch per unit of effort for other rockfish in the northeastern Pacific Ocean. Wash. Dep. Fish. Tech. Rep. 34, 31 p.

This report provides background data on the fishery for Northeastern Pacific rockfish, other than Pacific ocean perch, Sebastes alutus, from British Columbia to California. Available data from Canada, United States, U.S.S.R, Japan, and Poland for the years 1960 to 1975 provide minimum estimates of total removals and North American trawl CPUE and species composition of "Other Rockfish" from Charlotte, Vancouver, Columbia, Eureka, Monterey, and Conception International North Pacific Fisheries Commission Areas. The removals by U.S.S.R., Japan, and Poland, in addition to removals by Canada and the U.S., have affected abundance changes in key species in the Charlotte, Vancouver, Columbia, Eureka, and Monterey areas. All nation removals from all areas except the Vancouver area have declined in 1975 from high catches of previous years. Data on the 1971-1975 North American "Other Rockfish" landings by non-trawl gears are also presented.

Francis, R. C. 1986. Two fisheries biology problems in west coast USA groundfish management. N. Am. J. Fish. Manage. 6(4):453-462.

Frank, Kenneth T., and William C. Leggett. 1982. Coastal water mass replacement: its effect on zooplankton dynamics and the predator-prey complex associated with larval capelin (Mallotus villosus). Can. J. Fish. Aquat. Sci. 39(7):991-1003.

Onshore winds induced rapid water mass exchange in coastal Newfoundland resulting in the replacement of cold, high-saline, predator-laden waters with warmer, less-saline waters in which the abundance of an important fraction of the predator community was reduced 3-20-fold and zooplankton densities in the edible size fraction were increased 2-3-fold. In situ enclosure experiments indicate that the synchronous emergence of larval capelin during onshore

winds, coupled with the reduced predator density at this time, results in predator satiation. Wind-induced elevations of the biomass of the edible zooplankton size fraction can produce 5-fold increases in the daily growth rate of larval capelin. Capelin larvae thus initiate their drift and 1st feeding in a wind-induced safe site. The abundance of eggs and larvae of 11 other marine fish species Sebastes marinus, included.

Fraser, J. H. 1972. Introduction to plankton. Ann. Biol. 27(1970):58.

Frederikhsen, A. V. 1977. Identification of species of the genus Sebastes from bones found in the stomach of the spermwhale (Physeter catadon). J. Ichthyol. 17(3):483-487.

Species of rockfish comprising the diet of the sperm whale were determined on the basis of bone remains in its stomach. Using drawings from an article by E.I. Betesheva (1961) the rockfish bones found in the stomach of a sperm whale caught in the region of the northern Kuril Islands (Russian SFSR, USSR) were identified as belonging to a large specimen of S.iracundus, rather than S. borealis, S. flameus and S. aleutianus found in the same range.

French, Robert, Jr., Russell Nelson, and Janet Wall. 1981. The foreign fisheries off Washington, Oregon, and California, 1977-78. Mar. Fish. Rev. 43(5):36-44.

United States observers placed aboard foreign fishing vessels off the coast of California, Oregon, and Washington monitored the fishing operation during 1977 and 1978. It was estimated that Soviet and Polish fleets took approximately 130,000 t of fish in 1977 and 99,000 t in 1978. About 98% of the catch consisted of Pacific whiting, Merluccius productus, the target species It was also estimated that an incidental catch of around 14,600 Pacific salmon, Oncorhynchus spp., was taken in 1977 and 6,000 Pacific salmon were taken in 1978, mostly chinook salmon, O. tshawytscha. Other important commercial species of fish caught were from 500 to 700 t of rockfish annually and 2-4 t of flatfish.

Frey, H. W. 1971. California's living marine resources and their utilization. Calif. Dept. Fish Game, Resources Agency. 148 p.

Fricke, H., and J. Oehlenschlaeger. 1983. Changes in lipid class composition of homogenized redfish fillet (Sebastes marinus L.) during frozen storage at -12 degree C as monitored by HPLC. Fette Seifen Anstrichm. 85(12):474-476.

Redfish (S. marinus L.) were caught in the North Atlantic and its muscle was minced immediately after hauling. Samples of mince were stored at -12 degree C and subjected to lipid extraction at different time intervals, HPLC analysis showed a very low level of free fatty acids in fresh fish and an increase during storage at -12 degree C. Polar lipids decreased on storage, the neutral lipids were almost unchanged.

Fridriksson, A. 1954. The size distribution of redfish west of Iceland in 1953. Ann. Biol. 10:43-44.

Fridriksson, A. 1961. Some observations on redfish in the Iclandic area. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:163-166.

Fujita, S. 1957. On the larval stages of a scorpaenid fish, Sebastodes pachycephalus nigricans (Schmidt). Jpn. J. Ichthyol. 6:91-93.

Gabriel, Wendy L., and A. V. Tyler. 1980. Preliminary analysis of Pacific Coast demersal fish assemblages. Mar. Fish. Rev. 42(3-4):83-88.

The purpose of this portion of an on-going study was to describe demersal fish assemblages on the Oregon continental shelf between the mouth on the Columbia River and Yaquina Head, based on species biomass data collected during the 1977 Rockfish Survey, and to compare these assemblages with those described from data collected in 1973 during the Oregon Department of Fish and Wildlife otter trawl survey. Statistical clustering techniques (including the Bray-Curtis index of dissimilarity and group-average clustering strategy) yielded 12 assemblages. Except for one area (Falcon Shalebeds) species dominating each assemblage were consistent between the two surveys.

Gaevskaya, A. V., and A. A. Kovaleva. 1984. Copepoda of the genus Sphyrion (Sphyriidae) in Atlantic fish. Gidrobiol. Zh. 20(1):41-45.

S. quadricornis sp. nov. is found in Coelorhynchus braueri from the southeastern Atlantic. It differs from the closely related S. lumpi (Kryer) in a cephalothorax shape, meristic characteristics and size ratio of the body parts. Redescriptions are given for S. lumpi (from Sebastes mentella, S. marinus and Coryphaenoides rupestris) from the

northern Atlantic and for S. laevigatum Guerin (from Genypterus capensis and G. blacodes) from the southern Atlantic. S. kingi Cunningham, 1871 is considered a synonym of S. laevigatum. Sphyrion is associated with deep-sea fishes. A supposition is made on how the Sphyrion fauna was formed in the Atlantic Ocean.

Gaines, S. D., and J. Roughgarden. 1987. Fish in offshore kelp forests affect recruitment to intertidal barnacle populations. Science(Wash.) 235(4787):479-480.

Kelp forest along the coast of central California harbor juvenile rockfish that prey on the larvae of invertebrates from the rocky intertidal zone. This predation reduces recruitment to barnacle populations to 1/50 of the level in the absence of fish. The dynamics of the intertidal community are thus strongly coupled to the dynamics of the offshore kelp community.

Ganowiak, Z. 1972. Infection of the Norway haddock, Sebastes marinus with the parasitic copepods Copepoda Sphyrion lumpi. Biul. Sluzby. Sanit. Epidemiol. Wojewodztwa Katowickiego 16(1):105-108.

Gant, D. B., J. M. Choromanski, and L. J. Weber. 1984. A study of tissue acetylcholinesterase in fishes. 27th Annual Meeting of the Western Pharmacological Society Reno, NV (USA) 29 Jan-1 Feb 1984. In 27th Annual Meeting of the Western Pharmacologcial Society Reno, Nevada, USA 29 Jan-1 Feb 1984. Proc. West. Pharmacol. Soc. 27:213-216.

The experiments and reports of the lack of AChE in blood of fish led the authors to investigate the general occurrence of AChE in the tissues of various fishes and its phylogenetic relationship. The fishes studied included shortspine thronyhead (Sebastolobus altivelis), black rockfish (Sebastes melanops).

Garrett, T. L. 1980. Close encounters of a forced kind experimental evidence for shelter defense by the treefish, Sebastes serriceps. Am. Zool. 20(4):790.

Gascon, D., and R. A. Miller. 1981. Colonization by nearshore fish on small artificial reefs in Barkley Sound, British Columbia. Can. J. Zool. 59(9):1635-1646.

The structure of a temperate nearshore fish community was examined by examining the development of fish assemblages on small artificial reefs of concrete blocks constructed in 2 series 6 mo. apart. In each series, a species equilibrium, of .apprx. 6 spp. was rapidly reached within 6 mo. Eight of the 30 spp. which colonized the reefs from the surrounding rocky habitats were common on the reefs. Both juveniles and

adults of all species were present, except for the rockfishes (Sebastes spp.) which were represented only by young individuals (1-3 yr of age). Tagging indicated that the bottom-dwelling species (Gobiidae, Cottidae) remained permanently on the reefs, whereas a seasonal turnover in rockfish occurred. The communities inhabiting the reefs usually did not differ from each other within each series, whereas significant differences occurred between series. This difference was attributed to the differential colonizing ability of species. No evidence of interspecific competition was apparent among the species inhabiting the reefs. Current models of coral reef fish community structure are discussed. Factors affecting the differences observed between tropical and temperate waters are also discussed.

Gascon, D., and R. A. Miller. 1982. Space utilization in a community of temperate reef fishes inhabiting small experimental artificial reefs. Can. J. Zool. 60(5):798-806.

Using multidimensional contingency table analysis, the pattern of space use was investigated in an assemblage of nearshore reef fishes inhabiting small artificial reefs in Barkley Sound, British Columbia [Canada]. Two variables (shelter type and size, and elevation above substrate) were specifically studied. All species had precise microhabitat requirements, and they all showed segregation in the spatial dimension, with the exception of the pair Sebastes caurinus - S. maliger. Only S. melanops showed consistent shifts in its space use in response to increases in the density of the other members of the community, indicating that, with this exception, interspecific competition was probably a weak force in this system.

Gavaris, C. A. 1980. Assessment of redfish in Division 30. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 80/26, 6 p.

The status of redfish stock in Div. 30 was assessed using catch and standardized effort for 1959-79 in a non-equilibrium general production model. Results from the fitted model suggested that the stock was in a good condition. Fishing above the predicted MSY and two-thirds effort MSY levels of 19000 t and 16000 t respectively might be sustained, in the short term, without damage to the stock.

Gavaris, C. A. 1981. An assessment of redfish in Division 30. Can. Atl. Fish. Adv. Comm. Res. Doc. 81/38, 9 p.

Gavaris, C. A. 1981. An assessment of redfish in Subarea 2 and Division 3K. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 81/50.

Gavaris, C. A., and W. E. Legge. 1981. Distribution and abundance of small redfish on the Flemish Cap. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/9/119, 12 p.

Gavaris, C. A., and W. D. McKone. 1980. An assessment of subarea 2 + Division 3K redfish. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 80/25, 14 p.

A simple surplus production model which indicated a yield at two-thirds effort MSY of 34,000 t was updated based on the 1978 CPUE of the standard (USSR IC7 0T). The 1978 catch rate, down from 1977, was close to the expected catch rate at two-thirds effort MSY. To account for the increasing participation of Canadian vessels in the fishery, a new effort standard based on Canada (Nfld) TC 5 otter trawlers was developed. Both standards indicated a generally stable condition for the stock. A preliminary cohort analysis was presented but no projections were made due to the top few years of data available.

Gibson, D. I. 1986. Podocotyle araii, new species Digenea opecoelidae from Sebastes spp. off the coast of British Columbia, Canada, with a key to the species of Podocotyle, occurring off the Pacific coast of North America. J. Nat. Hist. 20(3):735-743.

Podocotyle araii sp. nov., from Sebastes spp. off Vancouver Island, differs from other members of the genus in that it has the following combination of features: a slender body, a short cirrus-sac containing a seminal vesicle with a single anterior loop, a sucker ratio of 1: > 2, and an indistinctly trilobed ovary. A key is presented to the eight species of podocotyle recognized as occurring off the Pacific coast of North America. [P. radifistuli, P. enophrysi, P. theragrae, P. sinusacca, P. californica, P. araii, P. apodichthysi and P. gibbonsia.].

Gilbert, C. H. 1890. Scientific results of explorations by the U. S. Fish Commission steamer Albatross No. 12. Proc. U. S. Nat. Mus. 13:49-126.

A preliminary report on the fishes collected by the steamer Albatross on the Pacific coast of North America during the year 1889, with descriptions of twelve new genera and ninety-two new species.

Gilbert, C. H. 1895. The ichthyological collections of the steamer Albatross during the years 1890 and 1891. U. S. Comm. Fish and Fisheries, Report of the Commissioner for 1893, Washington Govt., Printing Office, 1895:393-476.

During the sommer of 1890 the writer accompanied the Albatross as chief naturalist during its exploration of

Alaskan waters. The plans for the cruise, outlined by the Commissioner, contemplated a thorough examination of the cod banks of Bristol Bay and the area surrounding the Aleutian Islands, followed by an exploration of the deeper waters of the western portion of Bering Sea.

Gilbert, C. H. 1897. Descriptions of twenty-two new species of fish collected by the steamer Albatross of the United States Fish Commission. Proc. U. S. Nat. Mus. 19:437-457.

In the study of the different collections of fishes from the Albatross explorations, by Dr. Jordan and the writer, certain aberrant specimens have been set aside for further comparison. All these specimnens have been lately reexamined, and among them 14 species are found which seem to be new to science. These species are here described, each in the name of the person responsible for the determination and the description.

Gilbert, C. H. 1899. Report on fishes obtained by the steamer Albatross in the vicinity of Santa Catalina Island and Monterey Bay. U. S. Comm. Fish and Fisheries, Report of the Commissioner for 1898, Washington, Govt. Printing Office. 1899:25-29.

The fishes here reported on were collected by the United States Fish Commission steamer Albatross in April, 1897, during the progress of investigations conducted in the vicinity of Santa Catalina Island and of Monterey Bay in southern California. They were obtained by the use of the seine and of the hand line, trawl line, gill net, and dredge, usually at inconsiderable depths, and are therefore for the most part the common shore and market fishes of this region. Two dredge hauls and two sets of the gill net were at greater depths than 200 fathoms. The discovery of an undescribed species of Averruncus and one of Radulinus emphasizes again the great developement of Agonoid and Cottoid fishes in the North Pacific.

Gilbert, C. H. 1915. Fishes collected by the United States Fisheries steamer Albatross in southern California in 1904. Proc. U. S. Nat. Mus. 48:305-380.

Gill, T. 1861. Notes on some genera of fishes of the western coast of North America. Proc. Acad. Nat. Sci. Philadelphia 13:164-168.

Gill, T. 1862. Notes on some genera of fishes of western North America. Proc. Acad. Nat. Sci. Philadelphia 14:329-332.

Gill, T. 1864. Critical remarks on the genra Sebastes and Sebastodes of Ayres. Proc. Acad. Nat. Sci. Philadelphia 16:145-147.

Gill, T. 1864. Note on species of Sebastes of the eastern coast of North America. Proc. Acad. Nat. Sci. Philadelphia 1863:333-335.

Glover, R. S., and G. A. Robinson. 1968. The continuous plankton recorder survey in the Irminger Sea region during 1967. Ann. Biol. 24(1967):76-77.

Glover, R. S., and G. A. Robinson. 1969. The continuous plankton recorder survey in the Irminger Sea region during 1968. Ann. Biol. 25(1968):79-80.

Golden, James T., and Robert L. Demory. 1984. A progress report on the status of canary rockfish (Sebastes pinniger in the INPFC Vancouver, Columbia and Eureka areas in 1984. In Pacific Fishery Management Council, Status of Pacific Coast groundfish fishery and recommendations for management in 1985. Appendix 6, 1-45. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Golden, James T., Robert L. Demory, and William H. Barss. 1980. Abundance, size and age composition, and growth of Pacific Ocean perch, Sebastes alutus, sampled during 1977. Mar. Fish. Rev. 42(3-4):41-47.

From catch data, estimates of biomass, age and size composition were determined. Estimates of marketable biomass were 175 t in the INPFC Eureka area, 6467 t in the Columbia area, and 7685 t in the southern portion of the Vancouver area. The Columbia area estimate is well below that of the 1966-68 period but substantialy greater than the estimte for the 1973-74 period. The 1970 year class dominated catches of Pacific ocean perch in most strata samples. They were particularly abundant in the 100-149 fathom (183-272 m) depth strata. There were marked differences in age composition from south to north in the Columbia and Vancouver areas. Older fish were more abundant in the northern one-third of the Columbia area and throughout the Vancouver area. Statistical comparison of growth rates between the Columbia and Vancouver areas showed no significant differnce in growth rate.

Gomeliuk, V. E., V. P. Leunov, and A. I. Markevitch. 1987. The manner of refuge utilization and the nature of interrelations between specimens of the white-edged rockfish, Sebastes-Taczanowskii (Scorpaeniformes, Sebastinae). Zool. Zh. 66(2):307-311.

Article in Russian - Each abstract in English and Russian.

Gomelyuk, V. E., A. I. Markevich, and V. P. Leunov. 1985. Circadian rhythm of activity of the eastern rockfish in Peter-the-Great Bay, Sea of Japan. Biol. Morya. (Vladivost.) 3:68-71.

Daily activity of a group of the rockfish Sebastes taczanowskii was studied. In the daytime of rockfish was mostly observed hiding in the fissures of a stone bank at a depth of 5-10 m. During this time 2 peaks of activity, between noon and 1 p.m. and after 6 p.m. when the fish left their shelter, were revealed. In the evening twilight, the fish schools intensively migrated to coastal seagrass beds of Zostera spp. to stay there over night. In the morning the fish migrated backwards.

Gotshall, Daniel W. 1964. Increasing tagged rockfish (genus Sebastodes) survival by deflating the swim bladder. Calif. Fish Game 50(4):253-260.

Gotshall, Daniel W. 1969. A tagging study of the blue rockfish, Sebastodes mystinus. M.S. Thesis, Humboldt State Univ., Arcata, California. 67 p.

Gotshall, Daniel W., George H. Allen, and Roger A. Barnhart. 1980. An annotated checklist of fishes from Humboldt Bay, California. Calif. Fish Game 66(4):220-232.

Records of fishes occurring in Humboldt Bay have been kept since the mid-1950's in order to determine the Bay's importance as a nursery or spawning area, feeding area or residence for the various sport and commercial fishes of California's north coast. Occurrences were obtained from published and unpublished reports. Various methods were used to collect the fishes, including traps, trawl hook-and-line, beach seines and collections at a power plant's intake screens. To date, 110 spp. have been recorded from the Bay. The study indicates that the Bay plays an important role in the life history of several important sport and commercial fishes including: Clupea harengus (spawning); Embiotoca lateralis (resident); Hexagrammos decagrammus (nursery); Ophiodon elongatus (nursery); Parophrys vetulus (nursery); Oncorhynchus kisutch and O. tshawytscha (feeding); and Sebastes caurinus (nursery).

Gotshall, Daniel W., J. Gary Smith, and Allan Holbert. 1965. Food of the blue rockfish, Sebastodes mystinus. Calif. Fish Game 51(3):147-162.

The stomachs of 806 blue rockfish, collected during 1962 and 1963, yielded algae, hydroids, jellyfish, crustaceans, tunicates, fish, and a few other types of organisms. These fish came from the Bodega, Monterey, and Morro Bay areas, and ranged from 79 to 450 mm total length; 223 of the

stomachs were empty. Food habits were studied by fish size, by depth of occurrence, and by season to determine what changes occurred, if any.

Gowan, Ronnie E. 1983. Population dynamics and exploitation rates of rockfish (Sebastes spp.) in central Puget Sound, Washington. Ph.D. Thesis, Univ. Wash., Seattle, 112 p.

Rockfish in central Puget Sound have become an increasingly valued recreational resource. Present levels of effort directed towards these fish are such that some species may be overexploited in the near future. Age and growth parameters for selected species were determined from specimens collected from Puget Sound. A tagging study was conducted at a site in central Puget Sound to estimate fishing and natural mortality rates and the migratory behavior of adult rockfish. Concurrent with the tagging study a creel census was conducted in the study area to estimate angler effort directed towards the tagged specimens.

Greenwood, M. R. 1958. Bottom trawling explorations off S. E. Alaska 1956-1957. Commer. Fish. Rev. 20(12):9-21.

Griffith, D. G. 1983. The February-April 1983 stock assessments -- comments by ACFM. In Proceedings of the council meeting of the International Council for the Exploration of the Sea, Gothenbury, Sweden, 10 October 1983. ICES-CM-1983/ASSESS:22: 8 p.

Grimm, S., and M. Baranowski. 1979. Distribution and abundance of redfish larvae of Flemish Cap in April 1978. Int. Counc. Explor. Sea Demersal Fish Comm. ICES-CM-1979/G:28.

Gritsenko, O. F. 1968. Age and growth rate of the Pacific rockfish of the Bering Sea. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part I. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA, USA. TT 67-51203:328-331.

Groninger, H., J. W. Hawkes, and J. K. Babbitt. 1983. Functional and morphological changes in processed frozen fish muscle. J. Food Sci. 48(4):1388.

When frozen fish muscle was ground, there were drastic changes in salt-soluble protein, viscosity, emulsifying capacity, and elasticity compared to samples from fish thawed prior to grinding. When cod (Gadus macrocephalus) muscle was tested for cooked texture in sausages, ground-while-frozen muscle was unacceptably soft and crumbly while the ground-while-thawed muscle was acceptable. Electron microscopy showed the sarcomeres of pollock (Theragra chalcogramma) muscle ground while frozen or thawed

to be similarly disrupted. It appears that differences in functionality losses of pollock, and presumably of other species, were related to the particular type of fragmentation of muscle tissue that occurred when fish was ground-frozen rather than to the disruption of the submicroscopic structure of muscle.

Guillemot, Patrick J., Ralph J. Larson, and William H. Lenarz. 1985. Seasonal cycles of fat and gonad volume in five species of northern California rockfish (Scorpaenidae: Sebastes). Fish Bull., U.S. 83(3):299-312.

Seasonal changes in visceral fat volume and gonad volume are compared in five species of rockfish: Sebastes entomelas, S. paucispinis, S. goodei, S. pinniger, and S. flavidus. In these species, visceral fat was deposited between spring and fall, at the same time as gametogenesis. Visceral fat declined in volume between fall and spring, coinciding with the decline in volume of testes and preceding the release of embryos in females. We suggest that increased feeding in the summer upwelling season provides the energy for simultaneous fat accumulation, gametogenesis, and somatic growth. During subsequent seasons of presumed food storage, these rockfishes may utilize visceral fat reserves for maintenance. This pattern of fat deposition and utilization may contribute to the long life and repeated reproduction of rockfishes, at the expense of current fecundity and growth.

Gulland, J. A. 1961. A note on the population dynamics of the redfish, with special reference to the problem of age determination. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:254-257.

Gunderson, Donald R. 1969. Pacific ocean perch (Sebastes alutus) cruises off northewrn Washington coast during 1969. Washington Dept. Fish. Groundfish Data Rep. Ser. 6, 32 p.

Gunderson, Donald R. 1969. Population biology of Pacific Ocean perch (Sebastes alutus) stocks in the Washington-Queen Charlotte Sound region, and their response to fishing. Ph.D. Thesis, Univ. Wash., Seattle, 140 p.

Gunderson, Donald R. 1970. A note on techniques and intensity required for Pacific ocean perch catch sampling. Washington Dept. Fish., Fish. Res. Pap. 3(2):29-35.

Gunderson, Donald R. 1971. Evidence that Pacific Ocean perch (Sebastes alutus) in Queen Charlotte Sound form aggregations that have different biological characteristics. J. Fish. Res. Board Can. 29(7):1061-1070.

Pacific ocean perch (Sebastes alutus) in market samples from Queen Charlotte Sound showed considerable variation in mean

length, even when narrowly defined month-depth strata were considered. Available evidence indicated that there was also considerable between-sample variability in growth. Both phenomena were attributed to a tendency for commercially exploited Pacific ocean perch to form distinct aggregations, each with different biological characteristics. The relevance of aggregating behavior to age and growth analyses is discussed. (Author).

Gunderson, Donald R. 1971. Pacific ocean perch (Sebastes alutus) cruises off the northern Washington coast during 1970. Washington Dept. Fish. Groundfish Data Rep. Ser. 10, 27 p.

Gunderson, Donald R. 1971. Reproductive patterns of Pacific ocean perch (Sebastes alutus) off Washington and British Columbia and their relation to bathymetric distribution and seasonal abundance. J. Fish. Res. Board Can 28(3):417-425.

Females of the ovoviparous species Sebastodes alutus release their larvae in March in the Washington-British Columbia area. Male maturity data from Queen Charlotte Sound indicated that males probably inseminate females in September or October. Examination of the annual bathymetric cycle in three major commercial trawling areas showed that mating and insemination occur while Pacific ocean perch are moving to deep water from the shallow water regions inhabited in summer and that females release their larvae while in the deepest part of their bathymetric range.

Gunderson, Donald R. 1973. Pacific ocean perch (Sebastes alutus) cruises off the northern Washington coast during 1971 and 1972. Washington Dept. Fish. Groundfish Data Rep. Ser. 17, 26 p.

Gunderson, Donald R. 1974. Availability, size, composition, age composition, and growth characteristics of Pacific Ocean perch (Sebastes alutus) off the northern Washington coast during 1967-1972. J. Fish. Res. Board Can. 31(1):21-34.

Cruises were conducted off the northern Washington coast each year during 1967-1972 to study trends in the availability and biological characteristics of Pacific Ocean perch (Sebastes alutus). There were marked differences in catch rate between cruises, and corresponding differences in age composition and age-length structure indicated that they resulted form differential availability of an old, slow-growing segment of the population to on bottom trawling. Females from this segment of the population were particularly available when the cruise coincided with the period of peak spawning, and both sexes were available during the 1972 summer cruise.

Gunderson, Donald R. 1976. Proceedings of the 1st rockfish survey workshop, Jan. 20-22, 1976. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 128.

Gunderson, Donald R. 1977. Population biology of Pacific Ocean perch, Sebastes alutus stocks in the Washington Queen Charlotte Sound region and their response to fishing. Fish. Bull., U.S. 75(2):369-404.

Production and catch per unit effort of Pacific ocean perch S. alutus stocks have declined drastically in recent years, due to Soviet and Japanese exploitation during 1966-69. In the region off Washington and southern Vancouver Island, production declined from 39,000 metric tons in 1967 to 6000 metric tons in 1969. Pacific ocean perch are ovoviviparous, and lack the resilience of highly fecund, oviparous groups. Their ability to maintain even current levels of abundance is uncertain. Age composition, growth rates and mortality rates were estimated for 2 separate stocks: one in Queen Charlotte Sound, and one off northern Washington and southern Vancouver Island Instantaneous rate of natural mortality was estimated 0.1 and 0.2. Recruitment to the fishing grounds is not complete until age 16, and the proportion of each age group vulnerable to fishing was estimated by stock for age groups 10(0.31-0.35) through 15(0.87-0.94).

Gunderson, Donald R. 1978. Results of cohort analysis for Pacific Ocean perch stocks off British Columbia, Washington, and Oregon, and an evualation of alternative rebuilding strategies for these stocks. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept.

Gunderson, Donald R. 1979. Results of cohort analyses for Pacific Ocean perch stocks off British Columbia, Washington, and Oregon and an evaluation of alternative rebuilding strategies for these stocks. In Pacific Fishery Management Council, Technical papers referenced in the Fishery Management Plan for the California, Oregon and Washington groundfish fishery, p. 1-14. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon.

Gunderson, Donald R., Pamela Callahan, and Bernard Goiney. 1980. Maturation and fecundity of four species of Sebastes. Mar. Fish. Rev. 42(3-4):74-79.

Length-maturity relationships were determined for yellowtail rockfish, Sebastes flavidus, canary rockfish, S. pinniger, chilipepper, S. goodei, and bocaccio, S. paucispinis. Length-fecundity relationships were determined for all but the latter. Geographic differences in fecundity were examined for canary rockfish and chilipepper significant

differences were found in samples from chilipepper populations that were 93-185 mk (50-100 nautical miles) apart. The results obtained in this study were compared with the limited information published previously. The management implications of differences in fecundity are discussed.

Gunderson, Donald R., and William H. Lenarz. 1980. Cooperative survey of rockfish and whiting resources off California, Washington, and Oregon, 1977: Introduction. Mar. Fish. Rev. 42(3-4):1.

Pacific coast rockfish dominate commercial bottomfish landings in California, Oregon, and Washington. The Pacific Ocean perch, Sebastes alutus, is the most abundant rockfish in the eastern North Pacific Ocean. Shortcomings in existing knowledge of biology and stock conditions for all rockfish species made it apparent that an intensive survey of these resources would be desirable. A rockfish survey coordinating committee was established to develop a cooperative pilot survey in 1976 and a coastwide survey of rockfish and Pacific whiting, Merluccius productus, resources in 1977. The report describes the survey and describes future research.

Gunderson, Donald R., and M. O. Nelson. 1977. Preliminary report on an experimental rockfish survey conducted off Monterey, California, and in Queen Charlotte Sound, British Columiba, during August-September 1976. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept.

Gunderson, Donald R., and T. M. Sample. 1978. Distribution and abundance of rockfish off Washington, Oregon and California during 1977. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept.

Gunderson, Donald R., and Terrance M. Sample. 1980. Distribution and abundance of rockfish off Washington, Oregon, and California during 1977. Mar. Fish. Rev. 42(3-4):2-16.

Geographic and bathymetric trends in the abundance and species composition of the demersal rockfish community are discussed, and the results of the demersal and pelagic surveys are compared. Biomass estimates are given for the dominant rockfish species in each statistical area. Canary rockfish, Sebastes pinniger, yellowtail rockfish, S. flavidus, and Pacific ocean perch, S. alutus, dominated the rockfish biomass in the Vancouver and Columbia INPFC areas. Rockfish biomass was low in the Eureka area but increased again to the south. The rockfish biomass in the Monterey and Conception INPFC areas was dominated by shortbelly rockfish, S. jordani, splitnose rockfish, S. diploproa, chilipepper,

S. goodei, stripetail rockfish, S. saxicola, and bocaccio, S. paucispinis. Shortbelly rockfish were found to be principally pelagic in their distribution <10% of the stock was encountered during the demersal survey. The precision of most biomass estimates for rockfish was relatively low because of the highly contagious spatial distribution characterizing most of these species.

Gunderson, Donald R., S. J. Westrheim, R. L. Demory, and M. E. Fraidenburg. 1977. The status of Pacific ocean perch (Sebastes alutus) stocks off British Columbia, Washington, and Oregon in 1974. Can. Fish. Mar. Serv. Tech. Rep. 690, 63 p.

Haaker, P. L. 1978. Observations of agonistic behavior in the treefish, Sebastes serroceps (Scorpaenidae). Calif. Fish Game 64(3):227-228.

Several encounters between 2 treefish, S. serriceps, are described. Observations included grasping and facing behavior culminating with one fish having the other's head in its mouth. The color and pattern of both fish were unusual, and may be related to agonism.

Haldorson, Lewis, and Laura J. Richards. 1987. Post-larval copper rockfish in the Strait of Georgia: Habitat use, feeding, and growth in the first year. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 129-141. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Hallacher, Leon E. 1974. The comparative morphology of extrinsic gasbladder musculature in the scorpionfish Genus Sebastes (Pisces: Scorpaenidae). Proc. Calif. Acad. Sci. 40(3):59-86.

Hallacher, Leon E. 1977. Patterns of space and food use by inshore rockfishes (Scorpaenidae: Sebastes) of Carmel Bay, California. Ph.D. Thesis, Univ. Calif., Berkeley, 119 p.

Hallacher, Leon E. 1984. Relocation of original territories by displaced black-and-yellow rockfish, Sebastes chrysomelas, from Carmel Bay, California. Calif. Fish Game 70(3):158-162.

The black-and-yellow rockfish, S. chrysomelas, is a perennially territorial species that normally exhibits limited movement away from its territory. A total of 30 individuals were transported away from their territories during 4 translocation experiments. A high percentage (66%-71%) of fish returned to the site of capture within 2 wk, from distances up to 50 m. Fish moved 1.5 km from their territories did not return, even after 4 mo. Sensory

parameters used by this species for territory relocation are unknown. Homing behavior in a normally sedentary species seems paradoxical, and this species may be more mobile than previously thought.

Hallacher, Leon E., and Dale A. Roberts. 1985. Differential utilization of space and food by the inshore rockfishes (Scorpaenidae:Sebastes) of Carmel Bay California. Environ. Biol. Fishes 12(2):91-110.

Six rockfish species were found to be common in Carmel Bay kelp forests. Five of these occupy spatial zones that are distinct from one another. Three species (S. atrovirens, S.chrysomelas and S.carnatus) occupy species-specific spatial zones while 2 others (S. serranoides and S. melanops), although spatially distinct from each other, occupy zones that overlap completely with a 6th species, S. mystinus. Food overlap values indicate that S. mystinus has low competitive overlap with all other species, and hence can coexist with 2 spp. using the same habitat. Dietary arrays reflect the distinct spatial zones occupied by most of the rockfishes. Structural characteristics associated with feeding (maxillary,intestine and gill raker length) suggest that these species are differentially adapted in regard to feeding morphology.

Halliday, R. G., and A. T. Pinhorn. 1982. The groundfish resource in the Gulf of St. Lawrence. Can. Tech. Rep. Fish. Aquat. Sci. 1086, 20 p.

Groundfish have been fished in the Gulf of St. Lawrence for hundreds of years. The traditional species caught was cod (Gadus morhua) but in recent times redfish, (Sebastes spp.), American plaice, (Hippoglossoides platessoides), which (Glytocephalus cynogglossus) Greenland halibut (Reinhardtios hippoglossoides) and white hake (Merluccius bilinearis). In the last 20 yr, Gulf groundfish catches by all countries have been 11% of the total groundfish catch in the northwest Atlantic and the Canadian groundfish catches in the Gulf have been 31% of the Canadian groundfish catch in the northwest Atlantic. Yield prospects are currently improving and groundfish catches are projected to be about 230,000 mt annually in the 1982-85 period, as a result of continuing increases in cod abundance, but the redfish stock shows signs of improved recruitment. Longer-term projections suggest average catches in the 200,000-220,000 mt range. Continuing variability in resource productivity should be anticipated in management planning.

Halstead, B. W., M. J. Chitwood, and F. R. Modglin. 1955. The venom apparatus of the California scorpionfish, Scorpaena guttata Guard. Trans. Am. Microscop. Soc. 74(2):145-148.

Hansen, P. M. 1961. Studies on the growth of the redfish (Sebastes marinus) in Godthab Fjord, Greenland. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:258-261.

Hansen, V. K., and K. P. Anderson. 1961. Recent Danish investigations on the distribution of larvae of Sebastes marinus in the North Atlantic. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:201-215.

Hanyu, I., and M. A. Ali. 1962. Intra-sub-specific variation in retinal structure in Sebastes marinus mentella. Nature 196(4854):554-556.

Hara, A., A. Takemura, T. Matsubara, and K. Takano. 1986. Immunochemical identification of female-specific serum proteins in a viviparous fish the white-edged rockfish Sebastes taczanowskii during vitellogenesis and pregnancy and after estrogen treatment. Bull. Fac. Fish. Hokkaido Univ. 37(2):101-110.

Female-specific serum proteins were identified in the serum obtained from viviparous white-edged rockfish, Sebastes taczanowskii by immunoelectrophoresis. Four female-specific serum proteins were found by precipitin reaction in the serum of vitellogenic and pregnant females, using antiserum against mature female serum absorbed with male serum. On the other hand, five female-specific serum proteins were detected in the same serum tested by antiserum against egg extract adsorbed with male serum. Moreover, some of these multiple female-specific serum proteins, varying in number from one to three in different individuals, occurred in the serum of immature females which had ovaries containing oocytes at the oil drop stage. In the serum of estrogen-treated males, multiple female-specific serum proteins similar to those of vitellogenic females were induced to appear 3 days after injection. Based on the identification of iron-binding capacity, at least one of the female-specific serum proteins was defined to be the vitellogenin of this species.

Harada, E. 1962. A contribution to the biology of the black rockfish, Sebastodes inermis(Cuvier et Valenciennes). Publ. Seto Mar. Biol. Lab. 5:307-361.

Harling, W. R. 1966. Northern range extension record for the pygmy rockfish (Sebastodes wilsoni). J. Fish. Res. Board Can. 23(12):1967-1968.

Harling, W. R., and D. Davenport. 1977. G.B. Reed Groundfish Cruise No. 77-3, August 22 to September 8, 1977. Can. Data Rep. Fish. Mar. Serv. 42, 49 p.

The purpose of the cruise was to estimate the biomass of

Pacific ocean perch (Sebastes alutus) in Queen Charlotte Sound, and to assess catch rate differences using varying lengths of sweepline extensions. POP catch rates and biomass estimates were considerably lower this year than in 1976 although Goose Island Gully biomass estimates were similar to 1973 figures. Overall catch rates increased with an increase in sweepline length but did not vary directly.

Harling, W. R., D. Davenport, M. S. Smith, and U. Kristiansen. 1970. G. B. REED groundfish cruise no. 70-1, March 5 - June 18, 1970. Fish. Res. Board Can. Tech. Rep. 205, 81 p.

Purpose of cruise: Collect information on maturation, spawning season, and larvae identification of rockfish (Sebastodes) off southeastern Alaska (March-May), and in Queen Charlotte Sound (June). Investigate bathymetric distribution and abundance of Pacific ocean perch (S. alutus) off southeastern Alaska (March-May), and in Queen Charlotte Sound (June). Collect information on maturation, spawning season, and larvae identification of S. aleutianus variants A, B< and C off southwest Vancouver Island (March and April). Test off-bottom trawl (Universal Mark II) in Queen Charlotte Sound (June).

Harling, W. R., D. Davenport, M. S. Smith, A. C. Phillips, and S. J. Westrheim. 1973. G. B. REED groundfish cruise no. 73-2, September 5-25, 1973. Fish. Res. Board Can. Tech. Rep. 424, 37 p.

Purpose of cruise; to collect data for estimating biomass of Pacific ocean perch in two areas of Queen Charlotte Sound (Goose Island Gully and Mitchell's Gully); collect bottom water temperature data at selected stations in Queen Charlotte Sound and Hecate Strait.

Harling, W. R., D. Davenport, M. S. Smith, and R. M. Wilson. 1969. G. B. REED groundfish cruise no. 69-3, September 8 to 25, 1969. Fish. Res. Board Can. Tech. Rep. 144, 35 p.

Purpose:1) Conduct an in situ evaluation of the G. B. REED on bottom groundfish trawl and the Universal Mark II trawl, designed by the U.S. Bureau of Commercial Fisheries. 2)Collect length-weight data on Pacific ocean perch (Sebastes alutus) off southwest Vancouver Island and Queen Charlotte Sound. 3)Investigate the bathymetric distribution of Pacific ocean perch in southern Queen Charlotte Sound with respect to relative abundance, size composition, and age composition. 4) Determine the maturity stages of gonads from rockfish (Sebastodes) species inhabiting the waters off southwest Vancouver Island and in Queen Charlotte Sound.

Harling, W. R., D. Davenport, M. S. Smith, R. M. Wowchuck, and S. J. Westrheim. 1971. G. B. REED groundfish cruise no. 71-3, October 1-29, 1971. Fish. Res. Board Can. Tech. Rep. 290, 35 p.

Purpose of cruise: Collect specimens of S. alutus, S. Proriger, and S. reedi for determining the storage life of their frozen fillets. Investigate the distribution and abundance of Pacific ocean perch (S. alutus) in southern Queen Charlotte Sound.

Harling, W. R., D. Davenport, and S. J. Westrheim. 1967. G. B. REED groundfish cruise no. 67-1, February 1 to April 24, 1967. Fish. Res. Board Can. Tech. Rep. 22, 56 p.

Purpose of cruise: Investigate the bathymetric distribution and abundance of Pacific ocean perch (Sebastodes alutus) off La Perouse Bank. Determine the maturity stages of gonads from all species of rockfish caught. Collect eyed larvae from ovaries of rockfish species for identification studies. Sample the Smith Sound stocks of juvenile Pacific ocean perch.

Harling, W. R., W. Shaw, R. M. Wallis, and F. W. Mottl. 1979. G.B. Reed groundfish cruise No. 78-7, August 29-September 19, 1978. Can. Data Rep. Fish. Mar. Serv. 120, 67 p..

Estimated biomass of marketable (31 cm) Pacific ocean perch (Sebastes alutus) in Moresby Gully (southern Hecate Strait) for September 1978 was 77,000 m.t. (larger than the estimate of 73,000 m.t. obtained in September 1974). On-bottom water temperatures were similar in 1978 and 1974.

Harling, W. R., M. S. Smith, D. Davenport, and D. M. Bianchin. 1969. Preliminary report on maturity, spawning season and larvae identification of rockfishes (Sebastodes) collected in waters off British Columbia during February 1969. Fish. Res. Board Can. Manuscr. Rep. 1055, 11 p.

Harling, W. R., M. S. Smith, and N. A. Webb. 1971. Preliminary report on maturity, spawning season, and larvae identification of rockfishes (Scorpaenidae) collected during 1970. Fish. Res. Board Can. Manuscr. Rep. 1137, 26 p.

Harling, W. R., and S. J. Westrheim. 1966. Description of ground fish trawl (for Ocean perch, Sebastodes alutus) developed for the side-trawl research vessel G. B. Reed. J. Fish. Res. Board Can. 23(4):611-613.

Harry, George Y. 1956. Analysis and history of the Oregon otter trawl fishery. Ph.D. Thesis, Univ. Wash., Seattle, 328 p.

Hart, J. L. 1942. Red snapper fecundity. Fish. Res. Board Can. Pacific Biol. Sta. Progr. Rep. 52, 18 p.

Hart, J. L. 1953. The trawl fishery on the Pacific coast of Canada. Pac. Sci. Congr. Proc. 7th. (1949) 4:425-427.

Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Board Can. Bull. 180, 740 p.

Hart, P. J. B., and G. A. Cooper. 1972. Sebastes in continuous plankton records 1970. Ann. Biol. 27:60.

Hatanaka, M., and K. Iizuka. 1962. Studies on the fish community in the Zostera area. 3. Efficiency of production of Sebastes inermis. Bull. Jpn. Soc. Sci. Fish. 28:305-313.

Haunschild, G., B. Vaske, and Ch. Nagel. 1983. On the maturity and sex ratio of redfish (S. mentella) in the northeast Arctic. Int. Counc. Explor. Sea ICES-CM-1983/G:66, 16 p.

Heckmann, R. A., and L. A. Jensen. 1978. The histopathology and prevalence of Henneguya sebasta and Kudoa clupeidae in the rockfish, Sebastes paucispinis of southern California. J. Wildl. Dis. 14(2):259-262.

The pathogenesis of 2 histozoic myxosporidans, H. sebasta and K. clupeidae, was studied from the Pacific rockfish S. paucispinis. Infection of the bulbus and truncus arteriosus with H. sebasta was observed in 30 of 100 fish. The parasite metastasized throughout the tissue causing necrosis, hyperplasia and hypertrophy of the connective tissue and smooth muscle. K. clupeidae, found in 37 of 100 fish, caused necrosis and atrophy of host skeletal muscle. The unattractive appearance of Kudoa cysts in rockfish filets detracted from their commerical value.

Heimann, Richard F. 1963. Trawling in the Monterey Bay area, with special references to catch composition. Calif. Fish Game 49(3):152-173.

Paper presents the results of one year study. Eighteen species of rockfish are observed in Monterey Bay area trawl catches.

Heimann, Richard F., and Daniel J. Miller. 1960. The Morro Bay otter trawl and party boat fisheries August, 1957 to September, 1958. Calif. Fish Game 46(1):35-58.

Thirty species of rockfish (Sebastodes) are examined during these surveys of the fisheries.

Heinmann, R. F. G., and J. G. Carlisle. 1970. The California marine fish catch for 1968 and historical review 1916-68. Calif. Fish Game Fish Bull. 149, 70 p.

Helly, J. J., Jr. 1976. The effect of temperature and thermal distribution on gylcolysis in two rockfish species (Sebastes). Mar. Biol. (Berl.) 37(1):89-95.

Studies on the effects of temperature on the activities of Embden-Meyerhof (EM) glycolysis and the hexose monophosphate shunt (HMP) in fishes have dealt mainly with exotic and/or acclimated fishes. This study reports the effects of short-term reductions in temperature on EM and HMP activity in 2 closely related species of temperate fishes (Sebastes spp.) and its possible relation to the thermal distribution of the species. Thermal distribution data were collected for S. mystinus and S. serranoides in King Harbor, Redondo Beach, California, USA. Activities of the pathways were determined in liver-tissue studies, using glucose-14C and liquid scintillation techniques following the method of Hochachka (1968) with modifications. The data were analyzed by distribution-free methods. Tissue studies indicated HMP activity in both species at lowered temperature (5.degree. C), but only in S. serranoides at 15.degree. C. S. mystinus is capable of instantaneous temperature compensation, possibly related to its tendency to occupy cold water.

Helvey, M. 1982. First observations of courtship behavior in rockfish, genus Sebastes. Copeia 1982(4):763-770.

The courtship behavior of the blue rockfish, S. mystinus, is described from underwater observations off southern California [USA]. Courtship activity corresponded with male gonadal recrudescence, beginning in late summer-early fall, and extending until early winter. Courtship occurred just above the substratum at reefs deeper than 15 m. Males were the active participants during courtship while females were relatiely inactive. Males performed a sequence of stereotyped movements to the motionless females that included a front position, lateral pass, tail fan and turn. Females attracked varying sized entourages of males, but only a few males actually courted the female. Females were frequently courted within short periods of time but never appeared aroused. Arguments are presented that courtship behavior in blue rockfish functions in persuasion leading to mate selection.

Henderson, G. T. D. 1961. Continuous plankton records: the distribution of young Sebastes marinus. Bull. Mar. Ecol. 5:173-193.

Henderson, G. T. D. 1961. Continuous plankton records: the distribution of young stages of Sebastes. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:216-219.

Henderson, G. T. D. 1964. Adult redfish in the open ocean. Int. Comm. Northwest Atl. Fish. Res. Bull. 1:107-109.

Henderson, G. T. D. 1968. Continuous plankton records during the NORWESTLANT surveys, 1963- young redfish. In ICNAF environmental surveys, Norwestlant 1-3, 1963. Int. Comm. Northwest Atl. Fish. Spec. Publ. 7(1):157-161.

Henderson, G. T. D. 1968. Sebastes in continuous plankton records in 1967. Ann. Biol. 24(1967):77.

Hennessey, J. P., Jr., and J. F. Siebenaller. 1987. Pressure-adaptive differences in proteolytic inactivation of M-4 lactate dehydrogenase homologues from marine fishes. J. Exp. Zool. 241(1):9-16.

The inactivation by hydrostatic pressure of muscle-type lactate dehydrogenase (M4-LDH, EC 1.1.1.27; L-lactate: NAD+ oxidoreductase) homologues from five shallow-living and six deep-living marine teleost fishes was compared.

Henry, Francis D. 1985. A progress report on the status of chilipepper (Sebastes goodei) off California. In Pacific Fishery Management Council, status of the Pacific Coast groundfish fishery through 1985 and recommended acceptable biological catches for 1986, Appendix 5, p. 1-16. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Henry, Francis D. 1986. Status of the coast wide chilipepper (Sebastes goodei) fishery. In Pacific Fishery Management Council, Status of the Pacific Coast groundfish fishery through 1986 and recommended acceptable biological catches for 1987. Appendix 5, p. 1-16. Pacific Fishery Management Council, Metro Center, Suite 420, 2000 SW First Ave., Portland, Oregon 97201.

Heyamoto, H., and C. R. Hitz. 1962. Northern range extension of three species of rockfish (Sebastodes rubrivinctus, S. aurora, and S. helvomaculatus). Copeia 1962(4):847-848.

Hightower, Joseph E., and Gary Grossman. 1985. Comparison of constant effort harvest policies for fish stocks with variable recruitment. Can. J. Fish. Aquat. Sci. 42(5):982-988.

Environmental variability may have a substantial influence on marine fish stocks, primarily by affecting survival to the time of recruitment. Simulation studies at low, intermediate, and high levels of variability in recruitment were used to compare alternative constant effort policies for anchovy (Engraulis capensis), Atlantic menhaden (Brevoortia tyrannus), and Pacific ocean perch (Sebastes alutus) fisheries. These policies were either to maintain effort at the level producing maximum sustainable yield (fMSY), or to permit levels of effort 25-100% greater than

fMSY. An increase in effort of 25% above fMSY typically did not reduce annual yield significantly; a significant reduction in yield was apparent in all cases when effort increased by 75-100%. When recruitment is highly variable, comparable yield was apparent in all cases when effort increased by 75-100%. When recruitment is highly variable, comparable yields may be obtained at several levels of fishing effort. In such cases, environmental variability provides the fishery manager with considerable flexibility to enhance social or economic benefits without decreasing yields significantly.

Hightower, Joseph E., and William H. Lenarz. 1986. Status of the widow rockfish fishery. In Pacific Fishery Management Council, Status of the Pacific Coast groundfish fishery through 1986 and recommended acceptable biological catches for 1987, Appendix 4 , p. 1-34. Pacific Fishery Management Council, Metro Center, Suite 420, 2000 SW First Ave., Portland, Oregon 97201.

Hislop, J. R. G. 1979. Preliminary observations on the near surface fish fauna of the northern North Sea in late autumn. J.Fish. Biol. 15(6):697-704.

Hitz, Charles R. 1961. Occurrence of two species of juvenile rockfish in Queen Charlotte Sound. J. Fish. Res. Board Can. 18(2):279-281.

Hitz, Charles R. 1962. Seasons of birth of rockfish (Sebastodes spp.) in Oregon coastal waters. Trans. Am. Fish. Soc. 91(2):231-233.

Hitz, Charles R. 1965. Field identification of the northeastern Pacific rockfish (Sebastodes). U. S. Fish Wildl. Serv. Circ. 203, 61 p.

Hitz, Charles R., and D. L. Alverson. 1963. Bottomfish survey off the Oregon coast, April-June 1961. Commer. Fish. Rev. 25(6):1-7.

Bottom fish surveys were conducted in the spring of 1961 by the U. S. Bureau of Commercial Fisheries with the exploratory fishing vessel John N. Cobb off the Oregon coast in areas not commercially exploited. The surveys were designed to find areas suitable for trawling within and beyond the depth range now fished by commercial trawlers, evaluate the commercial potential of ground fishes inhabiting those areas and study the depth distribution of fishes and invertebrates found. Trawlable grounds and concentrations of commercially-valuable ground fishes were found.

Hitz, Charles R., and Alan C. DeLacy. 1960. Reproduction and fecundity of rockfishes (Sebastodes). Univ. Wash., Coll. Fish., Contrib. Res. Fish. 77:24.

Hitz, Charles R., and Alan C. DeLacy. 1961. Variations in the occurrence of coronal spines in Sebastodes auriculatus (Girard). Copeia 1961(3):279-282.

Hitz, Charles R., and Alan C. DeLacy. 1965. Clearing of yolk in eggs on the rockfishes, Sebastodes caurinus and S. auriculatus. Trans. Am. Fish. Soc. 94(2):194-195.

Hitz, Charles R., H. C. Johnson, and A. T. Pruter. 1961. Bottom trawling exploration off the Washington and British Columbia coasts, May-August 1960. Commer. Fish. Rev. 23(6):1-11.

Ho, J. S., and P. S. Perkins. 1980. Monogenea from fishes of theSea of Japan. 1.Order Monopisthocotylea. Annu. Rep. Sado. Mar. Biol. Stn. Niigata Univ. 10:1-10.

Six species of monogeneans reported are Benedenia derzhavini (Layman) from Sebastes inermis (Cuvier et Valenciennes), Metabenedeniella hoplognathi (Yamaguti) from Oplegnathus fasciatus (Temminck et Schlegel), Capsala ovalis (Goto) from Istiophorus platypterus (Shaw et Nodder) and Acanthocybium solandri (Cuvier et Valencinnes), Dendromonocotyle akajeii sp. nov. from Dasyatis akajei (Mueller et Henle), Parancyrocephaloides daicoci Yamaguti from Daicocus petersni (Nystrosem), and Diplectanum longipenis (Yamaguti) from Therapon oxyrhynchus Temminck et Schlegel. They are all newly recorded from the Japanese coast of the Sea of Japan.

Hobson, Edmund, Peter Adams, James Chess, Daniel Howard, and Wayne Samiere. 1986. Temporal and spatial variations in the numbers of first-year juvenile rockfishes off northern California. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Southwest Fish. Cent., Admin. Rep T-86-02, 16 p.

The numbers of first-year juvenile rockfishes (Sebastes spp.) in coastal waters of northern California vary tremendously from year to year, and since 1983 the Goundfish Communities Investigation of the Tiburon Laboratory has attempted to measure this variation. The possibliity that the numbers of first-year juveniles might provide the means to predict the relative size of that year class when it enters the fishery years later is examined.

Hobson, Edmund S., and James R. Chess. 1976. Trophic interactions among fishes and zooplankters nearshore at Santa Catalina Island, California. Fish. Bull., U.S. 74(3):567-598.

Most zooplankters in the nearshore water column by day are

very small (< 2 mm); included are cladocerans, copepods and various larval forms. Their small size precludes capture by most large-mouthed fishes, providing protection in daylight, when the visual sense of predatory fishes is most effective. Larger zooplankters in the water column by day, chaetognaths, tend to be transparent. Zooplankters (most > 2 mm) vulnerable to large-mouthed fishes tend to enter the water column only at night, when darkness offers some protection. Because successful defensive features of prey create pressures that modify the offensive features of predators, the tendencies toward reduced size and nocturnal habits among zooplankters have generated adaptations among planktivorous fishes. Fishes that prey on zooplankters during the day have specialized features, including a small highly modified mouth, that permit even relatively large individuals to take the tiny organisms in the daytime zooplankton. Fishes that prey on zooplankters at night take the larger organisms that join the zooplankton after dark. In their feeding morphologies and body form, these large-mouthed fishes have diverged less than their diurnal counterparts from the general.

Hobson, Edmund S., William N. McFarland, and James R. Chess. 1981. Crepuscular and nocturnal activities of California nearshore fishes, with consideration of their scotopic visual pigments and the photic environment. Fish. Bull., U.S. 79(1):1-30.

Activities in 27 of the major southern California nearshore fish species, with emphasis on trophic relationships, were studies between 1972 and 1975 at Santa Catalina Island. Because these fishes orient primarily by vision, they are strongly influenced by the underwater photic environment, which we define with representative spectra. We center on crepuscular and nocturnal events, but also describe daytime events for comparison. Species that feed mostly at night include Sebastes atrovirens, S. serranoides (subadult), S. serriceps.

Hodder, V. M. 1964. Assessments of the effects of fishing and of increases in the mesh size of trawls on the major commercial fisheries of the Newfoundland area (ICNAF Subarea 3). Fish. Res. Board Can. Manuscr. Rep. 801, 116 p.

A method, described by Gulland (1961), for estimating the effects on fisheries of changes in gear selectivity is reviewed and applied to data of the major commercial fisheries of the Newfoundland area (ICNAF Subarea 3). Methods of estimating the essential parameters are also briefly described. The changes in gear considered are in reality increases in the mesh size of trawls, the other gear components remaining unchanged.

Holden, M. J. 1971. Report of the International Council for the Exploration of the Sea. International Council for North Atlantic fisheries working groups in selectivity analysis. Int. Counc. Explor. Sea. Coop. Res. Rep. 25:4-144.

Holliday, D. V. 1971. Resonance structure in echoes from schooled pelagic fish. J. Acoust. Soc. Am. 51(4)pt2:1322-1332.

Explosive acoustic sources were used to obtain echoes from aggregations and schools of commercially important marine fish. Narrow-band spectral analysis of the echoes from these targets revealed significant structure in the frequency range from 200 Hz to 5 kHz. The targets were partially captured after the acoustic tests; three yields northern anchovey (Engraulis mordax), one consisted of a mix of anchovy and jack mackerel (Trachurus symmetricus), and the last sample contained an aggregation of seven species of rockfish (Sebastes), a whitefish (Caulolatilus princeps), and a striped seaperch (Embiotoca lateralis). The results of the direct biological sampling were combined with theoretical predictions for the resonant swinbladder response and compared with the experimentally observed resonances. (Author).

Holmes, J. C. 1971. Two new sanguinicolid blood flukes (Digenea) from scorpaenid rockfish (Perciformes) of the Pacific coast of North America. J. Parasitol. 57(2):209-216.

Holmes, John C. 1971. Habitat segregation in sanguinucolid blood flukes (Digenea) of scorpaenid rockfishes (Perciformes) on the Pacific coast of North America. J. Fish. Res. Board Can. 28(6):903-909.

Hoover, J. O. 1964. A new northern record for the green-spotted rockfish. Fish. Comm. Oregon Res. Briefs 10(1):73-74.

Hoshiai, Gen-ichi. 1977. Larvae and juveniles of the scorpaenid fish Sebastes schlegeli. Jpn. J. Ichthyol. 24(1):35-42.

S. schlegeli Hilgendorf is a viviparous scorpaenid fish distributed around Japan. The larvae and juveniles of this fish were reared for 80 days to clarify development, relative growth and mouth size in relation to feeding capability and behavioral changes. Development can be devided into 8 stages. Just-spawned larvae were 6.89 mm on average in total length. Individuals of 9.5-11.7 mm are regarded to have attained the juvenile stage, when all the fin rays were completed. Fish reached 30 mm total length in .apprx. 50-70 days. The growth of 7 body parts (post-anal length, ante-anal length, head length, trunk length, eye diameter, auditory vesicle diameter and mouth size) was

examined against changes of total length. The growth inflection of each body part occurred at the 9.1-12.9 mm size and coincided with the shift from the larva to juvenile stage or just after. Mouth size and trunk length demonstrated common change showing tachyauxesis before growth inflection and isauxesis after it. The size of food taken was determined by the mouth size. Mouth size of newborn larvae was 836 .mu.m, and food < 423-629 .mu. can be taken easily by these larvae. Mouth size can be roughly estimated from trunk length.

Houk, J. L., K. McCleneghan, and Robert N. Lea. 1977. Effects of canopy removal on juvenile rockfishes in Macrocystis pyrifera beds. J. Phycol. 13(Suppl.):31.

Hubbs, Carl L. 1916. Notes on the marine fishes of California. Univ. Calif. Publ. Zool. 16(13):153-169.

This paper is based on part upon several small collections made by the author during the last two years. In addition, notes are presented of fishes; first, in the Scripps Instution of Biological Research of the University of California, at La Jolla; second, in the collections of Stanford University; third, in the museum of the Los Angeles High School, and fourth, from the Aquarium at Avalon, Santa Catalina Island.

Hubbs, Carl L. 1921. Notes on Sebastodes. Copeia 93:27-28.

Hubbs, Carl L. 1926. The supposed intergradation of the two species of Sebastolobus (a genus of Scorpaenoid fishes) of Western America. Am. Mus. Novit. 216:1-4.

Hubbs, Carl L. 1928. A checklist of the marine fishes of Oregon and Washington. J. Pan. Pacific Res. Inst. 3:9-16.

Hubbs, Carl L. 1950. On the supposed occurrence in New Zealand of the North Pacific fish genus Sebastodes. Pac. Sci. 4(1):70.

Hubbs, Carl L. 1951. Allosebastes, new subgenus for Sebastodes sinensis, Scorpaenid fish of the Gulf of California. Proc. Biol. Soc. Wash. 64:129-130.

Hubbs, Carl L. 1959. Initial discoveries of fish faunas on seamounts and offshore banks in the eastern Pacific. Pac. Sci. 13:(4):311-316.

Hubbs, Carl L., W. I. Follett, and L. J. Dempster. 1979. List of fishes of California. Occas. Pap. Calif. Acad. Sci. 133, 51 p.

Included in this list are the native marine, euryhaline, and freshwater fishes of California, and those introduced fishes that have become established within the State (also, in a suppplement, those introduced fishes not known to occur at present in California). California waters are defined as including the entire Colorado River where it forms the California boundary, and the Pacific Ocean within 805km (500 miles) of any point of land in the State between the seaward porjections of its northern and southern boundaries.

Hubbs, Carl L., A. L. Kelley, and C. Limbaugh. 1970. Diversity in feeding by Brandt's cormorant near San Diego. Calif. Fish Game 56:156-165.

Hubbs, Carl L., and L. P. Schultz. 1933. Descriptions of two new American species referable to the rockfish genus Sebastodes, with notes on related species. Univ. Washington Publ. Biol. 2(2):15-44.

Hubbs, Carl L., and L. P. Schultz. 1935. A new blenny from British Columbia with records of two other fishes new to the region. Contrib. Can. Biol. Fish. 7(25):321-324.

Hubbs, Carl L., and L. P. Schultz. 1941. Contribution to the ichthyology of Alaska, with descriptions of two new fishes. Univ. Mich. Mus. Zool. Occas. Pap. 431:1-31.

Hueckel, G. J., and R. L. Stayton. 1982. Fish foraging on an artificial reef in Puget Sound, Washington. Mar. Fish. Rev. 44(6-7):38-44.

This study was designed to determine the degree of foraging by two embiotocids (Embiotoca lateralis) and Rhacochilus vacca) and one scorpaenid (Sebastes maliger) on organisms associated with an artificial reef in Puget Sound to increase our knowledge of the changes in the structure of the fish community during the reef's early stages of successional development.

Huh, S. H. 1986. Species composition and seasonal variations in abundance of fishes in eelgrass meadows. Bull. Korean Fish. Soc. 19(5):509-518.

Abundances of small fish that utilized eelgrass meadows of Hansilpo, Chungmu [Korea], were analyzed to determine fish species composition and monthly changes of this temperature seagrass fish community during 1985-1986. A total of 4,646 fish that comprised 35 species in 19 families was collected during the period of investigation. Pholis taczanowskii,

Pseudoblennius cottoides, Tridentiger grigonocephalus, and Syngnathus schlegeli predominated in ichthyofauna that occupied the eelgrass meadows most of the year. These four most abundant fish species accounted for approximately 64% of the number of fish collected. Juveniles of economically valuable fish species such as Sebastes inermis, Platycephalus indicus and Limanda yokohamae were also collected in the study area. Seasonal changes in both species composition and abundances of fish populations were major characteristics in these eelgrass meadows. A peak abundance of total fishes occurred during spring, with a secondary peak during fall. The lowest abundance of total fishes occurred in winter. Each abundant fish species showed its own seasonal abundance pattern, and a peak abundance 1-3 months separated from other species with some overlap of the increased larval recruitment.

Hunt, D. E. 1980. Predation by a rockfish, Sebastes chrysomelas, on Lamellaria diegoensis. Veliger 22(3):291.

The Lamellariidae represent a family of marine mesogastropods that apparently rely upon cryptic adaptations and defensive acid secretions to avoid detection and falling prey to a variety of predatory fish and invertebrates. A female specimen of S. chrysomelas (Jordan & Gilbert) measuring 245 mm was collected during a food habits study in San Luis Obispo County, California [USA] (120.degree. 51'23" W; 35.degree. 12'44" N). In the stomach contents of this individual was a single specimen of L. diegoensis Dall, 1885, the only prey item present. Past experience with 80 specimens of S. chrysomelas collected during the study, showed an apparent preference rockfish for Octopus spp. and small decapod crustaceans. The occurrence of L. diegoensis represents a food item never before documented for S. chrysomelas.

Huson, R. M., D. Rivard, W. G. Doubleday, and W. D. McKone. 1984. Impact of varying mesh size and depth of fishing on the financial performance of an integrated harvesting/processing operation for redfish in the Northwest Atlantic. N. Am. J. Fish. Manage. 4(1):32-47.

The impact of alternative mesh sizes for codends of otter trawls on the profitability of a fishery for redfish (Sebastes spp.) in Division 2J-3K of the Northwest Atlantic Fisheries Organization area was examined. The implications of mesh size on catch rates, size of fish in the catch, and on long-term catches were translated into financial terms. Fishing with a 114-mm mesh codend in a depth range of 401-500 m was found to maximize profitability in the case examined, but a mesh size exceeding 127 mm must be used to optimize the profit margin in the 301-400 m depth range.

Icanberry, John W., J. W. Warrick, and D. W. Rice, Jr. 1978. Seasonal larval fish abundance in waters off Diablo Canyon, California. Trans. Am. Fish. Soc. 107(2):225-233.

A 15 mo. study was conducted to describe the seasonal changes of total larval fish densities, fish egg densities and species composition in the nearshore marine environment of Diablo Canyon, San Luis Obispo County, California [USA]. Samples were collected at an inshore and offshore station located 300 and 1500 m southwest of the seaward perimeter of Diablo Cove, respectively. There were no statistical differences in total larval fish densities and total fish egg densities between the inshore and offshore stations. Statistical differences were found in 2 of the 6 most abundant taxa, Artedius spp. (greater densities found inshore) and Stenobrachius leucopsarus (greater densities present offshore). The greatest larval fish densities, 163.5/100 m3, occurred Feb. 1975, and the period of greatest abundance was Jan.-March 1975. A peak fish egg density of 475/100 m3 occurred in Sept. 1975 and egg densities averaged 79.8/100 m3 throughout the study period. A comparison of day and night hauls resulted in no statistically significant differences in densities or lengths of larval Sebastes spp.

Ida, H., T. Iwasawa, and M. Kamitori. 1982. Karyotypes in eight species of Sebastes from Japan. Jpn. J. Ichthyol. 29(2):162-168.

Karyotypes of 8 spp. of the genus Sebastes, family Scorpaenidae, from Japanese waters were analyzed in relation to morphology. Six of the 8 spp. examined are new to karyological study. The number of diploid chromosomes is 48 in all species except S. hubbsi, which has 46 chromosomes. The karyotypes of the other 7 spp., i.e., S. thompsoni, S. joyneri, S. schlegeli, S. oblongus, S. vulpes, S. pachycephalus nudus and S. trivittatus, consist of 2 meta or submetacentric and 46 acrocentric chromosomes, while the karyotype of S. hubbsi consists of 2 large-sized and 2 medium-sized metacentric and 42 acrocentric chromosomes. Morphological differences between these 2 groups are not clear except for the difference found in the number of dorsal spines. The eresent results emphasize the stability of karyotypes among the fishes of the genus Sebastes, compared with various karyotypes found in other families of the order Scorpaeniformes.

Igarashi, T. 1968. Ecological studies on a marine ovoviviparous teleost Sebastes taczanowskii. I. Seasonal changes of the testis. Bull. Fac. Fish. Hokkaido Univ. 19(1):19-26.

Igarashi, T. 1968. Ecological studies on a marine ovoviviparous teleost, Sebastes taczanowskii. II. About the copulatory organ elasmobranch. Bull. Fac. Fish. Hokkaido Univ. 19(1):27-31.

Ikawa, J. Y., and C. Genigeorgis. 1987. Probability of growth and toxin production by nonproteolytic Clostridium-botulinum in rockfish fillets stored under modified atmospheres. Int. J. Food Microbiol. 4(2):167-182.

Whether toxin production by Clostridium botulinum precedes or follows spoilage of fish stored under modified atmospheres (MA), remains unclear. In this factorial design study we inoculated a pool of nonproteolytic C. botulinum spores (5 type E, 4 type B, and 4 type F strains) at 6 levels (104 to 10-1) between two rockfish fillets and then incubated the fillets at 4, 8, 12 and 30.degree. C under vacuum, 100% CO2 and 70% CO2 + 30% air for 21 days. The probability of toxigenesis by one spore was significantly affected (P < 0.005) by temperature (T) and storage time (St), and not (P > 0.1) by MA, MA .times. T or MA .times. St. At the 10.degree. spore/sample level, the earliest time to detect toxin production at 4, 8, 12 and 30.degree. C under all MAs was > 21, 15-21, 6-9 and 2 days, respectively. No toxin production was detected at 4.degree. C. Only type B toxin was present in the toxic samples. At 30.degree. C storage, spoilage of fillets followed toxigenesis. Using linear and logistic regression models, equations were derived that could estimate the lag phase and predict the probability of one spore initiating growth under a particular storage condition.

Ikehara, K. 1968. Ecological aspect of the eggs and larvae of a few species of fish and squid based on the materials taken by means of two kinds of plankton nets: Watasenia scintillans, Engraulis japonica, Glossanodon septemfasciatus, Cololabis saira, Maurolicus japonicus, Sebastes pachycephalus pachycephalus, Todarodes pacificus. Bull. Jpn. Sea Reg. Fish. Res. Lab. 20:71-82.

Ikehara, K. 1977. Studies on the fish eggs and larvae accompanied with drifting seaweeds in the Sado Strait and its vicinity. Bull. Jpn. Sea Reg. Fish. Res. Lab. (28):17-28.

The seasonal variation of larval fish fauna accompanied with drifting Sargassum was studied from Feb.-Aug., 1975 and from April-Aug., 1976 in the vicinity of Sado [Japan] and Awashima. The eggs attached to the sea weeds were those of Hemiramphus sajori. Among 31 spp. (21 families), the most numerous larval fish was Sebastes thompsoni, and the following species occurred: S. schlegeli, Girella punctata, Navodon modestus, Oplegnathus fasciatus, Agrammus agrammus,Rudarius ercodes, Gasterosteus aculeatus aculeatus, S. vulpes and Syngnathus schlegeli. There was a seasonal sequence of species appearance. A. agrammus appeared 1st in Feb., and S.thompsoni, S. vulpes and G. a. aculeatus appeared in spring; S. schlegeli, G. punctata and

N. modestus occurred in July, and O. fasciatus and R. ercodes appeared Aug. There is probably a time lag of appearance between species of close affinities, e.g., S. thompsoni and S. schlegeli, N. modestus and R. ercodes.

Ikehara, K., and M. Nagahara. 1977. Fundamental studies for establishing rockfish culture techniques. Part 3. Examination of formula diets proper for culturing a rockfish, Sebastes thompsoni. Bull. Jpn. Sea Reg. Fish. Res. Lab. 28:9-16.

Six formula diets for culturing fish were examined to detect the most suitable nutritional composition for rockfish S. thompsoni, in comparison with cattle liver and jack-mackerel meat, pertaining to the appetite, growth and survival rate as key elements. Halver's basic diet for salmonoid fishes is not suitable for Sebastes larvae. Vitamins are essential to raise the nutritional value of formula diets. The casein diet is poor nutritionally when compared to the fish-meal diet. Jack-mackerel meat is unsuitable under the high temperature circumstance, as is the cattle liver diet. The high carbohydrate diet, and not the low protein diet, is the most suitable food for Sebastes larvae.

Ikehara, K., and M. Nagahara. 1978. Fundamental studies for establishing rockfish culture techniques. Part 4. On the favorable contents of protein and lipid in compound food for a young rockfish, Sebastes thompsoni. Bull. Jpn. Sea Reg. Fish. Res. Lab. 29:103-110.

The favorable contents of protein and lipid were detected in compound food used for raising a young rockfish, S. thompsoni. The favorable protein content is 47% in lipid-excluded compound food; addition of lipid effectively accelerates the growth of fish. The effect of lipid appears to annex more than 10%. Pollack oil shows its effect at 15-21.degree. C; at higher temperatures, 23-24.degree. C, corn oil is more effective for growth. The higher the content of pollack oil in food, the higher content of fat is in muscles of reared fish.

Ikehara, K., and M. Nagahara. 1980. Fundamental studies for establishing rockfish culture techniques. Part 6. The protein digesting ability and the favorable contents of protein in diets for the rockfish, Sebastes schlegeli. Bull. Jpn. Sea Reg. Fish. Res. Lab. 31:65-72.

Digestibility for different size young S. schlegeli under different thermal conditions and the growth rate and food efficiency for uniform size fish at various fish meal contents were studied in the lab. The feces/ration ratio was inversely proportional to fish size. The young fish (body

weight 4 g mean) commenced feces excretion 1 or 2 h after feeding at temperatures of 25-26.degree. C. Digestion at temperatures of 10-12.degree. C took twice as long as that at 18-26.degree. C. Digestibility of dietary protein increased with time in the initial 24 h to .apprx. 90%; after that no digestion was observed. They were independent of fish size and temperature. Fish fed on compound feed showed normal growth, but some fed on jack mackerel muscle for 2 mo. got hypovitaminosis or died. The most favorable protein content was estimated at about 41%.

Ikehara, K., M. Nagahara, and A. Furukawa. 1976. Fundamental studies for establishing rockfish culture techniques. Part 2. The duration of food passing through the digestive tract in a young rockfish Sebastes thompsoni. Bull. Jpn. Sea Reg. Fish. Res. Lab. 27:35-40.

Feeding experiments on a young rockfish, S. thompsoni were carried out to observe the duration of passing of food through the digestive tract. Chromium oxide, a marker of the food, did not effect the excretion of the fish, at levels around 5%. The feces was ejected 1st within 6 h after feeding in all fish examined, and .apprx. 64% of the animals excreted the 1st feces within 3 h. Excretion terminated within 47 h in some individuals it continued in others even at 74 h after feeding. Foods were not always discharged in regular sequence according to the given order; in some cases the inverted excretion was observed. This may be attributed to the T-shaped stomach of the species, but more detailed anatomical investigations will be necessary on this point.

Ikehara, K., M. Nagahara, Y. Yamada, and K. Naiki. 1980. Establishing rockfish culture techniques. 5. Feeding experiments on young rockfish, Sebastes thompsoni and Sebastes schlegeli during the summer season. Bull. Jpn. Sea Reg. Fish. Res. Lab. 31:57-64.

Growth rate, food efficiency and survival rate for young S. thompsoni fed on 2 kinds of diet were determined in 2 kinds of rearing system. Diets used were raw jack mackerel muscle and compound feed. A laboratory tank with running water of relatively low temperature and a cage at sea of higher temperature were used. These rates were also determined for young S. schlegeli fed on the compound feed in the running water system. Experiments occurred during the summer. In the running water system, the growth rate and food efficiency in S. thompsoni fed on the raw fish were higher than those fed on the compound feed. Similar data for raw fish at sea were not available. The final survival rate of the fish reared in the running water was higher than that in the cage at sea in each kind of feed. The fish in temperatures higher than 27.degree. C showed lower feeding

activities regardless of the kind of feed and the rearing systems. Some took no notice of raw fish and died. S. schlegeli actively fed at higher temperature and achieved high food efficiency and high growth.

Ikuno, Y., M. Shimizu, Y. Koshino, T. Maoka, and T. Matsuno. 1985. Stereochemical investigation of carotenoids from yellowtail rockfish Sebastes flavidus. Bull. Jpn. Soc. Sci. Fish. 51(12):2033-2036.

The carotenoids in the integuments of yellow-tail rockfish Sebastes flavidus were investigated from the stereochemical points of view.

Ishida, M. 1986. Comparative osteology and myology of caudal fin in the Scorpaenoid fishes. In Uyeno, T., et al. (editors), Indo-Pacific fish biology; Second International Conference, Tokyo, Japan, July 29-Aug. 3, 1985. The Ichthyological Society of Japan: Tokyo, Japan (Dist. by ISBS Inc.: Portland, Oregon). 985 p.

Ishii, K., and H. Yabu. 1981. Chromosomes in two species of rockfish. Chromosome Inf. Serv. 31:22-24.

Recent studies showed that the simple staining method recommended by Wittmann (1965) was quite successful for the observation of chromosomes in fishes. In the present investigation, the same method was employed for the seminal glands in two Japanese rock fishes of Sebastolobus macrochir (Guenther) and Sebastes iracundus (Jordan et Starks), both belonging to Scorpaenidae.

Ito, Daniel H. 1982. A cohort analysis of Pacific ocean perch stocks from the Gulf of Alaska and Bering Sea regions. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 82-15, 157 p.

Ito, Daniel H. 1987. Comparing abundance and productivity estimates of Pacific ocean perch in waters off the United States. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 287-298. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Ito, Daniel H., and James W. Balsiger. 1983. Condition of groundfish resources of the Gulf of Alaska in 1982. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/NWC-52, 204 p.

This report contains an assessment of the condition of groundfish in the Gulf of Alaska region through 1982. The assessments are based on species-by-species analyses of the data collected from the commercial fishery and research vessel surveys. Estimates of maximum sustainable yield and equilibrium yield are presented to guide management of the 1983 fishery.

Ito, Daniel H., Daniel K. Kimura, and Mark E. Wilkins. 1986. Current status and future prospects for the Pacific Ocean perch resource in waters off Washington and Oregon. In Pacific Fishery Management Council, Status of the Pacific Coast groundfish fishery through 1986 and recommended acceptable biological catches for 1987, Appendix 3, p.1-44. Pacific Fishery Management Council, Metro Center, Suite 420, 2000 SW First Ave., Portland, Oregon 97201.

Iverson, J. L. 1958. Technical note no. 48 - Pacific ocean perch - proximate composition. Comm. Fish. Rev. 20(12):22-24.

Jakobsen, T. 1972. Spawning saithe investigations on the coastal banks from More to Lofoten during the period March 1 to 11, 1972. Fisken Havet 3:62-65.

Jangaard, P. M., L. W. Regier, F. G. Claggett, B. E. March, and, J. Biely. 1974. Nutrient compositin of experimentally produced meals from whole argentine, capelin, sand lance, and from flounder and redfish filleting scrap. J. Fish. Res. Board Can. 31(2):141-146.

Jensen, D. 1970. Some observations on intrinsic cardiac rate regulation in several marine vertebrates. Comp. Gen. Pharmacol. 1(2):254-256.

Jensen, L. A. 1976. Parabothriocephalus sagitticeps: new combination Cestoda: Parabothriocephalidae from Sebastes paucispinis of southern and central California. J. Parasitol. 62(4):560-562.

P. sagitticeps (Dibothrium sagitticeps Sleggs 1927) from S. paucispinis is redescribed and given a generic reassignment. The new combination is based on the dorsal, submarginal genital atrium and testes arrangement. The tapeworm prevalence was 84% of 354 rockfish in the coastal waters of S. and Central California [USA].

Jensen, L. A., R. A. Heckmann, M. Moser, and M. D. Dailey. 1982. Parasites of bocaccio Sebastes paucispinis from southern and central California. Proc. Helminthol. Soc. Wash. 49(2):314-317.

Johnson, Allyn G. 1972. An electrophoretic investigation of the family Scorpaenidae. Ph.D. Thesis, Univ. Wash., Seattle, 65 p.

Johnson, Allyn G. 1977. A survey of biochemical variants found in groundfish stocks from north Pacific and Bering Sea. Anim. Blood Groups Biochem. Genet. 8(1):13-20.

This report provides information on biochemical variants

found in 16 spp. [Theragra chalcogramma, Sebastes aleutianus, S. borealis, S. alutus, Anoplopoma fimbriata, Atheresthes stomias, Microstomus pacificus, Glyptocephalus zachirus, Hippoglossoides elassodon, Platichthyes stellatus, Hippoglossus sterolepsis, Lepidopsetta belineata, Limanda aspera, Reinhardtius hippoglossoides, Limanda probascidea, Pleuronectes quadrituberculatus]. These variants may be useful in answering some of the questions facing fisheries agencies concerning stock separation, hybridization and life histories. Further studies should provide useful information in the areas of eopulation biology of fishes in Alaskan waters.

Johnson, Allyn G., and D. M. Ogrydziak. 1984. Genetic adaptation to elevated carbon dioxide atmospheres by pseudomonas-like bacteria isolated from rock cod Sebastes spp. Appl. Environ. Microbiol. 48(3):486-490.

The microorganisms on rock cod fillets stored in a modified atmosphere (MA; 80% CO2-20% air) at 4.degree. C for 21 days were isolated. Only Lactobacillus sp. (71-87%) and tan-colored Pseudomonas sp.-like isolates (TAN isolates) were found. The TAN isolates grew more slowly in MA than in air at 8.degree. C. When TAN isolates were grown in air at 8.degree. C and then transferred to MA at 8.degree. C, there was an initial decline in viable counts for 10-30 h followed by exponential growth. During this exponential growth phase in MA, the growth rates of the TAN isolates from MA-stored fish were significantly greater than those of the TAN isolates from fresh fish. When a TAN isolate from fresh fish was grown under MA for 21 days, it then grew as rapidly under MA as isolates from MA-stored fish. The TAN isolates genetically adapt to high levels of CO2.

Johnson, Allyn G., F. M. Utter, and H. O. Hodgins. 1970. Electrophoretic variants of L-alpha glycerophosphate dehydrogenase in Pacific ocean perch (Sebastodes alutus). J. Fish. Res. Board Can. 27(5):943-945.

Johnson, Allyn G., F. M. Utter, and H. O. Hodgins. 1970. Interspecific variation of tetrazolium oxidase in Sebastodes (rockfish). Comp. Biochem. Physiol. 37(2):281-285.

Johnson, Allyn G., Fred M. Utter, and Harold O. Hodgins. 1972. Electrophoretic investigation of the family Scorpaenidae. Fish. Bull., U.S. 70(2)403-413.

Thirty-one species of three genera of the family Scorpaenidae were separated into 17 groups based on starch gel electrophoretic comparison of muscle proteins and six enzymatic systems. This study concluded that relatively greater similarity existed between the Pacific Sebastes and the Atlantic Sebastes than between either and the other

genera. Ten of the 27 species of Pacific Sebastes tested had unique biochemical profiles which may be useful for identification of specimens. (Author).

Johnson, Allyn G., Fred M. Utter, and Harold O. Hodgins. 1972. Estimate of genetic polymorphism and heterozygosity in three species of rockfish (genus Sebastes). Comp. Biochem. Physiol. B Comp. Biochem. 44:397-406.

An estimate of the genetic polymorphism and average heterozygosity in three species of rockfish, Sebastes alutus, S. caurinus, and S. elongatus, was made using differences in electrophoretic mobility of proteins on starch gel. In S. alutus two of twenty-five loci; in S. caurinus, one of twenty-five loci; and in S. elongatus, two of twenty-four loci were polymorphic. This yield estimates of 8, 4 and 8 per cent of all loci polymorphic for the average species population and values of 3.8, 1.8 and 3.2 per cent for the proportion of the genome heterozygous per individual in the average population. (Author).

Johnson, Allyn, Fred M. Utter, and Harold O. Hodgins. 1971. Phosphoglucomutase polymorphism in Pacific ocean perch, Sebastes alutus. Comp. Biochem. Physiol. B Comp. Biochem. 39(2):285-290.

Johnson, G. D., and W. F. Smiht-Vaniz. 1987. Redescription and relationships of Parasphyraenops atrimanus Bean Pisces Serranidae with discussion of other Bermudian fishes known only from stomach contents. Bull. Mar. Sci. 40(1):48-58.

Parasphyraenops atrimanus Bean, an apparent Bermuda endemic known only from two specimens, is redescribed. Originally placed in the Cheilodipteridae, P. atrimanus is shown to be a planktivorous serranid belonging to the subfamily Serraninae. It is hypothesized to be most closely related to Serranus incisus and S. luciopercanus, based on unique modifications of the infraorbital series. A novel specialization of P. atrimanus is the configuration and articulation of its lacrimal, but otherwise this fish is remarkably similar to S. incisus, also a planktivore; the two species exhibit at least seven synapomorphies. Accordingly, we assign S. incisus to Parasphyraenops. Two additional fish species, Sebastes paucispinis and Cepola sp., recorded from Bermuda solely from stomach contents, are discussed.

Johnson, H. E., and C. J. D. Brown. 1962. Olfactory apparatus in the black rockfish, Sebastodes melanops. Copeia 4:838-840.

Jones, D. H. 1968. Angling for redfish. In ICNAF Environmental surveys, NORWESTLANT 1-3, 1963. Int. Comm. Northwest Atl. Fish. Spec. Publ. 7:225-240.

Jones, D. H. 1969. Some characteristics of the pelagic redfish Sebastes mentella from weather station Alfa. J. Cons. Cons. Int. Explor. Mer. 32(3):395-412.

Jones, D. H. 1970. Food parasites and the reproductive cycle of pelagic redfish, Sebastes mentella, from weather station Alfa in the North Atlantic. Bull. Mar. Ecol. 6(9):347-370.

Jones, D. H. 1972. A rare deep-sea angler from weather station "Alfa". Mar. Observ. 42(235):24-26.

Jonsson, J. 1983. The state of marine stocks in Icelandic waters and fishing prospects for 1983. Hakrannsoknir 26:5-65.

Estimates of 1983 fishing stocks in Icelandic waters are given for cod, haddock, saithe, redfish (Sebastes marinus and S. mentella), Greenland halibut, plaice, catfish, blue ling, herring, capelin, blue whiting, Nephrops, scallop and deep-sea prawn. Catches of the previous few years are discussed.

Jordan, D. S. 1884. The rock cods of the Pacific. In G. B. Goods (editor), The fisheries and fishery industries of the U. S., p. 262-277. Washington, Govt. Printing Office, 1884.

Jordan, D. S. 1887. A catalogue of the fishes known to inhabit the waters of North America, north of the Tropic of Cancer, with notes on species discovered in 1883 and 1884. In U.S. Comm. Fish and Fisheries, Report of the Commissioner for 1885, p. 789-973. Washington, Govt. Printing Office, 1887.

The synopsis of the Fishes of North America, by David S. Jordan and Charles H. Gilbert (Bulletin United States National Museum No. 16), was finished in September, 1882, and was issued about April 1, 1883. Since the publication of that work an active study of North American fishes has brought to light many species not included in the Synopsis, and has shown various errors in the nomenclature of species already known. The additions are cheifly in the Bassalian or deep-sea fauna of the Atlantic, in the tropical fauna of the Florida Keys, and in the fresh-water fauna of the lower part of the Mississippi Valley.

Jordan, D. S., and B. W. Evermann. 1896. A check-list of the fishes and fish-like vertebrates of North and Middle America. In U.S. Comm. Fish and Fisheries, Report of the Commissioner for 1895, p. 209-584. Washington, Govt. Printing Office, 1986.

The present paper is a list of all the species of fishes and fish-like vertebrates thus far recorded as occurring on American waters north of the Isthmus of Panama. For the sake of greater completeness the marine fishes of Guiana, Ecuador, and the Galapagos Islands are included, as all of these are sure, sooner or later, to be found within our limits. In like manner the few species known from Kamchatka are included as part of the fauna of the Alaskan Sea.

Jordan, D. S., and B. W. Evermann. 1898. The fishes of North and Middle America. Bull. U. S. Nat. Mus. 47(2):1241-2183.

Jordan, D. S., and B. W. Evermann. 1927. New genera and species of North American fishes. Proc. Calif. Acad. Sci. Ser. 4. 16(15):501-507.

Jordan, D. S., and C. H. Gilbert. 1880. Description of a new scorpaenoid fish (Sebastichthys maliger), from the coast of California. Proc. U. S. Nat. Mus. 3:322-324.

Description of species is given.

Jordan, D. S., and C. H. Gilbert. 1880. Description of a new scorpaenoid fish (Sebastichthys proriger), from Monterey Bay, California. Proc. U. S. Nat. Mus. 3:327-329.

Jordan, D. S., and C. H. Gilbert. 1880. Description of a new species of "rock cod" (Sebastichthys serriceps), from the coast of California. Proc. U. S. Nat. Mus. 3:38-40.

Jordan, D. S., and C. H. Gilbert. 1880. Description of a new species of "rock fish" (Sebastichthys carnatus) from the coast of California. Proc. U. S. Nat. Mus. 3:73-75.

Description of species is given.

Jordan, D. S., and C. H. Gilbert. 1880. Description of a new species of "rock fish" (Sebastichthys miniatus) from Monterey Bay, California. Proc. U. S. Nat. Mus. 3:70-73.

Description of species is given.

Jordan, D. S., and C. H. Gilbert. 1880. Description of seven new species of Sebastoid fishes, from the Coast of California. Proc. U.S. Natl. Mus. 3:287-298.

Jordan, D. S., and C. H. Gilbert. 1880. Description of two new species of Sebastichthys (Sebastichthys entomelas and Sebastichthys rhodochloris), from Monterey Bay, California. Proc. U.S. Natl. Mus. 3:142-146.

Jordan, D. S., and C. H. Gilbert. 1881. Description of a new species of "rockfish" (Sebastichthys chrysomelas), from the coast of California. Proc. U. S. Nat. Mus. 3:465-466.

In previous papers on the California rock-fish we have provisionally identified one of the common species as the Sebastes nebulosus of Ayres. Ayres himself, however, considered his own nebulosus as without question the Sebastes fasciatus of Girard, which is the Sebastichthys fasciolaris of Lockington. The two species agree closely in general characters, but differ in the developement of the spines on the head, and especially in color, the "fasciolaris" having the yellow markings in the form of small spots or specklings, which are confluent along the sides, forming a sort of band, the other species having the yellow areas all large.

Jordan, D. S., and C. H. Gilbert. 1881. Description of Sebastichthys mystinus. Proc. U. S. Nat. Mus. 4:70-72.

Two species have been confounded by previous writers under the name of Sebastes or Sebastomus melanops. The one, darker in color, with smaller mouth and black peritoneumm, in found from Puget Sound to San Diego, being most common southward, and is perhaps the most abundant species of the genus on the coast. The other, paler and more spotted, with larger mouth and white peritoneum, ranges from Monterey to Sitka, being most common northward. The first is the "Peche Pretre" of the Monterey fisherman, the second the "Black Bass" of the anglers of Puget Sound. The first is referred to by us as Sebastichthys melanops on page 289 and elsewhere in these Proceedings (Vol. III); the second as Sebastichthys simulans. The original description of Girard of his Sebastes melanops, however, can refer only to the second fish, as is shown by the following statements.

Jordan, D. S., and C. H. Gilbert. 1881. List of the fishes of the Pacific Coast of the United States with a table showing the distribution of the species. Proc. U. S. Nat. Mus. 3:452-458.

The writers have been engaged during most of the present year(1880) in making investigations of the fish and fisheries of the Pacific coast of the United States, in the interest of the United States Fish Commission and the United States Cencus Bureau. Extensive collections have been made at each of the principal fishing ports from New Westminster to San Diego. In the present paper a catalogue is given of

the species now known to inhabit the Pacific Ocean betweeen the mouth of Fraser's River on the north and San Diego on the south. Twenty five species of Sebastichthys listed.

Jordan, D. S., and C. H. Gilbert. 1881. Notes on the fishes of the Pacific coast of the United States. Proc. U. S. Nat. Mus. 4:29-70.

It is the purpose of this paper to present a list of the species of fishes known to occur along our Pacific coast, between the Mexican boundary and the boundary of British Columbia, together with notes on the distribution, habits, size, value, etc., of each species, in advance of the publication of a general descriptive work. The paper is to be consideed mainly in the light of a contribution to our knowledge of the geographical distribution of fishes. The "common names" here given are, in all cases, those heard by the writers among the fishermen on different parts of the coast.

Jordan, D. S., and C. H. Gilbert. 1882. Description of two new species of fishes (Sebastichthys umbrosus and Citharichthys stigmacus) collected at Santa Barbara, California by Andrea Larco. Proc. U. S. Natl. Mus. 5:410-412.

Jordan, D. S., and C. H. Gilbert. 1882. List of the fishes collected by Lieut. Henry E. Nichols, U.S.N., in the Gulf of California and on the west coast of lower California, with descriptions of four new species. Proc. U. S. Natl. Mus. 4:273-279.

The specimens of fishes collected by Lieut. Henry E. Nichols, comandant of the United States Coast and Geodetic Survey Steamer Hassler, in his voyage along the coast of Mexico and Central America, have been already noticed by us on page 225 of the present volume of the Proceedings. On the northward voyage of the Hassler (January-March, 1881), Lieutenant Nichols made another collection, also of much importance. A list of the species obtained, with their numbers as recorded in the register of the museum, is given below.

Jordan, D. S., and C. H. Gilbert. 1882. Synopsis of the fishes of North America. Bull. U.S. Nat. Mus. 16:1018.

Jordan, D. S., and E. C. Starks. 1904. A review of the Scorpaenoid fishes of Japan. Proc. U. S. Nat. Mus. 27:91-175.

Jow, Tom. 1979. Trawl mesh sizes and yields per units of recruitment in the California fishery. In Pacific Fishery Management Council, Technical papers referenced in the Fishery Management Plan for the California, Oregon and Washington groundfish fishery, p. 1-21. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon.

Jungmann, T. P. 1983. Application of sodium dodecyl sulfate electrophoresis of hemolysate to the biochemical systematics of the rockfish Sebastes. Biochem. Syst. Ecol. 11(4):389-396.

Sodium dodecyl sulfate electrophoresis of rockfish hemolysate was carried out to investigate problems in the systematics of the genus Sebastes. Results generally revealed species-specific electropherograms that were intraspecifically invariant. Experimental findings supported the distinction of S. chrysomelas and S. carnatus as valid species which hitherto had not been accomplished on a morphometric or meristic basis. Common protein subunits occurred within all specimens studied, and additional interspecific differences suggested several biochemical subgroupings (S. caurinus, S. nebulosus; S. paucispinis, S. qoodei; S. carnatus, S. chrysomelas, S. atrovirens, S. melanops, S. mystinus and S. serranoides). These proposed subgroupings generally differed from previous classifications based on morphometric and meristic data. Some of these differences may ultimately be attributed to pressure adaptive differences in the Hb molecule.

Kabata, Z., and S. N. Wilkes. 1977. Peniculus asinus (Copepoda:Pennellidae), a new species of copepod parasitic on fishes of the genus Sebastes along the west coast of North America. Can. J. Zool. 55(12):1988-1991.

P. asinus sp. nov., a copepod parasitic on Sebastes (Pisces: Teleostei) off the Pacific coast of Canada, is described and illustrated. The copepod is a unique member of its genus in that it possesses cephalothoracic holdfast processes. The discovery of a Peniculus with these processes is taken as evidence confirming the place of this genus in the family Pennellidae.

Kabata, Z. 1970. Some Lernaeopodidae (Copepoda) from fishes of British Columbia. J. Fish. Res. Board Can. 27(5):865-885.

Kajimura, Hiroshi, Clifford H. Fiscus, and Richard K. Stroud. 1980. Food of the Pacific white-sided dolphin, Lagenorhynchus obliquidens, Dall's porpoise, Phocoenoides dalli, and northern fur seal, Callorhinus ursinus, off California and Washington: with appendices on size and food of Dall's porpoise from Alaskan waters. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-F/NWC-2, 30 p.

The food of L. obliquidens, and P. dalli collected off California and Washington in 1958-72 is compared with food of C. ursinus. The 3 species are opportunistic feeders, preying primarily on small schooling fishes and cephalopods. Species identified for the first time as prey of L. obliquidens include Sebastes.

Kakimoto, H., and G. Yamamoto. 1979. Artificial fish reefs in Japan Sea coastal regions. In Proceedings of the Japan-Soviet joint symposium on aquaculture, Tokyo and Tsuruga, Japan, September 1978, p. 103-109. Tokai University (Japan) and Ministry of Fisheries (Moscow), 1979.

The Japanese government has promoted the construction of artificial reefs in Japanese waters since 1953, but the project was accelerated in 1976. The material used is mainly concrete blocks, but old boats, broken stone and timber are also used. Over 120 fish species are attracted to the reefs, but their construction is mainly aimed at the propagation of commercially important species such as Pagrosomus major, Paralichthys olivaceus, Seriola quinqueradiata and Sebastes inermis. The handline is the most favourable method for fishing in the reef area. The author describes the effects of the artificial reef with reference to type of fish attracted, distribution, developmental stages, the luring effect of the effect, predation and migration. The reef does seem to play a role as a site for spawning, sheltering, 'nursery' function and predation. The species caught are tabulated.

Kanamoto, Z. 1977. On the ecology of hexagrammid fish. Part 3. Niches of Agrammus agrammus and Hexagrammos otakii and the mode of life of some reef fish. Jpn. J. Ecol. 21(3):215-226.

The ecology of many species of reef fish has been studied by means of year-round underwater observation around the reef near Benten Island in Sendai Bay, where 21 species of reef fish, including 2 hexagrammid species, coexist. These fish were divided into 3 major types according to their mode of life (habitat, feeding habits, method of escape and so on), namely, touching-type, floating-type and swimming-type. The touching-type fish (A. agrammus, H. otakii etc.) spend long periods in a solitary state on the rocks or on the algae. Floating-type fish (Sebastes inermis and others) remain above the rocks or among the algae growing on the rocks, some in a solitary state, and some in a gregarious state in daylight. The swimming-type fish (Ditrema temmincki, Girella punctata etc.) swim on the surface or in the subsurface and bottom layers, mostly in a gregarious state in daylight. Although many species were observed in this particular area, there were few species which competed with each other.

Kanayama, T. 1981. Scorpaenidae fishes from the Emperor Seamount Chain. In Mishima, S. (editor), Pelagic animals and environments around the subarctic boundary in North Pacific. Res. Inst. N. Pac. Fish. Hokkaido Univ. Spec. Vol. :119-129.

Kang, Y. J. 1982. Studies on the structure and production processes of biotic communities in the coastal shallow waters of Korea. 1. Age and growth of Sebastes inermis from Namhae Island, Korea. Publ. Inst. Mar. Sci. Natl. Fish. Univ. Busan 14:51-58.

The aging and growing of Sebastes inermis from Namhae Island were studied by otolith reading. The annual ring where the opaque zone shifts to the translucent one was formed in May. Von Bertalanffy's growth equation was estimated with the back-calculated total length.

Kariya, T. 1969. The relationship of food intake to the amount of stomach contents in mebaru, Sebastes inermis. Bull. Jap. Soc. Sci. Fish. 35(6):533-536.

Karnop, G., R. Muenzner, and N. Antonacopoulos. 1978. The effect of on board irradiation on the shelflife of redfish. 2. Bacteriological and chemical results. Arch. Lebensmittelhyg. 29(2):49-53.

Bacteriological and chemical investigations on extending the shelflife of fresh iced unpacked redfish (Sebastes marinus}) by 100 krad irradiation were carried out during two voyages of RV Anton Dohrn. Bacteriological criteria indicated no shelflife extension on one voyage and an extension by 5-7 days on the other voyage. Chemical indices indicated an extension of 4-6 and more than 10 days, respectively. Delayed irradiation after 7 days storage in ice influenced only the chemical values (4-6 days shelflife extension), while reirradiation on the 6th day affected both the bacteriological (some days extension) and the chemical values (more than 10 days extension). The greatest effect was obtained with whole fish irradiated and stored in plastic bags, which - due to the dominance of biologically largely inactive Moraxella sp - on the 28th day showed nearly the initial chemical values. Together with the previously published sensoric findings these results indicate no or only a slight prolongation of shelflife of unpacked iced redfish due to irradiation at once or on the 7th day or both at once and on the 7th day.

Kauffman, Thomas A., John Lindsay, and Ronald Leithiser. 1981. Vertical distribution and food selection of larval atherinids. Rapp. P. V. Reun. Cons. Int. Explor. Mer 178:342-343.

Data on the vertical profile distribution of larval atherinids in coastal waters off Southern California was obtained using Manta neuston, mid water bongo, and epibenthic "tonga" bongo samplers. During the day, larvae were only collected at the surface, with a shift to lower depths occurring at night. Gut content analysis showed much food was located in stomachs of diurnally collected atherinids, while most food substances were found in the hind gut of nocturnally collected specimens. The majority of food items in larvae less than 10 mm in total length consisted of copepod nauplii and tintinnid protozoans. The most numerous prey item found in larvae between 10 and 28 mm in length was the cyclopoid copepod Oithona spp., followed by the harpacticoid Euterpina acutifrons and the cyclopoid Corycaeus anglicus. Densities of these three species were less than 2/m super(3.) in surface waters during the time of sampling. Thus, a size selective feeding behavior was indicated similar to that shown for larval Sebastes marinus

Kelly, George F., and Allan M. Barker. 1961. Observations on the behavior, growth, and migration of redfish at Eastport, Maine. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:263-275.

Kelly, George F., and Allan M. Barker. 1961. Vertical distribution of young redfish in the Gulf of Maine. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:220-233.

Kelly, George F., and Allan M. Barker. 1963. Effect of tagging on redfish growth rate at Eastport, Maine. Int. Comm. Northwest Atl. Fish. Spec. Publ. 4:210-213.

Kelly, George F., and Allan M. Barker. 1963. Estimation of population size and mortality rates from tagged redfish, Sebastes marinus L., at Eastport, Maine. Int. Comm. Northwest Atl. Fish. Spec. Publ. 4:204-209.

Kelly, George F., and Allan M. Barker. 1965. The copepod ectoparasite Sphyrion lumpi (Kroyer) in relation to redfish Sebastes marinus (L.) in the Gulf of Maine. Int. Comm. Northwest Atl. Fish. Comm. Spec. Publ. 6:481-500.

Kelly, George F., A. M. Barker, and G. M. Clarke. 1961. Racial comparison of redfish from the Western North Atlantic and Barents Sea. Rapp. P. V. Reun. Cons. Int. Explor. Mer 150:28-41.

Kelly, George F., and T. W. Martin. 1958. Variations in body proportions of redfish from the Gulf of Maine, Nova Scotian Banks, and the Grand Banks. Int. Comm. Northwest Atl. Fish. Spec. Pub. 1:335-337.

Kelly, George F., and Robert S. Wolf. 1959. Age and growth of redfish (Sebastes marinus) in the Gulf of Maine. Fish. Bull., U. S. 60(156):1-31.

Kelly, George F., and Robert S. Wolf. 1961. Age and growth of the redfish (Sebastes marinus) in the Gulf of Maine. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:262.

Kenchington, T. J. 1980. Species and stocks of redfish in NAFO Divisions 4VWX. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 80/30, 35 p.

Three species of redfish (Sebastes) and the blackbelly rosefish (Helicolenus dactylopterus) are now recognised from the northwest Atlantic. The occurrence of these in 4VWX, and the existence of stocks in this area, were examined using 25 characters (mostly meristic or morphometric) on 550 fish. Helicolenus can be readily identified (a key to these genera is included). They were only found in small numbers along the continental slope from Georges Basin to Western Bank. S. marinus was not found. S. mentella could only be distinguished from S. fasciatus by a discriminant function. There appeared to be some intermediates between these two species. S. mentella were only taken at one station, and may be vagrants from further north. S. fasciatus are the typical redfish of the Scotian Shelf. No conclusive evidence of separate stocks of S. fasciatus within 4VWX was found, but the data strongly suggest that these do occur.

Kenchington, T. J. 1981. Division 4VWX redfish: assessment and estimate of total allowable catch for 1982. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 81/17, 39 p.

Landings of Scotian Shelf redfish have declined since the early 1970's, and are now about 13,000 MT/yr. An analytical assessment of these fish was not attempted. Instead time series of catches, commercial catch rates, research vessel biomass estimates and length frequencies were examined. These seem to indicate a major decline in biomass during the 1970's, which appears to be continuing. A considerable reduction in the TAC is therefore, necessary.

Kenchington, T. J. 1982. Population structure and management units of redfishes (Sebastes sp.) on the Scotian Shelf. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 82/9/84, 43 p.

The nature of a fish "stock" is discussed with reference to redfish. The population structure of redfishes of the Scotian Shelf is described, using morphological, electrophoretic, and distributional data. It is shown that a reproductively isolated unit is not an appropriate one for management. Appropriate management units are suggested.

Kenchington, T. J. 1983. Comment on meristic variation in beaked redfishes, Sebastes mentella and S. fasciatus, in the northwest Atlantic. Can. J. Fish. Aquat. Sci. 40(9):1532-1533.

Kenchington, T. J. 1983. Morphological characters of Scotian shelf redfish (Sebastes spp.) and rosefish (Helicolenus dactylopterus). Can. Manuscr. Rep. Fish. Aquat. Sci. 1707, 65 p.

Data were gathered on a large number of morphometric, meristic and other morphological characters of 876 Sebastinid fish (Sebastes fasciatus, S. mentella and Helicolenus dactylopterus) from the Scotian Shelf. Those data are presented here with full details of the methods used, plots and summary statistics for each character and a discussion of the suitability of each character for use in multivariate studies. Data are appended on a further 30 fish, for which specific electrophoretic identifications are available.

Kenchington, T. J. 1984. Population structures and management of the redfishes (Sebastes spp. Scorpaenidae) of the Scotian shelf. Ph.D. Thesis, Dalhousie University, Halifax, Nova Scotia. 713 p.

Kenchington, T. J. 1986. Morphological comparison of two northwest Atlantic redfishes, Sebastes fasciatus and Sebastes mentella, and techniques for their identification. Can. J. Fish. Aquat. Sci. 43(4):781-787.

A knowledge of the taxonomy of the Atlantic redfishes, Sebastes spp., and techniques for their field identification are essential prerequisites for rational management of their fishery, but both remain poorly known. Through analysis of a set of morphological data for Sebastes fasciatus and S. mentella of the Scotian Shelf, using multivariate techniques, I examined the potential of 15 characters as field identifiers. Although the species are significantly different, they cannot be fully separated using these characters. I suggest that electrophoretic techniques are needed for precise identification, although a

rapid method for determining the species compositions of large samples, using anal fin ray counts, could be developed.

Kendall, Arthur W. 1982. A catalog of information, primarily illustrative, on larval development of Sebastes. U.S. Dep. Comer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 82-01, 23 p.

Kendall, Arthur W., and William H. Lenarz. 1987. Status of early life history studies of northeast Pacific rockfishes. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 99-128. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Kennedy, V. S. 1976. Arsenic concentrations in some coexisting marine organisms from Newfoundland and Labrador. J. Fish. Res. Board Can. 33(6):1388-1393.

Inorganic As concentrations in sea water and mud and total As concentrations in bodies of shrimp, zooplankton and fish from N. Newfoundland and S. Labrador [Canada] were measured. There was a positive relationship between concentration and carapace length in Pandalus borealis and P. montagui and a negative relationship in Eualus macilentus. There was no relationship between concentrations in shrimp eggs and carapace length. As concentrations in zooplankton and fish muscle were relatively low compared with the shrimp species; amphipods contained more As than copepods or euphausiids and American plaice (Hippoglossoides platessoides) more than redfish (Sebastes marinus), turbot (Reinhardtius hippoglossoides) and Atlantic cod (Gadus morhua). There was no evidence of increasing As concentrations through successively higher levels of the food chain.

Ketchen, K. S. 1954. The rockfish Sebastodes rubrivinctus in British Columbia waters. J. Fish. Res. Board Can. 11(3):335-338.

Ketchen, K. S. 1979. An overview of the Strait of Georgia winter trawl fishery, 1951-1952 to 1977-78. Can. Fish. Mar. Serv. Manuscr. Rep. 1511, 63 p.

Statistics of catch and effort for a 27-yr period have been examined to identify trends in landings and relative abundance of groundfish, with special reference to foodfish species consisting primarily of Pacific cod.

Ketchen, K. S. 1980. Reconstruction of Pacific ocean perch (Sebastes alutus) stock history in Queen Charlotte Sound, 1965-76. Part 1. Estimation of foreign catches, 1965-76. Can. Manuscr. Rep. Fish. Aquat. Sci. 1570, 50 p.

Need for accurate assessment of the state of stocks of S. alutus and estimation of optimum sustainable yield, has necessitated a re-examination of foreign fishery statistics. Published data do not provide reliable information on the catch of S. alutus as distinct from other rockfishes. The report describes the techniques used to derive this information and provides estimates of the annual removals from 1965 to 1976 for Queen Charlotte Sound, the principal fishing area for S. alutus adjacent to the British Columbia coast.

Ketchen, K. S. 1981. Reconstruction of Pacific Ocean perch (Sebastes alutus) stock history in Queen Charlotte Sound. Part 2. Catch per unit of effort as a measure of abundance. Can. Manuscr. Rep. Fish. Aquat. Sci. 1599, 78 p.

Statistics of the Canadian fishery for Pacific ocean perch (Sebastes alutus) in Queen Charlotte Sound have been used to develop a new CPUE measure of relative abundance. This index is positively correlated with an earlier one based on the performance of a U.S. fishing fleet and is compatible with independent, provisional estimates of available biomass. A rapid decline in abundance occurred between 1965 and the early 1970s, a period of relatively heavy removals. By the late 1970s catch as well as total effort had reached its lowest point since the inception of fishing in the early 1950s. The new index of abundance has been applied to a range of estimates of total removals (required because of uncertainty about the reliability of reported foreign catch) to obtain a range of estimates of total fishing effort. These data are to be used in further stock assessment studies and reported in this publication series.

Khudenko, G. V., M. Ya. Kuntsova, and V. V. Polenyuk. 1983. Morphofunctional peculiarities in sound perception of the eastern rockfish, Sebastes taczanowskii (Scorpaenidae), and the Spanish mackerel, Scomber japonicus (Scombridae). J. Ichthyol. 23(2):141-146.

The structure of the inner ear and its sensitivity to sound was investigated in the eastern rockfish, S. taczanowskii , and the Spanish mackerel, S. japonicus. After severence of the lateral line, sensitivity to a tone of 150 hertz decreased and increased to a tone of 800 hertz an increase in sensitivity to the "dolphin" sound was also noted in the mackerel. Denervation to the lateral line probably increases the sensitivity of the ear to high frequency signals, making it easier for fish to find their bearings in a long-distance sound field.

Killekar, S. P. 1950. Determination of vitamin A in livers of black rockfish (Sebastodes melanops), using various solvents. M.S. Thesis, Univ. Wash. Seattle.

Kim, J. B., and B. S. Kim. 1981. The observation on the epithelium in the olfactory sac of teleosts. J. Busan Med. Coll. 21(2):21-30.

To clarify the structure of the olfactory epithelium in the olfactory sac of several species of teleosts (Parasilurus asotus, Carassius, Can- therhines modestus, Pagrosomus major, Sebastes inermis and Clu- panodon punctatus), tissues were fixed in Zamboni's solution and the surrounding hard tissue was decalcified in EDTA. For light microscopy, the tissue blocks were sectioned and stained with H-E [hematox- ylin-eosin], PAS [periodic acid-Schiff], PAS-AB [Alcian blue] pH 2.5, nuclear fast red-AB pH 2.5 solutions. For EM, the tissues were postfixed in 1% osmic acid. They were embedded in Epon 812. Sections were stained with uranyl acetate and lead citrate and examined by the JEM 100 B EM. The olfactory mucosa in olfactory sac of teleosts was folded, and was especially conspicuous in that of P. asotus. The epithelium in the folded portion was pseudostratified columnar cells with developed cilia. Neutral and acid mucous cells were observed on the epithelium of Carassius, P. major and C. punctatus. The Bowman's gland seen in mammalian olfactory mucosa was not seen in teleosts. The epithelium in the flat portion which surrounds the folded one was stratified and contained many mucous cells. Taste buds were observed in the epithelium of the flat portion in the sac of P. asotus.

Kim, J. M., J. M. Yoo, H. T. Huh, and S. S. Cha. 1985. Distribution of fish larvae in the Ulsan Bay, South Korea and its adjacent waters. Ocean Res. (Seoul) 7(2):15-22.

Seasonal distribution of fish larvae in the adjacent waters of Ulsan was studied during February, April, July and September, 1984. Twenty four species of larvae were identified. The major species found in this survey were as follows: Engraulis japonica, Omobranchus elegans, Callionymidae, Ammodytes personatus and Sebastes inermis (?). Dominant species differed from month to month; Ammodytes personatus was the most abundant fish in February with 84% of the total, and Sebastes inermis (?) and Gobiidae were in April with 47% and 28% respectively, while Engraulis japonica dominated in July (85%) and September (53%). Unknown species of Callionymidae occurred in large number in July and September. Values for species diversity index were low in February and July, and high in April and September. Among the four most abundant fish larvae, Engraulis japonica temporally overlapped with omobranchus elegans, and Ammodytes personatus did not overlap with the others.

Kim, J. Y. 1982. A study on the distribution of fish larvae in the western water of Korea in spring. Bull. Fish. Res. Dev. Agency Busan 30:65-71.

The distribution of fish larvae in the western water of Korea was investigated during spring in 1980 and 1981. Larvae were classified into 16 species, 17 genera and 16 families. Enedrias spp. was the most abundant, dominant species were Engraulis japonica, Ammodytes personatus, Liparis tanakai and Astroconger myriaster. It was observed that the location of water area, in which larvae of Enedrias spp., A. personatus and L. tanakai were distributed, were moved northerly as they grew. In general, three horizontal distribution patterns were demonstrated as such the nearshore group with Enedrias spp. and L. tanakai the offshore group with E. japonica, Sebastes inermis and omnipresence group, nearshore to offshore, with A. personatus, Astroconger myriaster, and Sardinops melanosticta.

Kim, M. Y. 1985. Histochemical changes in mucosubstances of the river and sea teleostean esophageal mucous cells due to change of ambient water. J. Cathol. Med. Coll. 38(1):79-92.

This experiment was performed in order to clarify the nature and functions of mucosubstances in the esophagi. The species used were: Cyprinus carpio, Parasilurus asotus, Sebastes hubbsi and Agrammus agrammus. The river fishes were put in sea water and the sea fishes, in river water. The former were sacrificed at the 30th and 45th min, and the latter, at the 1st, 2nd and 3rd respectively. Tissues pieces obtained from the midportion of the esophagi were fixed in 10% neutral buffered formalin. They were embedded in paraffin and sectioned at 6 .mu.m. These sections were stained with hematoxylin and eosin for general histology, and with periodic acid-Schiff reaction, alcian blue (AB) pH 2.5 or 0.4, AB 2.5 -PAS reaction and aldehyde fushsin (AF) pH 1.7-AB 2.5 for histochemical differentiation of mucosubstances. Three general types of epithelial mucosubstances were identified as terms were recognized as neutral muco- substance, sulfomucin and sialomucin. The mucous cells of teleostean esophageal mucosae showed a diversity in their morphology, distribution and histochemical components according to species.

Kim, Y. U. 1983. Fish larvae of Changson channel in Namhae, Korea. Bull. Korean Fish. Soc. 16(3):163-180.

Fish larvae were collected from Changson channel, Namhae over the period from June 1982-May 1983. A total of 44 spp. (33 families and 41 genera) were identified and described morphologically. The larvae of Cyclopsis tentacularis are newly reported in Korean waters. Abundance of the species in

numbers was as follows: Engraulis japonica 86.56%, Acanthogobius flavimanus 5.91%, Enedrias sp. 1.71%, Sebastes inermis 1.18%, Leucopsarion petersi 0.78% and Hexagrammos otakii 0.68%. According to variation of seasonal abundance the larvae were grouped into 3 seasonal groups as follows: spring type, E. japonica, Astroconger sp., Enedrias sp., L. petersi, S. inermis and H. otakii; summer type, E. japica, Leiognathus nuchalis, A. flavimanus, Omobranchus elegans, Syngnathus schlegeli; winter type, Enedrias sp.

Kimura, Daniel K. 1981. Standardized measures of relative abundance based on modelling log (c.p.u.e.), and their application to Pacific ocean perch (Sebastes alutus). J. Cons. Cons. Int. Explor. Mer 39(3):211-218.

A form of the log-linear model for modelling catch per unit effort (c.p.u.e.) is described which treats the year category as an ANOVA classification. This model allows the calculation of two standardized relative abundance indices: 1) direct interpretation of regression coefficients for the year category, and 2) the usual estimates of c.p.u.e. calculated using standardized effort (adjusted c.p.u.e.). The regression coefficient estimates have advantages in theoretical simplicity and computational convenience. The model is applied to two trawl-fished populations of Pacific ocean perch (Sebastes alutus) in the northeast Pacific.

Kimura, Daniel K. 1985. Changes to stock reduction analysis indicated by Schnute's general theory. Can. J. Fish. Aquat. Sci. 42(12):2059-2060.

Recently, J. Schnute generalized the R. B. Deriso age-structured model by using a more general growth curve to derive a more general form of Deriso's delay-difference equation. I have outlined changes in the Stock Reduction Analysis (SRA) model that are required to take advantage of Schnute's more general approach. The proposed changes in the equations do not affect the way SRA is applied, but should reduce bias in the model.

Kimura, Daniel K., James W. Balsiger, and Daniel H. Ito. 1984. Generalized stock reduction analysis. Can. J. Fish. Aquat. Sci. 41(9):1325-1333.

Stock Reduction Analysis (SRA) is generalized so that the model now allows for growth in the fishable biomass and variable recruitment to the fishable biomass. The application of R.B. Deriso's delay-difference equation to SRA allows for growth and also provides justification for using a biomass based model. Variable recruitment is introduced into SRA using both a stock-recruitment relationship and exogenous variables. General methods for obtaining unique solutions to the SRA equations are

presented and give a new method for calculating the equilibrium sustainable yield curve. By applying the generalized SRA model to Pacific ocean perch (Sebastes alutus) stocks in the Gulf of Alaska [USA] sustainable yield from this stock is smaller than previously estimated.

Kimura, Daniel K., M. E. Fraidenburg, and B. M. Leaman. 1978. Comparative otter trawling experiment in Queen Charlotte Sound, British Columbia, Canada, September 1976. Can. Fish. Mar. Serv. Tech. Rep. 768, 47 p.

Kimura, Daniel K., Ruth R. Mandapat, and Sandra L. Oxford. 1979. Method, validity, and variability in the age determination of yellowtail rockfish (Sebastes flavidus) using otoliths. J. Fish. Res. Board Can. 36(4):377-383.

A method using otoliths is presented for the age determinations of [commercially important] yellowtail rockfish (S. flavidus). Most of the details of this method are applicable to other species of rockfish. The method is validated in younger fish by documenting growth of the otolith annular zone by month and by comparison with ages read from scales. Further validation is provided by length-at-age data, which show monotone growth for both males and females. Age reader variability was analyzed for each age category using random effects analysis of variance. Within-reader variances were similar for the 2 readers. Although there were significant variance components due to between-reader differences for aging some age categories, the contribution of this variance component to total variability was negligible. The SD for an age determination of an otolith was similar for both readers, ranging from about 0.6 at 8 yr to about 1.6 at 19 yr. For both readers, the coefficient of variation was approximately 0.08 at all ages.

Kimura, Daniel K., and Jack V. Tagart. 1982. Stock reduction analysis, another solution to the catch equations. Can. J. Fish. Aquat. Sci. 39(11):1467-1472.

In fishery stock assessments, catch equations provide the critical link between stock size, natural mortality rate, fishing rate and catch size. Catch equations are most powerful when age data are available, allowing cohorts to be followed through time using Virtual Population and Cohort Analysis. A simple new method of linking catch equations when age data are not available is proposed. Assuming catches are given in biomass, catch equations are written for each year with a constant recruitment (R), based on a single parameter, added to the total biomass at the beginning of each year. In addition to the catch equations, a final equation is added describing the change in biomass caused by the years of fishing. If n years of catch data are available, n + 1 equations can be written.

Kiot, Kunihide, and Mikio Oguri. 1984. Histological observations on the heart ventricles in 18 species of teleosts. Bull. Jpn. Soc. Sci. Fish. 50(2):257-262.

Using 18 teleostean species, light microscopic observations were made on the ventricular myocardium and the following results were obtained on the arrangement and development of cardiac muscle fibers. Muscular tissues of heart ventricles in these fish were classified into 2 major groups. In the 1st group, ventricular myocardium is composed of compact and spongy layers, and active swimming species have more well-developed compact layer as the outer zone of the ventricles. This group was divided into the following 4 cases: both compact and spongy layers well developed (type I); only compact layer well developed (type II); only spongy layers well developed (type III); and neither layer well developed (type IV). In the 2nd group, ventricular myocardium is composed only of spongy layer (type V). Sebastes inermis is one of the 18 species.

Kizevetter, I. V. 1971. Chemistry and technology of Pacific fish. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA TT 72-50019, 304 p.

Kliks, M. M. 1983. Anisakiasis in the western USA, four new cases from California. Am. J. Trop. Med. Hyg. 32(3):526-532.

Four cases of transient anisakiasis in northern California acquired by ingestion of raw fish were reported to health authorities between May,1977 and June, 1980. A single Phocanema decipiens-like 4th-stage (L4) larva was identified in each of 2 cases. A recently molted adult male P. decipens with a fragment of attached L4 cuticle and prominent caudal papillae was recovered from a 3rd person. The latter is the only human case known in which an anisakid worm developed to the adult stage was involved. Two Anisakis type I larvae were recovered in the 4th case, being the 1st parasitologically confirmed case of human infection with this worm described from the coterminous United States. Raw salmon or raw red snapper (probably Sebastes sp.) was the presumptive source of worms in 1 case each.

Klingbeil, Richard A. 1976. Southern range extensions of the blue rockfish, Sebastes mystinus: the flag rockfish, S. rubrivinctus: and the shortbelly rockfish, S. jordani. Calif. Fish Game 62(2):160.

Kochkin, P. N. 1980. How to prepare fish vertebrae for age determination. J. Ichthyol. 20(6):153-157.

During a study of the vertebrae of pike glassfish (Champsocephalus gunnari), some zonal characters were noted on the concave surface and a method was devised for the processing and staining of vertebrae that could be used to compare the position of the annual zones on the various recording structures. The method is described in detail and was successfully used to reveal the vertebrae structure of Notothenia rossi marmorata, N. gibberifrons, N. larseni, Chaenocephalus aceratus, Pseudochaenichthys georgianus, Neopagetopsis ionach, Dissostichus eleginoides its use for the straightening of other teleosts (Gadus morhua, Sebastes marinus and Theragra chalcogramma) is possible by slight modification of the method using an autoclave.

Kohler, A. C. 1966. Feeding and growth of redfish (genus Sebastes) in captivity. J. Fish. Res. Board Can. 23(10):1621-1623.

Konchina, Yu V. 1972. Feeding of redfish, Sebastes mentella Travin, in the Northwest Atlantic (from "Collected papers of young research workers"). Fish. Res. Board Can. Transl. Ser. 2085, 12 p.

Konchina, Yu V. 1985. The main trophic relationships of the redfish Sebastes mentella and Sebastes fasciatus Scorpaenidae from the northwestern Atlantic. Vopr. Ikhtiol. 25(6):973-985.

Data were presented on the food composition and features of feeding of S. mentella and S. fasciatus in the northwestern Atlantic. The trophic links that formed the biomass of young S. fasciatus were identified. The main trophic relations of adult S. mentella and S. fasciatus in the northwestern Atlantic were determined.

Konosu, S. 1971. Distribution of nitrogen containing extracts of muscles of marine animals. Bull. Jpn. Soc. Sci. Fish. 37(8):763-770.

Konstantinov, K. G. 1968. Some information on adult fishes taken during NORWESTLANT 1-3, 1963. In ICNAF Environmental surveys NORWESTLANT 1-3, 1963. Int. Comm. Northwest Atl. Fish. Spec. Publ. 7(1):219-224.

Konstantinov, K. G., V. G. Kovalenko, L. S. Lugovaya, E. G. Lukmanov, K. N. Nikeshin, and V. L. Tretyak. 1983. Data for substantiation of the trawl bag mesh size used during the specialized redfish Sebastes mentella fishery. Int. Counc. Explor. Sea ICES-CM-1983/B:13, 42 p.

Konstantinov, K. G., and M. N. Shterbino. 1958. Diurnal vertical migrations of the redfish. Rybnoe Khozyaitvo 10:11-13. (Transl. for Ministry of Agri., Fish. and Food by C. A. Mclean, Fisheries Laboratory, Lowestoft, Suffolk, Trans. N.S. No. 13., 1963.).

Koops, H., K. Tiews, J. Tiews, and J. Gropp. 1974. Efficiency starch and fat consumption in rainbow trouts Salmo gairdneri reared in net cages. Aquaculture 4(3):277-286.

Koslow, J. Anthony. 1984. Recruitment patterns in northwest Atlantic fish stocks. Can. J. Fish. Aquat. Sci. 41(12):1722-1729.

By analysing recruitment time series for 14 stocks of northwest Atlantic fish, consistent positive correlations have been found in recruitment among stocks within such species as cod (Gadus morhua), haddock (Melanogrammus aeglefinus), and herring (Clupea harengus). Significant positive correlations are also often found in recruitment among demersal, offshore-spawning species (cod, haddock, and redfish (Sebastes spp.)), and recruitment in these groups tends to be negatively correlated with that of pelagic species, which spawn inshore (herring) or in restricted waters (mackerel (Scomber scombrus)). These patterns emerge as well from a principal component (PC) analysis of the recruitment data. Three dominant patterns (PC 1-3) explain 78% of the variance of the data set. It is suggested that the spatial extent of these patterns which span the region from west Greenland to Georges Bank, indicates that large-scale physical forcing, rather than local biological interactions, predominantly regulates recruitment to northwest Atlantic fisheries.

Kosswig, K. 1971. Polarized optical research work on the scales of the redfish Sebastes marinus and Sebastes mentella. Ber. Dtsch. Wiss. Komm. Meeresforsch. 22(2):219-225.

Kosswig, K. 1971. Polarizing microscope studies on the scales of the redfish (Sebastes marinus L. and Sebastes mentella Travin). Fish. Res. Board Can. Transl. Ser. 2553.

Kosswig, K. 1971. Some comments about the pelagic fishery on redfish Sebastes marinus, type mentella, off southwest Iceland. Ber. Dtsch. Wiss. Komm. Meeresforsch 22(1):85-88.

Kosswig, K. 1973. Additional notes on the method of age determination in redfish (Sebastes marinus L. and Sebastes mentella Travin). Fish. Res. Board Can. Transl. Ser. 2980.

Kosswig, K. 1973. Further methodological notes on the age determination in redfish Sebastes marinus and Sebastes mentella. Ber. Dtsch. Wiss. Komm. Meeresforsch. 23(1):84-89.

Kosswig, K. 1973. Some comments about the pelagic fishery for redfish (Sebastes marinus, type mentella) off southwest Iceland. Fish. Res. Board Can. Transl. Ser. 2554.

Kosswig, K. 1974. Age and growth of Sebastes viviparus in the North Sea. Ber. Dtsch. Wiss. Komm. Meeresforsch. 23(4):400-402.

Kosswig, K. 1977. Investigations by the Federal Republic of Germany on redfish (Sebastes marinus and S.mentella) in 1975. Ann. Biol. 32:173-174.

The age compositions of redfish at East Greenland, SW Iceland, Bear Island and Spitsbergen and in the Barents Sea are presented. At East Greenland, most of the Sebastes marinus specimens were between 30 and 55 cm, representing an age of between 10 and 30 years. The catch of S.mentella was smaller, and the fish size was also smaller than that of S.marinus. Approximately 10 year classes were represented in the catch with a maximum of 14 years. There were significant quantities of 15 year classes represented in the catches of S.mentella at SW Iceland, and of these the 14th, 15th, 16th, 21st and 23rd made up 52% of the total catch. S.marinus was caught in the southern part of the Barents Sea. 20 year classes were represented, of which the 8th to 12th year classes made up 79.6% of the total catch. The mean lengths were only from 23.9 to 32.7 cm. S.mentella was caught around Spitsbergen and Bear Island. Of the 21 year classes, the 12 to 14 year olds showed a definite maximum, but their mean length was small. Fish of the 1954 year class, in their 21st year, were of a usable size (average length 42 cm) for the fishing industry.

Kosswig, K. 1977. On the biology of the pelagic redfish stock of Irminger Sea. Inf. Fischwirtsch. 24(6):204-208.

The occurrence of Sebastes mentella in Irminger Sea is described. Its growth and distribution is indicated. This pelagic redfish stock was heavily attacked by parasitic copepods (Sphyrion lumpi).

Kosswig, K. 1980. Fishery-biological investigations off east and west Greenland (40. cruise of FRV Walther Herwig), 9.6.-24.7.1980). Inf. Fischwirtsch. 27(5):171-179.

In June/July the first of several projected cruises for 1980 was made to investigate the fishing resources of east and west Greenland and to get information on the biology of commercially important demersal fish, especially Sebastes marinus, Reinhardtius hippoglossoides, and Gadus morhua. The length distribution in correlation to the horizontal distribution and the catch/effort are reported.

Kotthaus, A. 1984. Investigations concerning the ecology and fishery biology of redfish (Sebastes marinus L.). 2. Age determination of redfish. Can. Transl. Fish. Aquat. Sci. 5095, 18 p.

This article describes tests made to determine the age of redfish, S. marinus. Assessing the age of these fish is necessary for the successful completion of every aspect of the scientific investigations involving them. (Originally in: Ber. Dtsch. Wiss. Komm. Meeresforsch. Neue Folge. 12(4), 1952. Available from: Canada Inst. Sci. Tech. Inf., Natl. Res. Counc., Ottawa, Ont. K1A 0S2, Canada.).

Kotthaus, Adolf. 1958. Age and growth of redfish, Sebastes marinus (L.). Int. Comm. Northwest Atl. Fish. Spec. Publ. 1:217-222.

Kotthaus, Adolf. 1961. Preliminary remarks about redfish otoliths. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:45-50.

When studying redfish otoliths for age determinations, some interesting observations about the external feature and the growth of otoliths were made.

Kramer, D. E., and M. D. Peters. 1981. Effect of pH and prefreezing treatment on the texture of yellowtail rockfish (Sebastes flavidus) as measured by the Ottawa Texture Measuring System. J. Food Technol. 16(5):493-504.

This study is concerned with the influence of treatment prior to freezing (samples were frozen pre-rigor, in-rigor, post-rigor and after 6 days' chill storage in ice or refrigerated sea water) on the texture of yellowtail rockfish stored frozen as whole gutted fish or as fillets. The effect of pH was also studied. Texture was measured objectively using the Ottawa Texture Measuring System on samples stored for 6 months at - 28 degree C. A very good negative correlation was found between pH level and toughness as measured using a Kramer shear-compression cell in the Ottawa Texture Measuring System. Fish stored in refrigerated sea water prior to ereezing were appreciably more tender. There was no statistical difference in texture (shear press force) values between samples stored as whole fish versus samples stored as fillets.

Kramer, David, and Paul E. Smith. 1971. Seasonal and geographic characteristics of fishery resources. California current region Part-VI. Rockfish. Commer. Fish. Rev. 33(7-8):40-43.

Kramer, David E., and M. D. Peters. 1979. Utilization of Pacific rockfish 3. A quality comparison of Sebastes alutus and Sebastes flavidus during chill and frozen storage. Can. Fish. Mar. Serv. Tech. Rep. 879, 54 p.

Krefft, G. 1961. A contribution to the reproductive biology of Helicolenus dactylopterus (de la Roche, 1809) with remarks on the evolution of the Sebastinae. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:243-244.

Kubo, T., and N. Ebitani. 1984. The cell lines from fins of Sebasticus marmoratus and Sebastes inermis. In 55th Annual Meeting of the Zoological Society of Japan, Morioka, Japan, Sept. 27-29, 1984. Zool. Sci.(Tokyo) 1(6):894.

Kuntsova, M. Ya, M. A. Sorokin, and Yu. A. Kuznetsov. 1979. Change in sensitivity to sound of the inner ear of the eastern rockfish, Sebastes taczanowskii, with isolation of lateral line and when in movement. J. Ichthyol. 19(5):123-128.

An experiment was conducted with 20 free-swimming eastern rockfish, weighing 400-500 g and caught in Peter the Great Bay, Sea of Japan. A transmitter, located in the sea at a depth of 2 m, was used to send acoustic stimuli (tonal signals of 150 and 800 Hz and signals approximating the noise of rain and a propeller) to the S. taczanowski specimens 8 m away, confined in a mesh tank at a depth of 3 m. Respiratory and ECG changes were registered after rendering the fish's lateral line inoperative by severing the truncal nerve near the opercula. The fish's inner ear receptor structures became more sensitive to the 800-Hz tone and less sensitive to the 150-Hz tone and the rain and propeller noises. Facilitation of the denervated fish's reaction to the 800-Hz tone may be determined by the cessation of inhibitory messages from the lateral line receptors, which, when the mechanisms of central inhibition are in play, work with the inner ear receptors. Similar reactions were recorded under conditions of fish swimming with real rain.

Kusakari, M. Y., O. Mori, and K. Kudo. 1977. Studies on the breeding habit of a rockfish, Sebastes schlegeli (Hilgendorf). 2. On the breeding behavior of pregnant fish and the just spawned larvae. J. Hokkaido Fish. Exp. Stn. 34:1-11.

Kuwahara, A., and S. Suzuki. 1983. Vertical distribution and feeding of three species of rockfish Scorpaenidae larvae. Bull. Jpn. Soc. Sci. Fish. 49(4):515-520.

Larvae samplings were made in the Wakasa Bay, the Japan Sea during May and June, 1981. In view of the vertical distribution and feeding, differences among 3 spp. of Scorpaenidae larvae, Sebasticus marmoratus (Cuvier), Sebastes oblongus Guenther and S. pachycephalus pachycephalus Temminck and Schlegel are to be expected. The larvae of 3 spp. were distributed abundantly in the shallow

waters, between 0 m and 25 m. Plankton species belonging to Crustaceae were utilized as the main food for all 3 spp., of which S. marmoratus and S. pachycephalus began to feed on copepod nauplii and invertebrate eggs at the yolk-sac stage.

Lambert, D. S. 1960. The food of the redfish Sebastes marinus (L) in the Newfoundland area. J. Fish. Res. Board Can. 17(2):235-243.

Lampila, L. E., V. Mohr, and D. S. Reid. 1985. Scanning electron microscopic study of rockfish Sebastes paucispinis preserved at either ambient temperature or by isothermal freeze-fixation. Food Microstruct. 4(1):11-16.

Fresh rockfish (S. paucispinis) fillets were blast frozen and stored at either -5.degree. C or -20.degree. C for 60 days. At defined sampling intervals, specimens were removed and chemically fixed at either ambient temperature or isothermally, at the respective storage temperatures (-5.degree. C or -20.degree. C). Isothermally freeze-fixed specimens showed a degree of crushing and/or distortion of the muscle fiber, the deposition of presumed ice crystals in the cell membrane, the multi-dimensionality of connective tissue and the preservation of fine detail. In specimens fixed at ambient temperatures, structural components had relaxed back to a state similar to their native conformation. Isothermal freeze fixation appears to be an excellent means to preserve frozen muscle tissue for the study of the effects of freezing and frozen storage.

Langton, Richard W. 1982. Diet overlap between Atlantic cod, Gadus morhua, silver hake, Merluccius bilinearis, and fifteen other northwest Atlantic finfish. Fish. Bull., U.S. 80(4):745-760.

Diet overlap calculated as the percentage similarity between the diets of Atlantic cod, silver hake, and 15 other finfish species Sebastes marinus, Myoxocephalus octodecemspinosus, Stenotomus chrysops, Peprilus triacanthus, Urophycis tenuis, U. chuss, U. regia, Pollachius virens, Melanogrammus aeglefinus, Macrozoarces americanus, Hippoglossoides platessoides, Glyptocephalus cynoglossus, Limanda ferruginea, Paralichthys oblongus & Merluccius bilinearis was computed from stomach contents data collected in the northwest Atlantic from 1973-1976. Since crustaceans are preyed on by both Atlantic cod and silver hake and most of the 15 other groundfish species representing members of the Rajiformes, Perciformes, Gadiformes and Pleuronectiformes, completely dissimilar diets occur very rarely.

Lapi, L. A., and J. E. Richards. 1981. Data collected during rockfish (Sebastes spp.) assessments of west Langara Island and west coast Vancouver Island fishing grounds in 1979. Can. Data Rep. Fish. Aquat. Sci. 286, 117 p.

Commercial trawlers were chartered to survey two rockfish fishing areas off the west coast of Canada. The area west of Langara Island and north of 54 degree N latitude was surveyed simultaneously by the M/V Blue Waters and the M/V Scotta Bay. The area extending along the west coast of Vancouver Island was surveyed by the M/V Arctic Harvester. The primary objective was to determine the biomass of Pacific ocean perch (Sebastes alutus) stocks in these areas and to collect biological information. This report presents haul location, catch, and biological data collected during these cruises.

Laroche, Wayne A., and Sally L. Richardson. 1980. Development and occurrence of larvae and juveniles of the rockfishes Sebastes flavidus and Sebastes melanops (Scorpaenidae) off Oregon. Fish. Bull., U.S. 77(4):901-924.

Developmental series of larvae and juveniles of 2 important and very similar species of northeast Pacific rockfish (Scorpaenidae: Sebastes) are described and illustrated: S. flavidus (10.1-105.0 mm standard length) and S. melanops (10.6-111.6 mm standard length). Descriptions include a literature review, identification, distinguishing features, general development, morphology, fin development, spination, scale formation, pigmentation and color of fresh specimens. The main differences between S. flavidus and S. melanops within the size range described are pectoral fin ray number (usually 18 vs. 19), lateral line pore number (usually > 50 vs. < 50), and caudal peduncle depth/caudal peduncle length ratio (mean values 0.73, 0.64, 0.64, 0.80 vs. 0.88, 0.78, 0.74, 0.92 in postflexion larvae, transforming, pelagic juvenile and benthic juvenile specimens, respectively). Occurrence of these 2 spp. in waters off Oregon is discussed. Small benthic juveniles of S. flavidus seem to inhabit deeper waters, > 20 m depth, than those of S. melanops. Comparisons are made among known larvae and juveniles of Sebastes spp. Identification problems within the S. flavidus-S. melanops/S. entomelas-S. mystinus groups are discussed.

Laroche, Wayne A., and Sally L. Richardson. 1981. Development of larvae and juveniles of the rockfishes Sebastes entomelas and S. zacentrus (Family Scorpaenidae) and occurrence off Oregon, with notes on head spines of S. mystinus, S. flavidus, and S. melanops. Fish. Bull., U.S. 79(2):231-258.

Developmental series of larvae and juveniles of 2 species of

NE Pacific rockfishes are described and illustrated: S. entomelas (9.9-74.5 mm standard length) and S. zacentrus (7.4-74.8 mm standard length). Ontogeny of S. entomelas is very similar to that of S. flavidus and S. melanops among species for which development is known. Larval and juvenile S. entomelas within the size range described are distinguished by presence of preocular and supraocular spines, pectoral fin rays usually 18, dorsal fin rays usually .ltoreq. 8, lateral line pores 52-56, and lack of melanophores at the articulation of dorsal and anal fin rays. Ontogeny of S. zacentrus is rather distinctive among species for which development is known. They are distinguished by presence of preocular and absence of supraocular spines, pectoral fin rays usually 17, dorsal fin rays usually 14, anal fin rays usually 7, lateral line pores 38-48, gill rakers 32-37, and relative lack of pigment. New information is presented to aid in the separation of 4 similar species, S. entomelas, S.flavidus, S. melanops & S. mystinus.

Larson, Ralph J. 1972. The food habits of four kelp-bed rockfishes (Scorpaenidae,Sebastes) off Santa Barbara, California. M.A. Thesis, Univ. Calif., Santa Barbara, 57 p.

Larson, Ralph J. 1977. Habitat selection and territorial competition as the causes of bathymetric segregation of sibling rockfishes (Sebastes). Ph.D. Thesis, Univ. Calif., Santa Barbara, 170 p.

Larson, Ralph J. 1980. Competition, habitat selection, and the bathymetric segregation of two rockfish (Sebastes) species. Ecol. Monogr. 50(2):221-240.

S. carnatus and S. chrysomelas are morphologically and ecologically similar residents of rocky reefs off the coast of California. They segregate bathymetrically, with S. chrysomelas occurring shallower than S. carnatus. Each species extended its depth distribution where its congener was removed, and no distributional changes occurred in a control area. Both species tolerated conditions beyond their normal depth ranges, and were limited in part to their normal depth ranges by interspecific competition. Their segregation was apparently initiated by the preferential settlement of young fish from the plankton, S. chrysomelas in shallow water and S. carnatus deeper. Their segregation was maintained by interspecific territoriality. The distribution of S. chrysomelas, the socially dominant species, may also have been affected by a strong preference for food-rich areas that occurred mainly in shallow water. Such a preference may be due to the advantage of smaller home ranges in shallow water, where strong wave surge makes the shelter hole a more important part of a fish's territory.

Larson, Ralph J. 1980. Influence of territoriality on adult density in two rockfishes of the genus Sebastes. Mar. Biol. 58(2):123-132.

Nonterritorial S. carnatus and S. chrysomelas existed, along with territorial individuals, at 3 tagging sites off southern California. To test the hypothesis that territoriality affected adult density in these species, territorial fish were removed and the subsequent utilization of vacated territories by other fish was monitored. Intrusion of other fish into vacated territories increased significantly in 90% of the removals. Other fish colonized both the feeding and sheltering parts of the vacated territories; the previous owners had successfully defended both parts of their territories. Many colonizers had already possessed territories; they expanded their territories or moved into presumably better habitat. Several previously nonterritorial fish also moved into vacated areas, and at least some appeared to establish territories. These fish had previously been capable of establishing territories but were prevented from doing so by resident territory holders. Territoriality, rather than such other factors as predation or low recruitment, limited the number of territorial fish at each site.

Larson, Ralph J. 1980. Territorial behavior of the black and yellow rockfish and gopher rockfish (Scorpaenidae, Sebastes). Mar. Biol. 58(2):111-122.

Tagged black-and-yellow rockfish Sebastes chrysomelas and gopher rockfish S. carnatus were observed in situ for 1 yr at 3 study sites off California, USA, in order to determine the nature of their home ranges and territories. Three basic patterns of space use were identified: (1) a shelter hole located within a larger area of activity (in which the fish presumably fed, since its size increased with size of fish and decreased with prey density) (2) discontinuous home ranges, in which the shelter holes and feeding areas were separate and (3) dispersed home ranges with little or no exclusive area. Fish in the first category were regarded as territorial, since their home ranges were defended and relatively exclusive. Because individuals did not patrol borders, however, territories often overlapped at their peripheries.

Larson, Ralph J. 1987. Progress in rockfish recruitment studies. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Southwest Fish. Cent., Admin. Rep. T-87-01, 31 p.

Lauder, J. T., W. A. MacCallum, and D. R. Idler. 1970. Keeping time of frozen redfish (Sebastes marinus mentella) fillets in relation to handling of the raw material and storage temperatures after processing and freezing. J. Fish. Res. Board Can. 27(9):1589-1605.

The effect of various periods of prefreezing storage for iced, whole redfish (Sebastes marinus mentella) on the frozen-storage keeping times (at -23 C) of the fillets and the effect of various periods of fillet storage at temperatures equal to and higher than -23 C are reported. The fish were caught on the Grand Bank and on Banquereau in May and June. Assessment was by taste panel with chemical tests for protein solubility, rancidity, and pH made for purposes of comparison.

Lea, Robert N. 1983. Sebastodes atrorubens Gilbert, 1898, a junior synonym of Sebastes atrovirens (Jordan and Gilbert, 1880), with notes on individual variation in the species. Bull. South. Calif. Acad. Sci. 82(3):147-149.

The author finds no justification for recognizing S. atrorubens as a distinct and valid species.

Lea, Robert N., and John E. Fitch. 1972. Sebastes rufinanus, a new Scorpaenid fish from California waters. Copeia 1972(3):423-427.

A new California rockfish, Sebastes rufinanus, is described from two specimens that were killed by an underwater explosion near San Clemente Islands. This dwarf rockfish is distinguished from all other eastern Pacific species of Sebastes, except S. diploproa, by a combination of two characters: a low number of pored scales in the lateral line and the lack of supraocular spines. It is readily distinguished from S. diploproa by a lack of prominent dentigerous knobs on the snout. Its discovery brings to 57 the number of species of Sebastes known from California waters.

Lea, Robert N., and John E. Fitch. 1979. A new species of rockfish, genus Sebastes (Scorpaenidae), from the eastern North Pacific off Mexico and California. Contrib. Sci. Natur. Hist. Mus. Los Angeles County, California. 320:1-7.

Leaman, B. M., and S. J. Westrheim. 1976. G. B. Reed groundfish cruise 76-2, July 6-20, 1976. Can. Fish. Mar. Serv. Circular 103, 9 p.

Leaman, B. M., D. A. Nagtegaal, R. D. Stanley, and E. W. Carter. 1985. Rockfish fecundity cruise (GBR-R82-1), November 8-28, 1982. Can. Data Rept. Fish. Aquat. Sci. 526, 64 p.

Preliminary results of a research cruise to collect reproductive biology data from the five stocks of Pacific ocean perch in B. C. waters are presented. The cruise sampled stocks off southwest Vancouver Island, Queen Charlotte Sound, Hecate Strait, West Queen Charlotte Islands and Dixon Entrance, Mean round weights, ovary weights and length-maturity data are presented, along with detailed catch information and sea temperature observations. Length-weight regressions are compared with previous data for the species.

Leaman, Bruce M. 1976. The association between the black rockfish (Sebastes melanops Girard) and the giant kelp (Macrocystic integrifolia Bory) in Barkley Sound, British Columbia. M.S. Thesis, Univ. B. C., Vancouver. 109 p.

Leaman, Bruce M. 1977. The diel activities of the black rockfish, Sebastes melanops, in beds of Macrocystis integrifolia in Barkley Sound, British Columbia, Canada. J. Phycol. 13(Suppl.):39.

Leaman, Bruce M. 1987. Incorporating reproductive value into Pacific ocean perch management. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 355-368. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Leaman, Bruce M., and R. J. Beamish. 1984. Ecological and management implications of longevity in some northeast Pacific ground fisheries. In Symposium on determining effective effort and calculating yield in groundfish fisheries, and on Pacific cod biology and population dynamics, Vancouver, B.C., Canada, Oct. 28-30, 1981, p. 85-97. Int. North Pac. Fish. Comm. Bull. 42, 247 p.

Leaman, Bruce M., and D. A. Nagtegaal. 1982. Biomass estimation of rockfish stocks off the west coast of the Queen Charlotte Islands during 1978 and 1979. Can. Manuscr. Rep. Fish. Aquat. Sci. 1652, 50 p.

Leaman, Bruce M., and D. A. Nagtegaal. 1986. Biomass survey of rockfish stocks in the Dixon Entrance - southeast Alaska region, July 5-22, 1983 (R/V G.B. Reed and M/V FREE ENTERPRISE NO.1). Can. Tech. Rep. Fish. Aquat. Sci. 1510, 67 p.

Leaman, Bruce M., and D. A. Nagtegaal. 1987. Identification of species assemblages and results of management applications for shelf and slope rockfishes off British Columbia. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 309-328. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Leaman, Bruce M., and R. D. Stanley. 1985. Shelf and slope rockfishes. Can. Manuscr. Rep. Fish. Aquat. Sci 1813:247-342.

Leaman, J. E. 1982. Catch and effort statistics of the Canadian goundfish fishery on the Pacific Coast in 1981. Can. Tech. Rep. Fish. Aquat. Sci. 1124, 90 p.

Leaman, J. E. 1984. Catch and effort statistics of the Canadian groundfish fishery on the Pacific Coast in 1983. Can. Tech. Rep. Fish. Aquat. Sci. 1312, 91 p.

Leaman, J. E. 1985. Catch and effort statistics of the Canadian groundfish fishery on the Pacific coast in 1984. Can. Tech. Rep. Fish. Aquat. Sci. 1422, 93 p.

Catch and effort statistics for the Canadian groundfish fishery (excluding halibut) on the Pacific coast in 1984 are presented. Statistics are shown by major areas, minor areas and International North Pacific Fisheries Commission areas in metric tonnes (t). Total landings in 1984 were 38,509 t, 5% more than in 1983. The bulk (83%) of the catch was taken by trawl gear. The main species landed were Pacific ocean perch Sebastes alutus, hake Merluccius productus, sablefish Anoplopma fimbria lingcod Ophiodon elongatus, Pacific cod Gadus macrocephalus, and dogfish Squalus acanthias .

Leaman, J. E. 1986. Catch and effort statistics of the Canadian groundfish fishery on the Pacific coast in 1985. Can. Tech. Rep. Fish. Aquat. Sci. 1508, 80 p.

LeBlanc, P. J., and A. L. Jackson. 1973. Arsenic in marine fish and invertebrates. Mar. Pollut. Bull. 4(6):88-90.

An environmental survey has been undertaken on the Pacific coast of Canada to document natural background levels of a number of heavy metals, including arsenic in various species of marine fish and invertebrates. The majority of fish studies from four different sampling locations near a proposed mine site, contained arsenic with levels ranging from less than 0.4 to 37.8 mg kg (wet weight). Crabs were found to contain the highest level of arsenic of all marine organisms tested. Results indicate that arsenic accumulates in marine fish and invertebrates and may be a micronutrient.

Lee, R. F. 1975. Lipids of parasitic copepods associated with marine fish. Comp. Biochem. Physiol. B Comp. Biochem. 52(3):363-364.

Leknes, I. L., and T. S. Saetersdal. 1981. The ultrastructure of specific heart granules in teleosts. J. Fish. Biol. 19(5):575-579.

The ultrastructure and chemical reactivity of teleostean specific (atrial) heart granules (SHG) are described. In atrial cells of Glyptocephalus cynoglossus and Gadus morhua, large aggregations of SHG occur in areas of the sarcoplasm rich in glycogen and poor in myofibrils. The SHG often appear to be in a process of lysis. A number of heart granules were also noted in atrial cells of Cichlasoma meeki, Pistella riddlei and Sebastes viviparus, although large aggregations were not seen. The mean diameters of SHG in G. cynoglossus and S. viviparus are 110 and 210 nm, respectively. SHG are regularly found in ventricular cells although less frequently than in the atrium. Ultrahistochemical tests suggest that the teleostean SHG mainly contain proteins.

Lenarz, William H. 1980. Shortbelly rockfish, Sebastes jordani : A large unfished resource in waters off California. Mar. Fish. Rev. 42(3-4):34-40.

This paper contains: a description of the biology of the species first approximations of the effect of fishing on the stock a review of the rockfish survey results with regard to fishing a review of the potential for development of a fishery and a discussion of management options for the fishery.

Lenarz, William H. 1984. Status of the widow rockfish fishery. In Pacific Fishery Management Council, Status of Pacific Coast groundfish fishery and recommendations for management in 1985. Appendix 4, p. 1-28. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Lenarz, William H. 1987. Ageing and growth of widow rockfish. In W. H. Lenarz, and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 10-11, 1980, p. 31-35. U.S. Dep. Commer., NOAA Tech. Rep. NMFS. 48.

Lenarz, William H. 1987. A history of California rockfish fisheries. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 35-41. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Lenarz, William H., and Peter B. Adams. 1980. Some statistical considerations of the design of trawl surveys for rockfish (Scorpaenidae). Fish. Bull., U.S. 78(3):659-674.

This study is in 2 parts. The 1st part reviews statistical theory for choosing among random, stratified random and systematic sample survey schemes when strata are of equal size and receive equal sampling effort. The theory is applied to data collected during a pilot trawl survey for rockfish in Queen Charlotte Sound, British Columbia [Canada] and a full scale survey along the coasts of Washington, Oregon and California [USA]. On a scale of about 80 km, a systematic survey scheme seems to provide more precise estimates than the other schemes. The differences in erecision are slight and probably should not outweigh other factors such as logistical constraints in the design of trawl surveys. The 2nd part of the study reviews statistical theory for sampling from negative binomial distributions. Results of the Queen Charlotte Sound pilot survey indicate that except for fish with very low densities, numerous tows of short distances are relatively more precise than fewer tows of longer distances for trawl surveys for rockfish.

Lenarz, William H., and Tina Wyllie Echeverria. 1986. Comparison of visceral fat and gonadal fat volumes of yellowtail rockfish Sebastes-flavidus during a normal year and a year of El Nino conditions. Fish. Bull., U. S. 84(3):743-745.

Lenarz, William H., and Donald R. Gunderson. 1987. Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48, 57 p.

These proceedings contain the report of the workshop discussion panel, status reports on California, Oregon and Washington fisheries through 1980, and a collection of seven papers presented at the workshop. The status reports provide an historical perspective of the development of the widow rockfish fishery. A survey of biological knowledge of widow rockfish, economic status of the fishery, and fishery-independent methods for estimation of abundance is presented.

Lenarz, William H., and Joseph E. Hightower. 1985. Status of the widow rockfish fishery. In Pacific Fishery Management Council, status of the Pacific Coast groundfish fishery through 1985 and recommended acceptable biological catches for 1986, Appendix 3, p. 1-23. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Lenarz, William H., and Sharon Moreland. 1985. Progress report on rockfish recruitment studies at the Tiburon Laboratory. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Southwest Fish. Cent., Admin. Rep. T-85-02, 19 p.

Lestev, A. V. 1961. The trawl fishery for rockfish in the Bering Sea. Fish. Res. Board Can. Transl. Ser. 439.

Lestev, A. V. 1968. Techniques of rockfish trawling in the Bering Sea. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific, Part III. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA, USA. TT 67-51205:319-336.

Li, M. F., V. Marryatt, and A. Moore. 1983. A primary report on the prevalence of erythrocytic inclusions in Atlantic coast stocks of haddock (Melanogrammus aeglefinus), pollock (Pollachius virens) and redfish (Sebastes marinus). In Council Meeting of the International Council for the Exploration of the Sea, Gothenburg, Sweden, Oct. 10, 1983. ICES-CM-1983/GEN:3, 10 p.

Lilly, G. R. 1980. Year-class strength of redfish and growth of cod on Flemish Cap. Int. Comm. Northwest Atl. Fish. Sel. Pap. 6:35-39.

The Flemish Cap lacks large resident populations of fish species whose adults are of a size suitable as prey for adult cod. The growth rate of adult cod on the bank had been slow compared to that on adjacent areas of the Grand Bank, but has increased in recent years. This increase coincides with the appearance of highly successful year-classes of redfish. Intermediate-sized redfish may provide the energetically-favorable forage needed for continued growth of adult cod.

Lilly, G. R. 1981. Distribution and relative abundance of juvenile redfish on the Flemish Cap in 1978-81 based on recoveries from cod stomachs. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/9/118, 15 p.

The distribution and relative abundance of small (<100 mm) redfish (Sebastes sp.) on the Flemish Cap were determined from recoveries from stomachs of cod (Gadus morhua L.) for the period 1978-81. Small redfish were most abundant in an arc between 230 and 310 m on the western side of the bank, with abundance apparently highest to the south. The number of small redfish was low in 1978 and 1980 and high in 1979 and 1981. The year-class found abundantly in 1979 was relatively rare in 1980 and 1981, suggesting mortality of juveniles can be very high.

Lilly, G. R. 1987. Synopsis of research related to recruitment of Atlantic cod Gadus morhua and Atlantic redfish Sebastes on Flemish Cap North Atlantic. Northwest Atl. Fish. Organ. Sci. Counc. Stud. 11:109-122.

Lilly, G. R., and C. A. Gavaris. 1982. Distribution and year-class strength of juvenile redfish, Sebastes sp., on Flemish Cap in the winters of 1978-82. J. Northwest Atl. Fish. Sci. 3(2):115-122.

Distribution and abundance of juvenile redfish, Sebastes sp., on Flemish Cap in the winters of 1978-82 were estimated from catches during research bottom-trawl surveys and from numbers of redfish in stomachs of cod caught during these surveys. Two modal groups in the redfish length frequencies (7-8 cm and 11-12 cm) were assumed to represent 1- and 2-year-old fish respectively, but ageing remains uncertain. Both size-groups were found primarily in depths of 200-300 m, with major concentrations on the southern slope of the bank. The 1978 year-class, which appeared to be abundant in cod stomachs and moderately abundant in trawl catches in 1979, was not abundant in subsequent years, indicating that mortality of juvenile redfish can be high. The 1980 and 1981 year-classes, which appear to be stronger than the 1978 year-class on Flemish Cap, have been noted to be strong in other parts of the Northwest Atlantic, particularly on St. Pierre Bank, on the Scotian Shelf, and in the Gulf of St. Lawrence.

Lisovenko, L. A. 1967. Distribution of the larvae of rockfish (Sebastodes alutus Gilbert) in the Gulf of Alaska. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific, Part III. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA, USA. TT 67-51205:217-225.

Lisovenko, L. A. 1967. Fecundity of Sebastodes alutus Gilbert from the Gulf of Alaska. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part IV. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA, USA. TT 67-51206:162-169.

From 14 January to 24 March 1962 we studied the fecundity of the Pacific rockfish (Sebastodes alutus G.) in different parts of the Gulf of Alaska. Little is known about the fecundity of this species; the only data available apply to the Bering Sea (Moiseev and Paraketsov, 1961; Paraketsov, 1963) and the region of Vancouver Island (Alverson and Westrheim, 1959). This article reports what may be regarded as a poineer work on the fecundity of S. alutus in the Gulf of Alaska. This is an important problem because a study of fecuncity will provide a clue to the population dynamics of this species, which is the most important commercial item in

the gulf. Also, mortality during the early stages of life is much lower in viviparous fish such as S. alutus than in oviparous fish. Hence, it is important to know the degree of fecundity of S. alutus.

Lisovenko, L. A. 1972. A study of spermatogenesis in Pacific rockfish Sebastodes alutus (Gilbert) from the Gulf of Alaska. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part V. Nat. Tech. Inform. Serv., Springfield, VA, USA. TT 71-50127:248-266.

Lisovenko, L. A. 1978. Reproduction of rockfishes (Family Scorpaenidae) off the Pacific Coast of South America. J. Ichthyol. 18(2):262-268.

Histological analyses of the structure of testes and ovaries in 2 rockfish species (Helicolenus lengerichi and Sebastes oculatus) from the Pacific coastline of South America were presented. Rockfish inhabiting the coastline of S. America had the same reproductive cycles as did other representatives of the subfamily Sebastinae in the northern hemisphere.

Liston, J., and C. R. Hitz. 1961. Second survey of the occurrence of parasites and blemishes in Pacific Ocean perch, Sebastodes alutus, May-June 1959. U.S. Dep. Interior, Fish and Wildlife Ser., Spec. Sci. Rep. Fish. 383, 6 p.

A brief study was made of the occurence of parisites and blemishes in the Pacific Ocean perch, Sebastodes alutus, caught in the waters of Hecate Strait and those southward to Cape Blanco, Oregon, to test the findings made during a similar study in 1958.

Liston, John, John Peters, and Joseph A. Stern. 1960. Parasites in summer-caught Pacific Ocean rockfish. U.S. Fish. Wildl. Serv. Spec. Sci. Rep. Fish. 352, 10 p.

This investigation was carried out in the summer of 1958 on rockfishes caught in the area extending from Hecate Strait to Cape Blanco, Oregon. The purpose of the investigation was to study the relationship between the area of catch and the degree to which these fish are infested with parasites, the distribution of the parasites in the fillets of the fish and the method of detecting the parasites and of removing them from the fillets.

Litvinenko, N. I. 1979. Sebastes faciatus kellyi (Scorpaenidae) from coastal waters off Eastport Maine, USA. J. Ichthyol. 19(3):1-14.

A detailed morphological description is given of a subspecies of redfish from Eastport waters, previously described by the author. An identification key is given to the subspecies and synonyms of Sebastes fasciatus.

Litvinenko, N. I. 1980. Structure, function and origin of the drumming muscles in the north Atlantic Ocean perches of the genus Sebastes (Scorpaenidae). J. Ichthyol. 20(5):89-98.

The structure, function and origin of drumming muscles in 4 spp. of ocean perch were examined (Sebastes marinus L., S. viviparus Kroyer, S. mentella Travin and S. fasciatus Storer). The structure of drumming muscles, the origin of their tendons under the rib, and attachment of the latter to elements of the axial skeleton indicate a similarity between the species studied and species found in the Pacific Ocean, including S. phillipsi (Fitch), S. aleutianus (Jordan and Evermann), S. aurora (Gilbert) and others. S. mentella had the greatest similarity with Pacific ocean species in the structure of drumming muscles. This was attributed to a departure to lower depths and its greater mobility.

Litvinenko, N. N. 1974. Coloration and other morphological characters distinguishing juvenile Sebastes fasciatus from juvenile Sebastes mentella (Scorpaenidae). J. Ichthyol. 14(4):591-595.

Lockington, W. N. 1877. Remarks upon the various fishes known as rock cod. Proc. Calif. Acad. Sci. 7:79-82.

Longard, A. A., and L. W. Regier. 1974. Color and some composition changes in ocean perch (Sebastes marinus) held in refrigerated sea water with and without carbon dioxide. J. Fish. Res. Board Can. 31(4):456-460.

Loped, P. D. C. 1979. Eggs and larvae of Maurolicus muelleri (Gonostomatidae), and other fish eggs and larvae from two fjords in western Norway. Sarsia 64(3):199-210.

The distribution and abundance of eggs and larvae of M. muelleri (Gmelin, 1788) in Masfjorden and Fensfjorden were investigated from April-Sept. 1977, using the Bongo net (number 20). For each cruise the total number of M. muelleri eggs present in the spawning area was estimated. The total number of eggs spawned during this period was 9 .times. 1010 in Masfjorden and 58 .times. 1010 in Fensfjorden. The estimated stock sizes were 6400 and 30,700 tons for Masfjorden and Fensfjorden, respectively. Studies of fish eggs and larvae showed that 35 spp. were

present in both fjords. Eggs of Brosme brosme, Microstomus kitt, Gaidropsarus sp. and Ctenolabrus rupestris and larvae of Sebastes sp. and Benthosema glaciale were particularly abundant.

Lorz, Harriet V., William G. Pearcy, and Michael Fraidenburg. 1983. Notes on the feeding habits of the yellowtail rockfish, Sebastes flavidus, off Washington and in Queen Charlotte Sound. Calif. Fish Game 69(1):33-38.

Sebastes flavidus caught in bottom trawls off Washington fed almost exclusively on euphausiids. Those caught in midwater trawls in Queen Charlotte Sound had eaten euphausiids as well as pelagic and benthic fishes. The limited data suggested that feeding occurred mainly during the night or early morning hours, although some feeding probably occurred during daytime as well. Diel changes in behavior associated with feeding on vertically migrating prey may explain day-night differences in catches of some rockfishes.

Love, Milton S. 1978. Aspects of life history of the olive rockfish, Sebastes serranoides. Ph. D. Thesis, Univ. Calif., Santa Barbara, 195 p.

Love, Milton S. 1980. Isolation of olive rockfish, Sebastes serranoides, populations off southern California. Fish. Bull., U.S. 77(4):975-983.

Movements of S. serranoides, off Santa Barbara, were investigated, using mechanical and parasite tags. The movements were restricted over shallow reefs though somewhat less so around deeper oil platforms. Highly restricted movements may cause greater vulnerability of populations to overfishing - comparisons of olive rockfish size frequencies between two reefs indicated that fishing pressure had reduced olive rockfish populations to almost all prereproductive individuals on the more heavily fished site.

Love, Milton S. 1981. Evidence of movements of some deep water rockfishes (Scorpaenidae: genus Sebastes) off southern California. Calif. Fish Game 67(4):246-249.

Evidence is presented for movements of some rockfishes in deepwater (greater than 70 m) off southern California. Data taken during an 11 mo. period from sportfish partyboats indicate large fluctuations in catch-per-unit-effort of 3 rockfish species (Sebastes entomelas, S. miniatus and S. paucispinis) from a single rocky reef. On 2 occasions, movements (of up to 2.4 km a day) of rockfish aggregations were noted, based on echo location and hook-and-line sampling. Species taken from the aggregations included S. entomelas, S. goodei, S. levis, S. miniatus and S. paucispinis.

Love, Milton S., and Alfred W. Ebeling. 1978. Food and habitat of three switch-feeding fishes in the kelp forests off Santa Barbara, California. Fish. Bull., U. S. 76(1):257-271.

Diets and habitat distributions were compared among the blue rockfish Sebastes mystinus, kelp bass Paralabrax clathratus and olive rockfish S. serranoides, all of which occur together in areas of reef and giant kelp off Santa Barbara, California [USA]. The three spp. make up a feeding guild of large-mouthed predatory fishes that commonly switch among planktonic prey, nektonic prey (fish and squid) and substrate-oriented prey (invertebrates that live on or about reef and plant surfaces). At the semi-isolated study site, blue rockfish, which are somewhat better adapted than the others to ingest and retain small particles, ate relatively more plankton than did individuals of the other species; olive rockfish ate more fish. Kelp bass had the broadest diet and habitat distribution.

Love, Milton S., and Ralph J. Larson. 1978. Geographic variation in the occurrence of tympanic spines and possible genetic differentiation in the kelp rockfish, (Sebastes atrovirens). Copeia 1978(1):53-59.

The frequency of occurrence of tympanic cranial spines in the kelp rockfish (Sebastes atrovirens), an eastern Pacific scorpaenid, was examined over much of the species' geographic range. Tympanic spines occur significantly more often in individuals from the southern part of the range. The data indicate that S. atrovirens fall roughly into two groups: central and southern California, though there is clinal variation within each group. It is hypothesized that the occurrence of tympanic spine occurrence between the northern and southern parts of S. atrovirens' range is due to low gene flow between northern and southern populations. This restricted gene flow may be due to actions of the California Current and the southern California eddy.

Love, Milton S., and Michael Moser. 1976. Davisia reginae, new species Protozoa myxosporida from four California marine fishes. J. Parasitol. 62(6):982-983.

D. reginae sp. nov. was found in the urinary bladders of the olive rockfish, Sebastes serranoides; quillback rockfish, S. maliger; striped surfperch, Embiotoca lateralis; and pile surfperch, Damalichthys vacca from California, USA. This new Davisia belongs to the group whose lateral appendages are solid.

Love, Milton S., Kimberly Shriner, and Pamela Morris. 1984. Parasites of olive rockfish, Sebastes serraniodes, (Scorpaenidae) off central California. Fish. Bull., U.S. 82(3):530-537.

Love, Milton S., and John Vucci. 1974. Range extension of the China rockfish. Calif. Fish Game 60(3):149.

Love, Milton S., and William V. Westphal. 1981. Growth, reproduction, and food habits of olive rockfish, Sebastes serranoides, off central California. Fish. Bull., U.S. 79(3):533-545.

Data were collected on age-length and length-weight relationships, age at first maturity, spawning season, fecundity, and food habits of olive rockfish, Sebastes serranoides, off Diablo Cove, near Avila, California. Fish were aged from otoliths. Von Bertalanffy age-length parameters for females were L infinity = 51.9, k = 0.18, and t sub(0) = -1.57 for males L infinity = 43.3, k = 0.27, and t sub(0) = -1.03. Females grew at a faster rate than males beginning at the age where most males were mature. Age at first maturity ranged from 3 to 8 years, most fishes maturing by age 6. Olive rockfish spawned once per season, between December and March, with peak spawning in January. Fecundity ranged between 30,000 and 490,000 eggs. Small individuals preyed primarily on plankton, and larger ones concentrated on fishes, squids, and octopuses.

Low, Loh-Lee, and Jerry Berger. 1984. Estimation and standardization of fishing effort in data bases of Bering Sea trawl fisheries. In Symposium on determinimg effective effort and calculating yield in groundfish fisheries, and on Pacific cod biology and population dynamics, Vancouver, B.C., Canada, Oct. 28-30, 1981. Int. North. Pac. Fish. Comm. Bull. 42:15-22.

Lundstrom, R. C. 1983. Identification of Pacific rockfish (Sebastes) by isoelectric focusing. J. Assoc. Off. Anal. Chem. 66(4):974-980.

Isoelectric focusing (IEF) is currently the most reliable method available for the identification of fish species. The high resolution of this method usually allows discrimination between even closely related species. One genus, Sebastes, presents a problem. Using both low and high resolution, IEF is unable to differentiate several species. Disc electrophoresis does not differentiate the rockfish reliably. Using IEF, identical protein patterns were obtained for Pacific Ocean perch (S. alutus), bocaccio rockfish (S. paucispinis) and yelloweye rockfish (S. ruberrimus). A 2nd group, comprised of silvergray rockfish (S. flavidus), black rockfish (S. malnops) and canary rockfish (S. pinniger), also had identical protein patterns. Widow rockfish (S. entomelas) and chilipepper rockfish (S. goodei) each had a unique pattern, different from the above 2 groups and from each other. The actual taxonomic relationships of these rockfish species are not clear. Users of IEF and disc electrophoresis for identification purposes should be aware of this problem when working with the Sebastes.

Lussiaa-Berdou, J. P., R. Courtois, P. Dube, J. Frechette, P. Lamoureux, and C. Tremblay. 1983. A review of the sampling of commercial catches of marine species by the province of Quebec. Can. Spec. Publ. Fish. Aquat. Sci. 66:61-76.

Data are presented on the history, objectives, methods, and volumes of commercial catch samplings of cod, Gadus, redfish Sebastes marinus, Greenland halibut Reinhardtius hippoglossoides, plaice Hippoglossoides, herring, clupea, lobster Homarus americanus, and pink shrimp Pandalus borealis . Sampling of demersal fish at landing, initiated following ICNAF recommendations, has suffered from a change of priority in fisheries research activities in Quebec between 1966 and 1974. The importance, especially for pink shrimp and demersal fish, of the link between the gathering of statistics on the fishing effort and sampling at landing, is stressed. These two activities are tackled by technicians permanently present in the main landing ports during the fishing season.

Lyubimova, T. G. 1967. Biological characteristics of the school of Pacific rockfish (Sebastes alutus G.) in the Gulf of Alaska. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part III. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA, USA. TT 67-51205:208-216.

Lyubimova, T. G. 1967. The main stages in the life cycle of Pacific Ocean Perch (Sebastes alutus Gilbert) in the northeast Pacific. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part IV., U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Infor., Springfield, VA TT 67-51206:85-111.

The rockfish Sebastodes alutus G. belongs to the Pacific boreal ichthyofauna. It is widespread in the Pacific, where it inhabits temperate boreal (Kamchatka, Bering Sea, Gulf of Alaska)as well as southern boreal waters (southern Sakhalin, British Columbia, California. Owing to the ecological diversity of this large area, rockfish living in different regions differ in such biological characteristics as size, age, growth rate, fecundity, and reproductive cycles. Hence, it is assumed that several local stocks of Pacific rockfish exist.

Lyubimova, T. G. 1968. Basic aspects of the biology and distribution of Pacific rockfish (Sebasodes alutus Gilbert) in the Gulf of Alaska. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part I. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform., Springfield, VA, USA. TT 67-51203:308-318.

MacGregor, John S. 1970. Fecundity, multiple spawning, and description of the gonads in Sebastodes. U.S. Fish. Wildl. Serv. Spec. Sci. Rep. Fish. 596, 12 p.

More than 50 species of Sebastodes, an ovoviviparous genus of scorpaenid fishes, occur off the California coast. In the ovaries on nine species examined, evidence of two spawning per spawning season were found in three (S. ovalis, S. Constellatus, S. paucispinis) but not in the other six (S. Carnatus, S. rosaceus, S. serricpes, S. serranoides, S. atrovirens, S. ruberrimus).

MacGregor, John S. 1986. Relative abundance of four species of Sebastes off California and Baja California. Calif. Coop. Oceanic Fish. Invest. Rep. 27:121-135.

Maeda, Hiroshi, Koichi Fukada, and Naomitsu Iwasaki. 1983. Shooting and hauling speeds of rockfish bottom longline. Bull. Jpn. Soc. Sci. Fish. 49(7):1029-1037.

The variation of speeds of shooting (270 skates in 18 strings) and hauling (239 skates in 16 strings) of a skate rockfish (Sebastes) bottom longline by 50-ton FRP longliner was examined. The results obtained are summarized as follows: The shooting speed of a skate ranged from 24 to 47 seconds, and its frequency distribution was agreeable to normal distribution. The speed of shooting varied according to string and could be expressed mathematically (equations are given). The hauling speed was affected significantly by troubles in main line. The delay caused by tangling was about 1.4 to 3.2 min, by main line fastened to bottom object being about 4.0 min, main line torn-off being about 4.6 min, main line torn-off and dropped being about 10.5 to 12.3 min and main line tangled with anchor line being 9.5 min. The string mean of hauling speed of a skate without trouble ranged from 3.6 to 5.1 min.

Magnusson, J. 1955. Microscopical anatomical investigations on reproduction in redfish (Sebastes marinus Linne). Fish. Res. Board Can. Transl. Ser. 138.

Magnusson, J. 1959. On the sex ratio of redfish in east Greenland and Icelandic waters in 1957. Ann. Biol. 14:35-39.

Magnusson, J. 1961. Sex and maturity in relation to distribution and migration. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:242.

Magnusson, J. 1961. Sex ratio of catches of redfish and migration. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:251-252.

Magnusson, J. 1968. Report on redfish larvae, Sebastes marinus L. Int. Comm. Northwest Atl. Fish. Spec. Publ. 7:145-155.

In this paper the results of the redfish larvae sampling during NORWESTLANT 1-3, in 1963, are discussed.

Magnusson, J. 1977. Icelandic investigations on redfish in 1975. Ann. Biol. Copenh. 32:171-173.

The length distributions of commercial and research vessel catches of redfish (Sebastes sp) at East Greenland and Iceland in 1975 are presented. There were only 2 small samples analysed from the East Greenland Commercial catches in 1975. Most of the redfish caught by Icelandic trawlers on Icelandic grounds was from the region west of Iceland and particularly area W. Although a considerable part of the redfish landed consisted of relatively small fish, the trend this year was towards bigger fish. In the research vessel catches, the length distribution was characterized by a wide range in all 3 East Greenland areas. A large part of the catches consisted of relatively small redfish, and the length distribution showed peaks at 28-33 cm for all 3 areas. For East Greenland area the mean length increased from 33.49 cm in 1974 to 34.19 cm. In research catches at Iceland, range in the length distribution was very wide, particularly in areas W and SW. There was a predominance of small redfish in areas N, NW, E and NE. The mean length for the whole area increased from 28.63 cm in 1974 to 31.28 cm in 1975. The general increase in size between 1974 and 1975 is mainly due to an increase in the relative number and size of the 30-40 cm groups.

Magnusson, J. 1980. On the relation between depth and redfish in spawning condition, SW of Iceland. In Council Meeting of the International Council for the Exploration of the Sea, Copenhagen, Denmark, Oct. 6, 1980. ICES-CM-1980/G:46:13 p.

Magnusson, J. 1983. The Irminger Sea oceanic stock of redfish "spawning" and "spawning" area. In Council Meeting, 1983, of the International Council for the Exploration of the Sea, Gothenburg, Sweden, Oct. 10, 1983. ICES-CM-1983/G:56.

Magnusson, J., and J. Magnusson. 1980. The distribution and abundance of young redfish, Sebastes marinus, at Iceland 1974. Rit Fishidieldar 5(3):1-22.

Material which was mainly collected on 1 cruise around Iceland in Aug.-Sept 1974 using a bottom trawl was examined. The distribution and abundance of young redfish (S. marinus L., 32 cm and smaller) and its relation to depth and bottom temperature were discussed. Young redfish were abundant off all coasts except the southern coast where sampling was

scarce. The greatest densities were observed off the western, northeastern and eastern coasts. No direct relationship was found between the abundance and depth for the area as a whole but there was apparently a relationship between depth and temperature at one side and abundance on the other side. The mean size of the young redfish was highest off the southwestern coast (25.41 cm) and smallest off the eastern coast (15.73 cm). This may be due to the lack of larger redfish off the eastern coast. The abundance of young redfish off the northern and eastern coasts does not seem to correspond with the scarcity of pelagic stages of redfish fry in these areas.

Magnusson, J. V. 1981. Identification of Sebastes marinus, S. mentella and S. viviparus in O-Group Redfish. ICES Symposium on the Early Life History of Fish, Woods Hole, MA, Apr. 2-5, 1979. Rapp. P.-V. Reun. Cons. Int. Explor. Mer 178:571-574.

This paper was prepared to meet the urgent need to identify O-group redfish species for O-group surveys in the North Atlantic. The material derives from O-group surveys carried out in the Irminger Sea and at Iceland. Already in the late larval stage, two of the preopercular spines are outstanding on all redfish larvae. The growth of these spines is different according to species and these size differences which occur in all sizes of O-group redfish are used for identification. On S. marinus and S. viviparus, the upper one of the two largest preopercular spines is shorter than the lower one while on S. mentella the conditions are reversed. S. viviparus can be distinguished from all other O-group redfish by the outstanding spine appearing in the occipital region. Besides this, there exist slight differences in the general appearance of the different species. Several other parameters were measured but none of them gave such definite characteristics that could have been of use for the above described purpose.

Magnusson, J. V. 1982. Shrinkage of dying redfish larvae. In Council Meeting of the International Council for the Exploration of the Sea, Copenhagen, Denmark, Oct. 11, 1982. ICES-CM-1982/G:23:6 p.

Major, Richard L. 1986. Condition of groundfish resources of the Gulf of Alaska region as assessed in 1985. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-F/NWC-106, 312 p.

In the relatively short time since the Magnuson Fishery Management and Conservation Act (MFMCA) went into effect in 1977, the fisheries of the Gulf of Alaska have undergone dramatic changes. Overall production increased 76% between 1977 and 1984. Presented here are 15 contributions dealing with Gulf of Alaska groundfish resources. Ten of the 15

papers summarize information on commercially important species or groups of species--walleye pollock, Pacific cod, sablefish, Atka mackerel (Pleurogrammus monopterygius), Pacific ocean perch (Sebastes alutus), thornyhead rockfish (Sebastolobus alascanus), other rockfish, flatfish, squid, and the category known as 'other species.' There are also descriptions of the commercial fisheries for walleye pollock in 1984 and 1985, the 1984 U.S.-Japan cooperative survey, and the 1985 acoustic-midwater trawl surveys on the spawning populations of walleye pollock in Shelikof Strait.

Major, Richard L., and Herbert H. Shippen. 1970. Synopsis of biological data on Pacific Ocean perch, Sebastes alutus. U.S. Dep. Commer., NOAA Tech. Rep. NMFS Circ. 347, 38 p.

This synopsis has information on the taxonomy, life history, population structure, and harvesting of a species that is being intensively fished and studied by the United States, Canada, the U.S.S.R., and Japan. This synopsis includes data from scientific papers either printed in English or translated from Japanese and Russian into English.

Mandapat, Ruth. 1971. The 1970 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 12, 49 p.

Mangel, M., and J. H. Beder. 1985. Search and stock depletion theory and application. Can. J. Fish. Aquat. Sci. 42(1):150-163.

A general theory for the estimation of stock size from search data is developed. It assumes that discrete aggregations (schools of fish, beds of clams) are encountered. The search model is an extension of the Poisson process to include depletion. The theory provides a way of estimating stock size and confidence intervals around the estimate, as well as the ability to predict future catches for a given level of effort. Three applications of theory are described: estimating stock size when there is no catch; determining, in real time, the length of fishing season; and an empirical study of stock assessment of Pacific ocean perch (Sebastes alutus) near Rennell Sound, British Columbia Canada.

Mann, H. 1970. Copepoda and isopoda as parasites of marine fishes. In Stanislas F. Snieszko (editor), A synposium on diseases of fishes and shellfishes, p.177-189. American Fisheries Society Special Publication, No. 5. Washington, D.C., American Fisheries Society, 1970. 526 p.

Marak, R. R. 1974. Food and feeding of larval redfish in the Gulf of Maine. In J. H. S. Blaxter (editor), The early life history of fish. The proceedings of an international symposium held at the Dunstaffnage Marine Research Laboratory of the Scottish Marine Biological Association. Oban, Scotland May 17-23, 1973, p. 267-275. New York, Springer-Verlag, 1974.

Martin, W. R. 1961. The distribution of redfish catches landed on the southern Canadian mainland, 1949-1958. Int. Comm. Northwest Atl. Fish. Spec. Pub. 3:148-153.

Maslennikova, N. V. 1974. The amino acid composition of some fish tissues. J. Ichthyol. 14(6):943-954.

An analysis was performed of amino acid composition in the proteins of the muscles, liver and sexual products of various fish species, as well as free amino acids in these organs and tissues.

Maslov, N. A. 1983. Fishing for ocean perch in the Barents Sea and along the NW coast of Norway. Can. Transl. Fish. Aquat. Sci. 4906, 12 p.

Fish catch statistics of ocean perch (Sebastes marinus) are compared from German and Soviet data reports and from different regions. The decrease in catches of perch during 1934-36 was due to the fact that Soviet trawlers were fishing in areas with insignificant concentrations because fish scouting was focused on the search for cod in the Barents Sea and the northwest coast of Norway. Distribution of perch changes from autumn to spring. Catches may be increased by fishing the southern Barents Sea, the Bear Island - Spitsbergen area and along the northwestern coast of Norway.

Masuda, H., K. Amaoka, C. Araga, T. Uyeno, and T. Yoshino. 1984. Fishes of the Japanese Archipelago. Tokyo, Tokai University Press. 450 p.

Mathews, S. B., and M. W. Barker. 1983. Movements of rockfish (Sebastes) tagged in northern Puget Sound, Washington. Fish. Bull., U.S. 81(4):916-922.

Recreational scuba divers and hook-and-line fishermen in northern Puget Sound have taken an annual catch of 150,000 bottomfish of all species; four species of Pacific rockfish (sebastes) account for about 70% of the catch (Washington Department of Fisheries 1977-1980). These four species are copper rockfish, S. caurinus; quillback rockfish, S. maliger; black rockfish, S. melanops; and yellowtail rockfish. The tagging study was initiated in response to public concern expressed to the Washington Department of

Fisheries that certain heavily fished reefs in northern Puget Sound were becoming depleted of rockfish. The intent was to determine the extent of the differences in migratory behavior among rockfish species most commonly caught.

Matsubara, K. 1937. A new name, Sebastichthys hubbsi Matsubara, substituted for Sebastichthys brevispinis Matsubara, from Japan. Copeia 1:57.

In 1936, I proposed a new name, Sebastichthys brevispinis (Jour. Imp. Fish. Inst., 31(2):84), as a substitute for Sebastichthys elegans of Jordan and Starks. Dr. Carl L. Hubbs has kindly informed me that the specific name brevispinis has been used for an Alaskan species of the same genus. I, therefore, replace the name Sebastichthys brevispinis Matsubara with the new specific name Sebastichthys hubbsi, in honor of Dr. Carl L. Hubbs. It is my pleasant duty to return herewith my hearty thanks to him for kindness extended to me.

Matsubara, K. 1940. Studies on the Scorpaenoid fishes of Japan: IV: On a new classification of two subfamilies, Sebastinae and Scorpaenidae, based on osteological characteristics of suborbital ring (preliminary report). Bull. Jpn. Soc. Sci. Fish. 8:373-378.

Matsubara, K. 1943. Studies on the Scorpaenoid fishes of Japan. Anatomy, phylogeny and taxonomy. Transactions of the Sigenkogaku Kenkyusyo. 1 & 2, 486 p.

Matsunaga, K. 1976. Estimation of variation of mercury concentration in the oceans during the last several decades. J. Oceanogr. Soc. Jpn. 32(1):48-50.

Variation of Hg concentration in the oceans during the last several decades was investigated by determining the Hg concentration in rock fishes [Sebastes iracundus] caught recently and about 20 yr ago. There was no variation in Hg concentration in the oceans during the last several decades.

Matsuno, Takao, and Masaaki Katsuyama. 1976. Comparative biochemical studies of carotenoids in fishes-IX. On the 19 species of fishes in the division percichthyes. Bull. Jpn. Soc. Sci. Fish. 42(6):645-649.

The carotenoid pigments from the fin and skin of 19 spp. of fishes in the division Percichthyes [Scomber japonicus, Coryphaena hippurus, Auxis thazard, Scombrops boops, Ditrema temmincki, Parapristipoma trilineatum, Acanthopagrus schlegelii, Roccus saxatilis, Sparus sarba, Pristipomoides filamentosus, Lateolablax japonicus, Hexagrammos otakii, Sebastes inermis, Sebasticus marmoratus, Scorpaenodes littoralis, Navodon modestus, Stephanolepis cirrhifer,

Theragra chalcogramma, Callionymus punctatus were investigated. They have similar carotenoid patterns, consisting of .beta.-carotene, .alpha.-cryptoxanthin, tunaxanthin, lutein, zeaxanthin, diatoxanthin, cynthiaxanthin, astacene, .alpha.-doradecin and small amounts of unidentified pigments. The assumption that tunaxanthin might be a chemical indicator in the division Percichthyes was proved correct.

Matthews, Kathleen R., Bruce S. Miller, and Thomas P. Quinn. 1987. Movement studies of nearshore demersal rockfishes in Puget Sound, Washington. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 63-72. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Mayo, R. K. 1980. Exploitation of redfish Sebastes marinus in the Gulf of Maine Georges Bank region, with particular reference to the 1971 year-class. J. Northwest Atl. Fish. Sci. 1:21-37.

The redfish fishery of the Gulf of Maine-Georges Bank region is reviewed, and an assessment of the current status of the stock is presented. Annual nominal catches or approximately 13,000-14,000 metric tons in 1977 and 1978 were considerably below the peak annual yield of about 60,000 tons, but close to the estimated maximum sustainable yield (MSY) as determined by general production model analyses. The level of effort expended during the most recent years was 2-3 times higher than the level corresponding to the estimated MSY. Standardized effort calculations indicate that real effort has substantially increased since the mid-1960's due in part to a major shift in the size composition of the redfish fleet toward larger, more efficient vessels.

Mayo, R. K., E. Bevacqua, V. M. Gifford, and M. E. Griffin. 1979. An assessment of the Gulf of Maine redfish, Sebastes marinus (L.), stock in 1978. Int. Counc. Explor. Sea Demersal Fish Committee ICES-CM-1979/G:55, 47 p.

Mayo, R. K., U. B. Dozier, and S. H. Clark. 1983. Virtual population analysis of redfish, Sebastes fasciatus, in the Gulf of Maine-Georges Bank region. In Council Meeting of the International Council for the Exploration of the Sea, Gothenburg, Sweden, Oct. 10, 1983. ICES-CM-1983/G:49.

Mayo, R. K., V. M. Gifford, and A. Jearld, Jr. 1981. Age validation of redfish, Sebastes marinus (L.), from the Gulf of Maine-Georges Bank Region. J. Northwest Atl. Fish. Sci. 2:13-19.

Age determinations of redfish up to age 7 from the Gulf of Maine-Georges Bank region were validated by noting the

seasonal formation of hyaline and opaque edges of otolith sections and by comparing estimates of mean length at age with observed modes of length frequencies specific to the 1971 yr-class. Evidence was found for the formation in the otolith of 1 hyaline and 1 opaque edge annually. Hyaline edges predominate from Nov.-May and opaque edges from June-Oct. Deposition of hyaline material, as indicated by the presence of a very narrow edge, generally begins in Aug. and the formation of the opaque edge begins in April. Average length at age values based on otolith readings were similar to observed modes of lengths frequencies representing the 1971 year-class on the basis of the seasonal progression of modal length groups from 1971-1978.

Mayo, Ralph K. 1987. Recent exploitation patterns and future stock rebuilding strategies for acadian redfish, Sebastes fasciatus Storer, in the Gulf of Maine-Georges Bank region of the northwest Atlantic. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 335-353. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Mayor, R. L., and H. H. Shippen. 1970. Synopsis of biological data on Pacific Ocean perch, Sebastodes alutus. U.S. Dep. Commer., NOAA Tech. Rep., NMFS Circ. 347, 38 p.

A collection of references to other sources.

McAllister, D. E., and S. J. Westrheim. 1965. Widow rockfish, Sebastodes entomelas, new to British Columbia waters. J. Fish. Res. Board Can. 22(6):1559-1561.

McClure, Robert Edward. 1982. Neritic reef fishes off Central Oregon: Aspects of life histories and the recreational fishery. M. S. Thesis, Oregon State Univ., Corvallis, 94 p.

Recreational angling pressure has recently increased in the neritic reef areas off the central Oregon coast. This study describes weight-length and age-length relationships as well as ages at sexual maturity of the black, blue, canary, yelloweye, and yellowtail rockfish (Sebastes melanops, S. Mystinus, S. pinniger, S. ruberrimus, and S. Flavidus, respectively) and the lingcod (Ophiodon elongatus). These biological characteristics were examined in relation to the recreational fishery and compared to characteristics reported for the same species from other geographic locations.

McCosker, John E., Michael D. Lagios, and Thomas Tucker. 1976. Ultrastructure of Lymphocystis virus in the quillback rockfish, Sebastes maliger, with records of infection in other aquarium-held fishes. Trans. Am. Fish. Soc. 105(2):333-337.

Lymphocystis viral infection is reported for the 1st time from the quillback rockfish, S. maliger, the starry rockfish, F. constellatus, and the China rockfish, S. nebulosus, (family Scorpaenidae), recreationally and commercially important eastern North Pacific species. The ultrastructure of infected cells, identified as facultative fibroblasts, of S. maliger is described and illustrated. Other aquarium-held fishes previously unreported as lymphocystis hosts are Bodianus mesothorax, Chaetodon miliaris, C. auriga, C. lunulatus, Chelmon rostratus, Pomacanthus annularis, and Cichlasoma synspilum.

McDermott-Ehrlich, D., and George A. Alexander. 1976. Chemical studies of offshore oil platforms. South. Calif. Coastal Water Res. Proj. Annu. Rep. 1976:129-135.

As part of the effort to determine if drilling and oil production operations had an effect on organisms found around two oil platforms, chemical analyses of the nearby sediments and of the tissues of several marine animals found in the area were made. Levels of copper, zinc, hexane extractable materials, and volatile solids in sediments around the oil platforms were similar to average coastal background levels and were well below levels observed in sediments contaminated by municipal wastewater outfalls. The petroleum hydrocarbon content of all sediment samples collected was higher than values observed in areas with no natural seeps. The gas chromatographic fingerprints for all samples were indicative of highly weathered oil, indicating no recent contamination of the sediments. No statistically significant differences in metals were observed for yellow rock crabs collected from the oil platforms and control sites and no detectable amount of petroleum hydrocarbons were observed in any of the animals analyzed.

McElderry, H. I. 1979. A comparative study of the movement habits and their relationships to buoyancy compensation in two species of shallow reef rockfish (Pisces:Scorpaenidae). M.S. Thesis, Univ. Victoria, British Columbia.

McGlade, J. M., M. C. Annand, and T. J. Kenchington. 1983. Electrophoretic identification of Sebastes and Helicolenus in the northwestern Atlantic. Can. J. Fish. Aquat. Sci. 40(11):1861-1870.

An electrophoretic survey of 16 enzymes was conducted on

representatives of the genera Helicolenus and Sebastes. The survey was designed to develop an identification scheme for the commercially exploited species; in the absence of any detailed description of their geographic distribution in the Scotian Shelf, they are currently managed as a single unit. Twelve enzymes were diagnostic for H. dactylopterus and 3 for S. fasciatus. Based on the mobility of the most common allele none of the enzymes examined could distinguish between S. mentella and S. marinus. A protocol for the identification of S. fasciatus is presented which incorporates the results of this survey. It is also suitable to describe the geographic distribution of commercially important species. The electrophoretic identification of the Sebastes spp. allowed fish with intermediate meristic characters, such as the number of anal fin rays, to be unequivocally identified. Generic separation of Helicolenus and Sebastes is warranted, and S. fasciatus is distinct from S. marinus and S. mentella, but individuals of S. marinus and S. mentella cannot be differentiated electrophoretically.

McHugh, J. L. 1952. The food of albacore (Germo alalunga) off California and Baja California. Scripps Inst. Oceanog. Bull. 6(4):161-172.

McKone, W. D. 1981. Effects of changes in codend mesh size upon yield per recruit of redfish in Division 3M. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/6/52.

The relationship between the physical properties of fishing gear and the catch composition has been studies by biologists for many years. By far the most common experiment has been concerned with factors that affect the size caught, since optimum yields for a fish species are usually defined by the appropriate sizes from the stock that should be harvested. Long-term yields can theoretically be shown to change appreciably with a slight change in mesh size. Whether these changes can be demonstrated empirically during the fishery are yet to be proven. The major emphasis on selectivity of redfish by codend was during the 1960's. A number of experiments were carried out both in the ICES and ICNAF convention areas and a cooperative review of this work was assembled by Holden. This paper attempts to bring together historic findings on codend mesh selectivity of redfish with current yield per recruit curves for various codend mesh sizes as applied to 3M redfish.

McKone, W. D., D. B. Atkinson, and W. E. Legge. 1980. Gulf of St. Lawrence redfish assessment. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 80/60, 43 p.

Because of the problems with catch and effort data unadjusted survey data was used to estimate the biomass of

the Gulf of St. Lawrence redfish (Sebastes spp.) stock to key in the cohort. Using the survey data indicated the stock was larger than previously indicated. Thus some moderate increase in the T.A.C. was indicated. The recruitment prospects of year-classes from the early 70's indicate some moderate increase in the TAC over the next few years. But if subsequent year-classes remain as low in abundance as indicated the stock will revert to the general decline which has been noted.

McKone, W. D., C. Gavaris, and W. E. Legge. 1981. Redfish assessment for Division 4RST. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 81/58, 18 p.

Mearns, Alan J. 1977. Coastal gradients in sport fish catches. South. Calif. Coastal. Water Res. Proj. Annu. Rep. 1977:127-132.

Mearns, Alan J., M. James Allen, Michael D. Moore, and Marjorie J. Sherwood. 1980. Distribution, abundance, and recruitment of soft-bottom rockfishes (Scorpaenidae: Sebastes) on the southern California mainland shelf. Calif. Coop. Oceanic Fish. Invest. Rep. 21:180-190.

Data from nearly 400 small-mesh otter trawls taken throughout the southern California borderland between 1969 and 1979 were examined to reveal spatial and temporal patterns in the abundance and distribution of rockfishes. Rockfishes were common in all samples taken between 15 and 450 m. Predictably, species composition changed with depth. Catches were numerically dominated by either Sebastes saxicola (from 1971-75) or S. dalli (from 1975-70) on the mainland shelf south of Point Dume and inshore of 60 m variability in the recruitment of the young of these species was the major source of seasonal and year-to-year fluctuations in rockfish catches. These variations in recruitment were related to changing oceanographic conditions.

Merkel, Terrence J. 1967. Food habits of the king salmon, Oncorhynchus tshawytscha (Walbaum), in the vicinity of San Francisco, California. Calif. Fish Game 43:249-270.

Messtorf, J., and G. Wagner. 1980. Fishing Research in the North Atlantic With FMV Karlsburg From 28th August to 27th October 1980. Inf. Fischwirtsch. 27(6):219-227.

Statistical data was collected for stock assessment of pelagic fish in the North Atlantic. Preliminary data on geographical distribution, population density, weight and length of Micromesistius poutassou, Mallotus villosus, Reinhardtius hippoglossoides, Macrourus berglax, Coryphrenoides rupestris, Gadus morhua, Sebastes marinus and Sebastes mentella are given.

Meyers, T. R., T. K. Sawyer, and S. A. Maclean. 1977. Henneguya sp. (Cnidospora:Myxosporida) parasitic in the heart of the bluefish, Pomatomus saltatrix. J. Parasitol. 63(5):890-896.

A myxosporidan parasite, Henneguya sp., was discovered in the bulbus and truncus arteriosus of bluefish P. saltatrix. Infected fish were captured from the Atlantic Ocean near Montauk Point, Long Island, New York, Raritan Bay, New Jersey and Chesapeake Bay, Maryland [USA]. Comparative features of mature spores showed that they were similar to those of H. sebasta Moser and Love 1975 from the bulbus arteriosus of 7 spp. of California rockfish Sebastes. Studies on growth stages of the parasite from both host species are necessary before a definite identification of the bluefish parasite can be made.

Mezhnin, F. I. 1979. Interrenal and suprarenal glands of bony fishes. Biol. Bull. Acad. Sci. USSR 6(4):416-422.

Mezhnin, F. I. 1979. Stannius corpuscles in fish. J. Ichthyol. 19(2):105-123.

A study was made of the topography, histological structure and certain histochemical indices (lipids, polysaccharides, ascorbic acid and RNA) of Stannius corpuscles in 15 spp. of saltwater and freshwater teleosts belonging to 10 families: Coregonus peled, Mallotus villosus, Esox lucius, Rutilus rutilus, Abramis ballerus, Cyprinus carpio, Cobitis taenia, Silurus glanis, Lota lota, Lucioperca lucioperca, L. volgensis, Perca fluviatilis, Acerina cernua, Sebastes marinus, Myoxocephalus quadricornis. Guppies were used to observe the reaction of Stannius corpuscles to changing water salinity and also the effect of injections of KCl and ACTH. Stannius corpuscles of teleost fish form, together with juxtaglomerular cells, the renin-angiotensin system, which along with the interrenal body participates in the regulation of water-mineral metabolism. It is doubtful whether one should identify the Stannius corpuscles of teleosts with the zone glomerulosa of mammalian suprarenal cortex.

Miller, A., III, R. A. Scanlan, J. S. Lee, and L. M. Libbey. 1972. Volatile compounds produced in ground muscle tissue of canary rock fish (Sebastes pinniger) stored on ice. J. Fish. Res. Board Can. 29(8):1125-1129.

Volatile compounds associated with the progressive degradation of ground muscle tissue of canary rockfish (Sebastes pinniger) stored on ice were determined by combined gas-liquid chromatography and mass spectrometry. Compounds positively identified included dimethyl sulfide, n-propyl alcohol, acetaldehyde, propionaldehyde, acetone, ethyl alcohol, 2- and 3- pentanone, diacetyl, hexanal,

1-pentene-3-ol, 3-methyl-1-butanol, acetoin, trimethylamine, and dimethylamine. The following compounds were tenatively identified: propenal, octenal or octadienal, butyraldehyde, 3-methyl butanal, 2-butanone, and methyl vinyl ketone. (Author).

Miller, A., III, R. A. Scanlan, J. S. Lee, and L. M. Libbey. 1973. Volatile compounds produced in sterile fish muscle (Sebastes melanops) by Pseudomonas putrefaciens, Pseudomonas fluorescens, and an archromobacter species. Appl. Microbiol. 26(1)18-21.

Volatile compounds produced by Pseudomonas putrefaciens, Pseudomonas fluorescens, and an Achromobacter species in sterile fish muscle (Sebastes melanops) were identified by combined gas-liquid chromatography and mass spectrometry. Compounds produced by P. putrefaciens included methyl mercaptan, dimethyl disulfide, dimethyl trisulfide, 3-methyl-1-butanol, and trimethylamine. With the exception of dimethyl trisulfide, the same compounds were produced by an Achromobacter species. Methyl mercaptan and dimethyl disulfide were the major sulfur-containing compounds produced by P. fluorescens. (Author).

Miller, A., III, R. A. Scanlan, J. S. Lee, L. M. Libbey, and M. E. Morgan. 1973. Volatile compounds produced in sterile fish muscle (Sebastes melanops) by Pseudomonas perolens. Appl. Microbiol. 25:(2):257-261.

Volatile compounds produced by Pseudomonas perolens ATCC 10757 in sterile fish muscle (Sebastes melanops) were identified by combined gas-liquid chromatography and mass spectrometry. Compounds positively identified included methyl mercaptan, dimethyl disulfide, dimethyl trisulfide, 3-methyl-1-butanol, butanone, and 2-methoxy-3-isopropylpyrazine. Compounds tentatively identified included 1-penten-3-ol and 2-methoxy-3-sec-butylpyrazine. The substituted pyrazine derivative 2-methoxy-3-isopropylpyrazine was primarily responsible for the musty, potato-like odor produced by P. perolens. (Author).

Miller, B. S., and S. F. Borton. 1974. Geographical distribution of Puget Sound fishes:maps and data source sheets. Rep. to the Washington State Dept. Ecol. Contrib. 74-142, November, 1974.

Miller, D. J. 1961. Black rockfish. California ocean fisheries resources to the year 1960. Calif. Dept. Fish and Game, Sacramento 79p.

Miller, D. J., and J. J. Geibel. 1973. Summary of blue rockfish and lingcod life histories; a reef ecology study; and giant kelp, Macrocystis pyrifera, experiments in Monterey Bay, California. Calif. Fish Game Fish Bull. 158, 137 p.

Miller, D. J., and D. Gotshall. 1965. Ocean sportfish catch and effort from Oregon to Point Arguello, California July 1, 1957-June 30, 1961. Calif. Fish Game Fish Bull. 130, 135 p.

Miller, D. J., and J. E. Hardwick. 1973. The status of the rockfish resource and its management. Calif. Dept. Fish Game, Mar. Resource Tech. Rep. 17, 32 p.

Miller, D. J., and R. N. Lea. 1972. Guide to the coastal marine fishes of California. Calif. Fish Game Fish Bull. 157, 235 p.

Miller, D. J., M. W. Odemar, and D. W. Gotshall. 1967. Life history and catch analysis of the blue rockfish (Sebastodes mystinus) off central California, 1961-1965. Calif. Dep. Fish Game MRO Ref. 67-14, 130 p.

Miller, S. A., and W. D. Brown. 1984. Effectiveness of chlortetracycline in combination with potassium sorbate or tetra sodium edta for preservation of vacuum packed rockfish, Sebastes, fillets. J. Food Sci. 49(1):188-191.

Rockfish fillets were dipped in distilled deionized water (DDW), a solution of 1% Na4EDTA plus 5 ppm chlortetracycline (CTC) or 1% K-sorbate plus 5 ppm CTC. After dipping, fillets were vacuum packed and stored at 2.degree. C. Samples were evaluated after 0, 3, 7, 10, 14 and 21 days. The sorbate/CTC group differed less from fresh fillets than did the control (fillets dipped in DDW) for all indices measured. Fillets treated with EDTA/CTC differed to a greater extent from fresh fillets than the sorbate CTC group, but less than the controls. Results were corroborated by sensory analyses which tested for color, flavor and odor. Fish fillets dipped in a solution of 1% K-sorbate plus 5 ppm CTC retained odor and flavor properties of fresh fillets better than the EDTA/CTC treated fillets after 14 days of storage.

Mina, M. V. 1978. Species population structure in fishes an evaluation of some hypotheses. Zh. Obshch. Biol. 39(3):453-460.

The main inferences of the book Population Genetics of Fishes (1974) by Y. P. Altukhov are discussed. Elementary populations cannot be considered as hereditary, indivisible groups, identical in all fish species. It cannot be assumed that monomorphism of some characters in populations contradicts the synthetic theory of evolution and

substantiates the assertion that new species formation proceeds by genome reorganization in connection with the reproductive isolation of single individuals. [Sebastes mentella, Engraulis encrasicholus and Oncorhynchus nerka are discussed.].

Minchin, D., and J. Molloy. 1978. Notes on fishes taken in Irish waters in 1976. Ir. Nat. J. 19(5):160-162.

Brief descriptions of fishes taken about the Irish coast, during 1976, are presented in this paper. They include Sebastes marinus.

Minchin, D., and J. Molloy. 1980. Notes on some fishes taken in Irish waters during 1978. Ir. Nat. J. 20(3):93-97.

A brief description of unusual fish taken in Irish waters during 1978, is given. The following species is included: Sebastes marinus (red fish).

Minet, J. P., A. Forest, and J. B. Perodou. 1978. Biological data on the northern deepwater prawn, Pandalus borealis, off Baffin Island. Int. Comm. Northwest Atl. Fish. Sel. Pap. 4:15-21.

In the autumn of 1977, significant catches of the northern deepwater pawn, P. borealis were taken in a groundfish trawl survey by the research vessel Cryos in Statistical Area O. A minimum estimate of the biomass based on the area swept with the groundfish trawl, which is inefficient for shrimp, is about 4,000 metric tons. Modes of 12.9, 17.9, 23.1 and 29.5 mm in the length frequencies are considered to represent age-groups 2, 3, 4 and 5+, Greenland halibut, Reinhardtius hippoglossoides, and redfish, Sebastes marinus mentella, dominated the by-catches.

Mio, S. 1960. Biology of Sebasticus marmoratus Cuvier et Valenciennes. Rec. Oceanogr. Works Japan. 5(2):77-85.

Misra, R. K. 1985. Quadratic discriminant analysis with covariance for stock delineation and population differentiation: A study of beaked redfishes (Sebastes mentella and Sebastes fasciatus). Can. J. Fish. Aquat. Sci. 42(10):1672-1676.

Stock delineation is of vital importance in fisheries management programs. Linear discriminant function (LDF) has been employed extensively in population differentiation studies but is of severely restricted usefulness when populations differ in their dispersion matrices. Quadratic discriminant function (QDF) is the appropriate analysis to employ these situations. Here, I analyzed morphometric data of beaked redfishes (Sebastes mentella and S. fasciatus) by a recently developed conditional QDF.

Misra, R. K., and I-Hsun Ni. 1983. Distinguishing beaked redfishes (deepwater redfish, Sebastes mentella and Labrador redfish, S. fasciatus) by disciminant analysis (with covariance) and multivariate analysis of covariance. Can. J. Fish. Aquat. Sci. 40(9):1507-1511.

Analysis of morphometric data for differentiating fish species and stocks has frequently been unsatisfactory as a result of sampling bias associated with the varying size of specimens and the large overlapping of characters. These difficulties may be overcome by using a discriminant function with covariance and multivariate analysis of covariance. In a classification study of beaked redfishes, in which the specimens of Labrador redfish (Sebastes fasciatus) are relatively smaller than those of deepwater redfish (S. mentella), a single character would not separate species, but a compound criterion (discriminant function) of several characters separated the species effectively. A discriminant function with covariance separated species/populations remarkably well and better than one without covariance. Seven morphometric characters were identified as pertinent discriminators between S. fasciatus and S. mentella.

Mitchell, Charles T., and John R. Hunter. 1970. Fishes associated with drifting kelp, Macrocystis pyrifera, off the coast of southern California and northern Baja California. Calif. Fish Game 56(4):288-297.

Miyauchi, D., M. Patashnik, and G. Kudo. 1975. Frozen storage keeping quality of minced black rockfish Sebastes Sp. improved by cold water washing and use of fish binder. J. Food. Sci. 40(3):592-594.

Mizue, K. 1957. Studies on a scorpaenous fish Sebasticus marmoratus Cuvier et Valenciennes. On the monthly variation of gonad maturity. Bull. Fac. Fish. Nagasaki Univ. 5:27-29.

Mizue, K. 1958. Studies on a scorpaenous fish Sebasticus marmoratus Cuvier et Valenciennes: The seasonal cycle of mature testes and the spermatogenesis. Bull. Fac. Fish. Nagasaki Univ. 6:27-38.

Mizue, K. 1959. About the seasonal cycle of mature testes of Sebastes inermis. Bull. Fac. Fish. Nagasaki Univ. 8:111-122.

Mizue, K. 1959. Studies on a scorpaenous fish Sebasticus marmoratus Cuvier et Valenciennes. On the maturation and the seasonal cycle of the ovaries of the marine ovoviviparous teleost. Bull. Fac. Fish. Nagasaki Univ. 8:84-110.

Mizue, K. 1964. Studies on a marine viviparous teleost, Ditrema temmincki Bleeker. On the origin of oocytes of Ditreme temmincki, Sebastes inermis. Bull. Fac. Fish. Nagasaki Univ. 17:1-9.

Moiseev, P. A. 1935. To the knowledge of fishes belonging to the Scorpaenidae fauna of the Far Eastern Seas. Issled. Morei. SSSR 23:113-138.

Moiseev, P. A., and I. A. Paraketsov. 1961. Information on the ecology of rockfishes (family Scorpaenidae) of the northern part of the Pacific Ocean. Fish. Res. Board Can. Transl. Ser. 358, 10 p.

Mokhele, K., A. R. Johnson, E. Barrett, and D. M. Ogrydziak. 1983. Microbiological analysis of rock cod (Sebastes spp.) stored under elevated carbon dioxide atmospheres. Appl. Environ. Microbiol. 45(3):878-883.

The numbers and types of microorganisms on fresh rock cod fillets and fillets stored in air or in a modified atmosphere (MA 80% CO sub(2), 20% air) at 4 degree C were compared. After 7 days of storage in air, the fillets were obviously spoiled and had a 3- to 4-log cycle increase in microbial counts. Plate counts increased more slowly on MA-stored fillets. After 21 days, the counts on the latter had increased only 2 log cycles, and the fillets did not seem spoiled.

Mombeck, F. 1981. Assessment of bottom stocks off Labrador. Inf. Fischwirtsch. 28(1):4-9.

Stocks were assessed from 68 half-hour bottom trawls by FRV Anton dohrn using the stratified random sampling method. From the 68 trawls a total of 24,988 kg were caught. This was comprised of 28% cod, 30% sea bream, 15% dab, 10% catfish, 10% Greenland halibut, 4% grenadier and 3% others. Depth of catch, length distribution, and water temperature/catch data are given.

Mombeck, F. 1984. Investigations on ground fish stocks near Labrador. Inf. Fischwirtsch. 31(1):3-9.

The distribution of quantity and size of the commercially important ground fish species had been investigated in four depths near Labrador. The catch Sebastes mentella (38% of total catch), Gadus morhua (26%), Hippoglossus (14%), Hippoglossoides (11%), catfishes (6%) and grenadier (2%). Their vertical distribution is discussed in connection with water temperature.

Moravac, F., and K. Nagasawa. 1985. Ichthyofilaria-Japonica new-species Philpmetridae and some other nematodes from marine fishes from Hokkaido, Japan. Vestn. Cesk. Spol. Zool. 49(3):211-223.

In 1980 and 1981, samples of some marine fishes were collected from Hokkaido, Japan, which were examined for helminths. In addition to other parasites recovered, 9 species of nematodes were found of which one, Ichthyofilaria japonica sp. n. from the abdominal cavity of Sebastes schlegeli, proved to be new for science.

Morey, K. S., L. D. Satterlee, and W. D. Brown. 1982. Protein quality of fish in modified atmospheres as predicted by the computed protein efficiency ratio assay. J. Food Sci. 47(5):1399-1400.

The nutritional quality of proteins from fillets of fresh rockfish (Sebastes spp.) stored in air or in a modified atmosphere (MA) of 80% CO2 and 20% O2 at 4.degree. C was evaluated by the Computed Protein Efficiency Ratio (C-PER) method. This procedure involves determination of in vitro digestibility and the amino acid composition of the samples prior to computation of the C-PER. Casein was used as a standard. Air-held and MA-held fish showed similar amino acid profiles, but the air-held fish showed lower in vitro digestibility. The C-PER values of both types of samples were higher than the C-PER of 2.50 for standard casein. These results suggest that storage of fish in a modified atmosphere of 80% CO2 and 20% O2 does not result in deterioration in the nutritional quality of the fish proteins.

Morris, Robert W. 1956. Early larvae of four species of rockfish, Sebastodes. Calif. Fish Game 42(2):149-153.

Moser, H. Geoffrey. 1966. Reproductive and developmental biology of the rockfishes (Sebastodes spp.) off California. Ph.D. Thesis, Univ. Southern Calif., Los Angeles, 540 p.

Moser, H. Geoffrey. 1967. Reproduction and development of Sebastodes paucispinis and comparison with other rockfishes off Southern California. Copeia 1967(4):773-797.

Moser, H. Geoffrey. 1967. Seasonal histological changes in the gonads of Sebastodes paucispinis Ayres, an ovoviviparous teleost (family Scorpaenidae). J. Morphol. 123(4):329-352.

Moser, H. Geoffrey. 1971. Development and geographic distribution of the rockfish, Sebastes macdonaldi (Eigenmann and Beeson, 1893), family Scorpaenidae, off southern California and Baja California. Fish. Bull., U.S. 70(3):941-958.

The larval and juvenile stages of the scorpaenid fish, Sebastes macdonaldi, are described and illustrated. The sequence of ossification of bones and cranial spines in larvae is described in detail. S. macdonaldi appears to have the most southerly distribution of any species of Sebastes in the eastern north Pacific. The geographic distribution and seasonal abundance of S. macdonaldi larvae are discussed and compared with published information on the adults. (Author).

Moser, H. Geoffrey. 1974. Development and distribution of larvae and juveniles of Sebastolobus (Pisces, family Scorpaenidae). Fish. Bull., U.S. 72(4):865-884.

Moser, H. Geoffrey, and Elbert H. Ahlstrom. 1978. Larvae and pelagic juveniles of blackgill rockfish, Sebastes melanostomus, taken in mid water trawls off southern California and Baja California. J. Fish. Res. Board Can. 35(7):981-996.

Examination of 217 midwater trawl samples from the coastal basins off southern California [USA] and Baja California [Mexico] revealed a recurring group of rockfish species. The late larvae and pelagic juveniles of the blackgill rockfish, S. melanostomus, constituted 16% of the total number of rockfish specimens. The life-history stages of this species are described, with emphasis on the pelagic juvenile stage. Late stage larvae and pelagic juveniles develop a distinctive pattern of melanophore bands which, by disrupting the body outline, may help conceal the young during their midwater existence. Evidence from midwater trawl collections suggests that 30 mm pelagic juveniles migrate or are carried shoreward at a depth of .apprx. 200 m to the appropriate habitat for settling. The high relative abundance of blackgill rockfish pelagic juveniles in midwater trawl samples suggests that this species may represent a potential resource.

Moser, H. Geoffrey, Elbert H. Ahlstrom, and Elaine M. Sandknop. 1977. Guide to the identification of scorpionfish larvae (family Scorpaenidae) in the eastern Pacific with comparative notes on species of Sebastes and Helicolenus from other oceans. U.S. Dep. Commer., NOAA Tech. Rep. NMFS Circ. 402, 71 p.

Developmental stages of 51 species or forms of scorpionfishes are described and illustrated in this

identification guide. Thirty-eight are from the eastern Pacific and represent six of the eight scorpaenid genera known from that region. Sebastes is the most thoroughly treated; developmental series of six species from the eastern Pacific are described and illustrated; pigment patterns of early larvae of 33 species are given and 23 of these are illustrated. Larval series of three North Atlantic species of Sebastes are described and illustrated as is a series of Sebastes off Chile. In addition, the published information on eight northwestern Pacific species is summarized and discussed in relation to the eastern Pacific and Atlantic species.

Moser, H. Geoffrey, and J. L. Butler. 1981. Description of reared larvae and early juveniles of the calico rockfish, Sebastes dalli (Eigenmann and Beeson 1894). Calif. Coop. Oceanic Fish. Invest. Rep. 2:88-95.

Moser, H. Geoffrey, and John L. Butler. 1987. Descriptions of reared larvae of six species of Sebastes. In W. H. Lenarz, and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 19-20 U.S. Dep. Commer., NOAA Tech. Rept., NMFS 48.

Moser, H. Geoffrey, E. M. Sandknop, and D. A. Ambrose. 1985. Larvae and juveniles of Aurora rockfish, Sebastes aurora from off California and Baja California. In Meeting on descriptions of early life history stages of selected fishes held at the 3rd International Symposium on the Early Life History of Fishes and 8th Annual Larval Fish Conference, Vancouver, B.C., Canada, May 1984. Can. Tech. Rep. Fish. Aquat. Sci. 1359:55-64.

Moser, M., L. Haldorson, and L. J. Field. 1985. The taxonomic status of Sarcotaces komaii and Sarcotaces verrucosus Copepoda Phylichthyidae and host parasite relationships between Sarcotaces arcticus and Sebastes spp pisces. J. Parasitol. 71(4):472-480.

Five spp. of rockfish (Sebastes spp.) were examined off southeast Alaska [USA] for Sarcotaces arcticus (Copepoda). Only Sebastes ciliatus was infected. Sarcotaces, were compared to those found in 7 spp. of Sebastes collected off California [USA] and those from Molva dypterygia collected off Norway. Sarcotaces komaii be synonymized with S. arcticus. It is possible that S. arcticus is synonymous with S. verrucosus. Studies on aspects of the host-parasite relationship indicated that younger fish have a higher prevalence of infection and more multiple infections. There is no host-parasite size relationship. Of the female parasites 75% were associated with males, 85% had eggs and 10% nauplius larvae. Females ranged in size from 20-50 mm. Smaller specimens were represented by degenerated

cysts. There was no indication of parasite-induced host mortality. The absence of infection in some species may be more a result of the hosts' natural history and geographic distribution than parasite specificity.

Moser, M., and M. S. Love. 1975. Henneguya sebasta, new species protozoa Myxosporida from California rockfish, Sebastes. J. Parasitol. 61(3):481-483.

Moser, M., M. S. Love, and L. A. Jensen. 1976. Myxosporida protozoa in California rockfish, Sebastes. J. Parasitol. 62(5):690-692.

Six genera and 15 spp., 2 new, of Myxosporida [Ceratomyxa californica, C. elegans, C. hopkinsi, C. laxa, C. sebasta, C. vepallida, Henneguya sebasta, Kudoa clupeidae, Leptotheca informis, L. longipes, L. sebasta, L. macrospora, Myxidium calcariferi, M. incurvatum, Zschokkella ilishae] were recovered from 14 spp. of California [USA) marine rockfish, Sebastes. The spores of L. sebasta are arched with thick, equal shell valves and large round polar capsules. They are greater in width and sutural diameter and more crescentic than L. latesi. C. sebasta is crescentic in shape with equal shell valves. The spores of C. sebasta are shorter in sutural diameter, larger in width and less crescentic than C. hokarari.

Moser, M., and J. Sakanari. 1986. Experimental infection of blue rockfish Sebastes mystinus with larval anisakid nematodes. Fish Pathol. 21(2):81-84.

Five hundred and sixty blue rockfish (Sebastes mystinus) from central California [USA] were found to have no larval anisakid nematodes. The diet and presence of larval anisakids in S. mystinus are compared to five other species of rockfishes [S. chrysomelas, S. carnatus, S. atrovirens, S. melanops and S. serranoides] from the same kelp forest. Sebastes mystinus was successfully infected with larval anisakids in laboratory experiments. It is suggested that host diet plays an important role in limiting natural infections.

Moser, M., and J. Sakanari. 1986. Tubercular lesions in a central California rockfish Sebastes mystinus. Fish Pathol. 21(2):85-88.

A fillet from a blue rockfish (Sebastes mystinus) had large, dark solid nodules similar to those occasionally reported from other specimens of Sebastes spp. by local anglers. These nodules contained an acid-fast bacterium similar to Mycobacterium sp. The nodules decrease the food value of the fish and may indicate a potential human health hazard.

Moulton, Lawrence L. 1975. Life history observations on the Puget Sound rockfish, Sebastes emphaeus, (Starks, 1911). J. Fish. Res. Board Can. 32(8)1439-1442.

Large concentrations of Puget Sound rockfish (Sebastes emphaeus) were found at three locations in the San Juan Islands, Washington, at depths ranging from 10 to 25 m. Spawning females were found in August and September, the latest maturing Sebastes in this region. The existence of ripe females indicates that the taxon is not the juvenile form of another species. Total lengths of mature females ranged from 130 to 179 mm, and wet weights from 21 to 79 g. Fecundity estimates ranged from 20,177 for a 150-mm female to 57,103 for a 179-mm specimen. The age at maturity ranged from age II to age IV. Field and aquarium behavioral observations indicate that the species is adapted to crevice and cave existence in areas of strong currents and rocky substrate.

Munger, G. J. 1983. The occurrence of Anisakis sp type I larvae Nematoda anisakidae in fishes from the Gulf of Alaska and the Bering Sea. Can. J. Zool. 61(1):266-268.

Muroga, K., Y. Jo, and K. Masumura. 1986. Vibrio-ordalii isolated from diseased Ayu Plecoglossus-altivelis and rockfish Sebastes-schlegeli. Fish Pathol. 21(4):239-244.

The occurrences of Vibrio ordalii (V. anguillarum biovar II) infection in ayu (Plecoglossus altivelis) and fingerlings of rockfish (Sebastes schlegeli) are reported. The former fish was reared in freshwater ponds and the latter in net cages in the sea. These are the first records of V. ordalii infection in non-salmonid fishes. The V. ordalii isolates were confirmed to share both heat-labile and heat-stable common antigens with J-O-1 (A) serotype of V. anguillarum.

Musial, C. J., and J. F Uthe. 1980. Studies on phthalate esters in western Atlantic finfish. In Council Meeting of the International Council for the Exploration of the Sea, Copenhagen, Denmark, Oct. 6, 1980. ICES-CM-1980/E:11, 6 p.

Naevdal, G. 1978. Differentiation between marinus and mentella types of redfish by electrophoresis of haemoglobins. Fiskeridir. Skr. Ser. Havunders. 16(10):359-368.

Haemoglobins of 225 specimens of redfish from the Barents Sea and 357 specimens from Icelandic waters were analysed by electrophoresis to search for genetic differences between the morphologian marinus and mentella types. Two main haemoglobin patterns were commonly found, one characteristic for redfish of the mentella type and one characteristic for the marinus type. Specimens of Sebastes viviparus showed the marinus haemoglobin pattern. Morphological 'intermediates'

showed the marinus pattern in the Barents Sea while some specimens, which showed the mentella haemoglobin patterns, but could not be separated morphologically from the marinus type, were recorded in he Icelandic-Faeroe Ridge area. Four specimens showed a haemoglobin pattern which indicated hybridization between individuals with different haemoglobin pattern. The results indicate that Sebastes mentella Travin is a species distinct from Sebastes marinus (L), possibly with occasional interbreeding. However, for final conclusion about the species of redfish in the North Atlantic samples have to be collected from the total range of the redfish's distribution.

Nagahara, M., K. Ikehara, and A. Furukawa. 1975. Fundamental studies for establishing rockfish culture techniques. Part 1 On The protein digesting ability of a young rockfish, Sebastes thompsoni. Bull. Jpn. Sea. Reg. Fish. Res. Lab. 26:27-34

Nagtegaal, D. A. 1983. Identification and description of assemblages of some commercially important rockfishes (Sebastes spp.) off British Columbia, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1183, 82p.

The 1977-1978 commercial catch statistics were analyzed to determine if assemblages existed among some of the commercially important rockfishes (Sebastes spp.) and if these assemblages persisted over time. Initially, the catch statistics were analyzed to determine bathymetric, geographic and seasonal distribution. Cluster analysis and a relative catch proportion index were used to identify and describe assemblages, and covariance analysis was used to determine if assemblages persisted over time.

Nagtegaal, D. A., and S. P. Farlinger. 1980. Catches and trawl locations of M/V Blue Waters during rockfish exploration and assessment cruise to the west coast of the Queen Charlotte Islands, 1979. Can. Data Rep. Fish. Aquat. Sci. 215, 77 p.

The purpose of the survey was to estimate the biomass of rockfishes, (Sebastes) concentrating on three areas of higher abundance located in 1978: Rennell Sound, Buck Point and Anthony Island. In addition, the area of Langara Island, commonly known as Langara Spit, was briefly surveyed. Mean catch rates for most localities were approximately the same as in 1978. The general results of the cruise with regard to haul locations, catches of important species and biological data collected are presented.

Nagtegaal, D. A., and S. P. Farlinger. 1980. Catches and trawl locations of the M/V Southward Ho during a rockfish exploration and assessment cruises to Queen Charlotte Sound, September 7-27, 1979. Can. Data Rep. Fish. Aquat. Sci. 216, 98 p.

The general results with regard to haul locations, catch statistics and biological data collected are presented. Most productive areas for rockfish (Sebastes) spp) were the Southeast Corner of Goose Island Bank and the Cape Scott Spit. The highest catch rates occurred in the 164-218 m depth range. No significant concentrations of rockfishes were discovered in areas unknown to the commercial industry.

Nagtegaal, D. A., B. M. Leaman, R. Stanley, and B. J. Westman. 1982. Rockfish tagging cruise in Queen Charlotte Sound, R/V G. B. Reed, July 3-17, 1981. Can. Data Rep. Fish. Aquat. Sci. 326, 42 p.

Nagtegaal, D. A., B. M. Leaman, and R. D. Stanley. 1985. Pacific ocean perch data collected during jointly funded cruises aboard the M/V Ocean Selector (August 10-22) and the M/V Free Enterprise No. 1 (July 31-August 9), 1983. Can. Data Rep. Fish. Aquat. Sci. 525, 13 p.

The rockfish investigation unit of the Pacific Biological Station participated in two jointly funded commercial trawl fishing trips to examine the summer distribution and size composition of Pacific ocean perch (Sebastes alutus) in depths greater than 165 fath at the mouth of Goose Island Gully, Queen Charlotte Sound. Results of these cruises supported the contention that the winter fishery which commenced in 1983 was exploiting the traditional stock on its winter grounds.

Nagtegaal, D. A., B. M. Leaman, and R. D. Stanley. 1986. Catches and trawl locations of R/V G. B. REED and M/V EASTWARD HO during the Pacific ocean perch assessment cruise to Queen Charlotte Sound, August-September, 1984. Can. Data Rep. Fish. Aquat. Sci. 611, 112 p.

Nagtegaal, D. A., G. A. Thomas, and B. M. Leaman. 1980. Catches and trawl locations of M/V Blue Waters during rockfish exploration and assessment cruises to the west coast of the Queen Charlotte Islands and the northwest coast of Vancouver Island in 1978. Can. Data Rep. Fish. Aquat. Sci. 218, 106 p.

The Pacific Biological Station conducted exploratory rockfish (Sebastes spp) cruises off the west coast of the Queen Charlotte Islands (June 19-July 8, July 15-21, 1978) and off the northwest coast of Vancouver Island (Sept 5-30, 1978). The purpose of the 2 cruises was to estimate the

biomass of rockfishes and collect biological data and samples from these areas. This report presents the trackline and fishing positions, catch and biological data collected.

Nakahara, Motokazu, Shigeki Hirano, Toshiaki Ishii, and Taku Koyanagi. 1979. Accumulation and excretion of cobalt-60 taken up from seawater by marine fishes. Bull. Jpn. Soc. Sci. Fish. 45(11):1423-1428.

The accumulation and excretion of 60Co taken up from seawater were observed using marine fish to examine the radioactive pollution of marine organisms. Blood was a good reserving pool of the nuclide in the fish [Brevoortia tyrannus, Evynnis japonica, Sebastes nivosus, Seriola quinqueradiata and Paralichthys olivaceus] and it accumulated more than 15% of the radioactivity in the whole body of the fish reared for approximately 90 days in the uptake experiment. Only liver and kidney showed higher radioactivity per unit wt than blood and muscle showed the lowest concentration of the nuclide. The biological half-lives in muscle of sea bream, yellowtail and flounder at 15.degree. C were calculated as 38.5, 53.3 and 63.0 days, respectively. The steady-state concentration factors of muscle by direct uptake of 60Co from seawater were estimated in the range from 0.3-1.5 among the experimental fish.

Nashomoto, Katsuaki. 1980. The swimming speed of fish in relation to frequency of tail beating and body type. Bull. Jpn. Soc. Sci. Fish. 46(6):675-679.

Swimming speed depends on the frequency of tail beating, fish size and body type. A formula, $V = KL(F - f0) + V0$, was presented, where V is the speed of swimming fish, F the frequency of tail beating, V0 the minimum speed of swimming at the minimum frequency of tail beating f0, L the total length of the fish and K the coefficient of the body type that depends on the frontal area (S1) of the fish and lateral area (S2) of the fish from the center of the mass to the tip of the tail. The center of mass, S1 and S2 were measured on various fish of different body types, and the coefficient K was calculated. The coefficient K was 1.08, 1.04 for flat fish [Cleisthenes pinetorum herzensteini] and saury [Cololabis saira], and 0.72 for rock fish [Sebastes vulpes]. The former fish have maximum values for measured fish and the latter fish has a minimum value.

Nefedov, G. N. 1969. Serum hapto globins of the sea perch of the genus Sebastes. Vestn. Mosk. Univ. Ser. 6. Biol. Pochvoved. 24(1):104-107.

Nelson, Bonita, and Terrence J. Quinn. 1987. Population parameters for rougheye rockfish (Sebastes aleutianus). In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 209-228. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Nevdal, G. 1978. Differentiation between Sebastes marinus and Sebastes mentella types of redfish by electrophoresis of hemo globins. Fiskeridir. Skr. Ser. Havunders. 16(10):359-368.

Ni, I-Hsun. 1981. Application of factor analysis in redfish morphological studies. In Council Meeting of the International Council for the Exploration of the Sea, Woods Hole, MA, Oct. 5, 1981. ICES-CM-1981/G:39, 14 p.

Ni, I-Hsun. 1981. Numerical classification of sharp-beaked redfishes, Sebastes mentella and S. fasciatus, from northeastern Grand Bank. Can. J. Fish. Aquat. Sci. 38(8):873-879.

The distinction between Sebastes fasciatus and S. mentella has not previously been clearly established as good morphological discriminators had not been isolated. Eleven meristic and 14 morphological characters were examined individually (univariate statistics) and collectively (discriminant analysis) on 200 sharp-beaked redfish specimens representing both S. fasciatus and S. mentella which had been separated by the anatomical character of extrinsic gasbladder musculature. The result of the discriminant analysis demonstrated good (100%) separation of redfish with combinations of meristic and morphological characters. Anal fin rays, relative position of pectoral and pelvic fin to anus, number of the first left gill rakers, angle of the third preopercular spine, the fusion of the occipital-nuchal ridge, and vertebral number were good discriminators between S. mentella and S. fasciatus.

Ni, I-Hsun. 1981. Separation of sharp-beaked redfish Sebastes fasciatus and S. mentella, from northeastern Grand Bank by morphology of extrinsic gasbladder musculature. J. Northwest Atl. Fish. Sci. 2:7-12.

Separation by species of 199 sharp-beaked redfish, collected from northeastern Grand Bank and preliminarily assigned to Sebastes fasciatus or S. mentella on the basis of some subjective exterior characteristics, was confirmed by differences in the passage of the extrinsic gasbladder muscle between the ventral ribs and in its attachment to the vertebrae posteriorly. In S. fasciatus the gasbladder muscle passed between ventral ribs 3-4 in 94% of the specimens and between ribs 4-5 in 5%, whereas in all S. mentella the muscle passed between ventral ribs 2-3. Also, the posterior tendon of the gasbladder muscle in S. fasciatus commonly had three branches attached primarily to vertebrae 8, 9 and 10, whereas in S. mentella the tendons, usually not branched, was attached to vertebra 7.

Ni, I-Hsun. 1981. The use of anal fin ray frequencies to indicate the stock units of deepwater redfish, Sebastes mentella and rosefish, S. fasciatus. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/6/80.

It is important to have a good perception of redfish population units so as to have better stock assessment and management. Owing to the significant patterns of anal fin ray frequencies this report gives support to the distribution of sharp-beaked redfish proposed by a previous vertebrae frequency study (Ni 1981c). A preliminary understanding of the possible stock components in different depths of the Northwest Atlantic is explored.

Ni, I-Hsun. 1981. The use of vertebrae frequencies to indicate the distribution of sharp-beaked redfish, Sebastes mentella and S. fasciatus. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/6/70, 17 p.

Ni, I-Hsun. 1982. Meristic variation in beaked redfishes, Sebastes mentella and S. fasciatus, in the Northwest Atlantic. Can. J. Fish. Aquat. Sci. 39(12):1664-1685.

Ni, I-Hsun. 1982. Meristic variation in golden redfish, Sebastes marinus, in the Northwest Atlantic. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 82/9/82, 10 p.

The morphological differences among Northwest Atlantic redfishes have been somewhat confused in the past as all the morphological characters investigated overlapped. Meristic counts have been reported as the good discriminator between beaked redfishes, Sebastes mentella, and S. fasciatus. However, the role of S. marinus in redfish classification is not clear. Meristic elements of 3612 vertebral, 1379 anal fin ray and dorsal fin ray counts were utilized to examine the meristic variation in S. marinus. Chi square-test of independence of meristic frequencies showed no significant differences between sexes or among depth zones except a significant depth variation of anal fin ray and dorsal fin ray frequencies was observed on Flemish Cap. In comparison with beaked redfishes, S. marinus has less geographic variation and is similar to S. mentella in having 30 vertebral, 8 anal fin ray and 15 dorsal fin ray counts whereas S. fasciatus has 29, 7 and 14 respectively.

Ni, I-Hsun. 1984. Meristic variation in golden redfish, Sebastes marinus, compared to beaked redfishes of the Northwest Atlantic. J. Northwest Atl. Fish. Sci. 5(1):65-70.

Counts of the vertebral elements in 3,611 specimens and the anal and dorsal fin rays in 1,379 specimens were utilized to examine meristic variation in S. marinus in the Northwest

Atlantic from West Greenland to the Grand Bank-Gulf of St. Lawrence, for comparison with data reported in similar studies of the beaked redfishes, S. mentella and S. fasciatus . The x super(2)-test of independence for meristic frequencies showed no significant differences between sexes or among depth zones except for significant depth variation of anal fin-ray and dorsal fin-ray frequencies on Flemish Cap. Geographic variation in S. marinus) meristics was less than in the beaked redfishes. S. marinus was found to be similar to S. mentella in having 30 vertebrae (excluding urostyle), 8 anal fin rays and 15 dorsal fin rays, whereas S. fasciatus usually has 29, 7 and 14 elements respectively. The recently-adopted common name "golden redfish" is considered to be appropriate for S. marinus .

Ni, I-Hsun, and D. B. Atkinson. 1984. Assessment of the redfish stock in Subarea 2 and Div. 3K. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 84/33, 24 p.

Ni, I-Hsun, and W. D. McKone. 1981. The distribution and concentration of redfish species in Newfoundland and Labrador. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/6/69, 10 p.

Ni, I-Hsun, and E. J. Sandeman. 1982. The logistic model for determining size at maturity in species differentiation and stock discrimination for Northwest Atlantic redfishes. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 82/9/88, 13 p.

Ni, I-Hsun, and E. J. Sandeman. 1984. Size at maturity for northwest Atlantic redfishes (Sebastes). Can. J. Fish. Aquat. Sci. 41(12):1753-1762.

Morphological differences in Northwest Atlantic redfishes (Sebastes) are recognized but their biology is relatively unknown, due to the confusion associated with redfish systematics in past decades. For a redfish reproductive biology study historical sex and maturity data collected between 1957 and 1969 were used. The logistic model was applied to estimate the size at maturity from 4,501 S. marinus and 43,988 beaked redfishes (S. mentella and S. fasciatus combined) covering the whole Northwest Atlantic. The sizes at maturity in female redfishes were significantly larger than that of males for both S. marinus and beaked redfishes. The size at maturity for female S. marinus was significantly larger than that of beaked redfishes whereas in males there was no significant difference between groups. A geographic cline in size at maturity was noted in beaked redfishes, with a decreasing trend for S. mentella from Baffin Bay southward to the Gulf of St. Lawrence, and for S. fasciatus from Grand Bank to the Nova Scotian Shelf.

Ni, I-Hsun, and Wilfred Templeman. 1985. Reproductive cycles of redfishes (Sebastes) in southern Newfoundland waters. J. Northwest Atl. Fish. Sci. 6(1):57-63.

Knowledge of the ovoviviparous reproductive cycle of Sebastes sp. is important for species differentiation and stock discrimination. Investigations of sexual maturity and spawning in redfishes of southern Newfoundland waters (NAFO Division 3P) were carried out on the basis of 11,520 sex and maturity observations collected from 1957 to 1969. Stages of sexual maturity are described. Monthly changes of maturity condition and maturity factor indicated that beaked redfishes (S. fasciatus) spawned mainly in May/June and S. marinus probably spawned earlier.

Niggol, K. 1982. Data on fish species from Bering Sea and Gulf of Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/NWC-29, 129 p.

Mean values are presented values for two regions -- the eastern Bering Sea and Gulf of Alaska. Biometric characteristics of most species indicate that separate stocks exist in these two regions, although in some species considerable migrations and intermixing between these two areas occur. The biometric data are long-term mean values. Length and weight data are mean values for females and males together, assuming a 50:50 sex ratio. This summary contains several derived (computed) quantities, such as biomass distribution with age and age-specific total mortality, most of which are necessary for the ecosystem simulation. The annual individual growth rates are given in graphical form and the monthly growth rates of total biomass, juveniles and adults, are given in the table for given annual turnover rate of the biomass. The distribution of biomass with age for a given turnover rate and the corresponding distribution of total mortality with age (expressed as percent of mortality of the mean biomass at a given age) are given in the graphs.

Nikeshin, K. N., V. G. Kovalenko, Y. A. Kondratyuk, and A. S. Gorshkova. 1981. Selectivity of bottom and midwater trawl codends when fishing for deepwater redfish in the Northwest Atlantic. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/9/87, 17 p.

Results of determination of selectivity of bottom and midwater trawls codends when fishing deepwater redfish (Sebastes marinus) are given. Influence of a cover codend on the escapement of fish from the bottom trawl codend is estimated. Selectivity properties of the bottom trawl codend and those of the mid-water trawl codend are compared. Preconditions of exploitation of deepwater redfish stocks with a lowest damage possible are considered.

Nikol'skaya, T. L. 1967. Reproduction of deepwater redfish (Sebastes mentella Travin) of southern slopes of the Great Newfoundland Bank. Fish. Res. Can. Transl. Ser. 1136.

Nikol'skaya, T. L. 1969. The size-age composition of the ocean perch (Sebastes mentella Travin) of the southern slopes of the Great Newfoundland Bank. J. Ichthyol. 9(4):529-535.

In 1963-1968 material was collected by the workers of PINRO on the size-age composition, the sexual maturity, the rate of linear and weight increase of the ocean perch on the southern slopes of the Great Newfoundland Bank and on the St. Pierre Bank from vessels engaged in search and investigation.

Nikol'skaya, T. L. 1972. Size, age, and rate of growth of the deepwater redfish of Northeastern slope of the Newfoundland Grand Banks. Fish. Res. Board Can. Transl. Ser. 2435.

Nikol'skaya, T. L. 1973. Distribution of beaked redfish Sebastes mentella by depth in areas off Newfoundland and South Labrador. Int. Comm. Northwest Atl. Fish. Redb. Pt. III. 3:53-57.

Nikol'skaya, T. L. 1979. Changes in gonad maturity stages in the deep water redfish, Sebastes mentella, in the region of southern Labrador. J. Ichthyol. 19(4):154-156.

Changes in the correlations of gonad development stages in the deepwater redfish over a year's time are discussed. Specimens (40,000), collected from 1965 to 1975, were dissected and studied. The specimens were checked for age and food-intake and determinations were made as to gender, stage of gonad maturity, length and weight. An analysis of the S. mentella population distributed along the southern coast of Labrador established 2 predominant stages of gonad development: sexually immature and those which were maturing for the 2nd time. A comparison of the sexual cycle of S. mentella populations from southern Labrador and the Norwegian Sea made it possible to establish certain differences in the pairing season. Mass pairing in the Norwegian Sea population occurs in Aug.-Sept., while mass pairing in the southern Labrador population may be observed from July through Dec.

Nikolskaya, T. L. 1981. Isolation of deepwater redfish (Sebastes mentella) stocks in the Grand Newfoundland Bank. Northwest Atl. Fish. Organ. Sci. Counc. Rep 81/6/75, 9 p.

Nikol'skaya, T. L. 1982. Size-age composition and maturation of deep-sea redfish from the Notre Dame Bay. Sb. Nauchn. Tr. PINRO. p. 59-67.

Data are presented on size-age composition, maturity stages of and fishery for redfish (Sebastes mentella Travin) caught in the bay in 1970-1980. The average length and age of deep-sea redfish varied in different years without a definite tendency to decrease or increase. Males at the age of 8-18 years 25-40 cm long and females at the age of 10-25 years 28-50 cm long showed the highest abundance. Mass extrusion of larvae takes place at depths of 300-800 m in May and mating occurs at depths of 300-500 m in July-August.

Nishikawa, S., M. Honda, and A. Wakatsuki. 1977. Comparative studies on the chromosomes in Japanese fishes. 2. Chromosomes of 8 species in Scorpion fishes. J. Shimonoseki. Univ. Fish. 25(3):187-192.

The chromosome numbers and karyotypes of 8 spp. of the superfamily Scorpaenidae [Sebastes inermis, S. schlegeli, S. hubbsi, S. longispinis, Sebasticus marmoratus, Scorpaena neglecta neglecta, Pterois lunulata and Inimucus japonicus] are dealt with. The chromosomes were observed in the cells extracted from the kidney and the gill epithelium by air-drying method. The chromosome number of 7 spp. except S. hubbsi (2n = 46) shown 2n = 48. Various differences in the karyotypes exist within each species. The karyotypes of 5 spp. of Sebastes and Sebastiscus have much in common with one another in their chromosomal morphology. S. neglecta neglecta, P. lunulata and I. japonicus are specialized in external characteristics. Intra-individual variation of the chromosomes was observed in S. neglecta neglecta. Since the arm number is 86 in 47- and 48 cells, the variation may be interpreted by Robertsonian translocation.

Nishimoto, Jiro. 1970. Western range extension of the Rosethorn rockfish Sebastes helvomaculatus (Ayres). Calif. Fish Game 56(3):204-205.

Niska, E. L. 1976. Species composition of rockfish catches by Oregon trawlers 1963-1971. Oreg. Dept. Fish. Wildl. Information Rep. 76-7, 80 p.

Nitsos, R. J. 1965. Species composition of rockfish (family Scorpaenidae) landed by California otter trawl vessels, 1962-1963. Pac. Mar. Fish. Comm. 16th and 17th Ann. Repts. 1964:55-60.

Nitsos, R. J., and Paul H. Reed. 1965. The animal food fishery in California, 1961-1962. Calif. Fish Game 51(1):16-27.

Sebastes diploproa and various rockfish are mentioned.

Noguchi T., S. Fujiwara, Y. Takada, T. Mori, and M. Nagano. 1982. Metabolism of urea and glyoxylate degradative products of purines in marine animals. J. Biochem. (Tokyo). 9(2):525-530.

In marine fish and crustacean liver, degradative enzymes able to convert purines to urate are located only in the cytosol, and degradative enzymes able to convert urate to urea and glyoxylate, only in the peroxisomes. The subcellular distribution of these 2 enzymes involved in further metabolism of urea and glyoxylate in marine animal species was examined by centrifugation in a sucrose density gradient. No activity was detected with fish, Sebastes inermis.

Noguchi, T., S. Fujiwara, Y. Takada, T. Mori, M. Nagano, N. Hanada, E. Y. Saeki, and O. Asuo. 1984. Enzymatic and immunological comparison of alanine glyoxylate amino transferases EC-2.6.1.44 from different fish and mammalian livers. Comp. Biochem. Physiol. B Comp. Biochem. 77(2):279-284.

Alanine:glyoxylate aminotransferase was highly purified and characterized from mackerel liver. The mackerel enzyme was similar to partially purified alanine:glyoxylate aminotransferases from other fish gopher gray rock cod [Sebastes inermis] and yellow mackerel [Trachurus trachurus]) liver with respect to MW and substrate specificity. These fish enzymes were similar to mammalian [rat, dog, cat, guinea pig, monkey, human] liver alanine:glyoxylate aminotransferases 1 in substrate specificity and to mammalian [pig, bovine, rat, rabbit, monkey].

North, Wheeler J., and Carl L. Hubbs. 1968. Utilization of kelp bed resources in southern California. Calif. Fish Game Fish Bull. 139, 264 p.

Norton, Jerrold. 1987. Ocean climate influences on groundfish recruitment in the California Current. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 73-98. Univ. Alaska, Alaska Sea Grant Rep. 87-2, 393 p.

NTIS. 1984. Quality Improvement of Frozen Widow Rockfish Products. NTIS Tech. Note. 1 p.

This citation summarizes a one-page announcement of technology available for utilization. The fishery for widow rockfish (Sebastes entomales) off the Pacific Northwest Coast of Oregon and Washington expanded substantially in the past few years as a result of improved fishing technology. As the fishery expanded to over 20 million pounds landed,

the unprecedented landings made it difficult to expand fish markets rapidly enough to absorb the increased production. As a result, problems in loss of quality appeared in both the chilled and frozen products held too long before processing or marketing. The Northwest and Alaska Fisheries Center is attempting to develop methods of minimizing loss of quality of fresh frozen widow rockfish. The results of comparative studies have determined that the frozen quality of widow rockfish fillets and fillet blocks was greatly improved when treated with a mixture of sodium and hexametaphosphates, sodium erythorbate, and salt. ...FOR ADDITIONAL INFORMATION: Contact: Office of Research and Technology Applications, Mail Stop (D), Room 3316, NOAA, FB No. 4, Suitland, Maryland 20233; (301) 763-2419.

Numachi, K-I. 1971. Electrophoretic variants of catalase in the black rockfish, Sebastes inermis. Bull. Jap. Soc. Sci. Fish. 37(12):1177-1181.

Numachi, K-I. 1972. Genetic polymorphism of tetrazolium oxidase in black rockfish. Bull. Jpn. Soc. Sci. Fish. 38(7):789.

Nyman, L. 1976. Morphological similarity and hereditary distinction. Zool. Scr. 5(3/4):188-189.

O'Connell, Victoria M., and Fritz C. Funk. 1987. Age and growth of yelloweye rockfish (Sebastes ruberrimus) landed in southeastern Alaska. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 171-185. Univ. Alaska, Alaska Sea Grant Rep. 87-2, 393 p.

Odemar, Melvyn W. 1964. Northern range extension of the cow rockfish, Sebastodes levis. Calif. Fish Game 50(4):305.

Oehlenschlaeger, J. 1985. Changes of lipid composition in red fish during freeze storage. Fima. Schriftenr. 5:25-31.

Lipids of freeze-stored red fish (Sebastes marinus) have been analyzed employing HPLC methods. It was found, that lean fish with lipid contents of 1-2% contain about 40-50% phosphatidylcholin (PC) and phosphatidylethanolamin (PE). Animals with a medium fat content of 2-4%, on the other hand, contained 20-25% PC + PE, while red fish with 5% fat only reached 20% PC + PE. It was also found that, with rising storage temperature the concentrations of these phospholipids decreases.

Ohi, G., S. Nishigakis, H. Seki, Y. Tamura, T. Maki, K. Minowa, et al. 1980. The protective potency of marine animal meat against the neuro toxicity of methyl mercury its relationship with the organ distribution of mercury and selenium in the rat. Food Cosmet. Toxicol. 18(2):139-146.

The meats of 2 marine animals known to contain high levels of both methylmercury and Se were compared with respect to their protective potencies against the neurotoxicity of methylmercury. The organ distributions of Se and Hg in rats given diets containing these meats was also compared. Weanling rats were fed for 12 wk on a diet containing 17.5 ppm methylmercuric chloride and 1 of 2 levels of Se (0.3 or 0.6 ppm) originating from the meat of sebastes (Sebastes iracundus) or of the sperm whale (Physeter catodon), or from sodium selenite.

Okamoto, Mineo. 1983. Diurnal-nocturnal activity of fishes near the artificial seaweeds farm plant (experimental floating reef). Bull. Jpn. Soc. Sci. Fish. 49(2):177-182.

Artificial seaweeds farm plant, experimental floating reef made of steel, was anchored at the depth of 43 m off Tajima in the Japan Sea. Mean component of the plant was a shelf (22 .times. 22 m square) settled at 10 m depth layer and an observation tower rose at the center of the shelf toward the surface. Two years after the plant had been anchored, the activity of fishes around the plant was investigated by direct observation and by some automatic recording instruments. Some phenomena concerning the behavior of fishes were found. Around the plant, 17 kinds of fishes including Sebastes inermis, Sebastes thompsoni, Sebastiscus maroratus, were found and the dominants included S. aureovittata, and Sebastes inermis.

Okamoto, Mineo, Toshiro Kuroki, and Tohru Murai. 1979. Fundamental studies on the ecology of fishes near artificial reefs 1. Preparatory observation of fish amount. Bull. Jpn. Soc. Sci. Fish. 45(9):1085-1090.

To find out the environmental ecology and the gathering factor of fish near artificial reefs, an automatic underwater camera with a fisheye lens was developed. This was placed on the sea floor, and 250 photographs were taken using an electronic flash every 30 or 60 min. At the artificial reefs off Sarushima Island near Yokosuka [Japan], where diving research was conducted, observation studies were continued using an automatic underwater camera and a self-recording current meter. Sebastes inermis showed 2 peak shaped behavioral characters in 1 day in its appearance on the photograph. In 92% of the appearances, the observation point corresponded to the artificial reef's upper side or near the tidal current. In 85% of the appearances, S. inermis faced the current.

Okamoto, Mineo, Toshiro Kuroki, and Tohru Murai. 1979. Preliminary studies on the ecology of fishes near artificial reefs- outline of the artificial reefs off Sarushima Island. Bull. Jpn. Soc. Sci. Fish. 45(6):709-713.

The ecology and gathering factors of fish near artificial reefs were determined using diving techniques. Observations were conducted north of Sarushima Island near Yokosuka. Configurations of artificial reefs, current, settled animals, and fish gathering were discussed. Artificial reefs were laid down between 15-25 m in a range of 80 .times. 50 m, separated into 3 groups. One of them was a sunken ship reef (wooden ship about 100 tons) and the others were concrete block reefs located in the direction of the bow and the starboard side of the ship. Although these artificial reefs were laid down for about 10 yr, they seemed to maintain their original form. Fifteen kinds of fish were found near the artificial reefs, and they were mostly rock fish or settled-type fish: Oplegnathus fasciatus, Lateolabrax japonicus, Acanthopagrus schlegelii, Pterogobius zacalles, Ditreme temmincki, Halichoeres poecilopterus, Navodon modestus, Ostracion tuberculatus, Fugu sp., Sebastes sp., S. inermis, Sebasticus marmoratus.

Okiyama, M. 1965. A case of pugheadedness in the rockfish, Sebastes oblongus gunther. Bull. Jpn. Sea Reg. Fish. Res. Lab. 14:85-89.

Okiyama, M., and H. Sando. 1976. Early life history of the sea-raven Hemitripterus-villosus Hemitripterinae cottidae in the Japan Sea. Bull. Jpn. Sea. Reg. Fish. Res. Lab. 27:1-10.

The early life history of the Japanese sea raven, H. villosus, a common coastal cottid fish in the northern Japan Sea, was studied Of 16 specimens, food organisms were identified in 3 stomachs from prolarva, postlarva and juvenile. Of special interest were the common occurrences of the fish larvae such as Sebastes sp., even in the prolarval stomach. That pelagic marine fish larvae take other fish larvae as their primary foods was suggested. Cannibalistic behavior observed in the reared specimens might be associated with this peculiar habit. Comparisons between the wild and reared specimens revealed some significant differences with regards to the growth characteristics.

Oremland, Ronald S. 1979. Methanogenic activity in plankton samples and fish intestines: A mechanism for in situ methanogenesis in oceanic surface waters. Limnol. Oceanog. 24(6):1136-1141.

O'Rourke, Fergus J. 1961. An immunological and chromatographic study of Sebastes marinus (L.) and Sebastes mentella Travin. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:100-103.

Ouchi, K. 1977. Temperature tolerance of young rockfish Sebastes thompsoni. Bull. Jpn. Sea Reg. Fish. Res. Lab. 28:1-8.

For young rockfish (S. thompsoni) acclimated to temperatures between 10 and 25.degree. C, the upper incipient lethal temperature (defined as the temperature at which 50% of fish die after 24 h) ranged between 25.6-28.8.degree. C; the ultimate upper lethal temperature was about 28.6.degree. C. The upper thermal tolerance zones for the fish were 334.degree. C squared; and the thermal tolerance (sum of upper and lower thermal tolerance zones) was 701.degree. C squared. The temperature tolerance of the fish was closely similar to that of Perca flavescens. Larvae of S. thompsoni have an extremely low level of temperature tolerance among inhabitants of warm waters.

Ouchi, K., T. Suzuki, and K. Ikehara. 1978. Seasonal histological changes in the testis of Sebastes thompsoni. Bull. Jpn. Sea Reg. Fish. Res. Lab. 29:121-136.

The histological changes in the testis of S. thompsoni were observed throughout the yr. The testis of S. thompsoni consists of seminiferous tubules radiating from a single sperm duct, and they are lined by a seminiferous epithelium consisting of columna cells. Although some spermatogonia are present in the testis at all times of the yr, they clearly appear in Jan. between the basement membrane and the seminiferous epithelium in the seminiferous tubules, and soon begin to develop. Spermatogenesis gradually takes place starting in April and becomes extremely active in Oct. The testes in this season are closely filled with large cysts of germ cells in various developmental stages from spermatogonia to spermatozoa. In Dec. the cysts of mature spermatozoa release their spermatozoa into the lumina of the tubules, consequently the sperm duct and its neighboring tubules are compactly packed with mature spermatozoa. Spermiation apparently takes place in this phase.

Pacific Fishery Management Council. 1979. Technical papers referenced in the Fishery Management Plan for the California, Oregon and Washington groundfish fishery. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Pacific Fishery Management Council. 1984. Status of Pacific Coast groundfish fishery and recommendations for management in 1985. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Pacific Fishery Management Council. 1985. Status of the Pacific Coast groundfish fishery through 1985 and recommended acceptable biological catches for 1986. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Pacific Fishery Management Council. 1986. Status of the Pacific Coast Groundfish Fishery through 1986 and recommended acceptable biological catches for 1987. Pacific Fishery Management Council, Metro Center, Suite 420, 2000 SW First Ave., Portland, Oregon 97201.

Palsson, O. K. 1980. On the food of five demersal fish species in Icelandic waters. Aegir. 73(11):572-579.

Results are presented on the food and feeding of the following fish species in Icelandic waters (number of stomachs analysed in brackets): cod (1211), redfish (251), haddock (507), catfish (440) and long rough dab (417). The material was sampled in March and November-December 1979, on the continental shelf north and east of Iceland. Cod are nektonic predators preying mainly upon capelin, blue whiting, cod and other fish species. Redfish prey almost exclusively upon planktonic animals (euphausiids, copepods), and catfish mostly eat benthic prey (echinoderms, brachyuras, gastropods, bivalves). Haddock and long rough dab also prey heavily upon benthic animals.

Palsson, O. K. 1981. On the food of demersal fish species in Icelandic waters. In Council Meeting of the International Council for the Exploration of the Sea, Woods Hole, MA, Oct. 5, 1981. ICESS-CM-1981/G:25, 46 p.

Palsson, O. K. 1983. The feeding habits of demersal fish species in Icelandic waters. Rit. Fiskideildar 7(1):1-60.

The feeding of cod (Gadus morhua) in Iceland waters is characterized by the preference for fish prey, particularly pelagic species. Pronounced seasonal, regional and year to year variations are observed. On an annual basis Mallotus villosus is by large the most important prey and is estimated to yield 30% of the food of cod. The preference of cod for a particular prey is found to depend on the size of the predator in relation to that of the prey. With respect to prey preference, redfish (Sebastes) may be classified as a zooplanktonic feeder, preying mainly on Euphausiacea and Calanoida.

Palsson, O. K. 1985. The feeding habits of demersal fish species in Icelandic waters. Natturufraedingurinn 55(3):101-118.

On the basis of material sampled in 1980-82 the feeding habits of seven demersal fish species in Icelandic waters are described. The feeding of cod (Gadus morhua morhua) is characterized by the preference for fish prey, particularly pelagic species such as capelin (Mallotus villosus) and blue whiting (Micromesistius poutassou). Pronounced seasonal, regional and year to year variations are observed. With

increasing length of cod the food composition changes clearly from planktonic and benthic prey (Euphausiacea) over to small pelagic fish (M. villosus), and finally to large pelagic (M. poutassou) or demersal fish (Sebastes, G. morhua) in the largest predator length groups. On an annual basis M. villosus is by far the most important prey and is estimated to yield 35-40% of the food of cod. With respect to prey preference redfish (Sebastes marinus marinus) may be classified as plankton feeder, preying mainly on Euphausiacea.

Paraketsov, I. A. 1968. On the biology of Sebastodes alutus in the Bering Sea. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part I. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Infor., Springfield, VA, USA. TT 67-51203:319-327.

Parkin, K. L., M. J. Wells, and W. D. Brown. 1982. Modified atmosphere storage of rockfish Sebastes fillets. J. Food Sci. 47(1):181-184.

In modified atmosphere (MA) of 80% CO2 and 20% air was effective in extending shelf life of fresh rockfish fillets. Aerobic plate counts and trimethylamine levels were significantly lower ($P < 0.1\%$) for the fillets held in MA compared to those held in air. A decline in surface pH was observed on fillets stored in MA, presumably due to the absorption of CO2 and its hydration to carbonic acid. Oxidation-reduction potentials suggested a more aerobic environment on fillets stored in MA. There were no significant difference in weight loss between control and MA samples. Sensory evaluations indicated that fillets held under MA were of good quality for at least 13 days of storage.

Parrish, R. H., C. S. Nelson, and A. Bakun. 1981. Transport mechanisms and reproductive success of fishes in the California Current. Biol. Ocean. 1(2):175-203.

Parsons, L. S., and D. G. Parsons. 1974. Exploratory surveys for redfish off eastern Newfoundland-Labrador, CAPE FAREWELL, June-August 1973. Fish. Res. Board Can. Tech. Rep. 433, 73 p.

Patashnik, M., G. Kudo, and D. Miyauchi. 1974. Bone particle content of some minced fish muscle products. J. Food Sci. 39(3):588-591.

Patashnik, M., D. Miyauchi, and G. Kudo. 1976. Objective evaluation of texture of minced black rockfish Sebastes during frozen storage. J. Food Sci. 41(3):609-611.

Objective measurements (shear values and drip loss) were

made to characterize changes in texture of frozen binder-modified blocks of minced black rockfish as a part of a continuing study. Effect of variation in water content on sensory texture scores of washed-modified blocks was also determined. Objective measurements correlated with sensory evaluation of texture of fillets and minced products. Varying moisture content of the washed-modified product up to 4.5% above normal moisture content did not significantly affect texture, but lowering it to 1.6% below significantly reduced texture scores. Washing minced flesh before freezing into blocks resulted in higher shear values and cooked drip. Addition of a binder containing NaCl and sodium tripolyphosphate resulted in improved texture and lower shear values and cooked drip.

Patten, Benjamin G. 1973. Biological information on copper rockfish in Puget Sound, Washington. Trans. Am. Fish. Soc. 102(2):412-416.

Copper rockfish (Sebastes caurinus), a species that is becoming increasingly important as a sport fish, were studied in two shallow areas in Puget Sound, from 1963 to 1968, to obtain information on seasonal availability, growth, maturation, feeding habits, and ecology. Specimens examined ranged from 6.8 to 47.0 cm in fork length and from 0 to 8 years old. Availability was greatest in September and October and least in June and July. Length-weight regression was the same for both sexes but differed by time of year. Crustacea and fish were the principal foods. The rockfish hid in rock interstices in the winter but not in the summer.

Pattie, Brad. 1972. The 1971 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 14, 43 p.

Pattie, Brad. 1973. The 1963 and 1964 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 16, 73 p.

Pattie, Brad. 1973. The 1972 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 18, 43 p.

Pattie, Brad, and Wayne Gormley. 1975. The 1973 Washington trawl landings. Wash, Dept. Fish. Groundfish Data Rep. Ser. 20, 44 p.

Pattie, Brad, and Wayne Gormley. 1975. The 1974 Washington trawl landings. Wash. Dept. Fish. Groundfish Data Rep. Ser. 22, 45 p.

Paust, B., and J. Svensson. 1986. Quality handling of hook-caught rockfish. Alaska Sea Grant Program. Marine Advisory Bulletin. 20, 18 p.

Contents:1. Soak time; 2. Gaffing; 3. Bleeding; 4. Washing; 5. Dressing; 6. Holding; 7. Holding time; 8. Filleting; 9. Packing; 10. Dressed head-on; 11. Shipping; 12. Sanitation.

Pautov, G. P. 1970. Age composition and growth peculiarities of Sebastes alutus in the Bering Sea. Fish. Res. Board Can. Transl. Ser. 2312.

Pautov, G. P. 1973. Some characteristic features of the biology of Pacific Ocean Perch (Sebastes alutus Gilbert) in the Bering Sea. Fish. Res. Board Can. Transl. Ser. 2828.

Payne, R. H., and I-Hsun Ni. 1982. Biochemical population genetics of redfishes (Sebastes) off Newfoundland. J. Northwest Atl. Fish. Sci. 3(2):169-172.

Electrophoretic analysis of liver enzyme variants from redfish specimens, classified as S. marinus and S. fasciatus on the basis of meristics and gasbladder musculature, provides clear evidence that these taxa are valid biological species. Evidently S. fasciatus and S. mentella are genetically distinct and S. mentella is more closely related to S. marinus than to S. fasciatus. A biochemical genetic protocol may be devised that will readily and accurately distinguish specimens of the 3 sibling redfish species in the Northwest Atlantic.

Payusova, A. N. 1972. Preliminary populations of ocean perch in the north-west Atlantic and their importance for fisheries reconnaissance. Fish. Res. Board Can. Transl. Ser. 2501.

Payusova, A. N., and G. N. Nefedov. 1968. Analysis of thermostability of the isolated muscle tissue of bass of Sebastes species from the Barents Sea, Sebastes marinus, Sebastes mentella. Tsitologiya 10(1):133-137.

Pearcy, W. G. 1962. Egg masses and early developmental stages of the Scorpaenid fish, Sebastolobus. J. Fish. Res. Board Can. 19(6)1169-1173.

Peden, A. E., and D. E. Wilson. 1976. Distribution of inter tidal and subtidal fishes of northern British Columbia Canada and southeastern Alaska. Syesis 9:221-248.

Northern extensions of the known range are described for Sebastes miniatus. Southern extensions of the known range are described for Sebastes ciliatus.

Penny, R. W. 1982. Otolith analysis of age and growth of larval redfish (Sebastes spp.) on Flemish Cap. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 82/6/40, 8 p.

Sagittae of larval redfish (Sebastes spp.) were used to estimate age and growth of 8-17 mm S.L. larvae on Flemish Cap in 1981. The average growth rate of 0.08 mm/day is less than 60% of the growth rates recorded for 1979 and 1980. Back calculation procedures are investigated and shown to be useful in determination of instantaneous growth rates for examination of the individual growth history of larval redfish. Mean instantaneous growth rates of 0.96% per day were recorded.

Penny, R. W., and J. T. Anderson. 1981. Otolith analysis of age and growth of larval redfish (Sebastes sp.) on Flemish Cap 1979 and 1980. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/9/117, 15 p.

Sagittae of larval redfish (Sebastes sp.) were used to estimate age and growth of 5-25 mm larvae on Flemish Cap.

Penny, R. W., D. J. Power, and D. B. Atkinson. 1984. Species proportions and some reproductive aspects of three redfish species (Sebastes marinus, S. fasciatus, and S. mentella) on Flemish Cap, March 1983. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 84/6/22, 9 p.

Gas bladder musculature criteria are used to identify adult redfish from the pre-spawning assemblages in February-March, 1983 on Flemish Cap Bank. The relative proportions of each of the three species S. mentella, S. fasciatus, and S. marinus were determined for each of five depth zones.

Penney, Randy W. 1985. Comparative morphology of preextrusion larvae of the north Atlantic sharp-beaked redfishes Sebastes mentella and Sebastes fasciatus Pisces Scorpaenidae. Can. J. Zool. 63(5):1181-1188.

Preextrusion larvae of the ovoviviparous scorpaenid fishes, S. mentella and S. fasciatus, identified by the gas-bladder musculature characteristics of the parent, are described. Morphometrics, meristics and pigmentation characteristics were recorded for late-stage preextrusion larvae taken from adult females on St. Pierre Bank, an area immediately south of and adjacent to the island of Newfoundland, Canada. The morphology of preextrusion larvae of S. mentella, in comparison with S. fasciatus, is described in detail for the 1st time. Univariate statistics were calculated and the utility of each of several morphometric, meristic and pigmentation variables as a potential species identification criterion was evaluated. Discriminant analysis correctly classified up to 95% of larvae examined. The potential of the discriminant function in species identification for planktonic larvae is discussed.

Penney, Randy W., and Geoffrey T. Evans. 1985. Growth histories of larval redfish (Sebastes spp.) on an offshore Atlantic fishing bank determined by otolith increment analysis. Can. J. Fish. Aquat. Sci. 42(9):1452-1464.

Larval redfish, Sebastes spp., were collected for growth analysis on Flemish Cap, an offshore bank approximately 400-500 km east of insular Newfoundland, Canada. There is evidence that larval redfish form one sagittal growth increment daily, starting the day of extrusion from the mother. Length increases linearly with both age and sagittal radius. The mean daily growth rate was 0.16 mm/d in 1980 and 0.11 mm/d in 1981. Length at extrusion varied with date of extrusion in both years. Individual growth histories, inferred from measurements of sagittal radii, varied considerably with age and extrusion date. Larvae typically grew slowly for 10-15 d after extrusion and then rapidly for 60-70 d before slowing as they entered the pelagic juvenile stage.

Pennington, J. Timothy, and Fu-Shiang Chia. 1984. Morphological and behavioral defenses of Trochophore larvae of Sabellaria cementarium (Polychaete) against four planktonic predators. Biol. Bull. 167(1):168-175.

Eggs, pre-setal trochophores and setose trochophores of the polychaete S. cementarium were offered to 4 planktonic predators; Pleurobrachia bachei (Ctenophora), Aequorea victoria (Hydrozoa), brachyuran megalopa (Crustacea) and juvenile Sebastes spp. (Pisces). Each predator species captures prey differently and the prey, although similar in size, differ in motility and presence or absence of setae. Consumption of non-motile eggs was greater by megalopa and less by A. victoria than consumption of pre-setal trochophores; differences in predator feeding mechanisms account for this. Setose trochophores were always consumed at lower rates than the younger stages. Setae can function in larval defense against an array of predators with different feeding mechanisms, but swimming may increase, decrease, or have no effect on the rate of predation, depending on the predator species.

Pequeno, German Enrique. 1984. Trophic adaptation and relationships of rockfishes (Sebastes spp.) of Oregon. Ph. D. Thesis, Oregon State Univ., Corvallis, 198 p.

A comparative analysis of structures related to capture and processing of food, in 624 specimens belonging to 31 species of Sebastes of Oregon was made. The structure studies were the following: the tooth-bearing bones (premaxillary, dentary, vomer, palatine); the maxillary, angular, articular, parasphenoid and glossohyal bones; the lower limb of the first branchial arch and its gillrakers; the lenght

of the intestine; number of pyloric caeca; and width of orbit. Although a few species have distinctive features or specializations that alone or in simple combination can distinguish them, the overlap in trophic adaptation of the somewhat generalized predators is great. There is a continum of change from planktiphagous to ichthyophagous, so that the genus as a whole, should be capable of taking advantage of a wide spectrum of prey over a wide latitudinal and considerable bathymetric range. Overlaps in diet must be common, but there is probably sufficient difference in trophic adaptation so that each species would be successful in a particular niche if food were in short supply.

Pereyra, Walter T., William G. Pearcy, and Forrest E. Carvey. 1969. Sebastodes flavidus, a shelf rockfish feeding on mesopelagic fauna, with consideration of the ecological implications. J. Fish. Res. Board Can. 26:2211-2215.

Perez, Michael A., and Michael A. Bigg. 1986. Diet of northern fur seals, Callorhinus ursinus, off western North America. Fish. Bull., U.S. 84(4):957-972.

Data recorded from the stomach contents of 18,404 northern fur seals, Callorhinus ursinus, mostly females aged .gtoreq. 3 years collected off western North America during 1958-74, were analyzed to determine the relative importance of each prey species by region, subregion, and month. When weighted for energy content, the primary food species were small schooling fishes. Between western Alaska and California from December to August the most significant prey species were northern anchovy. Engraulis mordax (20%); Pacific herring, Clupea harengus pallasi (19"%); capelin, Mallotus villosus (8%), Pacific sand lance, Ammodytes hexapterus (8%); Pacific whiting, Merluccius productus (7%); salmon, Oncorhynchus spp. (6%); Pacific saury, Cololabis saira (4%); and rockfishes, Sebastes spp. (4%).

Perlmutter, A. 1951. A positional pattern of the copepod parasite Sphyrion lumpi on the rosefish, Sebastes marinus, and its relationship to the behavior of the fish. Copeia 1951(1):97-98.

Perlmutter, A., and G. M. Clarke. 1949. Age and growth of immature rosefish (Sebastes marinus) in the Gulf of Maine and off western Nova Scotia. Fish Bull., U.S. 51:207-228.

The rosefish (Sebastes marinus) is abundant on the fishing banks of the Gulf of Maine and Nova Scotia in depths ranging from 50 to 120 fathoms. Until 1935, rosefish were marketable only in limited quantities, and the yearly landings were well under 7,000,000 pounds. Technological advances in handling the fish, particularly filleting, quick freezing, and the perfection of an automatic scaling

machine, in addition to the development of markets in Midwestern states, stimulated a rapid increase in the rosefish fishery to an average yearly catch of more than 100,000,000 pounds. The catch reached a peak in 1946 of 178,000,000 pounds. As a result of the growing importance of the fishery, the Fish and Wildlife Service began a study of the rosefish in the fall of 1942. This report summarizes one phase of the investigation; namely, the age and growth of immature rosefish in the Gulf of Maine and off the Browns Bank area of western Nova Scotia.

Phillips, Julius B. 1937. Rockfish. In The commercial fish catch of California for the year 1935. Calif. Fish Game Fish Bull. 49:42-47.

Phillips, Julius B. 1939. Rockfish of the Monterey wholesale fish markets. Calif. Fish Game 25(3):214-225.

Phillips, Julius B. 1949. Rockfish. In The commercial fish catch of California for the year 1947 with an historical review, 1916-1947. Calif. Fish Game Fish Bull. 74:116-120.

Phillips, Julius B. 1957. A review of the rockfishes of California (family Scorpaenidae). Calif. Fish Game Fish Bull. 104, 158 p.

Phillips, Julius B. 1958. Rockfish review. In The marine fish catch of California for the years 1955-1956 with rockfish review. Calif. Fish Game Fish Bull. 105:7-25.

Phillips, Julius B. 1961. Problems in the identification of fishes, with a comparison between shallow-water and deep-water species of Sebastodes (Scorpaenidae). Rapp. P. V. Reun. Cons. Int. Explor. Mer 150:51-55.

Phillips, Julius B. 1961. Range extensions for two California fishes, with a note on a rare fish. Calif. Fish Game 47(4):418-419.

Sebastes macdonaldi is mentioned.

Phillips, Julius B. 1964. Life history studies on ten species of rockfish (genus Sebastodes). Calif. Fish. Game Fish Bull. 126, 70 p.

Phillips, Julius B. 1968. Review of rockfish program. Calif. Dept. Fish Game MRO Ref. 68-1, 27 p.

Phillips, W. J. 1927. Notes on New Zealand fishes. Trans. Proc. New Zealand Inst. 58:125-135.

Phleger, C. F., and P. W. Grimes. 1976. Bone lipids of marine fishes. Physiol. Chem. Phys. 8(5):447-456.

Assessment of candidates for investigation of bone lipid metabolism yielded the following findings. (1) A tropical marine butterflyfish, Chaetodon ornatissimus, had oil-filled bones (66-80% lipid, percent dry weight) hence may be a suitable candidate. (2) The tropical marine fishes Exallias brevis, Pomacentrus jenkensi, and Chromus agilis, and a Canadian fish Sebastes ruberrimus, had intermediate quantities of oil in their bones (12-49% lipid). (3) In all the foregoing species the major bone lipid was triglyceride, usually more abundant in skull than spine. Sterol and phospholipid were also present. (4) The major fatty acids of the triglycerides (and phospholipids) were 16:0, 18:0, 18:1, and C{SUP-20}, C{SUP-22} acids. Those acids were dominated by 20:4, 20:5, 22:5, and 22:6. (5) There was more total unsaturation in the bone lipids of S. ruberrimus (from 10{degree}C water 67-72% unsaturation) compared to the tropical fish (from 25{degree}C water 32-67% unsaturation) with the exception of E. brevis. (6) One of the tropical species (Arothron meleagris) and a Canadian Chimaeron (Hydrolagus colliei) contained only 1-3% lipid in their bones.

Phleger, C. F., R. F. Lee, and J. Patton. 1974. Fish bone oil composition and turnover. J. Am. Oil Chem. Soc. 51(7):520A.

Pikitch, Ellen K. 1987. Impacts of management regulations on the catch and utilization of rockfish in Oregon. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 369-382. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Pinchuk, V. I. 1976. Ichthyo fauna of the inter tidal zone of the Kuril Islands, USSR. Biol. Morya. (Vladivost.) 2:49-55.

Information on fishes from the intertidal zone of the Kuril Islands [USSR] is presented. Species of Sebastes schlegeli is recorded for the 1st time.

Pinkas, Leo, Malcolm S. Oliphant, and Charles W. Haugen. 1968. Southern California marine sportfishing survey: private boats, 1964; shoreline, 1965-66. Calif. Fish Game Fish Bull. 143, 42 p.

Powell, Donald E., Donald L. Alverson, and Robert Livingstone. 1952. North Pacific albacore tuna exploration, 1950. U.S. Fish Wildl. Ser. Fish. Leafl. 402, 56 p.

Powell, Donald E., and Henry H. Hildebrand. 1950. Albacore tuna exploration in Alaskan and adjacent waters, 1949. U.S. Fish Wildl. Ser. Fish. Leafl. 376, 33 p.

Juvenile rockfishes are found in tuna stomachs.

Power, D., and D. B. Atkinson. 1986. NAFO Subarea 2 and Division 3K redfish. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 86/54, 26 p.

Power, D. J., and I-Hsun Ni. 1982. Morphology of the extrinsic gasbladder musculature in the golden redfish, Sebastes marinus. J. Northwest Atl. Fish. Sci. 3(2):165-168.

The morphology of extrinsic gasbladder musculature of Sebastes marinus was examined to provide criteria that may be useful in discrimination of the three Northwest Atlantic redfishes, particularly for small individuals. The investigation revealed that S. marinus has a short, wide L-shaped gasbladder muscle which is generally tricipital. The most frequent pattern of tendons extending posteriorly was attachment of dorsal head tendons to ventral rib 2, passage of central head tendons between ribs 2 and 3, and passage of ventral head tendons between ribs 3 and 4. This is significantly different from the long, narrow gasbladder muscle of beaked redfishes, with passage between ribs 2 and 3 in S. mentella and between ribs 3 and 4 in S. fasciatus.

Power, D. J., and I-Hsun Ni. 1985. Morphometric differences between golden redfish (Sebastes marinus) and beaked redfishes (S. mentella and S. Fasciatus). J. Northwest Atl. Fish. Sci. 6(1):1-7.

Morphometric characters were investigated to provide criteria, in addition to morphological differences that are presently employed, for species identification of Atlantic redfishes (genus Sebastes). The study involved the analysis of morphometric data for a sample of redfish which was collected in the Labrador-Newfoundland region [Canada] in 1958 and initially separated into 2 groups (S. marinus and beaked redfish) on the basis of color, eye size and beak shape. Standard length was used as a covariate to adjust the morphometric data because S. marinus were on the average larger than beaked redfishes. Discriminant analyses of 17 morphometric characters resulted in an 11-variable discriminant function where 65% of the variability was explained by the groups, the 2 traditional discriminators (length of symphyseal tubercle and width of orbit) resulted in a function where 56% of the variability was explained by the groups, and the remaining 15 morphometric characters resulted in a 9-variable function were 58% of the variability was explained by the groups. The results demonstrated good (87-90%) separation of golden redfish (S. marinus) and beaked redfishes (S. mentella and S. fasciatus).

Pozdnyakov, Yu F. 1970. On the distribution and feeding of young Sebastes marinus off the shores of eastern Murman. Fish. Res. Board Can. Transl. Ser. 1938.

Priebe, K., S. Karow, and E. Schutz. 1978. Content of mercury and organochlorine compounds in muscle of redfishes. Arch. Lebensmittelhys. 29(2):44-48.

Three groups of 8 redfishes of the following kinds from different catching areas around Island (North Atlantic) have been tested in regard to the content of mercury, DDT amount and polychlorinated biphenyls (PCB) in the musculature: (1) Flatsea redfish Sebastes marinus L. size 1 (body weight over 4 kg, so called giant redfish (2) Flatsea redfish Sebastes marinus L. size II (body weight below 2 kg) and (3) Deepsea redfish Sebastes mentella Travin size II. A tendency exists to a positive correlation between body weight and content of mercury in each group. The highest values of mercury have been registered in 25-35 years old giant redfishes. These gigant redfishes have in comparison to the 2 smaller kinds of redfishes a higher average value of DDT. This DDT amount shows a lower level than 10% of the official limit (2.0 mg/kg DDT). The PCB content of the 3 redfish-collectives varied insignificant. The mean value of PCB was lower than the average of DDT amount (PCB/DDT = <1).

Prince, Eric D. 1975. Pinnixed crabs in the diet of young of the year copper rockfish (Sebastes caurinus). Trans. Am. Fish. Soc. 104(3):539-540.

Prince, Eric D., and Daniel W. Gotshall. 1976. Food of the copper rockfish, Sebastes caurinus Richardson, associated with an artificial reef in south Humboldt Bay, California. Calif. Fish Game. 62(4):274-285.

The stomachs of 241 copper rockfish captured around an artificial reef in South Humboldt Bay, California [USA], were collected from March 1971-March 1972. Food habits were compared with fish age (size), season and time of day. Copper rockfish can be best categorized as opportunistic carnivores. Crustaceans, followed by fish and mollusks, were the most important food groups in the copper rockfish diet in terms of volume, number and frequency of occurrence. Juvenile Dungeness crabs, Cancer magister, were the most important individual food item in terms of volume and frequency of occurrence.

Pritchard, A. L., and A. L. Tester. 1944. Food of spring and Coho salmon in British Columbia. Bull. Fish. Res. Board Can. 65, 23 p.

Prosser, C. L., G. Somero, and F. R. Wilson. 1974. Temperature-metabolism relations of two species of Sebastes from different thermal environments. Comp. Biochem. Phys. B. 47(2):485-491.

Quast, Jay C. 1971. Distinctions between Pacific Ocean perch in the Bering Sea and at Davidson Bank with a discussion of possible subspecific separation of the two populations. Proc. Alaska Sci. Conf. 22:115.

Quast, Jay C. 1971. Sebastes variegatus, sp. n., from the northeastern Pacific Ocean (Pisces, Scorpaenidae). Fish. Bull., U.S. 69(2):387-398.

Quast, Jay C. 1972. Reduction in stocks of the Pacific ocean perch, an important demersal fish off Alaska. Trans. Am. Fish. Soc. 101(1):64-74.

The Pacific Ocean perch (Sebastes alutus) is an important commercial fish of the North Pacific Ocean and Bering Sea. Commercially exploitable populations extend from Kamchatka through the Bering Sea and along the Aleutian Islands to California. Heavy exploitation of the stocks off North America began around 1963, principally by stern-ramp trawlers of the Soviet Union and Japan. The original catchable biomass of the species off North America seems to have been about 3.5 billion pounds, and the stocks as of 1968 appeared to be about 39% of the original biomass. Because the fishery has significantly reduced the proportion of large fish in the populations and fecundity increases at a much faster rate than length or weight in the species, a severe drop in fecundity of the populations is hypothesized. (Author).

Quirollo, Lawrence F. 1987. Review of data on historical catches of widow rockfish in northern California. In W. H. Lenarz, and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 7-8. U.S. Dep. Commer., NOAA Tech. Rept. NMFS 48.

Radtke, R. L. 1980. The formation and growth of otoliths from redfish (Sebastes spp.) larvae from the Flemish Cap (Division 3M). Northwest Atl. Fish. Organ. Sci. Counc. Rep. 80/IX/153.

Raitt, D. F. S., and W. B. Hall. 1967. On the fecundity of the redfish, Sebastes marinus (L.). J. Cons. Cons. Int. Explor. Mer 31(2)237-245.

Randa, K., and O. M. Smedstad. 1982. The Norwegian groundfish survey at Bear Island and West-Spitsbergen in the autumn 1981. In Council Meeting of the International Council for the Exploration of the Sea, Copenhagen, Denmark, Oct. 11, 1982. ICES-CM-1982/G:42: 17 p.

Rees, E. I. S. 1983. Little auks scavenging at trawler. Br. Birds. 76(10):454.

On a few occasions during 12th-16th November 1959, the authors saw Little Auks Alle alle pick up waste fragments from alongside a research trawler fishing on the Nova Scotian Shelf (43 degree N, 63 degree W):in nearly calm weather, with the vessel stopped, singles fed without diving where a trickle of washdown water was carrying waste out of a scupper. One of the main fish in the catches was redfish Sebastes mentella, a species that often feeds on macroplanktonic crustaceans such as euphausiids, hyperiid amphipods and the larger copepods. Expansion of swimbladders often causes stomach eversion in redfish, so the washdown water would have contained items similar to the Little Auk's normal food.

Rehbein, H. 1983. Differentiation of redfishes from the Northeast Atlantic (Sebastes marinus L., S. mentella travin, S. viviparus Kroeyer and Helicolenus dactyloperus D. Delaroche 1809) by isoelectric focusing of sarcoplasmic proteins. In Council Meeting of the International Council for the Exploration of the Sea, Gothenburg, Sweden, Oct. 18, 1983. ICES-CM-1983/G:40, 11 p.

Rehbein, H., and J. Oehlenschlaeger. 1983. Differentiating between the red or rose-fish (Sebastes marinus) and its deeper sea-level variety (Sebastes mentella). Allg. Fischwirtschaftsztg. 35(10):397-400.

The chemical composition of S. marinus and S. mentella had been analysed in order to find subspecific characteristics, and so, if possible, to get provable criteria for these differences. The results show that the chemical composition of both varieties is identical, they only differ in respect to content of TMAO which is caused by the different water depths in which they occur. Because isoelectric focusing results in identical patterns of the water soluble muscle proteins it must be concluded that S. mentella and S. marinus are two varieties of one species.

Rehbein, H., and M. Tomic. 1979. Possibilities for the differentiation between fresh and thawed fillets by enzymatic analysis. Lebensmittelchem. Gerichtl. Chem. 33:122-124.

Fresh and thawed fillets of commercial marine fishes (cod, saithe, haddock, red fish) could be differentiated successfully by measuring the activities of lysosomal enzymes (-glucosidase, beta -N-acetylglucosaminidase) in the press juice. The enzyme activity ratio C defined as ratio between the specific enzyme activities in press juice and extract) was considerably higher for frozen/thawed fillets. To decide on doubtful cases (e.g. spoiled fillets), trimethylamine had to be determined too.

Reimold, W. V., and K. Lang. 1972. The fatty acid composition of the tissue lipids of the red perch, Sebastes viviparus. Z. Ernaehrungswiss. 11(2):69-79.

Reinacher, E., and D. Ehlermann. 1978. The effect of on board irradiation on the keeping quality of redfish. Arch. Lebensmittelhyg. 29(1):24-28.

Continuing former investigations during two voyages of the RV 'Anton Dohrn' redfish (Sebastes marinus) was irradiated onboard and stored under different conditions, wrapped and unwrapped under melting ice. A part of the irradiated, unwrapped samples was stored under irradiated ice. As in the former investigations the irradiation treatment effected no prolongation of shelflife in the range of marketable quality.

Reinsch, H. H. 1977. Studies on the commercial fish stocks of Bear Island and off Spitzbergen in summer 1977 (200/82 voyage of the FFS Anton Dohrn between 2.8. and 26.8.1977.). Inf. Fischwirtsch. 24(5):148-150.

Results on the 200/82 voyage of the FFS 'Anton Dohrn' to Bear Island and Spitzbergen is reported. The commercial fish stocks (Gadus calliaris, Melanogrammus aeglefinus, Sebastes and Hippoglossus) were studied. Bottom water temperature, depth and catches of commercial species are reported. Redfish was heavily attacked by parasites (Sphyrion lumpi).

Reinsch, H. H. 1978. Studies on the commercial fish stocks on the Baeren Island shelf off Spitzbergen in summer 1978. Inf. Fischwirtsch. 25(5):133-137.

Fishery-biology studies on the commercial fish stocks were conducted aboard the FES Anton Dohrn between 12.6 and 19.7.1978. In addition to a map of the route taken, tables are presented containing data on the catch protocol for cod, redfish, halibut, and blue whiting. Average lengths for individual study areas are also given. In another table results are presented on the occurrence of blue whiting. A graph of cod catches for 1976 and 1978 shows the reduction in cod catches in all 3 catch areas. Grenadier fish (Macrourus berglax) were only caught sporadically. Capelin and polar cod were almost completely absent from catches. Redfish showed heavy attack by Sphyrion lumpi.

Reinsch, H. H. 1979. Investigations on commercial species in southwest Barents Sea, near Bear Island and on the west coast of Spitzbergen in summer 1979. Inf. Fischwirtsch. 26(5):129-134.

The annual fisheries biological assessment of the commercial fish stocks in the Barents Sea, around Bear I. and off

Spitzbergen was made by the FFS Walther Herwig from 10 July-14 Aug 1979 using the stratified random sampling system. Four tables show the data on the presence of fishable stocks, along with the length and weight of cod, haddock, Sebastes marinus, S. mentella, Micromesistius poutassou and black halibut. S. mentella was heavily infested with Sphyrion lumpi.

Reinsch, H. H. 1980. Fishery-biological investigations in the Barents Sea and west of Spitzbergen (101 cruise of FRV Anton Dohrn from 20.6. to 27.7.1980). Inf. Fischwirtsch. 27(5):179-185.

To get information of the horizontal distribution and the biology of commercially important fishes, a cruise was made in June/July 1980 to the Barents Sea and Spitzbergen. For Gadus morhua, Reinhardtius hippoglossoides, Sebastes mentella and Micromesistius poutassou the length distribution is given for these and for some other species the catch rates in the different areas are summarized in a table.

Reinsch, H. H. 1981. Fishery biological experiments off western Greenland. Inf. Fischwirtsch. 28(1):9-16.

Data on total trawling times, bottom and surface water temperatures, catch and main sp. are tabulated, as are length data of the principal species. Cod was most prominent in NAFO areas 1C and 1F with a maximum hourly catch of 1442 kg. Sea bream was commonest in areas 1C and 1D with a maximum half-hourly catch of 7500 kg at 160-190 m off the Fiskenaes Bank. Length distribution tables for cod, sea bream, dab and Atlantic catfish are given.

Reinsch, H. H. 1982. Fishery biological investigations at Northern Norway in the Barents Sea and at Bear Island (119. Cruise of FRV Anton Dohrn from 8.7.-11.8.82.). Inf. Fischwirtsch. 29(4):167-174.

During the 119. cruises of FRV Anton Dohrn the stocks of commercially important fish species mainly near Bear Island and northern Norway had been investigated. The length distribution, catch/effort and vertical distribution of Gadus morhua, Sebastes marinus, Sebastes mentella, Melanogrammus aeglefinus, Micromesistius poutassou and Pollachius virens are described.

Richards, J. E., C. P. Archibald, and L. R. Rosenfeld. 1980. Exploratory midwater fishing for rockfish off the west coast of Vancouver Island, January 22-February 1, 1980. Can. Data Rep. Fish. Aquat. Sci 226, 47 p.

This report presents data from the exploratory midwater trawling survey for rockfish (Sebastes spp.) conducted off

the west coast of Vancouver Island, January 22-February 1, 1980. No large schools of rockfish were found at this time of year, although small, marginally exploitable schools were located, primarily in the area south of Estevan Point. These schools were usually associated with rough bottom and tended to be more diffuse during the day. Rockfish stomach contents were primarily herring, which were widely dispersed throughout the study area; this may have contributed to the dispersed distribution of the rockfish.

Richards, Laura J. 1986. Depth and habitat distributions of three species of rockfish (Sebastes) in British Columbia: observations from the submersible PISCES IV. Environ. Biol. Fishes 17(1):13-21.

I describe a technique to quantify spatial distribution patterns of deep reef-fishes, and apply this technique to inshore rockfish (Sebastes) communities in the Strait of Georgia, British Columbia, Canada. Observations were made along vertical transects between 21-140 m using the submersible PISCES IV. A total of 31 transects were completed at 14 sites during 16 submersible dives. S. elongatus, S. maliger and S. ruberrimus were the dominant rockfish species that were observed. S. elongatus and S. ruberrimus had similar depth distributions, but tended to segregate by habitat type. S. elongatus was most abundant on mud and cobble substrates that interspersed rocky areas. S. maliger and S. ruberrimus were both abundant in complex rock habitats, but tended to segregate by depth. For all three species there was an increase in size with depth. Hence, habitat type and depth were important influences on distribution patterns of this species group.

Richards, Laura J. 1986. PSARC working paper G86-1. 1986 assessment for commercially exploited rockfish stocks in the Strait of Georgia. Can. Manuscr. Rep. Fish. Aquat. Sci. 1885, 55 p.

Landed catch of rockfish (Sebastes) in the British Columbia inshore commercial fishery (minor statistical areas 12-20, 28, 29) increased by almost 600% between 1975 and 1984, from a low of 67 t annually to a 1984 level of 381 t and landed value of nearly one million dollars. Most of the rockfish landings are by handline/troll gear, with smaller amounts by longline and trawl. Handline/troll LPUE (landings per unit effort) decreased 15-23% between 1982 and 1984. This decrease in LPUE is indicative of major decreases in the stock size of rockfish in the Strait of Georgia over the past few years, associated with an increase in targeted fishing effort.

Richards, Laura J. 1987. Comparing imprecise abundance indices with a symmetric model. Can. J. Fish. Aquat. Sci. 44(4):793-802.

Richards and Schnute (1986. Can. J. Fish. Aquat. Sci. 43:1214-1227) presented an errors-in-variables model for testing the assumption that catch per unit effort (CPUE) is an index of stock abundance. Here, I generalize the model and extend its application to any pair of abundance indices for which the ratio of variances in the two indices can be estimated. I used the model to relate density indices from two years, CPUE values from two years, and the two CPUE-density combinations. Density estimates of nearshore reef fishes from the strait of Georgia, British Columbia, were obtained by SCUBA, and CPUE estimates were obtained by angling at the same sites. Among-site differences in both CPUE and density tended to be consistent between years. For quillback rockfish (Sebastes maliger), the relationship between CPUE and density was one of strict proportionality, as found by Richards and Schute over a different depth range.

Richards, Laura J., and A. J. Cass. 1985. 1985 Catch and effort data on nearshore reef-fishes in the Strait of Georgia B.C. (statistical areas 15 and 16). Can. Manuscr. Rep. Fish. Aquat. Sci. 1851, 72 p.

In 1984 the authors began a research program based on the need for stock assessments of nearshore reef-fishes in the Strait of Georgia. The 1985 results are presented in this report, and are compared with the 1984 results and with a small sample from the recreational fishery. Time of day, depth, weather conditions, sea state and tide did not affect CPUE. Dogfish (Squalus acanthias, copperback rockfish, yelloweye rockfish (Sebastes) and lingcod (Ophiodon elongatus) were the dominant species in the catch.

Richards, Laura J., and A. J. Cass. 1985. Transect counts of rockfish in the Strait of Georgia from the submersible Pisces IV, October and November 1984. Can. Data Rept. Fish. Aquat. Sci. 511, 99 p.

Richards, Laura J., and A. J. Cass. 1987. The British Columbia inshore rockfish fishery: Stock assessment and fleet dynamics of an unrestricted fishery. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 299-308. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Richards, Laura J., and A. J. Cass. 1987. 1986 research catch and effort data on nearshore reef-fishes in British Columbia statistical areas 12, 13 and 16. Can. Manuscr. Rep. Fish. Aquat. Sci. 1903, 119 p.

In 1984 we began a research program based on the need for stock assessments of nearshore reef-fishes in the Strait of Georgia. The 1986 results from minor statistical areas (MSA) 12, 13 and 16 are presented in this report, and are compared with the 1984 and 1985 results from MSA 16, and with a small sample from the sport fishery in MSA 12 and 16. Quillback rockfish, copper rockfish and lingcod were the dominant species of the catch.

Richards, Laura J., A. J. Cass, J. R. Selsby, R. van den Broek, and S. D. Loynachan. 1985. Summary of research catch and effort data for nearshore reef-fishes collected during 1984 in MSA 15 and 16 of the Strait of Georgia. Fish. Res. Board Can. Manuscr. Rep. 1833, 69 p.

In 1984 we began a research fishing program based on the need for stock assessments of nearshore reef-fishes in the Strait of Georgia. Five cruises were completed in MSA 15 and 16 during the 1984 field season. A stratified random design was used to choose fishing sites within these statistical areas. Three depth strata (<40 m, 40-70 m, and 70-100 m) were fished at most sites. Fishing during the first cruise was conducted by automatic jig. Standard angling gear (trolling rod and reel) was used on the remaining cruises. Dogfish, copper rockfish, quillback rockfish, yelloweye rockfish and lingcod were the dominant species in the catch. Raw data on catch, effort and associated set information and a description of a standardized methodology are presented in this report.

Richards, Laura J., H. I. McElderry, J. Carolsfeld, and C. P. Lauridsen. 1986. SCUBA survey of rockfish assemblages in the Strait of Georgia, B.C. (Statistical areas 15 and 16), September to November 1985. Can. Data Rep. Fish. Aquat. Sci. 586, 117 p.

This report summarizes observations from SCUBA surveys conducted during October and November 1985 at 12 sites in statistical areas 15 and 16 of the Strait of Georgia. A similar survey had been conducted at all but one of these sites during 1984. The surveys were designed to obtain visual estimates of density, species composition and size distribution of nearshore reef-fishes and to make related observations on fish behavior and habitat. Ten 50-m horizontal transects were completed at all sites, at depths between 8 and 16 m. Rockfish (Scorpaenidae) and perch (Embiotocidae) accounted for 92.9% of the fish recorded on the survey.

Richards, Laura J., J. Paul, A. J. Cass, L. Fitzpatrick, R. VanderBroek, and C. Lauridsen. 1985. Scuba survey of rockfish assemblages in the Strait of Georgia, July to October 1984. Can. Data Rep. Fish. Aquat. Sci. 545, 91 p.

Observations are summarized form SCUBA surveys conducted between July and October at 17 sites in statistical areas 15 and 16 of the Strait of Georgia. The surveys were designed to obtain visual estimates of density, species composition, and size distribution of near shore reef-fish populations, and to make related observations of fish behaviour and habitat. Raw data on species counts and habitat (including description of the invertebrate fauna) are presented for each transect in this report.

Richards, Laura J., and Jon T. Schnute. 1986. An experimental and statistical approach to the question: Is CPUE an index of abundance? Can. J. Fish. Aquat. Sci. 43(6):1214-1227.

Catch per unit effort (CPUE) is often assumed to be an index of stock abundance. Here we present an experiment and a general model for testing this assumption. We used the submersible Pisces IV to make visual estimates of reef-fish density in the Strait of Georgia, British Columbia [Canada]. These density estimates were compared with CPUE estimates obtained by research angling at the same sites. Our model allows for no relationships a between CPUE and density, strict proportionality, and departures from proportionality at either low or high densities or both. We performed the analysis using an ordinary least squares (OLS) model and an errors-in-variables (EV) model that includes error in both CPUE and density. For the dominant species (quillback rockfish, Sebastes maliger), the relationship was one of strict proportionality. However, CPUE was a poor abundance index when data were combined across species. In these cases the OLS and EV models generally resulted in different conclusions; the EV model explained a low CPUE at high density by allowing for error in the density measurement.

Richardson, Sally L. 1973. Abundance and distribution of larval fishes in waters off Oregon, May-October 1969, with special emphasis on the northern anchovy, Engraulis mordax. Fish. Bull., U.S. 71(3):697-711.

Richardson, Sally L. 1977. Larval fishes in ocean waters off Yaquina Bay, Oregon: abundance, distribution and seasonality, January 1971 to August 1972. Oreg. State Univ. Sea Grant Coll. Prog. Publ. ORESU-T-77-003, 73 p.

Richardson, Sally L., and Wayne A. Laroche. 1979. Development and occurrence of larvae and juveniles of the rockfishes Sebastes crameri, Sebastes pinniger, and Sebastes helvomaculatus (Family Scorpaenidae) off Oregon. Fish. Bull., U.S. 77(1):1-46.

Developmental series of larvae and juveniles of three species of northeast Pacific rockfishes are illustrated and described: S. crameri, S. pinniger, and S. helvomaculatus. The descriptions include a literature review, characters used for identification including meristics and supraocular spine patterns, distinguishing features, general development, morphology, fin development, spination, scale formation, and pigmentation. Occurrence in waters off Oregon is discussed. The approach that was used to identify larval and juvenile specimens of Sebastes from plankton, midwater trawl, and bottom trawl collections from Oregon waters is presented, since 36 species reportedly occur there. Developmental terminology is newly defined for Sebastes. Larval and juvenile spination is presented schematically and defined. Larvae and juveniles of the three species described here are compared with other known Sebastes larvae and juveniles from the northeast Pacific.

Richardson, Sally L., and William G. Pearcy. 1977. Coastal and oceanic fish larvae in an area of upwelling off Yaquina Bay, Oregon. Fish. Bull., U.S. 75(1):125-145.

A 1 1/2-yr survey of planktonic fish larvae collected from 2-111 km off the mid-Oregon coast [USA] in 1971-72 yielded 287 samples which contained 23,578 individuals in 90 taxonomic groups, 78 identified at the species level. Two distinct faunal assemblages were found: a coastal assemblage 2-28 km offshore and an offshore assemblage 37-111 km from shore. The coastal group was dominated by Osmeridae, Parophrys vetulus, Isopsetta isolepis and Microgadus proximus. The offshore group was dominated by Sebastes spp., Stenobrachius leucopsarus, Tarletonbeania crenularis, Lyopsetta exilis and Engraulis mordax. Peak abundance in both assemblages occurred between Feb. and July when > 90% of all larvae were taken. Larval distribution patterns in each assemblage were similar in 1971 and 1972, but larval abundance was greater in 1971 than 1972. Ninety-nine percent of the larvae in 53 taxa designated as coastal and 96% of the larvae in 31 taxa designated as offshore were taken 2-28 km or 37-111 km offshore.

Rivard, D. 1980. Back-calculating production from cohort analysis, with discussion on surplus production for two redfish stocks. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 80/23, 26 p.

This method, which requires detailed information on the age-composition of the catch, and the mean weight-at-age, is used to assess trends in surplus production for two redfish stocks. Since these calculations refer to the transient state, the method does not require the assumption of 'an equilibrium state'. The variations in stock biomass level and in the mean age of the two redfish stocks are sufficient to explain most of the variability contained in surplus production without the need for either explicit density-dependent or climate-dependent term. The age composition of a stock appears as an important factor for controlling production.

Rivard, D., and S. Gavaris. 1986. A non-equilibrium production model for Division 4RST redfish. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 86/99, 11 p.

Roberts, Dale A. 1979. Food habits as an ecological partitioning mechanisms in the nearshore rockfishes (Sebastes) of Carmel Bay, California. M.S. Thesis, Calif. State Univ., San Francisco. 74 p.

Roberts, John L. 1973. Respiratory interneuron activity in fishes. Am. Zool. 13(4):1304.

Robins, C. Richard, R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1980. A list of common and scientific names of fishes from the United States and Canada. 4th Edition. Am. Fish. Soc. Spec. Publ. 12, 174 p.

Robins, C. Richard, Reeve M. Bailey, Carl E. Bond, James R. Brooker, Ernest A. Lachner, Robert N. Lea, and W. B. Scott. 1986. Names of the Atlantic redfishes, genus Sebastes. Fisheries 11(1):28-29.

Robinson, G. A. 1972. A study of the Pacific ocean perch fisheries of the northeastern Pacific Ocean. Ph.D. Thesis, Univ. Wash., Seattle, 238 p.

Robinson, G. A. 1977. The continuous plankton recorder survey: plankton in the Irminger Sea region during 1975. Ann. Biol. Copenh. 32:53-54.

Histograms showing average monthly numbers per Recorder sample of phytoplankton, Thalassiothrix longissima, total Copepoda, Calanus finmarchicus V-VI, C. finmarchicus I-V, Euchaeta norvegica and Sebastes spp in the Irminger Sea region during 1975. The average monthly abundances based on the 1957-1974 results are also indicated. Phytoplankton and copepods were early and abundant in the western sector phytoplankton was less abundant from Aug onwards in the eastern sector, but, as in the western area, the over-wintering copepods appeared early.

Roche, Edward T, and Bruce W. Halstead. 1972. The venom apparatus of California rockfishes (family Scorpaenidae). Calif. Fish Game Fish Bull. 156, 49 p.

The family Scorpaenidae contains more known venomous fishes than any other bony fish family. The venom apparatus of an American representative of this family, the California sculpin or scorpionfish, has been described previously by several authors. The rockfish genus Sebastes is represented in California waters by over 50 species. Several species of Sebastes from European and Asiatic waters are known to possess a venom apparatus, but no previously published literature describes such an apparatus in American rockfishes. The gross anatomy of the spines, pelvic girdle, and musculature and microscopic anatomy of the spines, associated venom glands, and integument in the brown rockfish, Sebastes auriculatus, are described. The microscopic anatomy of the spines and venom glands in five other species of Sebastes is described and compared to that of the brown rockfish. The presence of venom tissue in at least one dorsal spine of eight additional species of Sebastes is reported.

Roe, H. S. J. 1969. The food and feeding habits of the sperm whales Physeter catodon taken off the west coast of Iceland. J. Cons. Cons. Perma. Int. Explor. Mer. 33(1):93-102.

Roedel, P. M. 1948. Common marine fishes of California. Calif. Div. Fish Game Fish Bull. 68:1-153.

This bulletin is written with two objectives in mind. First, it is designed to provide authorized names for the more common marine fishes of California, in the hope that these names will be used in the fishing industry and by sportsmen. Second, it is designed to provide a ready reference form which the fisherman or the buyer can identify those species seen most often in the commercial and the sport catch. It is not presented as a treatise on our

marine fishes, for it describes only a fraction of the species known from California. It is meant as a guide for any person interested in fish regardless of his technical background, so scientific terminology is avoided wherever possible.

Roland, W. 1978. Feeding behaviour of the kelp clingfish Rimicola muscarum residing on the kelp Macrocystis integrifolia. Can. J. Zool. 56(4):711-712.

The feeding behaviour of the kelp clingfish Rimicola muscarum Meek and Pierson residing on the blades of the kelp Macrocystis integrifolia Bory was described. The fish seized small invertebrates, mainly harpacticoid copepods, which were closely associated with the kelp blades. A four-step food chain involving R. muscarium was qualitatively determined. Diatoms epiphytic on the kelp blades were grazed by harpacticoid copepods. These and other small invertebrates were captured by the clingfish, which in turn was eaten by the black rockfish, Sebastes melanops, and the shiner perch, Cymatogaster aggregata.

Ronholt, Lael L., Herbert H. Shippen, and Eric S. Brown. 1976. An assessment of the demersal fish and invertebrate resources of the northeastern Gulf of Alaska, Yakutat Bay to Cape Cleare May - August 1975. U.S. Dep. Commer., NOAA, NMFS, Northwest Fisheries Center, Processed Rept. 184 p.

Rosenblatt, R. H., and Lo-Chai Chen. 1972. The identity of Sebastes babcocki and Sebastes rubrivinctus. Calif. Fish Game 58(1):32-36.

Rosenthal, Richard J., Larry J. Field, and Dale D. Myer. 1981. Survey of nearshore bottomfish in the outside waters of southeastern. Alaska Dep. Fish Game, Commercial Fisheries Div., Alaska Coastal Research. 85 p.

Assemblages of bottomfish that live in outer coast waters of southeastern Alaska were surveyed during summer 1980. Fish stocks were censused in the rocky nearshore zone between 56 and 58 degrees north latitude. Some 52 species of fish were encountered by us in this region.

Rosenthal, Richard J., Lewis Haldorson, L. Jay Field, Victoria Moran-O'Connell, Mark G. LaRiviere, Janet Underwood, and Margaret C. Murphy. 1982. Inshore and shallow offshore bottomfish resources in the southeastern Gulf of Alaska 1981-1982. Alaska Department of Fish and Game, Commercial Fisheries Division, Juneau, Alaska. 166 p.

Rounsefell, George A. 1957. A method of estimating abundance of groundfish on Georges Bank. Fish. Bull., U.S. 57(113):265-278.

Rybachuk, V. K. 1974. Identification of the species of the genus Sebastes from a bone found by A. Ya. Taranets in Middens of the Ilou tribe. J. Ichthyol. 14(5):798-799.

Rybachuk, V. K. 1976. Features of the structure of the skeleton and caudal fin muscles in Sebastes nebulosus and Sebastes jordani (Sebastinae, Scorpaenidae). J. Ichthyol. 16(3):452-458.

The structure of the skeleton and muscles of the caudal fin was investigated in species of the ocean perch (Sebastinae) with a rounded caudal fin S.nebulosus and an emarginate caudal fin S.jordani. The overall structural design is very similar in both species, the differences consist in the relative thickness of the individual skeletal elements and also of the muscles of the caudal fin. In S.nebulosus, with the exception of vertebral centra and the larger hypurals, the skeletal elements and the muscles of the fin are thicker and the attachment of the rays to the hypurals weaker than in S. jordani this indicates greater independence in the function of the fin. The structure of the skeleton and caudal fin muscles of these species is very similar to that in some groups of the order Perciformes.

Rybachuk, V. K. 1979. Skeleton and muscles of the dorsal fin of Sebastes jordani and Sebastes nebulosus (Scorpaenidae). J. Ichthyol. 19(4):92-100.

The skeletal and muscular structure of the dorsal fin of S. jordani (Gilbert), a species with a relatively low body, a sinuate caudal fin and thin spines, and of S. nebulosus Ayres, a tall-bodied fish with a rounded caudal fin and thick spines, were analyzed and discussed. The overall skeletal and muscular structure of both the dorsal and caudal fins are approximately the same. The differences are not significant; they may be due to different functional loads assigned to the individual parts of the fin. The spines of S. nebulosus are taller and thicker than those of S. jordani, and the anterior portion of its fin is used as a defense organ to a greater extent than that of S. jordani. S. nebulosus does not exhibit as great a cruising speed as S. jordani. S. nebulosus has a need for greater maneuverability than S. jordani and its dorsal fin is more actively used as a keel and front rudder. The pterygiophores of the spines and to a certain degree of the soft rays are thinner and shorter in S. jordani than in S. nebulosus, and its (S. jordani) proximal spine pterygiophores exhibit greater inclination toward the longitudinal body axis, in a caudal direction. The correspondences of greatest body height, spine length and proximal ptergiophore length are approximately the same for both species.

Rzhavskaya, F. M., A. M. Makarova, and E. L. Sorokina. 1978. Fatty-acid composition of muscle tissue lipids in some marine fish. Vopr. Pitan. 1:72-76.

Investigation of the fatty acid composition in the tissue lipids of a number of marine fish (Notothenia rossi, N. gibberifrons, Neptomenus crassus, Epinephelus epinephelus, Trachurus murphyi, Dissostichus eleginoides, Sebastes marinus and Brama raji) of different degrees of fatness showed substantial differences in the correlation of basic acid components and the nutritional value of the lipids. A comparison between the overall lipid content and the quantity of highly unsaturated acids disclosed a possible relative resistance of the fish studied to the oxidative decay of lipids.

Sado, Y. 1980. Properties of hexose 6 phosphate dehydrogenase from a Japanese ray, Raja pulchra. J. Fac. Sci. Hokkaido Univ. Ser Vi. Zool. 22(2):156-163.

Hexose 6-phosphate dehydrogenase [H6PD] was found in a Japanese ray, Raja pulchra, and its kinetic and immunological properties were studied. The ray H6PD apparently possesses catalytic properties strikingly similar to those of H6PDs from other species, Sebastes taczanowskii.

Saeki, Kiyoko, and Hiroshi Kumagai. 1984. Chemical components in ten kinds of wild and cultured fishes. Bull. Jpn. Soc. Sci. Fish. 50(9):1551-1554.

The contents of chemical components such as moisture, protein, lipid and ash were determined for the muscles of 10 kinds of wild and cultured fishes, Sebastes inermis is included. The fishes studied were classified into three groups in terms of the relative contents of the nutritive components of the cultured fishes to the contents of the wild fishes. In the first group which include rock fish, the lipid content is richer, and the moisture content is poorer in the cultured fishes.

Sahrhage, D. 1980. Biological investigations on fish stocks off western Greenland. Inf. Fischwirtsch. 27(4):135-142.

The 99th journey of FRV Anton Dohrn (26.4.-21.5.1980) was scheduled in waters off Western Greenland (NAFA Div. 1C-1F) to investigate the horizontal and vertical distribution and variations of ground fish. First results were figured for quantitative distributions of the catches and the measurements of length from Gadus morhua, Sebastes matella, species of Anarchichas, C. oryphaenoides rupestris,Macrourus berglaxand black Hippoglossus. The most frequent species of the by-catch were White Halibut and American plaice. Haddock, Blue Whiting, Cusk and Blue Leng had been found only in single specimens.

Sahrhage, D. 1982. Fishery surveys on the demersal stocks near the Labrador shelf. Inf. Fischwirtsch. 29(1):4-13.

From November to December 1981 the FRV Anton Dohrn continued it's annual ichthyological investigations of the commercially important fish species near Labrador. The vertical distribution of the fish and their length-distribution in the catches are described. The dominant species are Gadus morhua, Sebastes mentella, Hippoglossoides platessoides, and Rheinhardtius hippoglossoides. A diagram shows the course of isotherms at the bottom of this area.

Saito, T., H. Kitayama, and Y. Tankawa. 1970. Frequency of Anisakis larvae in marine fishes and cuttlefishes captured in the area of Hokkaido. Rep. Hokkaido Inst. Pub. Health 20:115-122.

Sakai, Keiichi, Hiroshi Nagashima, and Katsuhiro Kiso. 1985. Growth and movement of artificially reared young rockfish Sebastes schlegeli after release in Matsushima Bay, Japan. Bull. Tohoku Reg. Fish. Res. Lab. 47:21-32.

This study aimed at ascertaining the growth and migration of tagged rockfish, Sebastes schlegeli, which had been reared artificially and released in Matsushima Bay, Miyagi Prefecture in October 1982 and October 1983. In 1982, 13,910 tagged fish (mean total length (TL): 10.9 cm) were released. In 1983, another tagging experiment was conducted using two six groups; small (8,955 fish, mean TL: 9.7 cm) and large (4,832 fish, mean TL: 11.9 cm). An analysis of the recovery of released fish was carried out using commercial and game fishing reports. One year after release, 95 of the 1982 group had been recovered, compared to 60 of the small-size 1983 group and 48 of the large-size 1983 group. Size range in all three groups was 20-22 cm TL. From January through March, there was no growth observed in either released fish or rockfish cultured in Matsushima Bay. Almost all fish released in October inhibited Zostera beds in the inner part of the bay until December, then moved around the rocky reefs at the mouth of the bay.

Samokhvalova, L. K. 1976. Diets and food coefficients in predatory fish from Kursiu Marios. Tr. Atlant. NIRO, Kaliningrad. 65:69-75.

The annual rations and food coefficients in pike-perch, pike and perch were calculated from the balance equation formula suggested by G. G. Vinberg. Food coefficients were found to increase with predator age and to be significantly higher in males than in females. It is stated that pike-perch and pike are valuable predatory spp from the points of view of biology and fishery. Piscicultural and protective measures are recommended aimed at increasing the stock by 2 times approximately.

Sample, Terrance M. 1984. Groundfish surveys conducted by the Northwest and Alaska Fisheries Center in 1983. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 84-08, 30 p.

Sandeman, E. J. 1961. A contribution to the problem of the age determination and growth rate in Sebastes. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:276-284.

Growth studies of redfish (Sebastes marinus L.) have been reported by several workers both in Europe and in North America. The integration of these data on growth rates into an overall picture of Sebastes, its distribution and biology, is somewhat complicated by the lack of agreement of the taxonomic status of the different "types" of redfish reported as occurring over almost its complete geographic range. This problem is particularly difficult since the maximum sizes attained and the growth rate appear to be considerably greater for marinus-type than for mentell-type redfish.

Sandeman, E. J. 1969. Age determination and growth rate of redfish Sebastes sp. from selected areas around Newfoundland. Int. Comm. Northwest Atl. Fish. Res. Bull. 6:79-106.

Ages have been determined from the otoliths of Mentella redfish from Hermitage Bay, the southwest slope of the Grand Bank, the Gulf of St. Lawrence, Flemish Cap, and Hamilton Inlet Bank and of Marinus redfish from the latter two areas. Empirically, growth of both Marinus and Mentella redfish form these areas was found to be well represented by the von Bertalanffy equation and the parameters of this equation were obtained by least squares fit to the mean length at age values for males and females from each of the areas examined. A comparison of ages obtained by two independent readers revealed that although considerable differences were apparent in the estimates for individual fish, when the results were expressed as growth curves these were virtually identical.

Sandeman, E. J. 1969. Diurnal variation in availability of different sizes of redfish, Sebastes mentella. Int. Comm. Northwest Atl. Fish. Res. Bull. 6:35-46.

During a series of alternate haul mesh selection experiments directed at redfish on the eastern part of the Grand Bank of Newfoundland, continuous fishing at the one position depleted the local population to a sufficient extent to allow DeLury estimates of the initial population to be made. With estimates of the initial population available it was possible to examine, for different size groups, the proportion of total fish present which were caught at the different time periods throughout the experiments.

Sasaki, T. 1974. On the larvae of three species of rockfish genus Sebastes in Hokkaido. Bull. Fac. Fish. Hokkaido Univ. 25(3):169-173.

Sasaki, T. 1976. The larvae of two Scorpaenid fishes Sebastes wakiyai and Sebastes iracundus. Bull. Jpn. Soc. Sci. Fish. 42(12):1353-1356.

The larvae collected from 2 mature females of S. wakiyai and S. iracundus were examined. The size of these larvae when released were 2.9-3.2 mm TL [total length] in S. wakiyai and 4.2-4.9 mm TL in S. iracundus. It was easy to identify these larvae from pigment character and body size. Comparison with 3 other species [S. steindachaeri, S. schlegeli and S. taczanowskii] of rockfishes from Hokkaido [Japan] showed that larvae of these 2 spp. had specific pigment patterns useful for identification.

Sasaki, T. 1977. The urogenital papilla of the tube-snout, Aulichthys japonicus. Jap. J. Ichthyol. 24(3):161-166.

The structure of the urogenital papilla of the oviparous fish, A.japonicus, was observed and the function of the organ was discussed. The epithelium, corium and layer striated muscle place continuously from the peripheral to central portion of the papilla. Although the origin of the papilla in this species appears to be the same as that of ovoviviparous rockfishes, Sebastes and Sebastiscus, the internal structure of the former shows marked differences from that of rockfishes.

Sasaki, T., and T. Igarashi. 1974. Seasonal changes of the testis and the spermatogenesis of Sebastes vulpes. Bull. Fac. Fish. Hokkaido Univ. 25(2):100-106.

Sasaki, T., and K. Sakamoto. 1977. Karyotype of the rockfish, Sebastes taczanowskii Steindachner. Chromosome Inf. Serv. 22:7-8.

The somatic chromosomes of a common species of rockfish, S. taczanowskii (Scorpaenidae) are described. The diploid chromosome number was determined as 48. No heteromorphic chromosome pairs, suggestive of sex elements, were observed.

Sato, Y., and M. Minokawa. 1978. Mercury content of fish and bottom mud from Sanriku coastal waters in northeastern Japan. J. Food. Hyg. Soc. Jap. 19(4):357-363.

The high mercuric level found in Menuke (red snapper, Sebastes iracundus) and Suzuki (common sea bass, Lateolabrax japonicus), from the Japanese Sanriku coastal waters was reported in 1973. Judging from the habit of these fishes, the authors considered both the inshore and 'x offshore to

be polluted by mercury and performed studies to confirm this possibility and to locate the central area of mercury pollution. (1) Inshore: the mercuric pollution level of 5 adjacent bays was studied preliminarily by survey of bottom mud, and then by a comparison of the mean mercury level of fish (Ainame, kelp greenling) with regressions of the mercury level on the weight basis. The results indicated all the bays to be polluted with mercury, and Kamaishi Bay to be most highly polluted. (2) Offshore: all fish and shellfish (10 species) 6 miles off Miyako were found to be polluted with mercury and bigger fish tended to show a higher mercury content. (3) Comparison with other coastal areas: upon comparing the mean mercury level and the regressions of mercury level per weight of fish (mackerel) in reference to its seasonal migration, the mercury pollution of this coastal area was found to be higher than that of other coastal areas.

Sawyer, F. M., A. V. Cardello, P. A. Prell, E. A. Johnson, R. A. Segars, O. Maller, and J. Kapsalis. 1984. Sensory and instrumental evaluation of snapper and rockfish species. J. Food Sci. 49(3):727-733.

Sensory and instrumental measures were made of the edibility characteristics of 18 fish species from the families Lutjanidae and Scorpaenidae. Descriptive sensory analysis and cluster analysis of the data showed Lutjanidae and Scorpaenidae families to differ in texture, but not in flavor. Lutjanidae species were less flaky, less fibrous, less firm and less chewy than the Scorpaenidae species. Only Atlantic Ocean Perch (Sebastes marinus), Longspinethornyhead (Sebastolobus altivelis), and Shortspinethornyhead (S. alascanus), were more similar in texture to the Lutjanidae species than to their own family, Scorpaenidae. Consumer data revealed a similar separation of family groups on the basis of texture, but not flavor. Sensory and instrumental data showed good correlations between sensory hardness and chewiness and the instrumental parameter of maximum shear stress ($r = 0.86$ and 0.84, respectively).

Schaefer, K. M. 1975. Food of the Black Rockfish Sebastes melanops (Girard 1856). Research project at Humboldt State University, Arcata, Calif.

The stomachs of 40 black rockfish, collected during the spring of 1978 contained the crab megalops (Cancer magister), the ctenophore (Pleurobrachia), various fishes, amphipods, isopods, and other types of organisms. These fish came from Patricks Point, Trinidad, and Blunts Reef, and were in the size range from 300-500 mm total length.

Schiller, K., and E. Schulz. 1970. The effect of fish species and production process on the ingredients and quality of fish meals. Landwirt. Forsch. 23(2):109-123.

Schmidt, V. F. 1975. On the reproduction in redfish. Fish. Res. Board Can. Transl. Ser. 3341.

Schoene, R., and K. H. Martin. 1977. Fishery biology studies on the blue whiting on the 28th (73) voyage. Inf. Fischwirtsch. 24(6):200-204.

The results of the 28th (73) voyage of the FFS 'Walther Herwig' are reported. These results concentrate on the fishery biological work on the north Atlantic stocks of redfish and blue whiting. An analysis on the length composition and the distribution of blue whiting in the northeast Atlantic is conducted.

Schultz, L. P. 1938. Keys to the fishes of Washington, Oregon, and closely adjoining regions. Univ. Wash. Publ. Biol. 2(4):103-228.

Schultz, L. P., and A. C. DeLacey. 1936. Fishes of the American Northwest. A catalog of the fishes of Washington and Oregon, with distributional records and a bibliography. J. Pan-Pac. Res. Inst. 11(1-4):1-45.

Scott, W. B., and S. N. Tibbo. 1974. Food and Feeding Habits of Swordfish, Xiphias gladius, Linnaeus, in the Northwest Atlantic Ocean. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF 675:138-141.

Food and feeding habits of swordfish were studied by examining stomachs of 141 individuals captured from July to October 1971 between the Grand Bank and the southeast part of Georges Bank in the Northwest Atlantic Ocean. A wide variety of fish species made up about 80% of the diet; the remainder was squid. Species and size composition of food fishes depended on the feeding area. Large redfish (Sebastes marinus) were the most important food item in the Western Bank and Grand Bank areas, whereas silver hake (Merluccius bilinearis) made the greatest contribution in the Georges Bank area.

Seeb, Lisa Wishard. 1986. Biochemical systematics and evolution of the Scorpaenid genus Sebastes (electrophoresis, rockfish, speciation, redfish, hybrids). Ph.D. Thesis, Univ. Wash., Seattle, 192 p.

Sekerak, A. D. 1975. Parasites as indicators of populations and species of rockfishes (Sebastes:Scorpaenidae) of the northeastern Pacific Ocean. Ph.D. Thesis, Univ. Calgary, Alberta. 251 p.

Sekerak, A. D., and H. P. Arai. 1973. Helminths of Sebastes alutus,Pisces Teleostei from the northeastern Pacific. Can. J. Zool. 51(4):475-477.

Sekerak, A. D., and H. P. Arai. 1974. A revision of Helicometra and related genera Trematoda opecoelidae including a description of Neohelicometra Sebastes new species. Can. J. Zool. 52(6):707-738.

Sekerak, A. D., and H. P. Arai. 1977. Some metazoan parasites of rockfishes of the genus Sebastes from the northeastern Pacific Ocean. Syesis 10:139-144.

A total of 55 taxa of metazoan parasites was recovered from complete or partial examinations of 691 specimens representing 26 species of rockfishes collected in the northeastern Pacific Ocean. The greatest number of parasite species (at least 37) was recovered from S. alutus), the host collected in the greatest numbers. The parasite groups and the respective minimum number of species of each include: Monogenea (7), Digenea (22), Cestoda (3), Acanthocephala (2), Nematoda (7), Hirudinoidea (1), and Copepoda (13).

Sen, A. R. 1984. Sampling commercial rockfish landings in California. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-45, 95 p.

Sen, A. R. 1986. Methodological problems in sampling commercial rockfish landings. Fish. Bull., U.S. 84(2):409-421.

Shaw, W. 1978. Heidi-J and Nore-Dick groundfish cruise No. 78-1 (July 21-August 11, 1978). Can. Fish. Mar. Serv. Data Rep. 118, 58 p.

A joint Canada-U.S. rockfish trawl survey was conducted during July-August in the Dixon Entrance-Cape Ommaney Region (54-56N Lat.). One Canadian vessel (Freeport) and two U.S. vessels Heidi-J and Nore-Dick were used. The principal commercial species caught were Pacific ocean perch (Sebastes alutus) and Dover sole (Microstomus pacificus). Results of the Freeport cruise were published earlier. For the Heidi-J, maximum catch rates, per 20-fm depth interval were 3,010 lb/hr for Pacific ocean perch (120-139 fm) and 19 lb/hr (140-159 fm) for Dover sole. For the Nore-Dick, maximum catch rates, per 20-fm depth interval were 460 lb/hr for Pacific ocean perch (120-139 fm), and 394 lb/hr (200-219 fm) for Dover sole. For Pacific ocean perch, mean catch rates by 20-fm depth interval, were frequently zero.

Shaw, W., and C. P. Archibald. 1981. Length and age data of rockfishes collected from B. C. coastal waters during 1977, 1978 and 1979. Can. Data Rept. Fish. Aquat. Sci. 289, 119 p.

Shaw, W., D. A. Nagtegaal, C. P. Archibald, and B. M. Leaman. 1981. Rockfish tagging cruises off southwest Vancouver Island (M/V Ocean King) and off northwest Vancouver Island and in Queen Charlotte Sound (M/V Blue Waters) during 1980. Can. Fish. Mar. Serv. Data Rep. 288, 137 p.

In 1980, the Groundfish Program at the Pacific Biological Station conducted two rockfish tagging cruises, concentrating primarily on the yellowtail rockfish (Sebastes flavidus), in commercially important areas off the west coast of Vancouver Island and in Queen Charlotte Sound. The purposes of this study were to develop techniques specific for rockfish, (Sebastes) tagging, determine migration, abundance and growth patterns, and provide additional information to validate rockfish ageing techniques. The first cruise (May 23-June 12), off southwest Vancouver Island, tagged and released 6,540 rockfish of which 2% were double-tagged with "suture" tags. The second cruise, off northwest Vancouver Island and in Queen Charlotte Sound (August 8-22), tagged and released 2,493 rockfish.

Shaw, W., R. M. Wallis, F. W. Mottl, and S. J. Westrheim. 1978. Freeport Groundfish Cruise no. 78-1 (July 21-August 11, 1978). Can. Fish. Mar. Serv. Data Rep. 112, 37 p.

A joint Canada-U.S. rockfish (Sebastes) trawl survey was conducted during July-August in the Dixon Entrance-Cape Ommaney Region (54-56N. lat). Two US vessels and one Canadian vessel Freeport were used. Principal commercial species caught were Pacific ocean perch (Sebastes alutus) and Dover sole (Microstomus pacificus). For the Freeport, maximum catch rates, per 20 fm depth interval were 432 lb/hr for Pacific Ocean perch (149-159 fm), and 325 lb/hr (80-99 fm) for Dover sole.

Shen, Shin-Chieh. 1984. Coastal fishes of Taiwan. National Taiwan University, Taipai, Taiwan. 190 p.

Shenker, Jonathan M. 1985. Biology of neustonic larval and juvenile fishes and crabs off Oregon, 1984 (Anoplopoma fimbria, Cancer magister.). Ph.D. Thesis, Oregon State Univ., Corvallis, 156 p.

Shenouda, S. Y. K., and G. M. Pigott. 1974. Lipid protein interaction during aqueous extraction of fish protein Myosin lipid interaction. J. Food. Sci. 39(4):726-734.

Sherwood, M. J., and A. J. Mearns. 1981. Fate of post larval bottom fishes in a highly urbanized coastal zone. In 2nd ICES (International Council for the Exploration of the Sea) Symposium on the Early Life History of Fish: Recent Studies, Woods Hole, Mass., USA, Apr. 2-5, 1979. Rapp. P-V Reun. Cons. Int. Explor. Mer 178:104-111.

Shestova, L. M., and E. G. Lukmanov. 1983. Biological substantiation of redfish fishery in the Barents Sea. In Council Meeting of the International Council for the Exploration of the Sea, Gothenburg, Sweden, Oct. 10, 1983. ICES-CM-1983/G:23, 21 p.

Shimizu, M., and J. Yamada. 1980. Ultrastructural aspects of yolk absorption in the vitelline syncytium of the embryonic rockfish, Sebastes schlegeli. Jpn. J. Ichthyol. 27(1):56-63.

The vitelline syncytium of the embryonic rockfish, S. schlegeli, was examined by EM. The syncytium encloses the entire yolk mass in the yolksac, separating it from the embryonic body and the circulating fetal blood. Numerous small yolk droplets fused into coagulated masses were detected in the syncytial cytoplasm near the border with the yolk mass. Two structurally different regions were distinguished in the syncytium: one characterized by an extensive network of the smooth surfaced endoplasmic reticulum, numerous mitochondria and a large number of glycogen granules and the other by compactly arranged cisternae of the rough surfaced endoplasmic reticulum and developed Golgi complexes. In some surface areas where the endothelial wall of blood vessels is incomplete and the fetal blood is in direct contact, the syncytium showed finely vacuolated cytoplasm forming an intricate structure between the cytoplasmic processes of the blood cells. These characteristic features of the vitelline syncytium are discussed in view of its functional significance in yolk absorption.

Shiokawa, T. 1962. Growth and maturity of the common rockfish Sebasticus marmoratus Cuvier et Valenciennes. Rec. Oceanogr. Works Japan, Spec. 6:91-102.

Shiokawa, T., and H. Tsukahara. 1961. Studies on the habits of coastal fishes in the Amakusa Islands: Part I: Early life history of the purple rockfish, Sebastes pachycephalus pachycephalus Temminck et Schlegel. Rec. Oceanogr. Wks. Japan Spec. No. 5:123-127.

Shon, T. J., J. S. Bag, and D. O. Soh. 1977. Studies on the shape of fish reefs and the thronging of fish schools. Bull. Korean Fish. Soc. 10(3):179-187.

The shape of artificial fish reefs in the waters of Seogwipo [Korea], and the attraction of fish schools to them were investigated. Two types of reefs were constructed off the coast, i.e., a circular vertical type made of Cryptomeria branches and a parachute type. Current and wind destroyed the vinyl and canvas type reef. One artificial reef which used sand bags attracted 16 spp. of fish from the area. The fish included black rock fish (Sebastes inermis) 13%.

Shrode, Joy B, Kim E. Zebra, and John S. Stephens, Jr. 1982. Ecological significance of temperature tolerance and preference of some inshore California fishes. Trans. Am. Fish. Soc. 111(1):45-51.

Dwarf perch Micrometrus minimus, shiner perch Cymatogaster aggregata, blacksmith Chromis punctipinnis, black perch Embiotoca jacksoni, rainbow seaperch Hypsurus caryi, and calico rockfish Sebastes dalli were collected in a vertical thermal gradient at the breakwater of King Harbor, Redondo Beach, California. Fish were acclimated at the field temperature. Acute preferred temperatures and avoidance temperatures determined in the laboratory were compared with temperatures in the field gradient at which the species were collected or observed by divers. Dwarf and black perch preferred temperatures significantly lower than their field temperatures. Preferred temperatures of the other 4 spp. were consistent with temperatures at their positions in the harbor. Although the field distributions of the 6 spp. are thermally differentiated, those of 2 spp. appear to be determined by factors other than temperature.

Siebenaller, J. F. 1978. Genetic variability in deep-sea fishes of the genus Sebastolobus (Scorpaenidae). In Bruno Battaglia and John Beardmore (editors), Marine organisms, p. 95-122. Plenum Publishing Corp., 1978.

Siebenaller, J. F. 1983. The Ph dependence of the effects of hydrostatic pressure on the M-4 lactate dehydrogenase EC-1.1.1.27 homologues of Scorpaenid fishes. Mar. Biol. Lett. 4(4):233-244.

The pH-dependence of the responses of the apparent (Km) of NADH of M4-LDH (lactate dehydrogenase) homologs to hydrostatic pressure was examined at 5.degree. C. The enzymes for 2 shallow-living fish and 1 deep-living species were purified to homogeneity using affinity chromatography. The LDH homologs have similar apparent Km of NADH values at atmospheric pressure. At elevated pressures at pH 7.5, the Km of NADH values of the LDH homologs of the shallow-living Sebastolobus alascanus and Sebastes melanops increase sharply. The enzyme of the deeper-living Sebastolobus altivelis is much less pressure-sensitive. At atmospheric pressure, the Km of NADH values of all of the LDH homologs are insensitive to pH. For the enzyme of the deeper-living S. altivelis, the Km of NADH at 204 atm is independent of pH. As the pH is increased between pH 8.0 and 9.0, the enzymes of the shallow species show a markedly decreased perturbation by hydrostatic pressure.

Sigmund, N., R. J. Beamish, J. Fargo, G. Kingston, and M. Stocker. 1979. Exploratory bottom trawling for sablefish southwest of Vancouver Island, 1978. Can. Manuscr. Rep. Fish. Mar. Serv. 1517, 49 p.

A moderate catch rate of 668 kg/h of sablefish (Anoplopoma fimbria) was obtained but large incidental catches of Pacific ocean perch (Sebastes alutus) (1521 kg/h) and turbot (Atheresthes stomias) (453 kg/h) were also obtained. Because of this high incidental catch, any trawl fishing for sablefish in the study area would have to be closely monitored if catch quotas existed for any of these incidental species. The modal age for male sablefish was 6 yr and 8 yr for females. Few males >8 yr were found but 41% of the females were >8 yr. However, age determinations using the whole otolith are very difficult and it is quite probable that ages are being underestimated especially for males. Pacific ocean perch ranged in length from 22 to 49 cm and in age from 7 to 28 yr. The number of fish in each age class was similar to a sample collected in 1968 except that the modal age of this sample was 13 yr compared to a modal age of 15 yr in the 1968 sample. In a separate study it was found that ages of Pacific ocean perch may be underestimated for fish over 22 yr old, unless otolith sections are examined.

Sindermann, C. J. 1961. Seriological studies of Atlantic redfish. Fish. Bull., U.S. 61(191):349-354.

Individual variations of erythrocyte antigens have been found in redfish, Sebastes marinus, from the western North Atlantic. Two closely related antigens, tentatively labeled A1 and A2, were demonstrated with specific reagents created by absorptions of rabbit antisera. Each reagent would agglutinate cells of only one antigenic type, so it was possible to identify fish as possessing A1 or A2 antigen. Individuals with the erythrocyte antigen A1 make up more than 75 percent of the Eastport (Maine) redfish population. Since antigen frequencies may vary form one population to another, quantitative studies of each major fishing area should provide further information about discreteness of groups and the extent of their movements.

Singer, Michael M. 1982. Food habit and activity patterns of juvenile rockfishes (Sebastes) in a central California kelp forest. M.A. Thesis, Calif. State Univ., San Jose. 75 p.

Singer, Michael M. 1985. Food habits of juvenile rockfishes (Sebastes) in a central California kelp forest. Fish. Bull., U.S. 83(4):531-542.

The diets and feeling morphology of juveniles of seven rockfish species (Scorpaenidae:Sebastes) were investigated in a kelp forest at Stillwater Cove, Carmel Bay, CA. The seven species could be divided into two groups, those which fed primarily on open water prey in the water column and those which fed on substrate-associated prey. Substrate-associated prey were generally larger than open water prey and were eaten by predators with relatively larger heads and mouths and shorter gill rakers. Comparison of juvenile diets and foraging patterns with those of adults showed that both foraged in similar manners and in the same general habitats. The absence of aggressive interactions within or among species and high intraspecific variability of foraging patterns suggests that little interference or exploitative competition was present.

Six, Lawrence D, and Howard F. Horton. 1977. Analysis of age determination methods for yellowtail rockfish, canary rockfish, and black rockfish off Oregon. Fish. Bull., U.S. 75(2):405-414.

Age determination methods and their application are presented for yellowtail rockfish Sebastes flavidus, canary rockfish S. pinniger and black rockfish S. melanops collected off Oregon [USA] during 1972-75. Of 25 anatomical structures examined, those compared for consistency of readings were the anal fin pterygiophore, opercle, otolith, scale and vertebra. Various heating, staining and microscopy techniques were applied to otoliths and scales with little success. The effect of deviation between otolith readings on survival estimates and age-length relationships is discussed. Consistency of otolith readings was generally superior to other structures for these 3 spp. For yellowtail, canary and black rockfishes, respectively, 71, 76 and 76% of 2 independent otolith readings deviated by no more than .+-. 1 assumed annulus. Consistency of otolith readings for all 3 spp. decreased with age. Even though age estimates were not completely consistent, Chapman-Robson and catch curve estimates of survival, as well as age-length relationships, each derived from 2 readings of the same set of otoliths, were not significantly different at the 95% level for the 3 spp. Age-length relationships are given for male and female yellowtail, canary and black rockfishes.

Skalkin, V. A. 1968. Diet of rockfish in the Bering Sea. In P. A. Moiseev (editor), Soviet fisheries investigations in the northeast Pacific. Part II. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inf., Springfield, VA, USA. TT 67-51204:159-175.

Skalkin, V. A. 1972. On the causes of variations in size composition of trawl hauls of Bering Sea rockfish. In P. A. Moiseev, (editor) Soviet fisheries investigations in the northeast Pacific, Part V. U.S. Dep. Commer., Clearinghouse Fed. Sci. Tech. Inform. Serv., Springfield, VA, USA. TT 71-50127:287-291.

Skreslet, S. 1979. The fish fauna of Skjomen, a fjord of north Norway. Astarte 11(2):67-78.

The fish fauna of Skjomen was sampled with a shrimp trawl at monthly or bimonthly intervals from Nov. 1969-May 1973, to describe its composition and the variations which normally occur. total of 24 spp. of fish were recorded, but only 8 [Gadus morhua, Melanogrammus aeglefinus, Boreogadus esmarkii, Gadiculus thori, Lumpenus maculatus, Sebastes marinus, Hippoglossoides platessoides and Glyptocephalus cynoglossus] were classified as regular elements of the fauna. The composition of the fish fauna varied considerably and rather irregularly due to a combination of migrations and specific differences in recruitment to the stocks.

Smidt, E. 1981. The wolffish fishery at West Greenland. Northwest Atl. Fish. Organ. Sci. Counc. Stud. 1:35-39.

Exploitation of wolffish off west Greenland involves two different fisheries on two different species, an inshore longline fishery mainly for spotted wolffish (Anarhichas minor), and an international trawl fishery for cod (Gadus morhua) and redfish (Sebastes spp.) in which Atlantic (or striped) wolffish (A. lupus) occurs as by catch. A history of the fishery statistics is given and management is considered.

Smith, Albert C. 1971. Protein differences in the eye lens cortex and nucleus of individual channel rockfish, Sebastolobus alascanus. Calif. Fish Game 57(3):177-181.

Smith, G. J. D., and D. E. Gaskin. 1974. The diet of harbor porpoises Phocoena phocoena in coastal waters of eastern Canada with special reference to the Bay of Fundy. Can. J. Zool. 52(6):777-782.

Smith, J. 1977. Catch and effort statistics of the Canadian groundfish fishery on the Pacific coast in 1976. Can. Fish. Mar. Serv. Tech. Rep. 736, 83 p.

Smith, J. E. 1978. Catch and effort statistics of the Canadian groundfish fishery on the Pacific Coast in 1977. Can. Fish. Mar. Serv. Tech. Rep. 835, 85 p.

Statistics are presented and shown by major and minor statistical areas by month, in both pounds and metric tons. Total landings in 1977 were 61 million pounds (27,659 m.t.), an increase of 6% from 1976. The bulk (90%) of the catch was taken by trawl gear. The main species landed was Pacific cod, which constituted 28% of the total landings.

Smith, J. E. 1980. Catch and effort statistics of the Canadian groundfish fishery on the Pacific coast in 1979. Can. Tech. Rep. Fish. Aquat. Sci. 961, 93 p.

Catch and effort statistics for the Canadian groundfish fishery (excluding halibut) on the Pacific coast in 1979 are presented. Statistics are shown by minor areas, major areas and INPFC areas in metric tons (t). Total landings in 1979 were 38,485 t, an increase of 21% from 1978. The bulk (83%) of the catch was taken by trawl gear. The main species landed were Gadus macrocephalus, Squalus acanthias, Theragra chalcogramma, Anaplopoma fimbria, Ophiodon elongatus and Sebastes spp.

Smith, J. E. 1981. Catch and effort statistics of the Canadian groundfish fishery on the Pacific coast in 1980. Can. Tech. Rep. Fish. Aquat. Sci. 1032, 94 p.

Catch and effort statistics for the Canadian groundfish fishery (excluding halibut) on the Pacific coast in 1980 are presented. Statistics are shown by minor areas, major areas and INPFC areas, in metric tons (t). Total landings in 1980 were 39,139 t, slightly higher than 1979. The bulk (84%) of the catch was taken by trawl gear. The main species landed were Pacific cod, Gadus macrocephalus, Pacific ocean perch, Sebastes alutus, dogfish, Squalus acanthiasis, sablefish, Anoplopoma fimbria, lingcod, Ophiodon elongatus and various rockfish (Sebastes) species.

Smith, J. E., and C. R. Forrester. 1973. Depth distribution of catch by Canadian otter trawlers. Fish. Res. Board Can. Manuscr. Rep. 1239, 141 p.

Smith, M. 1980. Some like it hot: Influence of upwelling on the distribution of subtidal fishes off Punta Banda, Baja California. In Annual meeting of the American Society of Zoologists, American Microscopical Society, American Society of Limnology and Oceanography, Animal Behavior Society, Canadian Society of Zoologists, Ecological Society of America, Society of Systematic Zoology, and the Western Society of Naturalists, Seattle, Wash., Dec. 27-30, 1980. Am. Zool. 20(4):948.

The fish assemblage in an area of intense, localized upwelling on the south side of Punta Banda differs from that on the warmer, north side, less than 2 km away. Underwater transects indicate that Chromis punctipinnis numerically dominates the cooler, south side. Several species as yet found exclusively on the northern side of Punta Banda include Lythrypnus dalli and Paralabrax nebulifer; those found only on the south side include Embiotoca lateralis, Sebastes mystinus, S. pinniger and S. chrysomelas.

Smith, M. S., D. Davenport, W. R. Harling, and S. J. Westrheim. 1972. Size and age composition of Pacific ocean perch, Sebastes alutus, in British Columbia trawl landings. Fish. Res. Board Can. Manuscr. Rep. 1199, 43 p.

Snytko, V. A. 1973. Biology and peculiarities of distribution of Pacific ocean perch, Sebastes alutus G., in Vancouver-Oregon area. Fish. Res. Board Can. Transl. Ser. 2805.

Snytko, V. A. 1973. Reproduction of the Pacific ocean perch in the Vancouver Island region. Fish. Res. Board Can. Transl. Ser. 2548.

Snytko, V. A. 1973. Sebastes alutus G. of Vancouver-Oregon region (catch-biological characteristics). Fish. Res. Board Can. Transl. Ser. 2431.

Snytko, V. A. 1986. New locations of captures of Sebastinae Spp. in the Northern Pacific. Vopr. Ikhtiol. 26(3):381-387.

Snytko, V. A., and L. A. Borets. 1972. Some data on fecundity of ocean perch in the Vancouver-Oregon region. Fish. Res. Board Can. Transl. Ser. 2502.

Snytko, V. A., and N. S. Fadeev. 1974. Data on distribution of some species of sea perches along the Pacific coast of North America during the summer-autumn season. Fish. Res. Board Can. Transl. Ser. 3436.

Snytko, V. A., and V. V. Fedorov. 1974. New data on the distribution of Scorpaenid fishes of the subfamily Sebastinae and notes on their biology. J. Ichthyol. 14(6):811-818.

New data are given on the distribution of Helicolenus hilgendorfi, Sebasticus sp.n., Sebastes matsubarae, S. aleutianus, S. baramenuke, S. flameus, S. iracundus, S. borealis, S. reedi, S. itinus, S. itinus, S. scytropus, S. brevispinis, S. ciliatus, S. polyspinis, S. variegatus and Sebastes sp. n. It is possible that some of the species along the American coast are extending their range at the expense of the ecological niche of S. alutus, left vacant as a result of overfishing for this fish.

Somerton, D. 1979. Competitive interaction of walleye pollock and Pacific ocean perch in the northern Gulf of Alaska. In S. Lipovsky, and C. A. Simenstad (editors), Gutshop '78. Fish Food Habits Studies. Proceedings of the Second Pacific Northwest Technical Workshop, Maple Valley, Wash., Wash. Sea Grant Prog., Univ. Wash., Seattle. 163 p.

Sorokin, V. P. 1960. Biology of reproduction of the red fishes Sebastes marinus L. and Sebastes mentella Travin in the Barents and Norwegian Seas. Fish. Res. Board Can. Transl. Ser. 308.

Sorokin, V. P. 1960. On the migration pattern of the redfish (Sebastes mentella Travin) of the Bear Island/Spitsbergen population in 1960. Ann. Biol. 17:96-97.

Sorokin, V. P. 1961. The redfish; gametogenesis and migration of the Sebastes marinus (L.) and Sebastes mentella Travin. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:245-250.

Sorokin, V. P. 1964. On a possible method of calculating the absolute abundance of the commercial population of Sebastes mentella Travin in the Barents Sea. Rapp. P.-V. Reun. Cons. Int. Explor. Mer 155:215-216.

Sorokin, V. P. 1965. On the influence of the fishery upon the population structure of redfish (Sebastes marinus L. and Sebastes mentella Travin). J. Cons. Cons. Int. Explor. Mer 28(3):405-409.

Sorokin, V. P. 1967. Some data on gametogenesis and sexual cycles of the Pacific Ocean Scorpaenidae. Fish. Res. Board Can. Transl. Ser. 1137.

South. Calif. Coastal Water Res. Proj. 1974. A Comparative trawl survey of three areas of heavy waste discharge. Rep. Monogr. 215, 76 p.

Spinelli, J., and B. J. Koury. 1981. Some new observations on the pathways of formation of Di Methylamine in fish muscle and liver. J. Agric. Food Chem. 29(2):327-331.

Dimethylamine (DMA) formed at a more rapid rate in frozen Pacific whiting [Merluccius productus] muscle that had been preheated (40-60.degree. C) than in unheated muscle. DMA formed during frozen storage and not during the heating cycle, indicating that its formation was not the direct result of enzymic activity on TMAO [trimethylamine oxide] but rather to the reaction between TMAO and compounds that were formed during the heating cycle. Catabolites of cysteine and Fe2+ catalyzed the degradation of TMAO to DMA: cysteinesulfinic acid hypotaurine taurine. In vitro studies showed that cysteine did not catalyze the degradation of TMAO to DMA but it accelerated the formation of DMA in fish [including rockfish (Sebastes ruberrimus) and Dover sole (Microstomus pacificus) liver homogenates.

Squires, H. J. 1966. Reproduction in Sphyrion lumpi, a copepod parasitic on redfish (Sebastes spp.). J. Fish. Res. Board Can. 23(4):521-526.

Stahl-Johnson, K. L. 1984. Rearing and development of larval Sebastes caurinus (Copper rockfish) and S. auriculatus (Brown rockfish) from the northeastern Pacific. M.S. Thesis, Univ. Wash., Seattle, 218 p.

Stahl-Johnson, K. L. 1985. Descriptive characteristics of reared Sebastes caurinus and Sebastes auriculatus larvae. In Meeting on Descriptions of Early Life History Stages of Selected Fishes held at the 3rd International Symposium on the Early Life History of Fishes and 8th Annual Larval Fish Conference, Vancouver, B.C., Canada, May 1984. Can. Tech. Rep. Fish. Aquat. Sci. 1359:65-76.

Stanley, Richard D. 1987. A comparison of age estimates derived from the surface and crossection methods of otolith reading for Pacific ocean perch. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 187-196. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Stanley, Richard D. 1987. Use of a length frequency simulator to explore the information content in length data for a long-lived species, Silvergray rockfish (Sebastes brevispinis). In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 155-170. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Starks, Edwin C. 1911. Results of and ichthyological survey about the San Juan Islands, Washington. Ann. Carnegie Mus. 7(2):162-213.

Starks, Edwin C. 1921. A key to the families of marine fishes of the west coast. Calif. Fish Game Fish Bull. 5, 16 p.

Starks, Edwin C., and E. L. Morris. 1907. The marine fishes of southern California. Univ. Calif. Publ. Zool. 3(11):159-251.

Stauffer, G. 1983. Condition of groundfish resources of the Gulf of Alaska region as assessed in 1983. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 84-02, 193 p.

Stede, M., and J. Stockemer. 1986. Biogenic amines in marine fish. Lebensm-Wiss. Technol. 19(4):283-287.

The analyses of samples of four species of fish from the catches of the sea and coastal fisheries have shown that trace amounts or very low concentration of biogenic amine are present when the catch has been efficiently cooled in the vessel holds using ice. In case of inadequate cooling, down to only 7.degree. C or more, there is an obvious increase in the form of biogenic amines; in particular, the formation of cadaverine reaches a level of several hundred mg/kg. The correlations between the formation of biogenic amines, corresponding free amino acids microflora, temperature and toxicological aspects are discussed. It is pointed out that the fish from that catches which are fit for human consumption contain virtually no histamine. Cadaverine, which was found in very low concentrations in the red fish (Sebastes marinus L.), is of no importance toxicologically.

Stocker, M. (Editor). 1981. Groundfish stock assessments off the west coast of Canada in 1981 and recommended total allowable catches for 1982. Fish. Res. Board Can. Manuscr. Rep. 1626, 282 p.

Recommended Total Allowable Catches (TACs) for 1982, are included for commercially important groundfish stocks off British Columbia, by statistical area (3C, 3D, 4B, 5A, 5C and 5D, and 5E). These TACs are based on the best available information but many are not considered to be precise values, due to the limited information available. Total (all species, all areas) recommended TAC for 1982 is 77,160 t, compared to 86,515 t for 1981. TAC estimates for principal species in 1982 (1981 in parentheses) were: Pacific hake, 45,000 t (35,000 t); dogfish, 9,000 t (9,000 t); Pacific Ocean perch, 3,900 t (4,400 t); sablefish, 3,500 t (3,500 t); yellowtail rockfish, 2,350 t (3,050 t); and arrowtooth flounder 2,200 t (3,150 t). No TACs are recommended at this time for Pacific cod and walleye pollock (except for Area 50). For all other species, recommended TACs for 1982 were less than 1,850 t each. All-nations all-species landings form B.C. waters totaled 57,084 t in 1980, and 52,483 t in 1979.

Strachan, A. R. 1965. New southern record for the silvergray rockfish, Sebastodes brevispinis (Bean). Calif. Fish Game 51(3):220-221.

Sunde, L. A., and C. C. Lindsey. 1958. Revised key to the rockfishes (Scorpaenidae) British Columbia. Univ. British Columbia Inst. Fish., Mus. Contrib. 1, 6 p.

Surkova, E. I. 1961. Redfish, growth and age. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:285-290.

The increasing importance of redfish in northern fisheries during the recent years has intensified the studies of this highly interesting fish. Along with other biological problems, the study of the growth and age composition of the redfish stocks has acquired especial significance.

Sutcliffe, W. H., Jr., K. Drinkwater, and B. S. Muir. 1977. Correlations of fish catch and environmental factors in the Gulf of Maine. J. Fish. Res. Board Can. 34(1):19-30.

In an investigation of catches of 17 commercial marine species of fish and shellfish [Alosa pseudoharengus, Peprilus triacanthus, Gadus morhua, Clupea harengus harengus, Brevoortia tyrannus, Sebastes marinus, Merluccius bilinearis, Morone saxatilis, Limanda ferruginea, Mercenaria mercenaria, Mya arenaria, Placopecten magellanicus, Homarus americanus, Pandalus borealis, Glycera dibranchiata, Scomber scombrus, Hippoglossus hippoglossus] from the Gulf of Maine, 10 showed statistically significant correlations with sea temperatures at St. Andrews, New Brunswick, Canada or Boothbay Harbor, Maine [USA]. Most fish records contained at least 40 yr of data. Descriptive equations are produced for 4 spp. based first on the correlation between catch and sea temperature and second on the correlation between catch and sea temperature allowing for fishing effort. Inclusion of fishing effort, not surprisingly, improved.

Suzuki, K. 1984. A light and electron microscope study on the Phagocytosis of Leukocytes in rockfish Sebastes schlegeli and rainbow trout Salmo gairdneri. Bull. Jpn. Soc. Sci. Fish. 50(8):1305-1316.

Identification and characterization of leukocytes in 2 teleosts, rockfish S. schlegeli and rainbow trout S. gairdneri were performed based on their morphology and phagocytic ability with bacteria, Escherichia coli and Staphylococcus aureus and zymosan particles. Cytochemical test for peroxidase was also applied to the leukocytes. Light microscopy and EM revealed that both neutrophils and monocytes in the 2 teleosts actively phagocytized bacteria. Thrombocytes ingested bacteria, but their phagocytic activity was very low. The process of phagocytosis was

observed with neutrophils and monocytes. Fusion of cytoplasmic granules into phagosomes was observed. Large phagosomes were present in neutrophils but entirely (rockfish) or almost absent (rainbow trout) in monocytes. Cytoplasmic granules in neutrophils of both fishes were positive for peroxidase. The peroxidase reaction product was also observed in phagosomes.

Suzuki, K., M. Kusakari, M. Shimizu, and J. Yamada. 1983. Hematological studies of a rockfish Sebastes schlegeli 1. classification of blood cells in circulating blood and hematopoietic organs. Sci. Rep. Hokkaido Fish. Exp. Stn. 29:201-216.

Classification of blood cells of a rockfish, S. schlegeli, was performed based on their morphological and histochemical characteristics in smear preparations of circulating blood and of hematopoietic organs, the thymus, the head kidney and the spleen. The results obtained are as follows: In the circulating blood were identified immature, mature and senile erythrocytes as the red blood cell series, and lymphocytes, thrombocytes, monocytes and neutrophils as the leukocyte series. Immature erythrocytes were divided into basophils and polychromatics, and senile erythrocytes into deformed and disintegrated types. Among mature erythrocytes, those having indented nuclei were identified as abnormal mature erythrocytes.

Suzuki, T., K. Ouchi, and K. Ikehara. 1978. On the determination of the age and growth of Sebastes thompsoni. Bull. Jpn. Sea Reg. Fish. Res. Lab. 29:111-120.

The age and growth of S. thompsoni (Jordan et Hubbs) were studied with the aid of otoliths of 389 specimens collected from the coasts of Niigata Prefecture [Japan] from 1973-1974. The mark on the otolith was defined as the boundary from the outer margin of the opaque zone to the transparent one. The long axis on the otolith was used as the measuring axis. The relationship between otolith-size (R) and fork-length (L) was linear and were expressed by a regression equation. The standard mark-size of each age group was obtained from each sampling data. Walford plot was a linear regression with excellent results. These marks were formed at the same time interval. The marginal growth index changed seasonally, attaining the minimum value in Aug. These marks were formed during that period 1 .times. a yr. The spawning season of this species was from Jan.-March. The 1st mark was formed in the next Aug. after hatching.

Swartzman, Gordon, Robert Francis, Anne Hollowed, and Patrick Sullivan. 1985. Adaptive environmental assessment and management of the Pacific Coast Sebastes fishery. U.S. Dep. Commer., NOAA, NMFS, Northwest & Alaska Fisheries Center, Processed Rept. 85-09, 76 p.

Tabeta, O., and H. Tsukahara. 1969. Ecological studies of fishes stranded upon the beach along the Tsushima current II Observations during the winter months of 1966 in northern Kyushu Japan Cololabis saira Sebastes SP Bregmaceros Maurolicus japonicus Ammodytes personatus mortality factor. Bull. Jpn. Soc. Sci. Fish. 35(1):43-54.

Tagart, Jack V. 1984. Update of the yellowtail rockfish status of stocks. In Pacific Fishery Management Council, Status of Pacific Coast groundfish fishery and recommendations for management in 1985. Appendix 8, p. 1-38. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Tagart, Jack V. 1985. Status of the yellowtail rockfish stocks in the International North Pacific Fishery Commission Vancouver and Columbia areas in 1985. In Pacific Fishery Management Council, status of the Pacific Coast groundfish fishery through 1985 and recommended acceptable biological catches for 1986, Appendix 6, p. 1-30. Pacific Fishery Management Council, 526 SW Mill St., Portland, Oregon 97201.

Tagart, Jack V. 1987. Description of the Washington state fishery for widow rockfish. In W. H. Lenarz and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 11-12. U.S. Dep. Commer., NOAA Tech. Rept. NMFS 48.

Takada, Y., and T. Noguchi. 1983. Degradation of urate in liver peroxisomes association of allantoinase EC-3.5.2.5 with allantoicase EC-3.5.3.4 in amphibian liver but not in fish and invertebrate liver. J. Biol. Chem. 258(8):4762-4764.

Allantoinase and allantoicase were copurified from frog (Rana catesbeiana) liver. The ratio of the 2 enzyme activities remained constant during purification and was unchanged by a variety of treatments of the purified enzyme. Allantoinase and allantoicase are probably located in the same protein. The 2 hepatic enzyme activities are also associated with the same protein in other frogs (Xenopus laevis and Rana nigromaculata), tadpoles (R. catesbeiana) and newts (Triturus pyrrhogaster). Allantoinase and allantoicase were different proteins in marine fish [Pnematophorus japonicus, Sebastes inermis, Madara broughtoni, Sardinops melanosticta] and invertebrate liver.

Takai, T., and T. Fukunaga. 1971. The life history of an Ovo-viviparous Scorpaenid fish, Sebastes longispinis (Matsubara) I: Egg and larval stages. J. Shimonoseki Univ. Fish. 20(2):91-95.

Takeo, K. 1969. Studies on Aldolases of fishes and other marine animals by disc electrophoresis. Physico. Chem. Biol. 14(2):179-184.

Talent, L. G. 1984. Food habits of wintering Brandts cormorants, Phalacrocorax penicillatus. Wilson Bull. 96(1):130-134.

Tanaka, M., M. Yoshimizu, M. Kusakari, and T. Kimura. 1984. Lymphocystis disease in Kurosoi Sebastes schlegeli and Hirame Paralichthys olivaceus in Hokkaido, Japan. Bull. Jpn. Soc. Sci. Fish. 50(1):37-42.

Lymphocystis disease of Kurosoi, S. schlegeli, and cultured and wild Hirame, P. olivaceus, in Hokkaido (Japan) was studied by light microscopy and EM. Seasonal variation in the incidence of lymphocystis was recognized and the incidence of lymphocystis was greatest in July (37%) in the cultured Hirame. Lymphocystis cells were observed mainly on the fins of Kurosoi and were observed in various places on the body surface of Hirame. Lymphocystis cells showed cellular hypertrophy, cell enclosure by a distinctive hyaline capsule, enlarged nucleus and granular-appearing cytoplasm with prominent inclusions. The virus particles were polyhedral, represented as hexagonal or pentagonal profiles in sections. They are .apprx. 273 nm in mean diameter in Kurosoi and .apprx. 259 nm in mean diameter in both cultured and wild Hirame. They may often be seen in crystalline array and they are always located in the cytoplasm. Virogenic particles were observed around the inclusion body seen by light microscopy.

Taning, A. V. 1961. Larval and postlarval stages of Sebastes species and Helicolenus dactylopterus. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:234-240.

Taylor, F. H. C. 1968. The relationship of midwater trawl catches to sound scattering layers off the coast of northern British Columbia. J. Fish. Res. Board Can. 25(3):457-472.

Taylor, F. H. C. 1984. Distribution and abundance of herring and other pelagic fish off the west coast of Vancouver Island in September, 1981. Can. Tech. Rep. Fish. Aquat. Sci. 1333, 48 p.

A hydroacoustic and fishing survey was carried out in September, 1981, to determine the distribution and abundance of herring Clupea harengus off the west coast of Vancouver Island from the Juan de Fuca Trench to the Ucluth Peninsula. The major herring concentration lay along the outer edge of the continental shelf extending inshore to the Finger Bank and Southeast Corner. There were estimated to be 61,700 t in this region and on Swiftsure Bank. The largest concentration lay between Nitinat and Barkley Canyons. Only about 11% of the herring occurred south of the U.S.-Canada fishing boundary, compared to 46% in September, 1980. No schools of herring were found beyond the edge of the continental shelf.

Taylor, F. H. C., and R. Kieser. 1981. Hydroacoustic and fishing surveys of Queen Charlotte Sound, January 26-February 10, and October 2-21, 1978. Can. Manuscr. Rep. Fish. Aquat. Sci. 1605, 92 p.

The G.B. Reed conducted hydroacoustic surveys of Queen Charlotte Sound from January 26-February 10, and October 2-21, 1978 to determine the distribution and abundance of pelagic and semi-demersal fish, particularly rockfishes (Sebastes spp.) other than Pacific ocean perch (Sialutus). Day and night surveys were made with priority given to the former. The chartered trawlers, Artic harvester and Blue Waters fished the same areas at the same time to determine the species composition of the midwater fish stocks and to obtain biological information about them.

Taylor, F. H. C., and R. Kieser. 1982. Distribution and abundance of herring and other pelagic fish off the west coast of Vancouver Island in September, November, 1980, and March, 1981, and in the Strait of Georgia in November, 1980. Can. Manuscr. Rep. Fish. Aquat. Sci. 1682, 173 p.

Hydroacoustic cruises were carried out in September, November, 1980, and March, 1981, to determine the distribution and abundance of herring off the west coast of Vancouver Island. In all months most of the herring (Clupea harengus pallasi) occurred south of Amphitrite Point, mainly along the outer edge of the shelf. In September 67,230 t of hake (Merluccius productus) and 31,880 t of pollock (Pollachius virens) were found in a broad band from Cape Beale Spit to the Juan de Fuca Trench. Dogfish (Squalus acanthias) increased from 10, 120 t in September to 33,455 t in November and 38,590 t in March. Yellowtail and redstripe rockfish (Sebastes) occurred in small quantities in September and November.

Teeny, F. M., and David Miyauchi. 1972. Preparation and utilization of frozen blocks of minced black rockfish muscle. J. Milk Food Technol. 35(7):414-417.

Black rockfish, which deteriorates in quality rapidly during frozen storage and thus is not fully utilized, was selected to study the concept of using the minced muscle obtained from the meat-bone separator machine to prepare modified fish blocks. The minced muscle was blended with several ingredients, which were added to protect the fish blocks against rancidity and to improve texture and flavor. These blocks had a storage life of 9 to 12 months at 0 F. Raw breaded fish sticks prepared from various lots of modified blocks that were held in frozen storage at 0 F for 6 to 12 months had an additional storage life of almost 6 months at 0.F. (Author).

Templeman, Wilfred. 1959. Redfish distribution in the North Atlantic. Bull. Fish. Res. Board Can. 120, 173p.

The distribution of Sebastes marinus and to a much lesser degree that of Sebastes viviparus are described. Although Sebastes marinus may be divided into Sebastes marinus marinus, the ordinary redfish, and Sebastes marinus mentella, the deep-water redfish, these two subspecies have not, as a rule, been differentiated in the available statistical and other data. Therefore, with regard to most of the information, it is possible to consider only the distribution of Sebastes marinus including both subspecies. The name redfish in this abstract refers to Sebastes marinus.

Templeman, Wilfred. 1967. Adult redfish, Sebastes mentella, pelagic over oceanic depths in the Labrador Sea. J. Fish. Res. Board Can. 24(6)1275-1290.

Templeman, Wilfred. 1973. First records of the gymno blastic hydroid Ichthyocodium sarcotretic on the copepod Sphyrion lumpi from redfish of the northwest Atlantic. J. Fish. Res. Board Can. 30(11):1655-1660.

Templeman, Wilfred. 1980. Incidence of subcaudal melanophores in pre-extrusion larvae of redfish species in the Newfoundland-Labrador area Canada. J. Northwest Atl. Fish. Sci. 1:7-19.

Pre-extrusion larvae of female redfish from the Newfoundland-Labrador area in 1958-1966 were examined for the presence or absence of subcaudal melanophores. The larval samples from the sharp-beaked mentella-type redfish were readily separated into 2 groups, one with all or nearly all of the larvae possessing subcaudal melanophores and recognized as Sebastes fasciatus, and the other tending to have a small fraction or none of the larvae with these melanophores and recognized as S. mentella. The larvae of S. fasciatus had on the average a greater number of subcaudal melanophores which were also usually larger than those of S. mentella. The presence of these melanophores in many of the North American S. mentella contrasts with the reported absence of subcaudal melanophores in larvae of Icelandic and Northeast Atlantic and of the North Atlantic oceanic populations of S. mentella. The female parents of larvae assigned to S. fasciatus had significantly lower vertebral, anal fin-ray and dorsal fin-ray numbers than those of larvae assigned to S. mentella.

Templeman, Wilfred, and T. K. Pitt. 1961. Vertebral numbers of redfish, Sebastes marinus (L.) in the Northwest Atlantic, 1947-1954. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:56-89.

Templeman, Wilfred, and E. J. Sandeman. 1959. Variations in caudal pigmentation in late-stage pre-extrusion larvae from marinus- and mentellas-type female redfish from the Newfoundland area. J. Fish. Res. Board Can. 16(6):763-789.

Templeman, Wilfred, and H. J. Squires. 1960. Incidence and distribution of infestation by Sphyrion lumpi (Kroyer) on the redfish, Sebastes marinus (L.), of the western North Atlantic. J. Fish. Res. Board Can. 17(1):9-31.

Thomas, David H. 1985. Status of California's Bocaccio stock. In Pacific Fishery Management Council, status of the Pacific Coast groundfish fishery through 1985 and recommended acceptable biological catches for 1986, Appendix 4, p. 1-9. Pacific Fishery Council, 526 SW Mill St., Portland, Oregon 97201.

Thompson, J. M. 1981. Walleye pollock study in Queen Charlotte Sound and Dixon Entrance during September 21-29, 1979: M/V Arctic Harvester. Can. Data Rep. Fish. Aquat. Sci. 251, 81 p.

Pollock (Theragra chalcogramma}) encountered on the southeast edge of the Goose Island Bank in Queen Charlotte Sound ranged 2-10 yr in age and 35-73 cm in length. The modal age for both sexes was 6 yr (1972 year-class). The adult females were larger than those in Dixon Entrance and the Strait of Georgia. A length-weight relationship was calculated for age 1 and older pollock from Dixon Entrance, where adults 36-63 cm in length were caught on the Two Peaks ground. Length sex,stomach contents and distribution data were collected from incidental catches of sablefish Anoplopoma fimbria, hake Microgodus productus, spiny dogfish Squalus acanthias, arrowtooth flounder Atheresthes stomias, herring Clupea harengus pallasi, rockfish Sebastes spp, lamprey Petromyzontidae.

Thompson, W. F. 1915. A new fish of the genus Sebastodes from British Columbia, with notes on others. Rep. British Columbia Comm. Fish. Dept. 1914:N120-N122.

Thorsteinsson, G. 1980. Icelandic bottom trawl and Danish seine codend selection experiments on cod, haddock, redfish and plaice in 1972-1976. In Council Meeting of the International Council for the Exploration of the Sea. Copenhagen, Denmark, Oct. 6, 1980. ICES-CM-1980/B:3, 14p.

Tomlinson, N., S. E. Geiger, G. A. Gibbard, and S. J. Westrheim. 1973. Utilization of Pacific rockfish. 1. Comparison of Sebastes alutus, S. reedi and S. proriger with respect to their quality during chilled and frozen storage. Fish. Res. Board Can. Tech. Rep. 425, 31 p.

Trams, E. G., and C. J. Lauter. 1978. A comparative study of brain calcium ion Atpase EC-3.6.1.3. Comp. Biochem. Physiol. B Comp. Biochem. 59(3):191-194.

Particulate brain ATPases from various vertebrates including Sebastes flavidus were optimally activated by Ca2+, Mg2+ or Mn2+. Specific enzyme activity with AT32P as substrate was low in lower vertebrates and increased on the evolutionary scale. The properties of the brain ATPases suggested that most of the activity was associated with plasma membrane ecto-ATPase.

Travin, V. I. 1961. A brief survey of Soviet investigations in redfish (genus Sebastes). Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:90-93.

Traynor, J., and M. Nelson. 1981. Calibration of a computerized echo integration and dual beam target strength measurement system. In Meeting on Hydoracoustical Methods for the Estimation of Marine Fish Populations. Cambridge, MA, Jun. 25, 1979. p. 395-424.

In 1974, the National Marine Fisheries Service's Northwest and Alaska Fisheries Center Initiated development of a Hydroacoustic system, and associated hydroacoustic/midwater trawl survey program. A major part of the program's work has involved the development and refinement of a real-time digital hydroacoustic (echo sounder) data acquisition and processing system designed for echo integration and dual beam transducer target strength measurement. The primary purpose of this paper is to provide information on methods used to measure and monitor the performance of the hydroacoustic system currently employed. The paper also includes descriptions of methods for implementing echo integration and dual beam target strength measurement.

Tremblay, C., B. Portelance, and J. Frechette. 1983. Bottom trawl survey of fish and crustaceans in the lower St. Lawrence River Estuary. Cah. Inf. Dir. Rech. Sci. Tech. Dir. Gen. Marit. (Que. Prov.). 103, 96 p.

In this paper, the authors present the results of a survey of the finfish and the main species of shrimp Pandalus borealis found in the eastern section of the Laurentian Channel and on Les Escoumins shelf, both areas being located in the lower St. Lawrence Estuary. The main marine species they considered for the purpose of this analysis were: northern shrimp, Greenland halibut (Reinhardtius hippoglossoides), witch flounder (Glyptocephalus cynoglossus), American plaice, (Hippoglossoides platessoides) redfish (Sebastes mentella) and cod (Gadus morhua).

Trout, G. C. 1961. A bibliography of north Atlantic redfish. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:94-99.

Trout, G. C. 1961. The growth of immature Sebastes viviporus (Kroger) from the north Norwegian coast. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:291-295.

Taning (1943) showed that S. viviparus, the "lille rodfisk", was taken in the commercial catches at Faroe. Elsewhere in Europe this species does not make any noticeable contribution as a food fish, being on the whole too small or perhaps because it is not differentiated from other redfish. There has been little incentive, therefore, to examine its growth rate and only Rasmussen (1958) has given even a rough approximation to its annual increment of growth.

Trout, G. C. 1961. The otolith of group-0 Sebastes mentell Travin. Int. Comm. Northwest Atl. Fish. Spec. Publ. 3:296-299.

One of the most controversial redfish problems has been the interpretation of the opaque structure of their otoliths, when used for age determination. This has resulted in alternative estimates of growth rates being put forward. Examination of a sample of bottom living young Sebastes has been of interest, since it throws some light on this problem.

Trout, G. C. 1961. Sebastes viviparus (Kroyer) and the redfish problem. Int. Comm. Northwest Atl. Fish. Comm. Spec. Publ. 3:94-99.

Tsukahara, H. 1962. Studies on habits of coastal fishes in the Amakusa Islands, Part 2: Early life history of the rockfish, Sebasticus marmoratus (Cuvier et Valenciennes). Rec. Oceanogr. Wks. Japan Spec. No. 6:49-55.

Tsuyuki, H., E. Roberts, R. H. Lowes, W. Hadaway, and S. J. Westrheim. 1968. Contribution of protein electrophoresis to rockfish (Scorpaenidae) systematics. J. Fish. Res. Board Can. 25(11):2477-2501.

During 1965-67, multiple hemoglobins of 1905 specimens,comprising 2 species of Sebastolobus and 26 of Sebastodes; muscle protein of 1677 specimens, comprising 1 species of Scorpaena, 1 of Scorpaenodes, 2 of Sebastolobus, 2 of Sebastes and 24 of Sebastodes; and eye lens proteins of 431 specimens, covering 1 species of Sebastolobus and 19 of Sebastodes were examined by starch-gel zone electrophoresis.

Tsuyuki, H., E. Roberts, and W. E. Vanstone. 1965. Comparative zone electropherograms of muscle myogens and blood hemoglobins of marine and freshwater vertebrates and their application to biochemical systematics. J. Fish. Res. Board Can. 22(1):203-213.

Tsuyuki, H., and S. J. Westrheim. 1970. Analysis of the Sebastes aleutianus-S. melanostomus complex and description of a new Scorpaenid species, Sebastes caenaematicus, in the Northeast Pacific Ocean. J. Fish. Res. Board Can. 27(12):2233-2254.

Taxonomic studies, based on biochemical and physical morphology, of the Sebastes aleutianus-S. melanostomus complex (family Scorpaenidae) resulted in the identification and description of new species, Sebastes caenaematicus, whose known range is Cape Flattery, Washington, to Cape Ommaney, Alaska. A synonymy and literature history for the complex is presented.

Tyler, A. V., and G. A. McFarlane (editors). 1985. Groundfish stock assessments for the west coast of Canada in 1984 and recommended yield options for 1985. Can. Manuscr. Rep. Fish. Aquat. Sci. 1813, 353 p.

Stock assessments and yield options are developed for the Pacific coast of Canada for the following species: lingcod, Pacific cod, Dover sole, rock sole, English sole, sablefish, Pacific hake, spiny dogfish, walleye pollock, Pacific ocean perch, yellowmouth rockfish, rougheye rockfish, silvergrey rockfish, and canary rockfish. The yield options are recommended to the fishery managers of the Field Services Division on catch limitations and other fishery management procedures.

Tyler, A. V., R. P. Foucher, and J. Fargo (editors). 1986. Groundfish stock assessments for the west coast of Canada in 1985 and recommended yield options of 1986. Can. Manuscr. Rep. Fish. Aquat. Sci. 1897, 108 p.

Stock assessment and yield options are developed for the Pacific coast of Canada for the following species: lingcod, Pacific cod, Dover sole, rock sole, English sole, sablefish, Pacific hake, spiny dogfish, walleye pollock, Pacific ocean perch, yellowmouth rockfish, rougheye rockfish, silvergrey rockfish, yellowtail rockfish, and canary rockfish. This is an interim report with assessments largely based on mathematical analysis and interpreted with 1985 landing statistics.

Tyler, A. V., and M. W. Saunders (editors). 1987. Groundfish stock assessments for the west coast of Canada in 1986 and recommended yield options for 1987. Can Manuscr. Rep. Fish. Aquat. Sci. 1930, 156 p.

Stock assessments and yield options are developed for the Pacific coast of Canada for the following species: lingcod, Pacific cod, Dover sole, rock sole, English sole, sablefish, Pacific hake, spiny dogfish, walleye pollock, Pacific ocean

perch, yellowmouth rockfish, rougheye rockfish, silvergrey rockfish, yellowtail rockfish and canary rockfish. This is an interim report with assessments largly based on mathematical analyses presented in Tyler and McFarlane 1985, and interpreted with 1986 landing statistics.

Ueber, Edward. 1987. Widow rockfish fishery. In W. H. Lenarz, and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 53-56. U.S. Dep. Commer. NOAA Tech. Rept. NMFS 48.

Ulltang, O., and P. Oynes. 1980. Norwegian investigations on shrimp, Pandalus borealis, off West Greenland in 1977 and 1978. Int. Comm. Northwest Atl. Fish. Sel. Pap. 6:26-34.

Investigations on the shrimp fishing grounds off West Greenland in June-July 1977 and July-August 1978 showed that the catches consisted mainly of large shrimp between 18 and 30 mm carapace length. The length compositions of catches on Store Hellefiske Bank were bimodal with peaks at 21-22 and 25 mm, the first being dominant in 1977 and second in 1978. The quantities of discarded shrimp were 21.7% of the observed shrimp catches in 1977 and 10.0% in 1978, the higher value in 1977 being attributed to the occurrence of a larger proportion of soft-shelled shrimp in the 1977 catches which were sampled about a month early in 1977 than in 1978. Small redfish (Sebastes marinus) (10-20 cm) dominated in the by-catches with small quantities of Greenland halibut (Reinhardtius hippoglossoides) and other groundfish species. Analysis of catch per unit of effort data for the Norwegian commercial fishery in 1977 and 1978 indicated that the mean fishable biomass may have declined by about 20% from 1977 to 1978 and by about 33% from 1975-76 to 1978.

Valdes, E., and B. Hernandez. 1980. Length-weight relationships of Sebastes spp. from the Flemish Cap bank and the Newfoundland's Grand Bank. Rev. Cub. Invest. Pesq. 5(4):82-86.

The length-weight relationships of Sebastes spp. were obtained from 2518 individuals (of which 1375 were females) from the Flemish Cap bank and 678 individuals (of which 344 were females) from the Newfoundland's Grand bank. The equations that were obtained are: females W = 0.011386 L super(3.0398) and W = 0.00255 L super(3.4941) males W = 0.005566 L super(3.0569) and W = 0.01210 L super(3.0064) for the Flemish Cap bank and the Newfoundland's Grand bank, respectively. The combined equations that were found (females and males) were: W = 0.002865 L super(3,2354) and W = 0.00885 L super(3.1075) for the Flemish Cap bank and the Newfoundland's Grand bank, respectively.

Valdes, E., and E. I. Fraxedas. 1981. Redfish selectivity study on Flemish Cap, May 1981. Northwest Atl. Fish. Organ. Sci. Counc. Rep. 81/6/44, 10 p.

Selection parameters for the 90 and 120 mm mesh kapron codends were determined from parallel and alternate fishing operations by 2 commercial trawlers engaged in the redfish fishery on Flemish Cap. The results show 50% retention length of 28.4 and 31.4 cm and selection factors of 3.1 and 2.6 for the 90 and 120 mm mesh codends respectively. A total length-girth relationship was determined and the results compared with those reported by other authors. Visual observations on most of the sets with the 120 mm mesh codend indicated the escapement of large numbers of redfish once the codend was at the surface, implying an unnecessary loss of the resource.

Van Arsdel, William C, III, and Carl E. Bond. 1964. Grass rockfish, Sebastodes rastrelliger (Jordan and Gilbert), from the Yaquina Bay area, Oregon. Calif. Fish Game 50(2):125.

Van Petten, L. E., J. E. Calkins, R. F. McConnell, H. M. Gottschalk, and P. S. Elias. 1980. Long term feeding studies in mice fed a diet containing irradiated fish 1. Multi generation reproduction mutagenicity teratology and longevity studies. Toxicol. Lett. 7(2):97-102.

A wholesomeness feeding study was carried out in mice fed equal amounts of cod [Gadus morhua morhua] or redfish [Sebastes marinus], comprising 45% of the diet. Three groups of animals received either irradiated [1.75 kilogray (175 krad)] fish, non-irradiated fish or stock ration. A 90 day subchronic study, a multigeneration reproduction, a dominant lethality and a teratology study were carried out together with an 80 wk oncogenic study on the F1 generation. No adverse effects were noted on growth, reproduction and litter behavior, in relation to dominant lethality, teratogenicity or oncogenicity.

Vermeer, Kees. 1979. Nesting requirements, food and breeding distribution of rhinoceros auklets, Cerorhina monocerata, and tufted puffins, Lunds cirrhata. Ardea 67:101-110.

Veshchezerov, V. V. 1984. Data on the biology and fishery of Norway haddock in the Barents Sea. Can. Transl. Fish. Aquat. Sci. 5110, 52 p.

The statistics on the Norway haddock, Sebastes marinus, fishery in the Barents Sea and the figures describing the concentration show a decline in catches, with 1934 having the smallest catch. Data indicate that in terms of the structure of the schools, 1934, compared to 1930-1931 which

were years with the highest concentrations, did not show signs of stock depletion, which characterizes overfishing. The decline in Norway haddock is affected by the trawling fleet being oriented to the cod fishery. For this reason, the catch figures do not entirely reflect the actual size of the migrations of haddock. (Originally in: Tr. Polyarn. Nauchno-Issled. Inst. Morsk. Rybn. Khoz. Okeanogr. (8), 1941. Transl. from Ru. to Eng. Available from: Canada Inst. Sci. Tech. Inf., Natl. Res. Counc., Ottawa, Ont. K1A 0S2).

Vilhjalmsson, H., and J. V. Magnusson. 1982. Report on the 0-group survey in Icelandic and east Greenland waters, August 1982. In Council Meeting of the International Council for the Exploration of the Sea, Copenhagen, Denmark, Oct. 11, 1982. ICES-C-1982/H:63, 26 p.

Vilhjalmsson, H., and J. V. Magnusson. 1983. Report on the 0-group fish survey in Icelandic and East Greenland waters, August 1983. In Council Meeting of the International Council for the Exploration of the Sea, Gothenburg, Sweden, Oct. 10, 1983. ICES-CM-1983/H:38, 26 p.

Vyncke, W. 1970. Determination of the ammonia content of fish as an objective quality assessment method. Meded. Fac. Landouwwet. Rijksuniv. Gent. 35(4):1033-1046.

Vyncke, W. 1970. Direct determination of the Thio barbituric acid value in tri chloro acetic-acid extracts of fish as a measure of oxidative rancidity. Fette. Seifen. Anstrichm. 72(12):1084-1091.

Vyncke, W. 1978. Determination of oxidative rancidity of redfish (Sebastes marinus L.) by thiobarbituric acid. Rev. Agric. 31(6):1119-1121.

The direct determination of the thiobarbituric acid values (TBA) on trichloracetic acid extracts of redfish as a measure of the oxidative rancidity was compared with the more classicial determination on steam distillates. The correlation coefficient was 0.664 and was significantly lower than values reported earlier for other fish species. The evolution of TBA-values determined with the direct extraction procedure only partially followed organoleptic scores. A better agreement was obtained with the distillation procedure. This latter method is to be preferred for redfish.

Waldron, K. D. 1968. Early larvae of the canary rockfish Sebastodes pinniger. J. Fish. Res. Board Can. 25(4):801-803.

Waldron, Kenneth D. 1972. Fish larvae collected from the northeastern Pacific Ocean and Puget Sound during April and May 1967. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Fish. 663, 16 p.

Wales, J. H. 1930. A new name, Sebastodes pavlenkoi Wales, substituted for Sebastodes ruber Pavlenko, from Peter the Great Bay. Copeia 1:10-11.

M. N. Pavlenko in 1910 described a new species, Sebastodes ruber from the southeast coast of Siberia. The specific name ruber has been used by Ayres for an American species of the same genus and has been incorrectly used by other authors for yet another form. Cramer proposed the name ruberrimus for the ruber of those other than Ayres, and the ruber of Ayres has been synonymized with auriculatus. I therefore replace the name Sebastodes ruber Pavlenko with the new specific name Sebastodes pavlenkoi, in honor of the late Russian ichthyologist. (description follows).

Wales, J. H. 1932. Report on two collections of Lower California marine fishes. Copeia 4:163-168.

Sixty of the sixty-nine species here reported were collected by the switer while he was a member of the California Division of Fish and Game Lower California Expedition of 1931. This boat trip was made to La Paz in the Gulf of California and back between March 31 and April 17.

Wales, J. H. 1952. Life history of the blue rockfish (Sebastodes mystinus). Calif. Fish Game 38(4):485-498.

Walford, L. A. 1931. Handbook of common commercial and game fishes of California. Calif. Fish Game. Fish. Bull. 28:1-181.

The purpose of this bulletin is primarily to establish official common names of the California fishes which are handled commercially, or which are of particular interest to fishermen or dealers. The authority for this work is derived from a State law enacted in 1919, which provides that "the Fish and Game Commission shall have the power to decide what is the common usage name of any variety." Incidentally, the Bureau of Commercial Fisheries has attempted to provide a handbook for the convenience of marketmen, sportsmen, and others who are interested in our natural resources. The restricted number and character of the species considered, the lack of complete keys, and the brevity of the description will make the book of small if any value to the pure scientist, for whom the work is not intended....Thus, it has been thought wise to call all of the species of the genus Sebastodes "rockfish" with certain individual descriptive subjectives....

Wall, Janet, Robert French, and Russsell Nelson, Jr. 1981. Foreign fisheries in the Gulf of Alaska, 1977-78. Mar. Fish. Rev. 43(5):20-35.

During 1977-78, 50 U.S. observers sampled on 61 foreign vessels in the Gulf of Alaska, covering 8.3% of the foreign effort in 1977 and 14.7% in 1978. Observer data were used in estimating a total foreign groundfish catch of nearly 300,000 t in 1977 and about 165,000 t in 1978. The predominant species caught both years and by all nations was walleye pollock, Theragra chalcogramma, which made up 58-59% of the total foreign catch. Other species and species groups of importance were Atka mackerel, Pleurogrammus monopterygius Pacific ocean perch, Sebastes alutus flounders (various species) sablefish, Anoplopoma fimbria and Pacific cod, Gadus macrocephalus. Estimates were also made of the incidental catches of species whose retention was prohibited: Pacific halibut, Hippoglossoides stenolepis Pacific salmon, Oncorhynchus spp. king crab, Paralithodes and Lithodes spp. and snow (Tanner) crab, Chionoecetes spp. In 1977, catch estimates of halibut and salmon were 413,000 and 5,270, respectively. The 1978 estimate were 293,000 halibut, 45,600 salmon, 94,000 king crab, and 24,000 snow crab.

Wang, Mary Y. 1984. Changes in microbial flora of rock cod (Sebastes ssp.) during and after storage in a carbon dioxide atmosphere (modified atmosphere, effect fish, psuedomonas). Ph.D. Thesis, Univ. Calif., Davis, 218 p.

The inhibitory effect of carbon dioxide (CO 2) on microbial growth on rockcod fillets was confirmed using modified storage (MA=80% CO 2 and 20% air) compared to air storage at 4 (DEGREES) C. Changes in the types and numbers of microorganisms were followed during the post-treatment stages (PT) after the MA-stored fish had been transfered into air. A residual effect, defined as a reduced rate of microbial growth following MA-storage when compared to the rate of growth on air-stored fish, was observed during PT.

Wang, Mary Y., and D. M. Ogrydziak. 1986. Residual effect of storage in an elevated carbon dioxide atmosphere on the microbial flora of rock cod (Sebastes spp.). Appl. Environ. Microbiol. 52(4):727-732.

A residual inhibitory effect on microbial growth due to modified-atmosphere (MA) storage (MA, 80% CO sub(2)-20% air) was demonstrated for rock cod fillets stored in MA and transferred to air at 4 degree C. Results of measurements of CO sub(2) concentrations of the fillets suggested that the residual effect after transfer from MA to air was not due to retention of CO sub(2) at the surface of the fillets but was probably due to the microbial ecology of the system,

Lactobacillus) spp. and tan Alteromonas spp. (TAN) predominated after 7 and 14 days of storage in MA. During storage in MA, Pseudomonas spp. were inhibited or killed. Following transfer from MA to air, the percentage of the total flora represented by Lactobacillus spp. and TAN bacteria decreased, and 6 days after transfer Pseudomonas spp. were again dominant.

Washington, P. M. 1977. First specimen of rosethorn rockfish, Sebastes helvomaculatus (Ayres 1859), recorded from Puget Sound, Washington. Northwest Sci. 51(3):216-218.

In Puget Sound, Washington, the rockfish family (Scorpaenidae) is one of the largest in terms of speciation. Twenty-one species (DeLacy et al., 1972) have been reported to date. The fish described adds another to the total.

Washington, P. M., R. Gowan, and D. H. Ito. 1978. A biological report on eight species of rockfish (Sebastes spp.) from Puget Sound, Washington. U.S. Dep. Commer., NOAA, NMFS Northwest & Alaska Fisheries Center Processed Rept. 256, 50 p.

Weinberg, Kenneth L., Mark E. Wilkins, and Thomas A. Dark. 1984. Pacific West Coast Bottom Trawl Survey of Groundfish Resources, 1983: Estimates of Distribution, Abundance, Age and Length Composition. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-F/NWC-70, 375 p.

The Northwest and Alaska Fisheries Center conducted a bottom trawl survey during July-October, 1983, the third in a series of triennial assessment surveys of Pacific whiting, Merluccius productus, and important continental shelf rockfish species. Two chartered bottom trawl vessels were deployed in the area from Monterey Bay, California to Estevan Point on Vancouver Island, British Columbia. Bottom trawl hauls were attempted at 596 stations at depths of 55-366 meters. This report describes the sampling and analytical methods used and summarizes the data collected during the bottom trawl survey. The contents include temperature data, catch composition, distribution and relative abundance of major groundfish species, and rankings of fish species by International North Pacific Fisheries Commission (INPFC areas and depth strata in terms of catch per unit effort.

Westrheim, S. J. 1958. On the biology of the Pacific Ocean perch, Sebastes alutus (Gilbert). M.S. Thesis, Univ. Wash., Seattle, 106 p.

Westrheim, S. J. 1964. Rockfish (Sebastodes brevispinis) in British Columbia waters. J. Fish. Res. Board Can. 21(4):855-856.

Westrheim, S. J. 1965. Northern range extension records for four species of rockfish (Sebastodes goodei, S. helvomaculatus, S. rubrivinctus, and S. zacentrus) in the north Pacific Ocean. J. Fish. Res. Board Can. 22(1):231-235.

Westrheim, S. J. 1966. Catch rates, size composition, and sex ratio of Pacific ocean perch (Sebastes alutus) caught in the eastern North Pacific Ocean by the G. B. REED, January-March 1963-1965. Fish. Res. Board Can. Manuscr. Rep. 869, 22p.

Westrheim, S. J. 1966. Northern range extensions for three species of rockfish, (Sebasodes flavidus, S. paucispinis, and S. pinniger), in the north Pacific Ocean. J. Fish. Res. Board Can. 23(9):1469-1471.

Westrheim, S. J. 1966. Northern range extensions records for two rockfish species, (Sebastodes caurinus and S. elongatus). J. Fish. Res. Board Can. 23(9):1455-1456.

Westrheim, S. J. 1966. Report on the trawling operations of the Canadian research vessel G. B. Reed from Queen Charlotte Sound, British Columbia, to Sitka Sound, Alaska, Aug. 24 to September 15, 1966. Fish. Res. Board Can. Manuscr. Rep. 891, 26 p.

Westrheim, S. J. 1967. Catch rates, size composition, and sex ratio of Pacific ocean perch (Sebastodes alutus) caught in the eastern north Pacific Ocean (Vancouver Island, B. C. to southeastern Alaska) by the G. B. REED, August-October 1966. Fish. Res. Board Can. Tech. Rep. 16, 32 p.

Westrheim, S. J. 1967. Report on the trawling operations of the Canadian research vessel G. B. REED off British Columbia and southeastern Alaska, September 6 - October 4, 1967. Fish. Res. Board Can. Manuscr. Rep. 934, 8 p.

The present report summarizes the results of G. B. REED groundfish cruise no. 67-2, September-October 1967. The main purpose of this cruise was to investigate the bathymetric distribution of Pacific ocean perch (Sebastodes alutus) in southern Queen Charlotte Sound and off Cape Ommaney, Alaska.

Westrheim, S. J. 1967. Report on the trawling operation of the Canadian research vessel G. B. Reed off Vancouver Island, British Columbia, February 1 to April 24, 1967. Fish. Res. Board Can. Manuscr. Rep. 932, 9 p.

The present report summarizes the results of G. B. REED groundfish cruise no. 76-1, February-April 1967. The main purpose of this cruise was to investigate the maturity of Pacific ocean perch (Sebastodes alutus) and other rockfish species off the west coast of Vancouver Island, British Columbia. Records of incidental catches of halibut were also collected.

Westrheim, S. J. 1967. Sampling research trawl catches at sea. J. Fish. Res. Board Can. 24(6):1187-1202.

Westrheim, S. J. 1968. First records of three rockfish species (Sebastodes aurora, S. ciliatus, and Sebastolobus altivelis) from waters off British Columbia. J. Fish Res. Board Can 25(11):2509-2513.

Westrheim, S. J. 1968. Report of the trawling operations of the Canadian research vessel G. B. Reed off Vancouver Island, British Columbia, April 2 to June 11, 1968. Fish. Res. Board Can. Manuscr. Rep. 977, 9 p.

Westrheim, S. J. 1969. Report of the trawling operations of the Canadian research vessel G. B. REED off British Columbia, September 1969. Fish. Res. Board Can. Manuscr. Rep. 1063, 6 p.

Westrheim, S. J. 1970. Survey of rockfishes, especially Pacific ocean perch in the Northeast Pacific Ocean, 1963-66. J. Fish. Res. Board Can. 27(10):1781-1809.

During 1963-66, a trawl and echo-sounder survey was conducted in the northeast Pacific Ocean to investigate the distribution and abundance of rockfish (Scorpaenidae) species, particularly Pacific ocean perch (Sebastes alutus), inhabiting the outer continental shelf and upper continental slope from Cape Blanco, Oregon to Unalaska Island, Alaska. Rockfish predominated in most trawl catches.

Westrheim, S. J. 1971. Length-weight and length-girth relationships for Pacific ocean perch (Sebastes alutus) collected off southeastern Alaska in August 1971. Fish. Res. Board Can. Tech. Rep. 281, 10 p.

Westrheim, S. J. 1972. Explorations of rockfish grounds off British Columbia in 1971. Fish. Res. Board Can. Manuscr. Rep. 1200, 29 p.

Westrheim, S. J. 1973. Age determination and growth of Pacific ocean perch (Sebastes alutus) in the northeast Pacific Ocean. J. Fish. Res. Board Can. 30(2):235-247.

Age was determined by means of otoliths of juvenile and adult Pacific ocean perch (Sebastes alutus) collected during 1963-1969 in the northeast Pacific Ocean, from Oregon to Unalaska Island, Alaska.

Westrheim, S. J. 1973. Preliminary information on the systematics distribution and abundance of the dusky rockfish Sebastes ciliatus. J. Fish. Res. Board Can. 30(8):1230-1234.

Information is presented on the systematics, distribution, and abundance of the dusky rockfish, Sebastes ciliatus. Morphological description of the taxon is provided, together with a translation into English of the original description. Geographic range is East Kamchatka (USSR) to Dixon Entrance (Canada). Maximum depth of capture in the Gulf of Alaska is 170 fath. Maximum size is 428 mm (17 inches), standard length. Relative abundance is low.

Westrheim, S. J. 1974. Echo-sounder and trawl survey of Queen Charlotte Sound and southern Hecate Strait, 1972-73. Fish. Res. Board Can. Manuscr. Rep. 1307, 43 p.

Westrheim, S. J. 1975. Reproduction, maturation, and identification of larvae of some Sebastes (Scorpaenidae) in the northeast Pacific Ocean. J. Fish. Res. Board Can. 32(12):2399-2411.

Insemination and parturition seasons, maturation, and descriptions of preextrusion larvae were reported for several Sebastes (Scorpaenidae) species (66,769 specimens;31 species) studies during 1963-73 in the northeast Pacific Ocean, from Oregon (43'N) to the western Gulf of Alaska (170'W).

Westrheim, S. J. 1977. Production and stock assessment of principal groundfish stocks off British Columbia. Can. Fish. Mar. Serv. Industry Rep. 94, 77 p.

Westrheim, S. J. (editor). 1980. Assessment of groundfish stocks off the west coast of Canada in 1979 and recommended total allowable catches for 1980. Can. Data Rep. Fish. Aquat. Sci. 208, 265 p.

Recommended Total Allowable Catches (TACs) for 1980, are included for all commercially important groundfish stocks off British Columbia, by statistical area. These TACs are based on the best available information, but many are not considered to be precise values, due to the limited information available. Total (all species, all areas) recommended TAC for 1980 is 89,885 t, compared to 80,210 t for 1979. TAC estimates for principal species in 1980 (1979 in parentheses) were:Pacific hake, Merluccius productus, 30,000 t (35,000 t) dogfish Squalus acanthias, 9,000 t (9,000 t) walleye pollock Theragra chalcogramma, 8,750 t (5,800 t) Pacific cod Gadus macrocephalus, 6,500 t (6,000 t) yellowtail rockfish Sebastes flavidus, 3,950 t (3,850 t) Pacific ocean perch Sebastes alutus, 3,200 t (2,670 t) and arrowtooth flounder Atheresthes stomias, 3,050 t (900 t).

Westrheim, S. J. 1984. Pacific research taps new fisheries. Pisces 5(3-4):3-4.

Westrheim, S. J. 1987. Keynote address:quality starts with fundamentals. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 5-11. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Westrheim, S. J. 1987. The rockfish fisheries off western Canada, 1860-1985. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 43-50. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Westrheim, S. J., D. Davenport, W. R. Harling, M. S. Smith, and R. M. Wowchuk. 1969. G. B. REED groundfish cruise no. 69-1, February 11-27, 1969. Fish. Res. Board Can. Tech. Rep. 113, 23 p.

Westrheim, S. J., D. Davenport, M. S. Smith, and D. M. Bianchin. 1969. G. B. REED groundfish cruise no. 69-2, June 18 - July 2, 1969. Fish. Res. Board Can. Tech. Rep. 132, 8 p.

The purpose of the cruise was to: 1. Collect length-weight data for Pacific ocean perch (Sebastodes alutus) on La Perouse Bank (off southwest Vancouver Island), and in south Queen Charlotte Sound. 2. Collect rockfish specimens particularly the S. "aleutianus A-B-C" complex, off southwest Vancouver Island and off Monterey Bay, California, for biochemical systematics studies.

Westrheim, S. J., and N. S. Fadeev. 1974. Echo-sounder and trawl net calibration studies with the G B REED and OGON, September 1972. Fish. Res. Board Can. Tech. Rep. 451, 23 p.

Westrheim, S. J., and W. R. Harling. 1973. Report on the 1972 comparison of Pacific ocean perch otolith and scale interpretations. Fish. Res. Board Can. Manuscr. Rep. 1259, 24 p.

During May-June 1972, special samples of otolith and scales were collected in the Gulf of Alaska by Japanese scientists, and in Queen Charlotte Sound by Canadian scientists. These otoliths or scales were read by the appropriate experts from Canada, Japan, and the United States. This report was prepared to provide a description of the experiments, and to present Canada's interpretation of the results.

Westrheim, S. J., and W. R. Harling. 1975. Age-length relationships for 26 Scorpaenids in the Northeast Pacific Ocean. Can. Fish. Mar. Serv. Tech. Rep. 565, 12 p.

Westrheim, S. J., W. R. Harling, and D. Davenport. 1968. G. B. REED groundfish cruise no. 67-2, September 6 to October 4, 1967. Fish. Res. Board Can. Tech. Rep. 46, 45 p.

Purpose of cruise: Investigate the bathymetric distribution of Pacific ocean perch (Sebastodes alutus) in southern Queen Charlotte Sound and off southeastern Alaska with respect to relative abundance size composition and age composition.

Westrheim, S. J., W. R. Harling, and D. Davenport. 1968. Preliminary report on maturity, spawning season and larval identification of rockfishes (Sebastodes) collected off British Columbia in 1967. Fish. Res. Board Can. Manuscr. Rep. 951, 23 p.

Westrheim, S. J., W. R. Harling, D. Davenport, and M. S. Smith. 1968. Preliminary report on maturity, spawning season, and larval identification of rockfishes (Sebastodes) collected off British Columbia in 1968. Fish. Res. Board Can. Manuscr. Rep. 1005, 28 p.

Westrheim, S. J., W. R. Harling, D. Davenport, and M. S. Smith. 1974. G. B. REED groundfish cruise no. 74-3, June 4-26, 1974 (data record). Can. Fish. Mar. Ser. Tech. Rep. 478, 26 p.

Westrheim, S. J., W. R. Harling, D. Davenport, and M. S. Smith. 1974. G. B. REED groundfish cruise no. 74-4, September 4-25, 1974 (data record). Can. Fish. Mar. Ser. Tech. Rep. 497, 37 p.

Westrheim, S. J., W. R. Harling, D. Davenport, M. S. Smith, and A. C. Phillips. 1973. G. B. REED groundfish cruise no. 73-1, June 5 - July 26, 1973. Fish. Res. Board Can. Tech. Rep. 410, 51 p.

The purpose of the cruise was to perform an exploratory survey by echosounder and trawl of groundfish stocks and their environment in Queen Charlotte Sound and Hecate Strait.

Westrheim, S. J., W. R. Harling, and L. E. McLeod. 1968. Mean tub weights for trawl-caught groundfish species aboard the G. B. Reed, 1965-67. Fish. Res. Board Can. Manuscr. Rep. 966, 11 p.

Westrheim, S. J., and B. M. Leaman. 1976. A selected bibliography of Northeastern Pacific rockfishes (Sebastes and Sebastolobus) other than Sebastes alutus. Can. Fish. Mar. Serv. Tech. Rep. 659, 20 p.

Westrheim, S. J., B. M. Leaman, W. R. Harling, D. Davenport, M. S. Smith, and R. M. Wowchuk. 1976. G. B. Reed Groundfish cruise no. 76-3, September 8-27, 1976. Can. Fish. Mar. Serv. Data Record 21, 47 p.

Westrheim, S. J., and F. W. Nash. 1971. Length-girth relationship for Pacific ocean perch (Sebastes alutus) collected from British Columbia in 1969. Fish. Res. Board Can. Tech. Rep. 251, 6 p.

Westrheim, S. J., and F. T. Pletcher. 1966. First records of the twoline eelpout, Bothrocara brunneum, Greenland halibut, Reinhardtius hippoglossoides, and shortbelly rockfish, Sebastodes jordani, in British Columbia waters. J. Fish. Res. Board Can. 23(2):309-312.

Westrheim, S. J., and W. E. Ricker. 1978. Bias in using an age-length key to estimate age frequency distributions. J. Fish. Res. Board Can. 35(2):184-189.

Consider 2 representative samples of fish [e.g., Sebastes alutus] taken in different years from the same fish population, this being a population in which year-class strength varies. For the parental sample the length and age of the fish are determined and are used to construct an age-length key, the fractions of the fish in each (short) length interval that are of each age. For the filial sample only the length is measured, and the parental age-length key is used to compute the corresponding age distribution. Trials show that the age-length key will reproduce the age-frequency distribution of the filial sample without systematic bias only if there is no overlap in length between successive ages. Where there is much overlap, the age-length key will compute from the filial length-frequency distribution approximately the parental age distribution. Additional bias arises if the rate of growth of a year-class is affected by its abundance, or if the survival rate in the population changes.

Westrheim, S. J., and M. S. Smith. 1970. Report of the trawling operations of the Canadian research vessel G. B. Reed off British Columbia and Alaska, March-June, 1970. Fish. Res. Board Can. Manuscr. Rep. 1101, 11 p.

Westrheim, S. J., and V. A. Snytko. 1974. Length weight relations of Pacific Ocean perch (Sebastes alutus) in the north Pacific Ocean. J. Fish. Res. Board Can. 31(3):363-366.

Length-weight relations for Pacific ocean perch (Sebastes alutus) were determined by the iterative method from data collected aboard Soviet research vessels in the North Pacific Ocean, from Kamchatka, USSR (53'N lat), to Oregon, USA (44'N lat).

Westrheim, S. J., and J. A. Thomson. 1971. Weight-length relationship for Pacific ocean perch (Sebastes alutus) collected off British Columbia in 1969. Fish. Res. Board Can. Tech. Rep. 237, 12 p.

Westrheim, S. J., and H. Tsuyuki. 1967. Sebastes reedi, a new Scorpaenid fish in the Northeast Pacific Ocean. J. Fish. Res. Board Can. 24(9):1945-1954.

Westrheim, S. J., and H. Tsuyuki. 1971. Taxonomy distribution and biology of the northern rockfish Sebastes polyspinis. J. Fish. Res. Board Can. 28(10):1621-1627.

Available information is summarized on the taxonomy, distribution, abundance, and biology of the northern rockfish, Sebastes polyspinis. Morphological and biochemical descriptions of the taxon are provided. Geographic range is east Kamchatka (USSR) to Yakutat, Alaska. Maximum depth of capture in the Gulf of Alaska is 196 fath (358 m). Absolute abundance appears to be low and centered in shallow water with juvenile Pacific ocean perch (Sebastes alutus).

Westrheim, S. J., and H. Tsuyuki. 1972. Synonymy of Sebastes caenaematicus with Sebastes borealis and range extension record. J. Fish. Res. Board Can. 29(5):606-607.

Sebastes caenaematicus Tsuyuki and Westrheim (1970) is synonymized with Sebastes borealis Barsukov (1970). Recorded geographic range of S. borealis has been extended southward in the eastern Pacific Ocean at least 600 miles, to Cape Flattery, Wash. and probably 1,000 miles. to Eureka, Calif.

Whitehead, S. S. 1929. Rockfish. In The commercial fish catch of California for the years 1926 and 1927. Calif. Fish Game Fish Bull. 15:32-34.

Wilderbuer, Thomas. 1987. Rockfish in the Aleutian Islands: Results from the 1980 and 1983 U.S.-Japan cooperative demersal trawl surveys. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 267-285. Univ. Alaska, Alaska Sea Grant Rep. 87-2, 393 p.

Wilderbuer, Thomas K, Kiyoshi Wakabayashi, Lael L. Ronholt, and Hirotsune Yamaguchi. 1985. Survey report: Cooperative U.S.-Japan Aleutian Islands groundfish trawl survey-1980. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-F/NWC-93, 356 p.

The results of the first comprehensive resource assessment survey of groundfish stocks in the Aleutian Island region is presented. During July-November 1980, two U.S. fishing vessels and a Japanese stern trawler successfully completed 319 demersal trawl sampling stations. Species encountered in highest abundance include walleye pollock, Theragra chalcogramma; giant grenadier, Albatrossia pectoralis; Pacific ocean perch, Sebastes alutus; Pacific cod, Gadus macrocephalus; and Atka mackeral, Pleurogrammus

monopterygius. Information on the principal species occurring in the catches includes biomass estimates, catch rates, distribution and abundance, individual haul and catch listings, and size composition.

Wiley, S. W. 1983. Effects of chlorine residuals on rock bluefish Sebastes mystinus. In Jolley, R. L. et al (editors), Water chlorination: environmental impact and health effects, Vol. 4. Part 2. Environment, Health, and Risk. Proceedings of the 4th Conference, Pacific Grove, Calif. Oct. 18-23, 1981, p. 1019-1028. Ann Arbor Science Publishers: Ann Arbor, Mich.

Wilimovsky, Norman J. 1954. List of the fishes of Alaska. Stanford Ichthyol. Bull. 4(5):279-294.

Wilkes, S. M. 1957. The parasitic copepods of the longjawed rockfish, Sebastodes alutus (Gilbert). M.S. Thesis, Oregon State College, Corvallis, 28 p.

Wilkins, Mark E. 1980. Size composition, age composition, and growth of chilipepper, Sebastes goodei, and bocaccio, S. paucispinis, from the 1977 rockfish survey. Mar. Fish. Rev. 42(3-4):48-53.

Von Bertalanffy growth parameter estimates were similar to published values. For both species, females grew faster than males after the mean length at maturity had been reached. Size composition and age composition plots indicated offshore movements of older fish of both species, chilipepper beginning to move into the 100-199 fathom (183-364 m) depth zone rather abruptly between ages 4 and 5, and bocaccio beginning to move out more gradually between ages 3 and 7. Mean size for both sexes of both species increased with latitude. With all areas, depths, and sexes combined, age-class strength of chilipepper was notably weak at age 3 and greatest at age 5, and bocaccio age-class strength was greatest at age 4.

Wilkins, Mark E. 1986. Development and evaluation of methodologies for assessing and monitoring the abundance of widow rockfish, Sebastes entomelas. Fish. Bull., U.S. 84(2):287-310.

Rapid expansion of a new fishery for widow rockfish, Sebastes entomelas, stocks off the Pacific coast of the United States began in 1979. Within 3 years, landing rose from < 1,000 to almost 30,000 t of a species for which little information on abundance or life history was available. It was known that widow rockfish occurred in irregularly distributed, dense midwater, and semidemersal schools primarily during the night, which posed problems in directly assessing this resource. Therefore, a project was

designed to further investigate the habits and distribution of the species and develop an adequate assessment methodology. Line transect survey methods, using sector scanning sonar to estimate the number of schools per unit area and standard hydroacoustic echo integration techniques to estimate school biomass, were used in study areas off Washington and Oregon [USA]. The applicability of this methodology will depend on our ability to resolve technical problems and minimize the effects of distributional variability by refining survey design.

Wilkins, Mark E. 1987. Results of an investigation of widow rockfish Sebastes entomelas behavior. In W. H. Lenarz, and D. R. Gunderson (editors), Widow rockfish: Proceedings of a workshop, Tiburon, California, December 11-12, 1980, p. 43-47. U.S. Dep. Commer. NOAA Tech. Rept. NMFS 48.

Wilkins, Mark E., and James T. Golden. 1983. Condition of the Pacific ocean perch resource off Washington and Oregon during 1979: Results of a cooperative trawl survey. N. Am. J. Fish. Manage. 3(2):103-122.

Pacific ocean perch, Sebastes alutus, stocks in the northeastern Pacific Ocean off the coasts of Oregon, Washington, and British Columbia experienced severe damage from overexploitation in the mid-1960's. Catch limits were imposed during 1978. Fishermen questioned the need for these limitations. To provide an updated biomass estimate, a trawl survey was conducted between 22 March and 2 May 1979. The survey was designed and conducted jointly by the Northwest and Alaska Fisheries Center, the Washington Department of Fisheries, and the Oregon Department of Fish and Wildlife with the primary objective of obtaining information needed for improved management of this species. Review of the survey data indicated that (1) these stocks remain in serious condition despite an apparent increase in abundance attributable to the strong 1970 year class, and (2) the stock north of the Columbia River was composed of a wider range of sizes and ages than the stock off the coast of Oregon.

Wilkins, Mark E., and Kenneth L. Weinberg. 1987. Results of a bottom trawl survey of Pacific ocean perch off Washington and Oregon during 1985. In Proceedings of the International Rockfish Symposium, October, 1986, Anchorage, Alaska, p. 241-265. Univ. Alaska, Alaska Sea Grant Rep. 87-2

Williamson, H. C. 1911. Report on the reproductive organs of Sparus centrodontus, Delaroche; Sparus canthorus, L; Sebastes marinus (L); and Sebastes doctylopterus (Delaroche) and on the ripe eggs and larvae of Sparus controdontus (?) and Sebastes marinus. Sci. Invest. Fish Board Scotland. 1:1-35.

Wilson, Christopher D. 1984. The effects of different otolith ageing techniques on estimates of growth and mortality for two species of rockfishes, Sebastes pinniger and Sebastes diploproa. M.S. Thesis, Oregon State Univ., Corvallis, 101 p.

Wilson, F. R., F. Ray, G. Somero, and C. L. Prosser. 1974. Temperature metabolism relations of 2 species of Sebastes from different thermal environments. Comp. Biochem. Physiol. B Comp. Biochem. 47(2):485-491.

Wilson, T. C. 1982. An under water fish tagging method. Calif. Fish Game 68(1):47-50.

This paper describes a tagging method which minimizes potential trauma to fish and has proven successful for various species.

Wilson, T. C., and S. J. Krenn. 1986. Construction and evaluation of an artificial reef designed to enhance nearshore rockfish production. In Oceans'86 Conference Record: Science-Engineering-Adventure. Vol. 2. Data Management, Instrumentation and Economics. p. 547-551.

Material from a storm damaged breakwater was used to construct an artificial reef to evaluate potential to enhance select rockfish (Sebastes) species through recruitment. Site selection differed from previous artificial reefs by selecting sand substrate in close proximity to natural rock reefs, rather than placement in areas of low productivity. The substrate heterogenity of the artificial reef exceeded that of the natural reefs. Algal development of the overstory canopies differed. Early evidence suggests that properly designed artificial reefs may have a beneficial effect on rockfish by creating nursery habitat for early development.

Wine, V. 1978. Southern California independent sport fishery survey annual report no. 2. Calif. Dept. Fish Game, Marine Resources Administrative Report 78-2, 79 p.

Wishard, Lisa N., Fred M. Utter, and Donald R. Gunderson. 1980. Stock separation of five rockfish species using naturally occurring biochemical genetic markers. Mar. Fish. Rev. 42(3-4):64-73.

Samples of Pacific ocean perch, S. alutus, were collected off Washington and Oregon and in the Gulf of Alaska from Dixon Entrance to Kodiak. Three stock groups were recognized for Pacific ocean perch. One exists off the Washington and Oregon coasts, while another is found in the Gulf of Alaska. A third previously unrecognized stock was tentatively identified off Prince William Sound. Samples of

canary rockfish, S. pinniger yellowtail rockfish, S. flavidus chilipepper, S. goodei and bocaccio, S. paucispinis, were collected off the California, Oregon, and Washington coasts. Two stocks may exist for canary rockfish one located off northern California and southern Oregon and the other located off northern Oregon and Washington. Only one stock group per species was recognized for yellowtail rockfish, chilipepper, and bocaccio. The relationship of the different species to each other and the general applications of the techniques of electrophoresis to work in marine fisheries are also discussed.

Wong, J., A. Barnes, Y. C. Lau, and M. Yamamoto. 1975. Quality and quantity of deboned flesh recovered from under-utilized fish. Can. Fish. Mar. Serv. Tech. Rep. 575, 10 p.

Several species of frozen rockfish, flatfish, and other locally available but under-exploited fish were examined for deboned flesh yield, protein, lipid, moisture, bone fragment content and quality. Yield of flesh ranged from 32 to 43% for the rockfish species, and from 25 to 45% for flatfish. Of those miscellaneous species tested, Pacific hake and pollock gave 46% and 44% flesh yields respectively. Yield figures were less than those reported by other workers for some species since yield was sacrificed in order to improve the quality of deboned flesh obtained. In terms of quality, the rockfish species provided the best deboned flesh while the flatfish species yielded the poorest product.

Word, J. Q., A. J. Mearns, and M. J. Allen. 1977. Better control stations the 60 meter survey. South. Calif. Coastal Water Res. Proj. Annu. Rep. 1977:89-97.

Wright, S. 1969. Marine fisheries investigations. Troll fishery progress report, 1967. Wash. Dept. Fish. 12p.

Wyllie Echeverria, Tina. 1987. Relationship of otolith length to total length in rockfishes from northern and central California. Fish. Bull., U.S. 85(2):383-387.

Wyllie Echeverria, Tina. 1987. Thirty-four species of California rockfishes: maturity and seasonality of reproduction. Fish. Bull., U.S. 85(2):229-250.

The viviparous rockfishes (Sebastes spp.) differ among species in age and size at maturity, and in the timing of peak spermatogenesis, fertilization, and larval extrusion. Reproductive development at the cellular level was compared with the coincident changes in the gross morphology of the gonads. The resulting description of the developmental sequences of the testes and ovaries enables the determination of maturity stage in the filed.

Yamagishi, H., K. Takano, and H. Ohta. 1984. Social behavior of the white-edged rockfish Sebastes-taczanowskii. Bull. Fac. Fish. Hokkaido Univ. 35(1):1-7.

Aggressive behavior, social hierarchy and courtship behavior of the white-edged rockfish (S. taczanowskii) were studied in captivity, both in the breeding (beginning of Nov.) and non-breeding seasons (late Aug.). Chasing, nipping, threatening (mainly laternal threat) and fighting were taken as expressions of aggressiveness in both seasons, but distinct territorial defense was not observed except on 1 day of Aug. In the fighting, mutual pushing with grasping jaws was rarely observed, except for the usual mutual nipping of the abdomen or head of the opponent fish. In nipping and fighting, the components of lateral threat (erection of all the fins and bending of the body) were often observed in the attacked fish. Dominance orders of the despotism and nip-dominance types were recognized in Aug. and Nov., respectively. In Nov. a male successively showed the lateral pass, tail fan and biting at the region near the female's genital pore, as expressions of courtship behavior. This courting was not carried through to copulation because of avoidance by the female.

Yamamoto, I., M. Nishizawa, and K. Mori. 1976. A study on contamination of foodstuffs by pesticides Part 9 organic chlorine pesticide residues in dairy products meats and fish produced in Hokkaido in 1975. Rep. Hokkaido. Inst. Public Health 26:58-62.

Yamashita, H. 1967. Hematological study of a species of rockfish, Sebasticus marmoratus- I:The effect of chlorinity on the moisture content and specific gravity of blood, serum protein and erythrocyte counts. Bull. Jpn. Soc. Sci Fish. 33(2):81-90.

Yamashita, H. 1967. Hematological study of a species of rockfish, Sebasticus marmoratus- II: Changes of the moisture content of blood, specific gravity, serum protein, hematocrit value and urea nitrogen level of serum in the specimens affected by ulcers. Bull. Jpn. Soc. Sci Fish. 33(11):995-1001.

Yamashita, H. 1968. Hematological study of a species of rockfish, Sebasticus marmoratus-III:Change of serum protein fractions during storage. Bull. Jpn. Soc. Sci Fish. 34(12):1059-1065.

Yamashita, H. 1969. Hematological study of a species of rockfish, Sebasticus marmoratus-V: Seasonal changes of blood elements, electrophoretic pattern of serum proteins and their percentage fractions. Bull. Jpn. Soc. Sci Fish. 35(4):379-385.

Yamashita, H. 1969. Hematological study of a species of rockfish, Sebasticus marmoratus-IV: Changes of the amount of blood elements and the electrophoretic pattern of serum protein under the influence of stress. Bull. Jpn. Soc. Sci Fish. 34(12):1066-1071.

Yamashita, H. 1970. Blood characteristics of marine fish in relation to the change of osmotic pressure of sea water-I:Changes of osmotic pressure of serum and the electrophoretic pattern of the serum protein of rockfish. Bull. Jpn. Soc. Sci. Fish. 36(5):439-449.

Yang, Y-R. 1981. Photo taxis of fish 4. Response of gray rock cod Sebastes inermis and cat shark Scyliorhinus torazame to the white lights. Bull. Korean Fish. Soc. 14(2):59-65.

The light intensity which induces maximum gathering rate was studied and the variation of the gathering rate in daytime and night was observed by using 2 spp. of commercial fish: gray rock cod, S. inermis (Cuvier et Valenciennes) and cat shark, S. torazame (Tanaka). An experimental tank was set up in a dark room. An illumination system was attached to 1 end of the tank to control horizontal light intensity. Six artificial light sources were prepared by combining 2 light bulbs (5W, 150W) and 7 filters. During the experiment water depth was maintained at 50 cm level in the tank. The tank was marked into 6 longitudinal sections, each being 60 cm long, to observe the distribution of fish. The fish were acclimatized in the dark for 40 min prior to the main experiment. Upon turning on the light, the number of fish in each section was counted 40 times every 30 s, and the gathering rates were obtained from the average number of fish in each section. The gathering rate of the gray rock cod did not show any definite pattern but fluctuated irregularly. The gathering rate fluctuated at night. That of the cat shark was almost constant and did not show any distinctive difference between day and night.

Yang, Y-R. 1983. Response of gray rock cod to the colored lights. Bull. Korean Fish. Soc. 16(4):330-334.

An experiment was conducted to find the response of gray rock cod, (Sebastes inermis) to colored lights. An experimental tank was set up in a dark room. Six longitudinal sections with 60 cm intervals were marked in the tank to observe the location of the fish. Light bulbs of 20W at the both ends of the tank projected the light horizontally into the tank. Two different colored filters were selected from four colors -- red, blue, yellow, and white. The fishes were acclimatized in the dark for 50 min before they were tested for light response. Upon turning on the light, the number of fish in each section was counted 40 times in 30-sec intervals, and the mean of the number of fish in each section was given as the gathering rate of the

fish. The colors favored by the fish was found in the order of white, blue, yellow and red.

Yang, Y-R. 1985. Response of rockfish Sebastes schlegeli to the colored lights. Bull. Korean Fish. Soc. 18(2):119-123.

The response of rockfish, Sebastes schlegeli (Hilgendorf) to the color lights was studied. The experimental tank was set up in a dark room. Six longitudinal sections with 60 cm intervals are marked in the tank to observe the location of the fish. Water depth in the tank was kept at 50 cm. Light bulbs of 20 W at the both ends of the tank projected the light horizontally into the tank. Two different colored filters were selected from 4 colors of red, blue, yellow and white, and placed in front of the light bulbs to make different colors of light. Light intensity was controlled by use of auxiliary filters intercepted between the bulb and the filter. The fishes were acclimatized in the dark for 50 min before they were used. Upon turning on the light, the number of fish in each section was counted 40 times at 30 s intervals and the mean of the number of fish in each section was given as the gathering rate of the fish. The colors favored by the fish was in the order blue, white, yellow and red in daytime, and yellow, blue, white and red at nighttime. The gathering rate of fish on illumination period was not constant and fluctuated with irregularly. The difference of the gathering rate on 2 different colors of light was great and the difference was larger in daytime than in nighttime.

Yoshiyama, R. M., C. Sassaman, and R. N. Lea. 1986. Rocky intertidal fish communities of California temporal and spatial variation. Environ. Biol. Fishes 17(1):23-40.

We examined data from our own and published collections of intertidal and shallow littoral fishes of the North American Pacific Coast with respect to temporal and spatial trends in species composition and dominance. We compared (1) recent and past intertidal collections made five and seven years apart, respectively, for two California localities, (2) intertidal collections from twelve localities in California, Oregon, and British Columbia, and (3) intertidal versus subtidal collections at one California locality. Temporal comparisons indicated substantially lower abundance of the cottid Oligocottus synderi at two California localities during 1984 at one locality due to depressed abundance of young. Interannual differences in abundances suggested that other tidepool fish assemblages undergo significant changes as well. Geographical comparisons indicated generally similarity in species composition, with cottids predominating in tidepools although several other families also were well represented (e.g., Scorpaenidae). Comparison of collections from the intertidal and subtidal

zones at one California locality demonstrated that fishes of these habitats form two essentially distinct assemblages, with most species restricted to or concentrated in one or the other habitat.

Young, D. R., M. D. Moore, T. J. Jan, and R. P. Eganhouse. 1981. Metal in seafood organisms near a large California municipal outfall. Mar. Pollut. Bull. 12(4):134-138.

With the possible exception of Cu and Zn, 8 trace metals [Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn] in muscle tissue of 5 popular benthic-feeding sportsfish [Genyonemus lineatus, Citharichthys sordidus, Scorpaena guttata, Paralichthys californicus, Sebastes paucispinis] caught near the Los Angeles County municipal wastewater outfalls were not concentrated above levels measured in island and coastal control specimens. Edible portions of 5 invertebrate seafood organisms [Haliotis cracherodii, Hinnites giganteus, Panulirus interruptus, Cancer anthony, Strongylocentrotus franciseanus] collected from the highly contaminated bottom sediments in this discharge zone concentrated some of the metals several-fold above control values. Maximum contamination observed was a 10-fold elevation of Cr in abalone and scallop muscle.

Young, Parke H. 1969. The California party boat fishery, 1947-1967. Calif. Fish Game Fish Bull. 145, 91 p.

Zaitlan, J. A. 1986. Geographical variation in the life history of Sebastes chrysomelas. M.A. Thesis, Calif. State Univ., San Francisco, 87 p.

Zhang, C. I. 1981. Growth of Pacific ocean perch Sebastes alutus in the Gulf of Alaska. Bull. Korean Fish. Soc. 14(3):171-178.

The growth of S. alutus was studied by scale reading to check the change of growth rate in early life stages. Lee's phenomenon was recognized on the scale measurements except the 1st ring radius. No evidence was found to support the change of growth rate at early stage. Von Bertalanffy's growth equation was estimated with the back-calculated fork lengths.

Zitko, V. 1978. Nonachlor and chlordane in aquatic fauna. Chemosphere 7(1):3-7.

The levels of cis- and trans-nonachlor and chlordane in a sample of aquatic fauna collected on the East Coast of Canada are presented. Samples were obtained from lobster (Homarus americanus) hepatopancreas, cod (Gadus morhua) liver, commercial herring (Clupea harengus) oil, commercial redfish (Sebastes marinus) oil and data on other specimens in the literature are also presented. Trans-nonachlor was

detected in all samples and most samples contained cis-nonachlor and the chlordanes. A comparison of recent (1977) data with those obtained on samples taken a few years ago (1971-1976) indicates that the levels of these substances have not changed appreciably. It is concluded that the cis- and trans-nonachlor levels may not be toxicologically significant.

Zwanenburg, K. 1983. 1983 status report on the 4VWX redfish. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 83/17, 25 p.

Zwanenburg, K. 1986. Redfish (Sebastes spp.) in management unit 4VWX: an assessment of present stock status. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 86/116, 31 p.