

NMPC Books



Philippine Shore Fishes of the Western Sulu Sea



Robert E. Schroeder

A Project of the Bureau of Fisheries and Aquatic Resources,
Ministry of Natural Resources, Republic of the Philippines

Foreword

THE PHILIPPINES has one of the richest and most diverse marine ecosystems in the world. The identification of its fishes has traditionally been difficult in the absence of a suitable concise field guide.


President Ferdinand E. Marcos, aware of the importance of fish to the nation's economy and the people's diet, has taken timely steps to promote and speed up fisheries development. The First Lady, Mrs. Imelda Romualdez Marcos, has constantly shown her concern for the ecology and conservation of natural resources. The Bureau of Fisheries and Aquatic Resources, which is engaged in the exploration, assessment and exploitation of the Philippines' potential as a fishery resource, has been encouraging related research. The accurate identification of species is a prerequisite to sound planning and effective management of fisheries resources, measures which are necessary to optimize their productivity.

For this reason and with the constant encouragement and support given by Minister of Natural Resources Jose J. Leido Jr., the Bureau and NMPC have undertaken this project of publishing a comprehensive illustrated guide to the fishes of the Western Sulu Sea, most of which are common throughout Philippine coastal waters and many of which occur throughout the tropical Indo-Pacific region.

Author Robert E. Schroeder, assisted by Bureau personnel, went to great lengths to photograph the fishes in their live colors and to ensure accurate and current identification. A particularly useful feature of the book is the coupling of the common Philippine fish names with corresponding photographs.

This field guide should prove helpful to fisheries researchers, statisticians, extension workers and students, as well as to fish commerce and industry. Knowledge of undersea life should lead to the enjoyment of Philippine waters and aquatic resources at the same time that attention is focused on the need for their wise use and conservation. Because the Philippines is one of the major exporters of tropical aquarium fishes to the United States and Europe, this book should enhance the interest of foreign aquarists by providing them with a wide range of information about local specimens.

We welcome the book as a valuable contribution to marine science.



FELIX R. GONZALES
*Director of Fisheries
and Aquatic Resources*

Philippine fisheries and aquatic resources

FISHING is one of the Philippines' oldest industries and one of the most promising foreign-exchange earners of the country. In 1978 the industry contributed 4.9 percent to the gross national product. As a source of livelihood, the industry employs close to 795,000 commercial and municipal fishermen and around 176,000 fishpond culturists. Allied and secondary industries dependent on fishing include fish processing, operation of ice plants and cold storages, salt making and boat building. Shellcraft, seaweeds and sponges have also been profitable business ventures.

Geographic location and physical attributes make the Philippines a rich fishing ground. In its vast territorial and insular waters abound more than 2,000 known species of fishes, as well as countless varieties of other marine life.

Territorial waters are almost six times the total land area of 300,780 square kilometers. Marine waters cover 1,666,300 square kilometers; coastal waters, from shore

to depths of 200 meters, extend to 265,000 square kilometers. Of these marine and coastal waters, 126,500 square kilometers are traditional fishing grounds. Maximum potential yield of Philippine marine waters has been estimated to be 3.7 million metric tons of fish a year.

Of 50 known commercial fishing grounds, three have been the most productive: the Visayan Sea with a total annual production of 152,000 metric tons, the Southern Sulu Sea with 113,000 metric tons and Moro Gulf with 46,000 metric tons in 1978.

Inland resources consist of about 818,000 hectares, which include freshwater and brackish-water swamplands, fishponds, lakes, rivers and reservoirs. The Philippines has 68 lakes covering an area of 200,000 hectares, as well as rivers and reservoirs of 618,000 hectares.

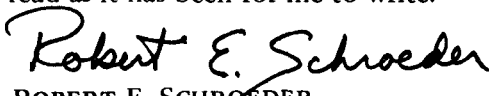
The Bureau of Fisheries and Aquatic Resources is responsible for the development, improvement, management and conservation of these resources.

Preface

IN JULY OF 1976 I came to the Philippines as a US Peace Corps Volunteer to work for the Bureau of Fisheries and Aquatic Resources. I was assigned to the South Palawan District Fisheries Office, where I began a survey directed toward the conservation of local commercial fishes. During this investigation I became aware of the need for a well-illustrated identification guide to the area's fishes, along with a reference collection of specimens from this remote and "virgin" island. I began collecting and photographing fresh specimens on a daily basis. As the only marine biologist in Palawan I was fortunate to host visiting scientists such as ichthyologist Dr. Roger Lubbock of the University of Cambridge, who took a particular interest in the project. Another encouraging scientist, Dr. Leslie Knapp of the Smithsonian Institution, helped to arrange for the identification of many of the specimens. As the project progressed I found that many people were interested and willing to help in any way they could.

Palawan is far from the national capital and still largely undeveloped; working there had its difficulties. I had to hand-pump and carry all water for both laboratory and personal use, and often worked without electricity. Numerous supplies and repairs were unavailable. Delays, misunderstandings and other frustrations were common. Despite this, the survey was exciting and tremendously enjoyable: island-hopping in helicopters, spending hundreds of hours diving and photographing beautiful fishes on unspoiled reefs, living in nipa huts and eating fresh, raw fish by hand.

I hope this book will serve its purpose and be as much a pleasure for fish enthusiasts around the world to read as it has been for me to write.


ROBERT E. SCHRÖEDER
Manila, Philippines
January 1980

Acknowledgments

I AM PARTICULARLY thankful to Mr. Felix R. Gonzales, Director of the Philippine Bureau of Fisheries and Aquatic Resources (BFAR), and Mr. Matias A. Guieb, Director of the BFAR Regional Office IV, for their generosity in providing administrative and financial support for this project.

For field support more credit must go to Mr. Agustin Go, of Puerto Princesa, Palawan, than to anyone else. He generously gave of his time, advice, hospitality, jeeps and scuba equipment, as well as served as my constant diving buddy almost exclusively for the underwater work. Commander Gil S. Fernandez of the Philippine Western Command Base deserves special thanks for providing interisland air transportation. I am thankful to the many fishermen, aquarium-fish exporters, and fish-market vendors of Palawan for providing fresh specimens and first-hand information on the Philippine names, life histories and sizes of the fishes described.

My grateful thanks go to the following ichthyologists who gave freely of their time in providing assistance with specimen identifications, most notably Dr. Leslie W. Knapp, of the Smithsonian Oceanographic Sorting Center, who in addition handled the specimen shipments to these specialists: Dr. Bruce B. Collette, Dr. Roger F. Cressey, Ms. Janet R. Gomon, Dr. Ernest A. Lachner and Dr. Victor G. Springer, all of the US National Museum of Natural History, Dr. John E. Randall and Mr.

Kent E. Carpenter of the Bernice P. Bishop Museum, Dr. William F. Smith-Vaniz and Dr. James Bohlke of the Academy of Natural Sciences of Philadelphia, Dr. Stewart Springer and Mrs. Patricia M. Bird of the Mote Marine Laboratory, Dr. Gerald R. Allen and Mr. Barry Hutchins of the Western Australian Museum, Dr. James C. Tyler of the National Marine Fisheries Service, Dr. Peter Whitehead of the British Museum of Natural History, Dr. Roger Lubbock of the University of Cambridge, Dr. Martin Gomon of the National Museum of Victoria, Mr. R.J. McKay of the Queensland Museum, Mr. C.E. Dawson of the Gulf Coast Research Laboratory, Dr. Richard Winterbottom of the Royal Ontario Museum, Dr. William Eschmeyer of the California Academy of Sciences, Mr. Edward O. Murdy of the University of the Philippines Marine Sciences Center, Dr. Gareth J. Nelson of the American Museum of Natural History, Dr. Torao Sato of the Misaki Marine Biological Station, and Mr. Peng-chee Lim of Kashim-Kata, Tokyo.

I am greatly indebted to the following people for reading and criticizing the text: Dr. Gordon Hendler and Dr. Leslie W. Knapp of the Smithsonian Oceanographic Sorting Center, Mr. Edward O. Murdy and Mr. Carl J. Ferraris Jr. of the University of the Philippines Marine Sciences Center, Mr. Kim Podkulski, Mr. Ramon I. Miclat, Mr. Inocencio A. Ronquillo, Mrs. Apolonia C. Pascual and particularly Ms. Charito V. Mallen, who meticulously

read the manuscript at all stages of its development as well as compiled the Philippine fish names, all of the BFAR, Dr. William D. Anderson Jr. and Dr. G. David Johnson of the College of Charleston Grice Marine Biological Laboratory, Dr. Daniel Pauly of the International Center for Living Aquatic Resources Management, Dr. Phil Heemstra of the J.L.B. Smith Institute of Ichthyology, Mr. Ian S.R. Munro of the Australian Division of Fisheries and Oceanography, Commonwealth Scientific and Industrial Research Organisation, Mr. Enrico P. Viloso of the University of the Philippines College of Fisheries, Dr. James C. Tyler, Dr. Roger Lubbock, Dr. Gerald R. Allen, Mr. Kent E. Carpenter and Mrs. Patricia M. Bird. I also thank Ms. Felicidad G. Selda for patiently typing the manuscript.

I sincerely thank Ms. Angelita L. Altea, the Peace Corps Fisheries Program Manager, who was a source of inspiration toward my efforts, as well as the Peace Corps co-directors Elizabeth and John Abernethy. I also acknowledge the valuable administrative assistance provided by Ms. Marjorie T. Tinaja, Mr. Pol Alapan and Mr. Carlos G. Macolor, all of the BFAR. Special recognition is due Mr. Kent E. Carpenter, Mr. Edward O. Murdy, Mr. Carl J. Ferraris Jr. and the members of the BFAR coral-reef research team for providing invaluable facilities and advice. I would also like to thank Mr. Jose Marcelo Jr. and Mr. Greg Stankie for lending their support to the project.

Finally, very special thanks are due Ms. Charito V. Mallen and Ms. Felicidad G. Selda for their dedicated assistance throughout this project.

Introduction

THE WATERS of the Sulu Sea teem with various marine organisms. Adjacent seas in which some endemism has occurred include the Philippine Sea to the east, the Celebes Sea to the south and the South China Sea to the west, with the Philippines located between the much larger Indian and Pacific Oceans. This proximity to such geographically separate basins has contributed to the diversity of marine fauna observed in the Sulu Sea. Each basin has, over geologic time, contributed to the pool of species which has resulted in the fauna currently indigenous to this area.

Rapid and accurate identification of fishes in the field is difficult because of the lack of a field guide for the fishes of the Sulu Sea. Fish publications treating adjacent areas such as Southern Japan, New Guinea, New Caledonia and the Great Barrier Reef may together cover many of the fishes found in the Philippines, but are each generally unsatisfactory for the identification of Philippine fishes. Previous works dealing with Philippine fishes (notably that of Henry Fowler) are badly out of date and due to their technical nature are poorly suited for use as a field guide.

While involved in fisheries research for the Philippine Bureau of Fisheries and Aquatic Resources (BFAR), I had difficulty in identifying common marine fishes of Palawan, and I became convinced of the need for an iden-

tification guide. Such a guide should be a concise, well-illustrated treatise sufficiently detailed to be informative for the trained zoologist, yet comprehensible to the layman interested in rapid species identification.

Preparation of this field guide took over three years, during which I collected more than 3,000 specimens and shot over 2,000 photographs. Concise statements including scientific name, English common name, Philippine name, ecology, commercial and aquarium significance, morphology and size information are included. I hope that the information contained in this book will prove useful to ichthyologists, fisheries biologists, Filipino fishermen, fishery industry personnel, aquarists and fish enthusiasts alike—in short, to anyone interested in the habits, uses and identification of fishes native to the Sulu Sea.

The fishes represented here were taken from the inshore waters of the Western Sulu Sea. Most of the species illustrated are common, which means those most frequently obtained by the methods used for collection. Offshore pelagic fishes such as marlin and dolphins are not treated here, although some tunas, which occur both pelagically offshore and inshore, are included. A few species, such as the deep-water *Anthias*, are included, as they may be encountered by scuba divers, although they are unknown to fishermen.

Methods

THE HEADQUARTERS for work on this book was the fisheries station laboratory in Puerto Princesa, Palawan. This city is the largest urban center along the Western Sulu Sea and the hub of fishing activities. Regular field surveys were also carried out at Roxas, Palawan (150 kilometers northeast of Puerto Princesa), Balabac Island (the far Western Sulu Sea, between Palawan and Sabah), and briefly at the Cagayan Islands (the North Central Sulu Sea). The far Eastern Sulu Sea (bordering the Central Visayan Islands) and the very Southern Sulu Sea were not covered by this study.

Daily fish collections were made by meeting local fishermen at the main fish landings and scanning the Puerto Princesa fish market for new specimens. Fishes were also taken directly from aquarium-fish divers, a large local industry. Underwater collections were made periodically in the Puerto Princesa area using scuba, ichthyotoxins and hand nets, as well as in the other regions of the Sulu Sea listed above. Colored sketches were made of the species previously collected. Reference to these sketches at the collection sites helped determine whether or not the species had previously been taken and photographed.

For each "new" species a color photograph was taken in the laboratory. Fishes to be photographed were stored in an ice bath to preserve their colors. Their fins were extended, pinned and painted with 37-percent aqueous formaldehyde (a liquid preservative) to secure

their position, and when the pins were removed the fishes were placed horizontally underwater in a shallow glass aquarium with a black background. The fishes were photographed using two spotlights and a hand-held 35 mm SLR camera. These specimens are preserved in aqueous formaldehyde and deposited in the BFAR reference collection in Manila, Philippines.

Underwater photography, using both natural and artificial light, was employed to document the fishes in their natural habitats.

Standardized interviews with about a hundred Sulu Sea fishermen were conducted. During these sessions, color transparencies of the fishes were projected and notes were taken on the fishermen's comments. They provided firsthand information on local names, habitats, depth range, diets, notable behavior, fishing methods, uses and sizes.

Much of the reference materials used for this book stem from the libraries of the BFAR Research Division, the South China Sea Fisheries Development Programme, the University of the Philippines College of Fisheries and Marine Sciences Center, the International Center for Living Aquatic Resources Management, and the Philippine National Museum, all in Metropolitan Manila, Philippines. Brief visits to the libraries of the University of Cambridge Department of Zoology, the US National Museum of Natural History, the Mote Marine Laboratory, and the Bernice P. Bishop Museum also provided valuable information.

Explanation of format

The Sulu Sea: This section is an introduction to the location, topography, habitats, fish fauna, fishermen and fishing methods of the Sulu Sea.

The Illustrated Guide: Most fishes can be identified by a color photograph. Each photograph bears a number corresponding to the fish's description in the text. The scientific name and length of the specimen photographed are listed below it.

The Fishes. The shore fishes of the Western Sulu Sea are described by family and species. The families are arranged taxonomically. Descriptions of species are outlined as follows:

Scientific Name: Generic and species names are listed, followed by the name of the person who originally described the fish (i.e. the "author" of the species). Species that have been identified only as to genus are designated by "sp." following the generic name. For these and species with questionable identifications the available specimen meristic counts are listed. Scientific names may at first appear difficult and unnecessary to the layman, but with the great variation, overlap and inconsistencies of local or common names they are necessary for accurate identification.

English Common Name(s): This is the name most commonly used by the layman to refer to a species, genus or family of fish. They were mainly adapted from usage by aquarium exporters, fishermen and scuba divers, or

were coined using the most prominent descriptive characteristic of the species.

Local Name(s): This is the Philippine name most commonly used by Sulu Sea fishermen to refer to a fish. Several names may be listed since a number of dialects are spoken on the borders of the Sulu Sea. The Philippine name listed is usually the most common or widespread term in usage for that particular fish, although this determination is by nature highly subjective and, at times, arbitrary. Cuyonin, Visayan, Tagalog and Tausug are the primary dialects used in the Sulu Sea region. Cuyonin originates from the Palawan Islands bordering the North-western Sulu Sea. Visayan originates from the Central Philippine Islands which border the Eastern Sulu Sea. Tagalog (or Pilipino), the most widespread of the Philippine dialects, originates from the central region of the island of Luzon. This island does not border the Sulu Sea, but many Tagalog immigrants inhabit the Sulu Sea region. Tausug is the only common Sulu Sea dialect lacking in the description. This is the main dialect of the Muslim Filipinos, who predominate around the southern boundaries of the Sulu Sea. Unfortunately, because of political dissidence and piracy during the period of study, no sampling was done in the Southern Sulu Sea.

Ecology: Habitat, depth range, behavior, feeding, fishing methods, domestic use and aquarium suitability are discussed where applicable. This information was obtained from research in the literature, interviews with fishermen, and firsthand observations using scuba.

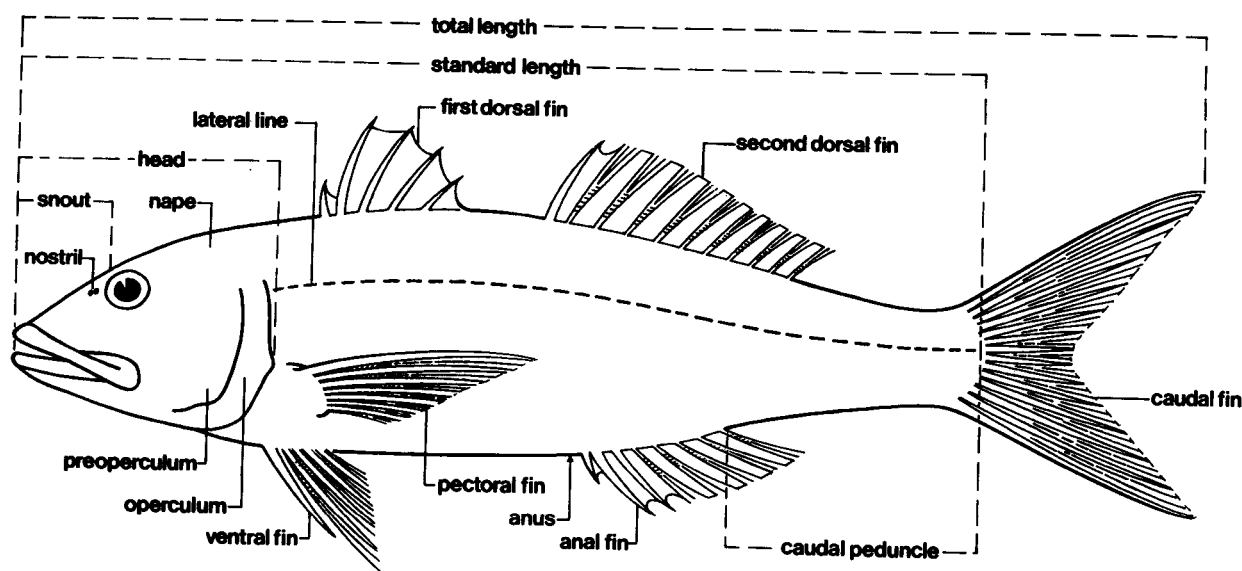
Diagnosis: To help in the identification of the fish a meristic formula is given. The first abbreviated terms represent the fin-ray formula. In bony fishes the fins have rays and often spines, and the name of the fin is abbreviated by having the first letter capitalized (i.e. D. for dorsal, A. for anal, P. for pectoral, V. for ventral [or pelvic], and C. for caudal). Roman numerals indicate the number of fin spines; spines are usually harder than rays and are unsegmented. Arabic numbers represent the number of soft rays of the fin; rays are bilaterally paired and segmented and they are often branched and flexible. When the number of spines or rays commonly varies for a count, a range may be listed with the numbers separated by a swung dash (~). In a fin composed of two separate sections, the numbers are separated by an em dash (—) which refers to the location of the break. Where spines and rays occur within the same section, the Roman and Arabic numbers are separated by a comma. The lateral line is a tube running along the side of the fish's body and forming a line that is usually raised and visible as a series of pores. It serves as a sensory organ for the fish. The scale count along the lateral line (L.l.) is obtained by counting the number of scales, starting anteriorly from the shoulder girdle (above the gill cover), and continuing to the base of the caudal fin, or by counting only the number of pored scales along this line (L.l.p.). Scutes are scales modified into large bony plates, often with keels or sharp elevated ridges. When present they commonly occur along the straight posterior portion of the

lateral line. They are counted in the same manner as the lateral-line scales. The number of scales before the dorsal fin (Pred. S.) is counted along the dorsal midline of the head to the origin of the dorsal fin. Gill rakers (G.r.) are a series of bony projections along the front edge of the gill arch. Usually two numbers are listed following G.r. which are separated by a plus sign (+), indicating the number of rakers along the upper and lower limbs of the first arch. A single number following G.r. indicates the number of rakers along the entire first arch. For counts that commonly vary, a numerical range separated by a swung dash is given.

Distinctive anatomical features and color patterns are described. Common general characteristics stated in the family descriptions are not repeated in each species diagnosis.

Differences between juveniles and adults and between males and females are described when known.

Size: The "common" and "maximum" size for each are expressed in standard length or in total length. Standard length (S.L.) is measured from the tip of the snout to the base of the caudal fin (the posterior margin of the last vertebra). Total length (T.L.) is measured from the most anteriorly projecting part of the snout to the posterior tip of the tail or that of the caudal fin when its rays are squeezed together. The common size is the rough size estimate of the fish usually encountered by fishermen, divers or others working with the Sulu Sea fishes. The maximum size is the largest reliably reported size for that species.



The Philippine Islands



0 50 100 150 Km
0 50 100 Mi



Luzon

Philippine Sea

Manila

Mindoro

South China Sea

Visayas

Panay

Cuyo Islands

Roxas

Cagayan Islands

Negros

Palawan
Puerto Princesa

Tubbataha Islets

Balabac Island

Sulu Sea

Cagayan Sulu Island

Zamboanga Peninsula

Mindanao

Sabah

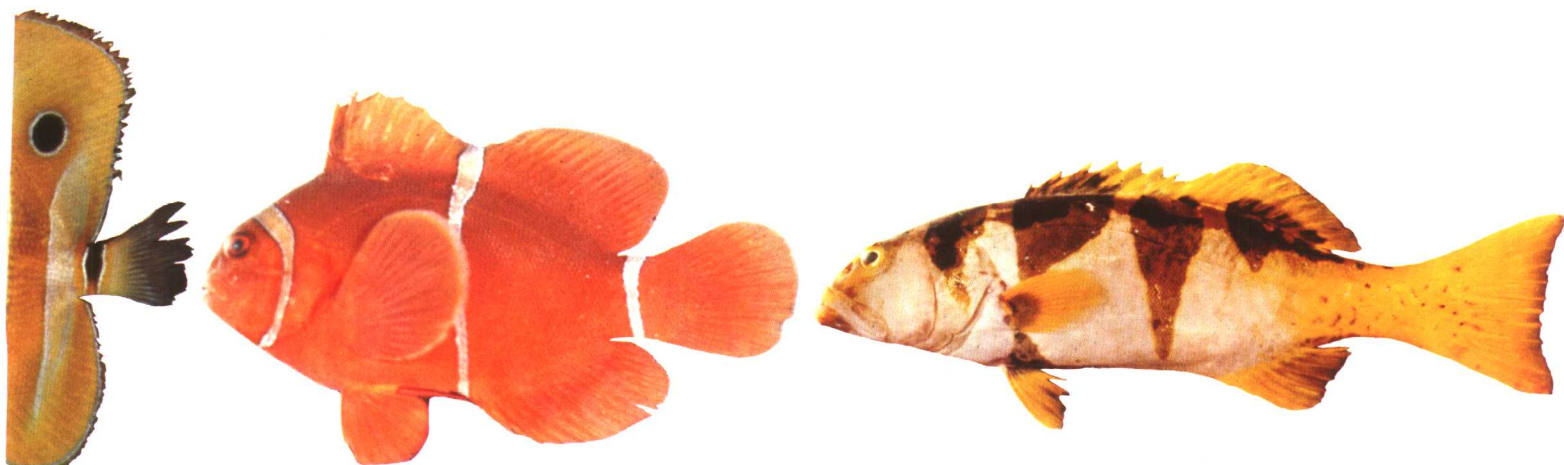
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Celebes Sea

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The Sulu Sea

Geography: The Sulu Sea, occupying the southwest region of the Philippine Archipelago, is the largest enclosed sea of the Philippine Islands. It is roughly diamond-shaped, extending from approximately 12°N latitude and 123°E longitude to 5°N latitude and 117°E longitude. The natural boundaries of the Sulu Sea are the islands of Mindoro, Panay and Negros along the northeast, the Zamboanga Peninsula and Sulu Archipelago along the southeast, Sabah along the southwest and the Palawan Islands along the northwest. Other than nearshore islands along these boundaries the few island groups contained within the Sulu Sea include the Cuyo Islands (north), the Cagayan Islands (north central), the Tubbataha Islets (central) and the Cagayan Sulu Island (southwest).

The Sulu Sea is fairly deep with a mean estimated depth of roughly 3,000 meters. The greatest depth is approximately 6,000 meters, occurring just off the Zamboanga Peninsula. The area is tectonically active, and major earthquakes have recently occurred. From the surface the offshore waters appear deep blue, while inshore areas are aqua green. The inshore shallow waters have temperatures ranging from 27 to 32°C throughout the year.

Habitats. A variety of tropical marine habitats are represented within the Sulu Sea. The nearshore, mangrove ecosystem introduces detritus into the aquatic food chain and provides refuge for juvenile fishes as nursery grounds. Estuarine areas occurring at river mouths and bays export terrestrial nutrients to the Sulu Sea. Areas dominated by

seaweeds provide herbivorous species with food and shelter. The coral reef is the richest ecosystem in the tropical marine environment and is the home of many colorful and prized aquarium fishes. Sandy and silty areas shelter numerous gobies and garden eels. The warm, greenish inshore waters contain productive planktonic organisms and many small schooling fishes; the less productive deep blue waters are the home of sharks, billfishes, tunas and other carnivores.

Fishing Methods. Fishing is essential for the people of the Sulu Sea. In an average day the fishermen may spend ten or more hours at sea engaged in various fishing activities. They frequently go on extended trips to distant regions, and many have firsthand knowledge of the waters and common species of the entire Sulu Sea. A number of Palawan fishermen, originally from the Visayan Islands along the Eastern Sulu Sea, have indicated that overfishing of their native waters has brought them to Palawan.

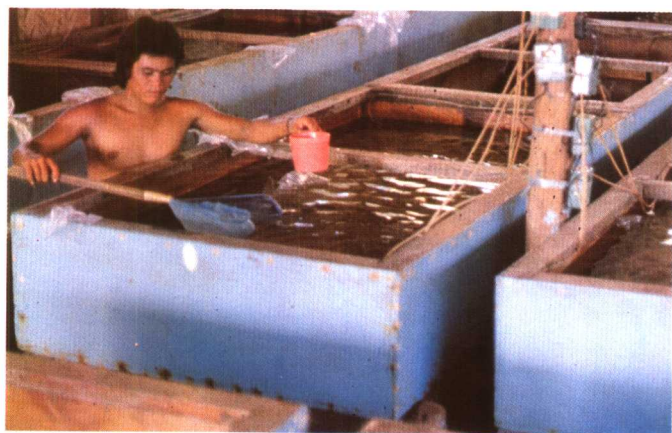
Municipal (or artisanal) fishermen are small-scale fishermen using boats of less than three tons capacity and traditional methods. Commercial fishermen use larger vessels typically employing more advanced gear (e.g. trawlers and purse seiners).

Their traditional fishing boats are called *bancas* and "pumpboats." These are canoes fitted with bamboo outriggers on both sides. Except for a few large commercial vessels operating from distant metropolitan areas, these boats are still the sole fishing craft in use. *Bancas* are



A fisherman's paradise: Cañón Island in Honda Bay, Palawan.





(Upper left) Pumpboats with the catch. (Lower left) Aquarium fishes for export. (Right) This spearfisherman's accessories are homemade.

small and powered mainly by hand with a single oar. They can accommodate up to 200 kilos of catch. Pumpboats are similar in design to *bancas*, but are propelled by an inboard motor (usually a 3- to 16-horsepower gasoline engine). They are called pumpboats because the motor is adapted from a water-pump engine. Large pumpboats can carry up to a ton of fish.

The principal fishing methods along the Western Sulu Sea are fish corral, fish trap, gill net, beach seine, trawl, hook and line, hand net and spear.

The "fish corral" (*baklad*) is a large V-shaped, fence-like structure made of two-centimeter mesh nylon monofilament, supported by equally spaced vertical bamboo or mangrove poles. These walls vary from 30 to 50 meters in length and are approximately 2 meters high. They are erected by securing the supporting poles into the substratum with the top of the walls always above water. The opening to the trap compartment at the vertex is only a few centimeters wide. The trap compartment is constructed of strong chicken wire and is roughly one by

three meters. Fishes moving to deep water with the falling tide are channeled by the walls of the corral to the enclosure at the vertex. Fishermen enter this compartment daily to spear and net fishes that have been trapped.

The "fish trap" (*bubu*) is a large box approximately one by two by five meters with a funnel-like opening, centrally. It is constructed with coarse chicken-wire screening supported by a bamboo frame, or made of webbed bamboo splints. It is placed on the bottom in 2 to 20 meters of water. Fishes seeking shelter enter this funnel and have difficulty finding the small exit hole. The *bubu* catches mainly reef fishes, which are retrieved when the trap is brought to the surface.

"Gill nets" (*panti*) catch fishes by entangling their gill covers in a nylon monofilament mesh. This net is commonly 5 meters high and 100 meters long, with floats supporting the top edge and weights anchoring the bottom. Depending on the buoyancy, which can be adjusted to catch different fishes, this net may be set on the bottom for demersal species like goatfishes and slipmouths,