FAO FISH FINDER

FAO SPECIES IDENTIFICATION GUIDE FOR FISHERY PURPOSES

ISSN 1020-6868

FIELD IDENTIFICATION GUIDE TO THE LIVING MARINE RESOURCES OF KENYA

WIOMSA Western Indian Ocean Marine Science Association

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FIELD IDENTIFICATION GUIDE TO THE LIVING MARINE RESOURCES OF KENYA

by

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 2012

ISBN 978-92-5-107239-4

PREPARATION OF THIS DOCUMENT

This field guide was prepared under the direction of the FishFinder Programme, Marine and Inland Fisheries Services (FIRF) of the Food and Agriculture Organization of the United Nations (FAO). Valuable collaboration was given by the Kenya Marine and Fisheries Research Institute (KMFRI) of Mombasa, Kenya.

The initial draft was initiated in 2009 following an agreement between FAO and KMFRI. In December 2009, the authors started collecting information for the compilation of this guide by means of interviews with fisheries stakeholders on local names and catch methods in the Islands of the Lamu District; similar interviews were also conducted in the Districts of Malindi, Kilifi, Mombasa and Kwale. Information collected through interviews and sampling was augmented with literature with the bulk coming from FAO Species Identification Sheets for Fisheries Purposes, which led to the production of a first draft in February 2010. This Guide is not meant to be considered a complete checklist but a comprehensive list of marine and brackish-water commercial fish species that occur in Kenya waters. It is aimed at being a reference guide for fishery officers, fishers and local scientists to help improve recording, assessment and conservation of marine resources.

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Cover illustration: Emanuela D'Antoni (FAO, Rome)

Anam, R. & Mostarda, E.

Field identification guide to the living marine resources of Kenya.

FAO Species Identification Guide for Fishery Purposes.

Rome, FAO. 2012. x + 357 pp., 25 colour plates.

ABSTRACT

This field guide covers the major resource groups likely to be encountered in the fisheries of Kenya. This includes shrimps, lobsters, crabs, bivalves, gastropods, cephalopods, sea cucumbers, sharks, batoid fishes, bony fishes, and sea turtles. Each resource group is introduced by a general section on technical terms and measurements pertinent to that group and an illustrated guide to orders and families of the group. The more important species are described in a subsequent guide that includes scientific nomenclature, FAO names in English and French (where available), local names used in Kenya, diagnostic features, one or more illustrations, maximum size, and notes on fisheries and habitat. Colour plates for a large number of the species are included. The guide is fully indexed and a list of further literature is appended.

FOREWORD

This publication documents the major marine and brackish–water resource groups likely to be encountered in the fisheries of Kenya, which should provide fishery workers, students, environmentalists, sport fishers and tourists visiting the Kenya coast with a user–friendly tool for the correct identification of the species occurring in our part of the Indian Ocean.

The field guide, of course, was prepared with a lot of input by many fisheries stakeholders who provided information on local names and catch methods in the Districts of Lamu, Malindi, Kilifi, Mombasa and Kwale at the Kenya Coast; their input augmented by sampling and literature review.

As we are all aware, the fishery resources of the Kenyan Exclusive Economic Zone (EEZ) are not well known. As such, this guide may be considered as a tentative checklist of the marine and brackish water fish species of commercial value occurring in Kenya waters. Since there are considerable gaps in our knowledge on the biology, ecology and fishery status of species in this part of the Indian Ocean, it is our hope that the authors together with the efforts of partners and colleagues will produce a future, more complete and comprehensive checklist of Kenya fish fauna.

The publication comes at a time when the Government of Kenya is giving marine fisheries a lot of attention. To this end, Kenya has developed an Ocean and Fisheries Policy (2008) which forms the basis of a new Fisheries Management and Conservation Bill 2012. As part of this endeavour, an Ocean and Fisheries Council of Ministers has been established with a view to encouraging effective information sharing on sustainable development of our Economic Exclusive Zone.

Undoubtedly, this guide will find space in the lives of Kenyans, our visitors and friends from all over the world.

M. J. Ntiba
Permanent Secretary
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Nairobi, Kenya

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to all those who assisted them in one way or another with the successful implementation of this project. Special thanks are due to: Mr. J.R Gonda (KMFRI), for providing fundamental information for the drawing up of the species list, local names and fishing methods employed; Dr. J. M. Kazungu, Director-KMFRI (Kenya) for allowing the author to use Institute facilities; Dr. R. K. Ruwa, Deputy Director Marine/ Coastal (KMFRI); Dr. E. Kimani, Fisheries Programme Coordinator and Mr. H. O. Onganda-KMFRI for assistance in organizing our internal travels, necessary local contacts, advice and encouragement; KMFRI Staff in Mombasa and FAO Staff in Rome for the valuable assistance at various stages of the project; Mr. Simon Komu, Lamu District Fisheries Officer (Kenya) for organizing our visits to the Islands of Lamu, Kizingitini, Faza, Kiwayu, Mkokoni and a meeting with Fisheries Department staff from Kiunga; Ms. Pamela Ochieng for diligently computing the collected information into the initial draft of the guide; Mr. John O. Opiyo, KMFRI SACCO for providing us with his Laptop to be used as backup during compilation of the initial draft of the guide; Mr. Boaz Orembo and Dixon Odongo during identification, local names and catch method compilation; Mr. Ronald K. Deche, fishery officer of Vanga; Mr. Mwambwiza ''Magongo'', secretary of the BMU of Jimbo; Ms. Masika Mohamed, treasurer of the BMU of Jimbo; Mr. Omari Robota Abdallah, auctioner of the Vanga fish market; Mr. Mohame H. Kibundugo, secretary of the Vanga fish market; Mr. Charles Odindo, fishery officer of Shimoni; Mr. Shebwana Ali Famau, BMU chairman of Shimoni; Mr. Rishadi Iki Hamisi, BMU secretary of Shimoni; Mr. Kenneth Omondi, KMFRI technician for his help in Shimoni; all the fishermen of Shimoni for their help providing information on local names and fishing methods; Mr. Philip Aguanda, District Fisheries Officer (DFO) of Malindi; Mr. Isaac Wafula, Assistant DFO of Malindi; Mr. Edward Wale, fisheries assistant officer of Ngomeni; the handline fishermen of Ngomeni, Mr. Athumani Azuayi, Mr. Kassim Daudi, Mr. Dhuu Madi, Mr. Badi Hussein, Mr. Aweso Amin, Mr. Anwar Bahero, Mr. Mohamed Famau; the gillnet fishermen of Ngomeni, Mr. Mwinyi Kai, Mr. Ahmed Shee Ahmed; Mr. Fuad Sheyumbe and Mr. Abuu Mohamad, chief fisheries assistant and fisheries assistant, respectively, of Lamu.

Thanks to Ms. Luigia Sforza for preparing a first InDesign draft of this Field Guide. Thanks for the illustrations that have been made available by the South African Institute for Aquatic Biodiversity (SAIAB), a research facility of the National Research Foundation. These illustrations are copyright and have been produced by illustrators employed by SAIAB over time.

Many thanks to Mr. O. Gon and Mr. W. Holleman, senior Aquatic Biologist and Research Associate, respectively, of the South African Institute for Aquatic Biodiversity, Grahamstown, South Africa for critically reviewing the final draft, and for their precious suggestions and useful information. Thanks to Mr. Dave Ebert, Research Faculty of the Moss Landing Marine Laboratories, Moss Landing, California, United States of America, for reviewing the Sharks and Batoids sections. Thanks to Mr. Nicolas Bailly, Project Manager for FishBase, and Scientific Adviser for SeaLifeBase, for reviewing the taxonomy of the included groups.

Finally, a special thanks to Mr. Julius Francis and to the Western Indian Ocean Marine Science Association (WIOMSA) for providing funds for printing this Field Guide.

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INTRODUCTION

The Republic of Kenya, has a coastline of about 640 Km extending from 1°41's to 4°30'S latitude and forming part of the western border of the Indian Ocean marine eco–region (Fig. 1). It is characterized by the presence of a continuous fringing coral reef commonly distributed at depths between 16 and 40 meters. Mangrove forests occur in many estuaries and deltas, while sea grass beds are distributed between the mangrove and reef areas. The Kenyan marine habitats support a wide variety of species, most of which are harvested by artisanal fishers, mostly operating between the shoreline and the reef. With the exception of mangrove swamps, which have been studied in detail, there is currently limited taxonomical information on the marine biota of Kenya, so that species lists for coastal and pelagic environments are known to be incomplete.

The description of assemblages at high levels of taxonomic resolution (species) is logistically difficult and requires a high level of expertise. Attempts to identify the extraordinary variety of individual species entering the fisheries are strictly related to the quality of the taxonomic information available to fishery workers. This becomes particularly true for the identification of numerous tropical, subtropical and unconventional species in the absence of training of personnel responsible for the collection of such data in the field and of an up–to–date taxonomic literature. Although Caddy & Garibaldi (2000) found that 65.9% of the total capture production reported to the FAO for 1996 was at the species level, it was also observed a great difference between temperate areas, with 90% at the species level, and tropical areas, where it was often lower than 40%. In this direction, the FAO FishFinder programme (formerly, SIDP) provides and disseminates tools to facilitate species identification in fisheries and, in so doing, improve fisheries data quality. Misidentification of species has become a high risk in fishery operations. Failure to identify species or erroneous species identifications still represent one of the most serious handicaps in the collection of meaningful data by species in tropical and subtropical waters (Fischer, 1989).

This field guide is aimed at national fishery workers in need of quick identification of species in markets and landing places for the specific purpose of improving statistical and other fisheries data by species. Moreover, it is intended to be a baseline for monitoring and

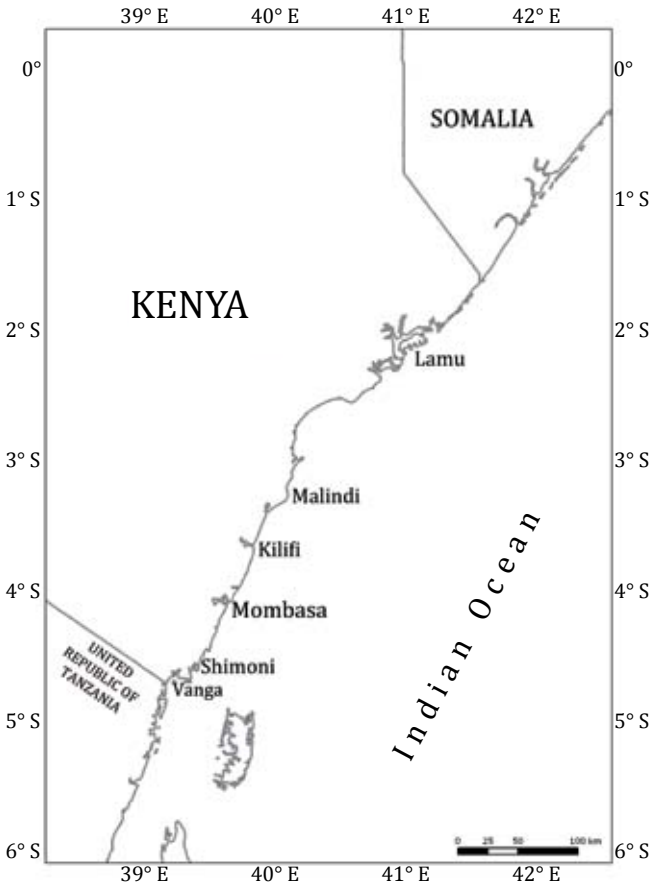

Fig. 1 Map of Kenya showing the main landing sites

updating information on relevant species which have still never been officially recorded in Kenya waters, but have been observed in neighboring countries, and are thus likely to occur.

Physical Features

The Kenya coast has a narrow continental shelf which in many places is less than 4 km wide, while it widens on the northern part and has a rough bottom topography of coral formation. This shallow water area is broken only by the river estuaries discharging into the Indian Ocean at Vanga, Mombasa, Mtwapa, Mida Creek, the Sabaki River mouth, the Tana River and the extensive Lamu archipelagos. The coastline is very irregular, indented and fronted by several islands of which the larger are in the northern part (Lamu, Manda, Pate and Kiwayuu). Between the northern islands there are many reefs and shoaling coral reefs that may extend for 8–10 km offshore. The northern islands have high sandhills on their seaward sides, but elsewhere the islands are fringed with mangroves. Mombasa Island and Funzi Island are found on the southern coast of Kenya. The Malindi and Mombasa areas have long sandy beaches and low overhanging coral cliffs associated with scrubs and bushes, fringed by coral reefs extending in some places to a maximum of 5 km offshore. The seaward coast near Mombasa area is very flat but around the island itself there are many creeks and mangrove swamps. The southern area of the Mombasa coast has overhanging cliffs, coral points and sandy beaches (Ochumba, 1983).

Oceanography

The Kenya coast is characterized by a weather regime influenced by the Inter–Tropical Convergence Zone (ITCZ), an area of the atmosphere above the earth's surface where two air–streams (the North East and South East Trade Winds) converge. This low pressure zone moves north and south of the equator according to the movement of the sun, creating two distinct seasons, the northeast and southeast monsoons (McClanahan, 1988), which alter sea temperatures, rainfall, wind and sea conditions. The northeast monsoon (NE) which prevails from November to March is characterized by weaker winds and higher air temperatures (> 30°C) than the southern monsoon (SE) that prevails from June to September and is marked by lower air temperatures (approximately 25°C) as well as strong winds and is occasionally associated with events such as cyclones and storms (McClanahan, 1988). The SE monsoon's meteorological parameters are characterized by high cloud cover, rainfall, river discharge, terrestrial runoff and wind energy while solar insulation and temperatures are low and oceanographic conditions are characterized by cool waters, a deep thermocline, high water–column mixing and wave energy, fast currents, low salinity and high phosphorus. These parameters are reversed during the NE monsoon. The inter–monsoon periods occur in the months of March/April and October/November and are the calmest. June and July are the windiest months while March, April and November experience the lowest and most variable wind speeds (McClanahan, 1988). The NE Monsoon comes with the Somali counter current, a current which creates an upwelling in the upper reaches on the North Kenya Banks, subsequently creating a lavish fishing ground along the North Coast. The Somali counter current converges with the East African Coast current moving offshore forming the Equatorial counter current. The turbulence thereof enhances primary productivity and thereby forming a fertile fishing ground (McClanahan, 1988). During the SE Monsoon, the flow of the East African coastal current is increased and its range extends further north, becoming the Somali current.

Tides

Kenyan coastal waters are characterized by semi–diurnal tides or rather about two tidal cycles for every 24 hour period. With the exception of limited periods of the year, the levels of high and low water of each successive tide differ considerably from the corresponding tide before and the tide following. The tides can thus be defined as mixed semi–diurnal tides. The tidal range in Kenya is 4 m which is relatively large for a tropical coastline (Brakel, 1982). The reference port for tidal observations is Kilindini (Port of Mombasa). Tidal range for Malindi is 2.0 m for neap tide and 2.9 m for spring tide. There is a lag in the tidal state which increases with distance moving north along the Kenyan coast. Deviations from the predictions in tide tables are influenced by barometric pressure, onshore winds and oceanic swell. However, the lowest tides occur persistently during the NE Monsoon since they combine with the prevailing winds to drive water offshore (UNEP, 1998).

Sea temperature and salinity

Sea surface temperature and salinity vary with the monsoon season. The highest temperatures of 28–29°C occur after the NE Monsoon in March and April. The lowest sea surface temperature occurs in August and September with a minimum of 24°C.

In coastal waters, the lowest salinities occur at the onset of the SE Monsoon when discharge, cloud cover and rainfall are high; highest salinities occur during NE Monsoon when air temperatures and solar insolation are high and rainfall and discharge low (McClanahan, 1988). Sea currents influence as well salinity. During the SE Monsoon the shifting of ocean currents brings Pacific Ocean water of high salinity into the South Equatorial Current while during the NE Monsoon the South Equatorial Current draws water of low salinity from the Malay Archipelago. These changes in turn result in changing salinities of the East African Coastal Current waters. As can be expected, offshore waters are influenced mainly by the oceanic currents and surface water salinities in Kenyan coastal waters vary from a minimum of 34.5 ‰ to a maximum of 35.4 ‰ (UNEP, 1998).

Coastal Habitats

Different tropical marine and wetland habitats occur

along the coast of Kenya including coral reefs, sea grass beds, mangroves, and salt marshes (UNEP, 1998).

Coral reefs

Kenya coral reefs are divided into two main areas: a fairly continuous 200 Km fringing reef in the south extending from Malindi to Shimoni broken up by creeks that drain coastal rivers, with a shallow lagoon along its length and, patch reefs (exposed and protected) and fore reef slopes in the north of Lamu to the Somali border. Both areas are interspersed with sand, seagrass and algae beds.

Coral diversity is high, with 112 species of hard corals identified in Kenya and Tanzania (Sheppard, 1999) and 28 species of soft corals in Kenya (Samoilys, 1988). Kenya's coral reefs were severely impacted by the 1998 El Nino bleaching event, which resulted in the widespread bleaching and mortality of 50–90% of its reefs (Wilkinson, 1998).

Being accessible in most weather conditions during both monsoon seasons, lagoons and fore–reef areas are heavily utilized by fishers.

Mangrove forests

There are twelve patches of mangrove forests along the Kenya coast, with a total area estimated to be between 53,000 and 61,000 ha, with 67% occurring in the Lamu district and 10% each in the Kilifi and Kwale Districts (Government of Kenya, 2009). Mangrove forests are nutrient–rich environments which support a variety of food chains and function as a nursery and feeding ground for fish and invertebrates. Many of these species spend part of their life cycle in coral reefs, seagrasses and open waters. Mangrove trees are also important for shoreline stabilization, and provide resources for both rural and urban coastal populations (Government of Kenya, 2009).

Rocky shores and substrates

The Kenya coastline from Ngomeni southwards, and the islands from Lamu northwards is made up of fossil Pleistocene reef rock formations, resulting in large areas of intertidal reef platform below cliffs of 4–6 m in height. The cliffs are in the upper intertidal and exposed to the air for most of the tidal cycle, and thus have sparse biological communities (Ruwa, 1984, 1996). The rocky platforms below the cliffs are inundated by the tides twice a day, resulting in a strong zonation of fauna and flora. Because of their accessibility at low tide, rocky shores and intertidal platforms have been the focus of numerous ecological and taxonomic studies, as well as exploitation and extraction (Government of Kenya, 2009).

Seagrass beds

Seagrasses occur in extensive beds that cover the largest proportion of shallow reef slopes, and form an important habitat for many species living in them and in adjacent systems. Twelve seagrass species are found in Kenya, with *Thalassondendron ciliatum*, which forms monospecific stands, being the dominant one. Its canopy structure provides habitat for small and juvenile fish and invertebrates. Seagrass beds are important foraging grounds for endangered species such as dugongs and marine turtles as well as important habitats for fish species like rabbitfish, surgeonfish and parrotfish. Various species of shellfish and sea cucumbers are also found in seagrass beds (Government of Kenya, 2009).

Soft–bottom habitats

Sandy sub–tidal habitats dominate the shoreline from Malindi to Lamu, supplied with sediment from the Tana an Sabaki rivers to the south, and extensive creek systems to the north. Kenya's soft–substrate communities are not well known, but support significant shrimp and bottom fish populations. There is an active trawling industry exploiting these habitats, particularly from Malindi northwards to Ungwana Bay, at the mouth of the Tana river (Government of Kenya, 2009).

Pelagic zone

Beyond the continental shelf, at depths ranging from 200 m and deeper, is the pelagic zone, where productivity is limited by light and nutrients. Primary and secondary productivity in this zone is heavily influenced by the monsoons, being lower during the rough SE Monsoon and higher during the calmer NE Monsoon. Large schools of migratory pelagic stocks abound in the offshore waters of Kenya (Government of Kenya, 2009).

Fishery

Most fishing in Kenya is artisanal, with a little industrial fishing by prawn trawlers. The deep sea (Exclusive Economic Zone, EEZ) fishery resources are currently exploited by Distant Waters Fishing Nations (DWFN) through a licensing system, and only a small quantity of catch from the EEZ is landed in Kenya, primarily tuna for export. The local fishers lack the capacity to exploit deeper water resources.

Artisanal fishing activities are undertaken by 10,276 fishers, of which 9,600 are boat fishers using 2,368 boats and 675 are foot fishers (Government of Kenya, 2006). Of the fishing crafts along the coast, 135 are motorized, 991 use paddles while 1,179 use sails for propulsion. The most common fishing gears are gillnets, traditional traps, seine nets, long lines, hooks and line and traps. Fishing in the territorial waters is carried out by 2 trawlers, which fish for shrimp, although they also harvest large quantities of by–catch, some of which is discarded. Annual marine fish production from artisanal fishery in Kenya from 1980 to 2005 show a high of 9,972 t in 1990 and a low of 4,336 t in 1993. For most of the period, production fluctuated between 6,000 and almost 10,000 t. Overfishing in inshore areas has continued to cause a decline in fish catches, while the deeper territorial waters remain underexploited due to the lack of deep sea fishing capacity by the local fishers (FAO, 2007).

Sport fishing

Kenya enjoys a reputation as one of the world's great big game sports fishing destinations. Kenya's marine waters

contain most of the major target game species, primarily billfishes, especially sailfish, swordfishes, the marlins, sharks and some tunas. Sport fishers are registered in the several sport–fishing clubs, which coordinate the fishing activity and record data. The peak sport fishing season is in September to March. The popular sport fishing areas are Malindi, Watamu, Shimoni and Lamu. In 2005, 30 sport–fishing clubs were registered (FAO, 2007).

Species included in this guide

This guide is designed as a practical tool for all fisheries workers within Kenya, particularly those who are confronted with the daily task of collecting fisheries statistics and other data by species on landing points, fish markets, fish on transit, on board commercial and research vessels. It is also aimed at creating taxonomic interest among fisheries students so as to improve the number of taxonomists in the country.

The guide includes those marine and brackish–water species of bony fishes, batoid fishes, sharks, lobsters, shrimps, sea cucumbers, cephalopods, molluscs and marine turtles, considered to be as regular components of the catches along the Kenyan coast. It also includes those species which are known to occur in Kenya neighboring countries, but have still not been officially recorded in Kenya waters. **These are marked with an asterisk beside the scientific name.** In case of a first record of one of these species, the user can follow the instructions here provided regarding its preservation and description and/or contact the FishFinder Programme.

Preservation of specimens

Preserved fish specimens are central to documenting and describing global biodiversity over time. Worldwide, museum and university collections provide irreplaceable resources and have an enduring role in taxonomic, ecological, biogeographical, and evolutionary studies. It is therefore important that the correct preservation procedures be followed to ensure the quality and longevity of preserved fish specimens.

Specimens should be rinsed in water to clean off any mud or sand. Then, if possible, they should be immediately placed in 10% formalin solution upon capture (this is made by combining 1 part full strength formalin with 9 parts clean water). Fish specimens should be fixed in a natural posture, with the body straightened and mouth closed prior to fixation. The specimens should be placed head first into a wide–mouthed jar filled with enough formalin solution to cover the fish. Before fixing large specimens it is advisable to inject formalin into the body cavity (through the vent) or to make a lateral incision on the right side of the body cavity to allow the fixative into the body cavity. This is particularly important with large herbivorous fishes, as their guts will rapidly deteriorate.

Formalin is the best available fixative and is widely available from pharmacies worldwide. However, it contains formaldehyde, a hazardous chemical, so it is highly toxic and its fumes should not be inhaled. Rubber gloves should be worn while using formalin or handling formalin–fixed specimens. If you get formalin on your skin or in your eyes wash it off with large amounts of water. Always use formalin outdoors or in a well–ventilated area.

Specimens usually have to be left in formalin to be fixed for a week or slightly more if larger than 10 cm. Subsequently they should be soaked for a day or two in clean freshwater before being transferred to 70–75% alcohol for long–term preservation. Alcohol is usually safe to handle, but can cause irritation to the skin in cases of prolonged contact and is highly flammable. Always rinse hands thoroughly with water after working with alcohol. Industrial alcohol is toxic and should never be drunk. Receptacles containing alcohol should always be properly and clearly labelled. Alcohol is prone to rapid evaporation, and receptacles holding it should be securely covered at all times, and not be opened unnecessarily (M.L.J. Stiassny, in litt.).

Presentation and format

Our leading idea was to produce a compact and easily manageable guide that would be at the reach of fishery workers at all levels. Consequently, the guide had to be based largely on illustrations, while the text was kept as succinct as possible. This obviously implies certain limitations of the guide for an accurate identification of all species. It is therefore recommended, in case of any doubt, that the regional sets of FAO Species Identification sheets for the Western Indian Ocean (Fischer & Bianchi, 1984) and/or the taxonomic literature cited in this guide be consulted, being more comprehensive in species coverage and giving much more detailed account of the diagnostic characters of each species.

Each of the major taxonomic groups is introduced by a schematic illustration of the main body parts of a typical representative species and some measurements and technical terms of general use to fishery workers. Families (block letters at upper right corner of the sheets) are arranged in phylogenetic (systematic) order. The arrangement of species within a family is alphabetical by genus and species. Text for each species is restricted to information on names: scientific names; FAO names in English (En) and French (Fr) (where available) and local names in Swahili (where available). The letters in brackets following local names indicate the localities from where the names were obtained: South (S) for Mombasa (M) and Kwale (K) districts; North (N), which includes the Districts of Lamu and Kilifi. The local names included are those gathered in the course of the field work for this project. It is hoped that other local names will be added directly on the sheets by users and communicated to Fisheries offices or FAO. The size is expressed usually as total length, unless otherwise specified as fork length (FL), standard length (SL), or disc width (DW) for batoids. Moreover, information on catch methods and habitat is provided. All information on species identification is summarized as it is meant to supplement species illustrations as a means of quick species identification and reference in the field.