

The Pacific Coast Fishes of North America

The "Peterson Field Guide Series" has long been known for its authoritative and useful handbooks on identifying birds, mammals, wildflowers, seashells, and much more. The latest in this series, "**A Field Guide to Pacific Coast Fishes of North America**," by William N. Eschmeyer, Earl S. Herald, and Howard Hammann, continues that high quality and reliability and fills a considerable regional gap. Its coverage ranges from the Gulf of Alaska to Baja California.

The field guide is obviously intended for general public use and will be excellent reference, but it will also be widely used and appreciated by the scientific community, commercial fishermen, sport fishermen, and scuba divers.

Over 600 species are described in detail and there are over 525 illustrations (with 211 in 22 full-color plates) to aid

quick and accurate field identification. The book uses the time-tested Peterson Identification System to group similar species for easy comparison and to note the particular marks that help distinguish species similar in appearance.

Besides the plates (26 black and white, 22 color), the text has an additional 44 numbered figures illustrating important anatomical characters. About 70 percent of the fishes shown in full color are so illustrated for the first time. All fishes found in less than 200 m of water are included, along with many deep-sea species. Names used follow the AFS Special Publication 12, although additional popular names are provided for some species.

Introductory material on fish names, sizes, range, habitat, sex differences, color, and activity patterns and on collecting, observing, and conserving fishes is exceedingly brief. However, the data provided for each order and family are complete and well written and presented. The many species accounts are concise but thorough, providing necessary and current data on identification, range, habitat, similar species and other remarks (often on similarly named or similarly looking species, commercial or sport uses, methods of harvest (if any), value as prey, danger to humans, how marketed or consumed, etc.). Also provided are a glossary, selected references, and an index.

Eschmeyer is Director of Research and Curator of the Department of Ichthyology at the California Academy of Sciences in San Francisco where the late Earl S. Herald was Associate Director of the Steinhart Aquarium. Illustrator is Howard Hammann, though Jon Gnagy contributed 9 of the 48 plates; Katherine P. Smith was Associate Illustrator. The authors have also drawn on

scores of other fisheries experts for review, advice, and assistance, and the result is a highly authoritative, useful field guide that will be of great value to people ranging from casual anglers or divers to commercial and sport fishermen and the scientific community.

Published by the Houghton Mifflin Company, Boston, the 366-page volume is sponsored by the National Audubon Society, National Wildlife Federation, and the Sport Fishing Institute. It is available in most bookstores for \$11.95 (soft cover) and \$19.95 (hard cover) or by mail (tax and postage paid) from the California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118 for \$11.00 and \$18.00, respectively. Make checks payable to "Field Guides." Foreign mail orders are \$2.00 additional.

World Freshwater and Marine Gamefish Records

The year 1982 set a new record for new angling records for the International Game Fish Association (IGFA), owing to their implementation of new light-tackle world record categories for saltwater anglers and to a greater awareness among anglers of IGFA's expanded world record programs. Over 630 new world game fish records were granted last year.

The newest records, plus an update of the listings in all-tackle, line class, and tippet class categories for over 150 freshwater and saltwater species are now included in the IGFA's new "**1983 World Record Game Fishes**." Almost 100 pages of world angling achievements are listed. In addition, the book includes the official international angling rules and world record requirements set by the organization. Equally important are its articles by expert anglers and fishery scientists on topics of interest to serious anglers.

New articles (Section 2) include a discussion of the development of the striped bass freshwater fishery by outdoor writer Vlad Evanoff; an in-depth look at "Sight and Sound Perception in Fishes," plus some excellent under-

The Biology and Evolution of Crustacea

Australia's first international conference on Crustacea was held at the Australian Museum in Sydney in May 1980, with more than 160 carcinologists from 15 countries attending. Some 90 papers and posters were presented on crustacean evolution, physiology, community ecology, behavior, biogeography, reproductive biology, and taxonomy.

Twenty of those contributions have now been published in "**Papers from the Conference on the Biology and Evolution of Crustacea**," edited by James K. Lowry, Memoir 18 of the Australian Museum. Copies of the 218-page paperbound volume are available from the Museum in Sydney, New South Wales, at \$21.00 each (postage and handling charges not listed).

water fish photos, is provided by Parry B. Larsen of the University of Miami; Peter Goadby of Australia gives seasoned advice on the setting and enforcing of fishing tournament rules; outdoor writers Mark Sosin and Lefty Kreh discuss tackle and techniques for fly fishing the flats; and Jim C. Chapralis gives tips for traveling anglers.

Section 3 provides a rundown on the angling rules, record requirements, IGFA's annual fishing contest, and its new 5, 10, 15, and 20-to-One Clubs, which recognize anglers for taking fish weighing one of those multiples of the line weight.

Meanwhile, IGFA's Eighth Annual Fishing contest, now underway, provides recognition and documentation

for anglers who catch the biggest fish each year, whether they are world records or not. This program emphasizes entries for species not yet listed in the world records to help determine which ones should be considered for the listing and what the heaviest acceptable line class for each new species will be.

Section 4 is the world record listings and Section 5, the 80-page "Guide to Fishes," describes and illustrates all the record species. This data has been revised and expanded with new data on distribution, habitats, fishing methods, food and sporting value, biology, etc. Section 1, of course, relates IGFA's goals, philosophy and programs.

Appendices include listings of the "Game Fish Records of Nations and

Continents" as recorded by angling clubs around the world, a revised synopsis of major gamefish tagging programs, a knot-tying guide, an index to common and scientific names of the species, and a directory to state conservation agencies.

With its sound fishing rules, record listings, articles, and game fish species data, the volume is both comprehensive and authoritative and is an excellent reference for both marine and freshwater anglers and conservationists. Copies of the 328-page paperbound volume are available from the publisher, International Game Fish Association, 3000 East Las Olas Blvd., Fort Lauderdale, FL 33316-9987 for \$7.95 postpaid (US\$9.75 for foreign orders).

New NMFS Scientific Reports Published

The publications listed below may be obtained from either the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; from the Publications Services Branch (E/A113), National Environmental Satellite, Data, and Information Service, NOAA, U.S. Department of Commerce, 3300 Whitehaven St., Washington, DC 20235; or from the National Technical Information Service, Springfield, VA 22151. Writing to the agency prior to ordering is advisable to determine availability and price, where appropriate (prices may change and prepayment is required).

NOAA Technical Report NMFS SSRF-761. Bretschneider, Dale Emil, and Douglas R. McLain. "Sea level variations at Monterey, California." January 1983, iii + 50 p., 16 figures, 3 tables, 2 appendices.

ABSTRACT

Sea level data from Monterey, Calif., 1963 through 1976 were compared with data

from coastal stations from Peru to Alaska. Sea level fluctuations at Monterey were correlated with data from these stations, particularly those to the south. The causes of sea level fluctuations at Monterey were investigated by correlation, regression, and spectral analysis of sea level with atmospheric pressure, zonal and meridional wind stress, Ekman and Sverdrup transport, surface temperature and salinity, and dynamic height data from nearby locations. Of these variables, dynamic height was the best predictor of sea level fluctuations. Atmospheric pressure, surface temperature, and meridional wind stress were of secondary importance. The prediction was better during the Davidson Current period than during the upwelling period.

NOAA Technical Report NMFS SSRF-762. Squire, James L., Jr. "Abundance of pelagic resources off California, 1963-78, as measured by an airborne fish monitoring program." February 1983, v + 75 p., 65 figures, 4 tables.

ABSTRACT

From September 1962 through December 1978 commercial aerial fish-spotter pilots

operating off southern and central California and northern Mexico, maintained a flight log indicating the geographical areas searched and an estimate of the quantity of pelagic species observed. These flight logs were analyzed for quantities of the various species observed per block area (10' longitude by 10' latitude area). Flights were recorded as surveying all or a portion of 164,753 block areas. A total of 110,375 block areas were surveyed during the day and 54,378 during night operations. An annual index of apparent abundance (arbitrary values) was computed for each of the major species observed, both for day and night aerial observations from selected geographical areas, and for total observations. The index value computed is not directly comparable between species.

During the period of the survey, the apparent abundance index for Pacific sardine, *Sardinops sagax caerulea*, declined from 1.03 in 1964 to 0.00 in 1974, and no significant schools have been observed by aerial surveys since. The northern anchovy, *Engraulis mordax*, night apparent abundance index remained relatively constant from 1963 to 1969 (2.99-4.35), increased substantially in 1973 to 14.99, then declined by 1978 to a level (1.91) near that observed in 1963-69. The day index for Pacific bonito, *Sarda chiliensis*, declined to a low level in 1968-69 (0.43-0.26), increased in 1972 to 1.11 (a year of above average sea surface temperature), and in subsequent years declined again to a low level (± 0.1). Pacific mackerel, *Scomber japonicus*, population biomass was apparently low in 1962 at the start of the surveys, and continued to decline to very low night abundance levels during 1967-75 (undefined range of 0.00 to 0.03). In 1976 a small increase in the overall

apparent index was recorded. By 1977 the night index had increased to 2.62, and in 1978 it again increased to a high level of 7.46. Jack mackerel, *Trachurus symmetricus*, showed a declining abundance index value during 1969-75 (0.66-0.40). A small increase in the night index apparent abundance was noted in 1976, and in 1977 the night index increased to 2.77. In 1978 it then increased about 1.5 times to a record high of 4.20.

Downward trends in apparent abundance indexes were noted 1-2 years in advance of declines in the commercial catches for northern anchovy and Pacific bonito. Limitations of collected nonrandom data and variations in sightings and school size estimation between pilots are discussed. The apparent abundance indexes obtained from aerial surveys are compared with measures from larval and acoustical surveys.

A rank correlation analysis was made to measure the agreement between independent estimates of northern anchovy spawning biomass, larval index, and aerial index. Significant correlations were found for the aerial and acoustical survey indices of 1972-78 for the northern anchovy ($r_s = 0.810$, significant at the 0.05 level). During this period only three larval surveys were conducted, insufficient to calculate correlation. For earlier data, 1962-66 and 1968-69, larval vs. aerial index gave a poor correlation (+ 0.30). A significant correlation was evident for Pacific mackerel aerial index vs. spawning biomass index ($r_s = 1.00$).

NOAA Technical Report NMFS SSRF-763. Nelson, Craig S., and David M. Husby. "Climatology of surface heat fluxes over the California Current region." February 1983, iii + 155 p., 21 figures, 1 table, 2 appendices.

ABSTRACT

Historical surface marine weather observations are used to compute large-scale atmosphere-ocean heat exchange components over the California Current region. Heat exchange components are summarized by 1° square areas and long-term months, and major features of the monthly distributions are described. The accuracy of the derived air-sea interaction variables and methods of computation are discussed.

The region off the west coast of the United States and Baja California is characterized by net annual heat transfer from atmosphere to ocean. Net oceanic heat gain reaches a maximum during summer off Cape Mendocino. Near the coast, surface heat flux is determined by a balance between incoming solar radiation and effective back radiation. In the offshore regions, high cloudiness reduces the magnitude of the short-wave radiative flux, and latent heat flux produces the largest heat loss. The prin-

cipal seasonal and spatial variations in air-sea heat transfer are a consequence of coastal upwelling which contributes to relatively low cloudiness and high incident solar radiation near the coast, suppression of evaporative heat loss, and reversal of the sensible heat flux. Simplified heat budget calculations demonstrate the importance of advective processes in maintaining the seasonal heat balance in coastal upwelling regions. Nonseasonal fluctuations are evident in time series of heat exchange processes, but low frequency components are not well described by the surface marine data used in this study.

NOAA Technical Report NMFS SSRF-764. Frost, Kathryn J., and Lloyd F. Lowry. "Demersal fishes and invertebrates trawled in the northeastern Chukchi and western Beaufort Seas, 1976-77." February 1983, iii + 22 p., 4 figures, 6 tables, 1 appendix.

ABSTRACT

Thirty-five successful otter trawl tows were conducted in the northeastern Chukchi and western Beaufort Seas in August-September of 1976 and 1977. Nineteen species groups of fishes and 238 invertebrate taxa were identified. Three of the fishes (*Boreogadus saida*, *Lycodes polaris*, and *Icelus bicornis*) accounted for 65 percent of all fishes caught. Information on size, reproductive condition, and food habits is presented for those three as well as for *Artediellus scaber*, *Aspidophoroides obriki*, *Liparis* spp., *Eumicrotremus derjugini*, *Gymnelis viridis*, and *Icelus spatula*. The first Beaufort Sea records are reported for three species: *Arctogadus glacialis*, *Lycodes raridens*, and *Eumesogrammus praecisus*. Of the invertebrate taxa, echinoderms (mainly brittle stars and crinoids) were the most abundant, and in most cases comprised more than 75 percent of the total trawl biomass. West of long. 154° W, brittle stars, *Ophiura sarsi*, were predominant whereas east of long. 150° W, the invertebrate community was characterized by crinoids (*Heliometra glacialis*) and small scallops (*Delectopecten groenlandicus*). Information on size, reproductive condition, and depth distribution is presented for brachyuran crabs and shrimps and the occurrence of other major invertebrate groups is summarized. A complete list of species and stations at which each was caught is included.

NOAA Technical Report NMFS SSRF-765. Haynes, Evan. "Distribution and abundance of larvae of king crab, *Paralithodes camtschatica*, and pandalid shrimp in the Kachemak Bay area, Alaska, 1972 and 1976."

April 1983, iii + 64 p., 29 figures, 1 table, 3 appendix tables.

ABSTRACT

Distribution and abundance of larvae of king crab, *Paralithodes camtschatica*, northern shrimp, *Pandalus borealis*, humpy shrimp, *P. goniurus*, coonstripe shrimp, *P. hypsinotus*, and sidestripe shrimp, *Pandalopsis dispar*, were studied in the Kachemak Bay area, Alaska, in 1972 and 1976. In both 1972 and 1976, larvae of king crab, northern shrimp, and humpy shrimp first appeared in outer Kachemak Bay; their abundance was greatest in the central portion of the outer bay. Two additional species were studied in 1972, coonstripe shrimp and sidestripe shrimp. In 1972, the center of abundance of sidestripe shrimp larvae was similar to that of larvae of king crab, northern shrimp, and humpy shrimp. Coonstripe shrimp larvae were most abundant in the inner bay and along the northern shore of the outer bay.

The direction in which larvae were transported out of outer Kachemak Bay was only in partial agreement with suspected water-current patterns and may have been influenced by behavior of the larvae. Continued abundance of larvae in outer Kachemak Bay may be caused by entrainment of the larvae in gyres.

Depending on species and area, pandalid shrimp larvae are released at different times and over different periods. For example, larvae of northern shrimp appeared in plankton catches earlier than larvae of humpy shrimp. Coonstripe shrimp had the longest release period of all the shrimp sampled.

From the percentage of glaucothoe in the samples, king crab larvae probably settle in the Bluff Point area in outer Kachemak Bay. Larvae of pandalid shrimp probably settle in outer Kachemak Bay and possibly lower Cook Inlet, but exact locations cannot be determined only by observing changes in morphology of the larvae.

Vertical depth distributions of larvae of king crab and pandalid shrimp were generally similar. Early-stage larvae of king crab, northern shrimp, and humpy shrimp migrated vertically in a diel cycle. A thermocline did not prevent migration to surface waters.

NOAA Technical Report NMFS SSRF-766. Caracciolo, Janice V., and Frank W. Steimle, Jr. "An atlas of the distribution and abundance of dominant benthic invertebrates in the New York Bight apex with reviews of their life histories." March 1983, v + 58 p., 69 figures, 5 tables.

ABSTRACT

Distribution, abundance, and life history

summaries are given for 58 important species of benthic invertebrates collected in the New York Bight apex during five sampling cruises in 1973 and 1974. These species showed affinities to major community types that have been previously identified in the Middle Atlantic Bight and some showed varying degrees of tolerance of areas in the apex where the dumping of New York Harbor dredge spoils and New York metropolitan area sewage sludge occurs. *Capitella capitata*, a species often associated with pollution stress, dominated the sewage sludge dump site.

NOAA Technical Report NMFS SSRF-767. Creaser, Edwin P., Jr., David A. Clifford, Michael J. Hogan, and David B. Sampson. "A commercial sampling program for sandworms, *Nereis virens* Sars, and bloodworms, *Glycera dibranchiata* Ehlers, harvested along the Maine coast." April 1983, iv + 56 p., 16 figures, 30 tables, 1 appendix.

ABSTRACT

Brief discussions of the history and development of the marine worm fisheries for bloodworms, *Glycera dibranchiata*, and sandworms, *Nereis virens*, the methods of digging both species, the packing media used in their shipment, and the various marine worm markets, are presented.

The status of the commercial marine worm fishery between April and September 1973-76 was investigated. A sampling program for bloodworms and sandworms revealed that there was no significant difference in the mean size of bloodworms (18.72 ± 0.60 - 20.83 ± 0.54 cm) and sandworms (25.69 ± 0.42 - 26.77 ± 0.53 cm) harvested. Marine worm diggers avoid picking up potential spawning sandworms during the months of March, April, and May and bloodworms during the month of May. During August and September, potential sandworm spawners comprise 15.6-38.3 percent of the commercial catch; during April, potential bloodworm spawners comprise 7.33-13.58 percent of the commercial catch. Sandworm spawners were found coastwide but bloodworm spawners were never collected east of the Taunton River (Sullivan, Maine). Approximately 8 percent of the sandworms and 5-7 percent of the bloodworms had regenerated tails and approximately 19-23 percent of the sandworms and 12-13 percent of the bloodworms were broken.

The use of probability sampling expansions has enabled us to estimate that sandworm diggers dug a total of 45,746-66,004 hours/sampling season during a total of 23,402-31,587 tides/sampling season and landed a total catch of 307,426-409,189

pounds. Bloodworm diggers dug a total of 89,691-177,909 hours/sampling season during a total of 30,545-62,339 tides/sampling season and landed a total catch of 109,936-206,577 pounds.

It cannot be conclusively stated that sandworm and bloodworm abundance changed significantly between 1973 and 1976. Ratio estimates of the numbers of marine worms dug/digger tide varied between 1.024 ± 60 - $1,184 \pm 38$ (sandworms) and 536 ± 36 - 662 ± 26 (bloodworms).

The 6-month mean value/tide and value/hour varied between \$27.97-\$40.30 and \$14.34-\$19.15, respectively (sandworms), and \$27.97-\$31.59 and \$10.11-\$11.00, respectively (bloodworms).

A significant difference exists in the length-weight relationships for sandworms and bloodworms from eastern Maine and the Sheepscot River. This observation may result from the fact that bloodworm spawners are rare in eastern Maine and bloodworms may substitute an increase in weight for the production of gametes. No explanation for this observation in sandworms can presently be given.

The numbers of bloodworms and sandworms per pound were calculated from mean length and length-weight data. Although the mean number of bloodworms per pound decreased during the 4-year sampling period, the decrease was not significant at 95 percent confidence limits (1.96 SE). No significant changes in the mean number of sandworms per pound were recorded during the same period.

The MSY (maximum sustainable yield) for the fishery was obtained with approximately 815 bloodworm diggers, 386 sandworm diggers, and 99 diggers who dug both species. OSY (optimal sustainable yield) was approximately 564-689 bloodworm diggers, 267-327 sandworm diggers, and 69-84 diggers who dug both species. Very rough quotas of 28-33 million bloodworms, and 26-30 million sandworms are associated with these OSY figures.

The overall average frequencies of bloodworm and sandworm digging (expressed as the number of low tide periods occurring since the last low tide dug) were 5.3 and 3.4, respectively. The numbers of years of digging experience recorded for bloodworm and sandworm diggers show that worm digging is frequently a short-lived work experience. 35-51 percent of the bloodworm diggers and 22-34 percent of the sandworm diggers have dug between 1 and 4 years. The mean age of bloodworm and sandworm diggers varied between 27.7 and 31.9. The vast majority of both bloodworm and sandworm diggers are male.

NOAA Technical Report NMFS SSRF-768. Theroux, Roger B., and Roland L. Wigley. "Distribution and abundance of east coast bivalve mol-

lusks based on specimens in the National Marine Fisheries Service Woods Hole collection." June 1983, xvi + 172 p., 121 figures, 327 tables.

ABSTRACT

The distribution and numerical abundance of over 108,000 specimens of bivalve mollusks (81 percent of which were alive when captured) collected and maintained by the Benthic Dynamics Investigation at the NMFS Northeast Fisheries Center at Woods Hole, Mass., are presented. They are illustrated in a series of charts, and their bathymetric range and bottom sediment preferences are outlined in tabular form. Taxonomic groups represented include 5 subclasses, 8 orders, 46 families, 99 genera, and 164 species. The specimens are contained in 10,465 lots from 2,767 sampling sites along the east coast continental shelf and slope, and upper continental rise between Nova Scotia and southern Florida. Samples range in depth from 0 to nearly 4,000 m. The collections were obtained by a variety of research vessels and persons using quantitative and qualitative sampling devices (i.e., grabs, dredges, trawls, etc.) over a period of 21 years. Also included are current vernacular names, zoogeographic data, and a reference to the original description of represented species. The data upon which this report is based are stored on magnetic tape and disc files, and the specimens are stored in a Specimen Reference Collection at the Northeast Fisheries Center in Woods Hole, Mass.

NOAA Technical Report NMFS Circular 448. Darcy, George H. "Synopsis of biological data on the grunts *Haemulon aurolineatum* and *H. plumieri* (Pisces: Haemulidae)." February 1983, iv + 37 p., 33 figures, 26 tables.

ABSTRACT

Information on the biology and fishery resources of two common species of western Atlantic grunts, *Haemulon aurolineatum* and *H. plumieri*, is reviewed and analyzed in the FAO species synopsis style.

NOAA Technical Report NMFS Circular 449. Darcy, George H. "Synopsis of biological data on the pigfish, *Orthopristis chrysoptera* (Pisces: Haemulidae)." March 1983, iv + 23 p., 22 figures, 15 tables.

ABSTRACT

Information on the biology and resources of the pigfish, *Orthopristis chrysoptera* is reviewed and analyzed in the FAO species synopsis style.