

Guide
pratique

Fishes of the Indian Ocean and Red Sea

M. Taquet, A. Diringer



éditions
Quæ

Fishes of the Indian Ocean and the Red Sea

Marc Taquet, Alain Diringer

Translated by Janet Heard-Carnot

Collection *Guide pratique*

Découverte naturaliste des garrigues

Luc Chazel, Muriel Chazel

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2^e édition

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Les plantes et leurs noms. Histoires insolites

François Couplan

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B. Pintureau

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A word from the partners

Agency for marine protected areas (AAMP)

It was quite far from the Indian Ocean, on the emerald green waters of the Marquesas islands, that this partnership came into being. The Agency for marine areas had organised a knowledge-gathering cruise in the Polynesian archipelago. Marc Taquet took part in it on behalf of Ifremer. He spoke of his passion for fish and for the Indian Ocean. We told him about the Marine nature park of Mayotte and that of the Glorieuses – the two largest French marine protected areas – and about the Agency's intention to get more involved in regional cooperation programmes in the Indian Ocean. All of this struck a common chord.

Indeed, this practical guidebook about fish helps address the need to develop knowledge about the marine environment. The Indian Ocean holds some of the hot spots of global biodiversity, including the Mozambique Channel. This book shows the biological diversity in these waters and clarifies the ecology of species there. It is an invaluable piece of work for managing this marine environment. France is especially accountable there, since 10 % of French waters are located in the Indian Ocean. Successfully protecting them will require knowledge and sharing it with decision-makers and all those who depend on the sea for their livelihood. This book contributes to that goal. As a newly-created public institution devoted to preserving the marine environment, it was natural that the Agency for marine protected areas support this initiative.

Jérôme Bignon, President of the French Agency for marine protected areas

Western Indian Ocean Marine Science Association (Wiomsa)

As was with the First Edition, WIOMSA is proud to be associated with the production of the Second Edition of this high quality and very relevant publication and wish to congratulate the authors for this updated and expanded version. The content and the quality of this guide clearly affirms that WIOMSA made the right decision to partially support the publication of the First and Second Editions.

I believe that this guide, with its beautiful illustrations, will be valuable to scientists, researchers and divers, to help in the identification of the listed species. It will also be an asset to policy makers and the young who will be fascinated by and attracted to the beauty and diversity of fishes illustrated in the guide and hopefully, this fascination will make them become even more supportive of the need to conserve the coastal and marine environment in the region

Nirmal Shah, President

French research institute for exploitation of the sea (Ifremer)

The fruit of considerable effort for *in situ* observation, this richly illustrated and perfectly documented "field guide" offers an attractive panorama of the ichthyofauna of the Indian Ocean and the Red Sea. Above and beyond the beautifully presented illustrations, which can only increase the public's fascination for the beauty of the underwater world, this publication makes a very valuable contribution to the scientific community, as a census of the fish which populate environments still relatively less explored than those of other oceanic regions.

In keeping with the biodiversity inventories and censuses underway, the authors have succeeded in going beyond simply describing the criteria required for the visual quick-find of nearly 1,200 species. In fact, they show us these fishes in their natural environment, thus emphasizing that the survival of species depends first and foremost on preserving the quality of their habitats.

By letting us share in the beauty of nature, with talent, Marc Taquet and Alain Diringer remind all those who use the maritime realm of the significant stakes and challenges ahead to preserve marine ecosystems, their functions and their treasures.

Jean-Yves Perrot, President-Managing Director



Foreword

The earth is experiencing the extinction of species at a greater rate than any time in its history from the degradation of environments, introduction of invasive species, overexploitation of biological resources, and especially accelerated climate change from the increased level of carbon dioxide in the atmosphere.

In addition to warming the atmosphere and the sea, the CO₂ causes acidification in the sea, which impairs coral growth. The increasing sea temperature is occurring at a greater rate than corals can tolerate over time. Reef-building corals are expected to be extinct within 30 to 50 years, along with all the life dependent on coral reefs

This new edition of Marc Taquet and Alain Diringer's *Fishes of the Indian Ocean and the Red Sea*, with their lovely underwater photographs of fishes, is a reminder of what the world will lose if we continue to burn fossil fuels at the present rate.

If coal, oil, and natural gas did not exist (or if we had been wise enough not to burn them), we would have in time developed nonpolluting sources of energy to achieve the technological advances we now enjoy (though we would have continued to ride horses and cross the seas in sailing vessels much longer).

Governments must increase their effort to subsidize industry for other sources of power.

Marc and Alain have added 340 fishes to their new edition, thus a total of 1,200 species. In addition to their photographs, they provide characters for species identification, size attained, depth of occurrence, and details of habits and habitat. A real pleasure to have it all in one volume!

John E. Randall



Foreword

Fauna in the Indian Ocean is much less known than that in the Atlantic and Pacific, due to the fact that the few countries with high-level scientific research, i.e., Australia and South Africa, have only a small part of their seafront on this ocean. Therefore, this Guide to *Fishes of the Indian Ocean and the Red Sea* is a most welcome publication. The authors, Marc Taquet from Ifremer and his friend Alain Diringer, are not unknown in this field. In 1992, they gratified us with a beautiful book on Indian Ocean groupers entitled *Les mérous de l'océan Indien*.

In this new book, they present nearly 1,200 species of fish, illustrated with over 1,500 underwater photographs. It is the result of nearly 25 years of diving together in the Indian Ocean and the Red Sea: in their home location of Reunion Island, Madagascar, the Comoros Islands, and the French Scattered islands (Glorioso, Europa and Tromelin). For the needs of this book, they extended their explorations further afield to South Africa, Australia, Indonesia, Thailand, Sri Lanka, the Maldives and the Red Sea. Dives were even made far offshore, in the middle of the Indian Ocean, around drifting fish aggregating devices (FADs*) which attract large pelagic* species.

I know Marc Taquet particularly well. At the start of his career at Ifremer, he spent three years in the laboratory where I worked, in La Rochelle. During his stay there, I had the opportunity to appreciate his human and professional qualities. Apparently, it was after I'd asked him to identify Triglids during a research cruise that he was bitten by the ichthyology* bug. Later, when posted to Reunion Island, he introduced me to Alain Diringer, a professor of art and design, ever seeking aesthetic beauty. Marc and Alain share the same passion for subaquatic activities.

I am very honoured that Marc and Alain have asked me to write a preface for their book. Having studied the deep-sea ichthyological fauna of Reunion Island and Madagascar, the attraction of this region, linked to the excitement of discovery, has remained alive for me.

My congratulations go to Marc Taquet and Alain Diringer for serving knowledge through their shared passion and for the effort they have made to share it with one and all.

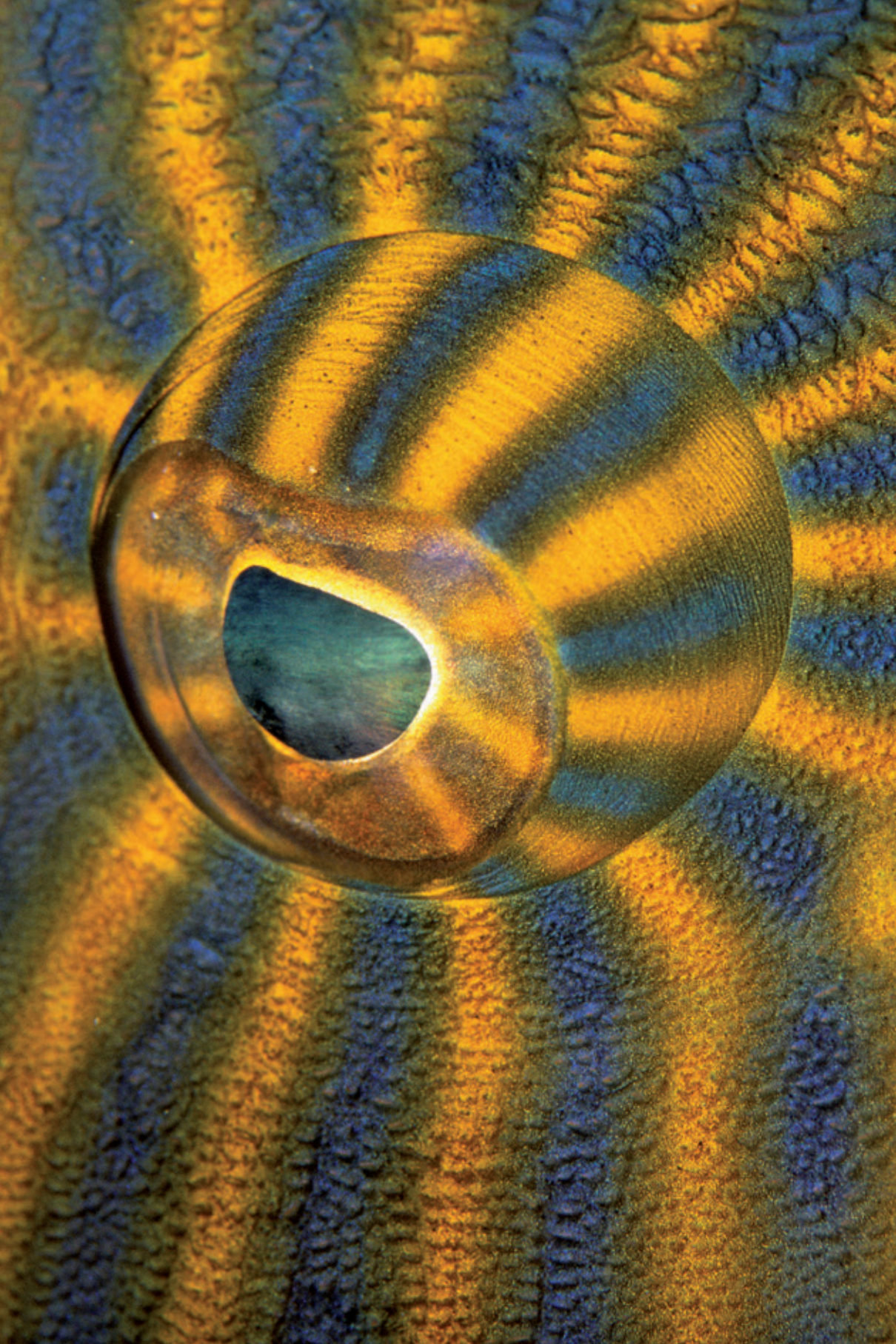
Jean-Claude Quéro



Contents

A word from the partners	3
Foreword by John E. Randall	5
Foreword by Jean-Claude Quéro	7
Introduction	13
Habitats	17
Visual quick-find of fishes	20
Visual approach to families and groups	22
Description of groups.....	27
Sharks	29
Rays	47
Morays, snake eels, conger eels and garden eels	61
Catfishes	77
Lizardfishes, flatheads and dragonet	81
Small pelagic fishes	91
Anglerfishes and frogfishes.....	103
Soldierfishes and squirrelfishes	109
Bigeyes and bulleeyes	119
Unclassified species	123
Trumpetfishes, cornetfishes and shrimpfishes	145
Seahorses, pipefishes, ghost pipefishes and sea moths.....	151
Scorpionfishes and lionfishes.....	165
Stonefishes	185
Anthias.....	189
Groupers.....	199
Soapfishes	227
Dottybacks.....	233
Hawkfishes	237
Cardinalfishes	245
Jacks and trevallies	259

Snappers.....	275
Fusiliers	289
Sweetlips and grunts	297
Seabreams.....	309
Emperor and large-eyed bream.....	321
Coral breams.....	333
Goatfishes.....	341
Chubs.....	353
Spadefishes and batfishes.....	359
Butterflyfishes	365
Angelfishes.....	391
Damselfishes, clownfishes and anemonefishes	407
Barracudas	439
Fingerfins and marblefishes	445
Wrasses, Hogfishes, Coris	451
Parrotfishes	507
Sandperches and sand divers	523
Combtooth blennies	531
Dartfishes.....	543
Gobies	549
Surgeonfishes and unicornfishes.....	573
Rabbitfishes.....	595
Tuna and other large pelagic fishes	603
Flounders and soles.....	613
Triggerfishes and filefishes.....	619
Boxfishes	639
Puffers and porcupinefishes.....	647
References and recommended reading	663
Acknowledgements	665
Glossary.....	667
Index of scientific names	669
Index of French names	681
Index of English names	693





Introduction

This guidebook is intended for everyone who is interested by fish and who wants to identify them or know more about them. To make it, we went to find the fishes in their natural surroundings, in order to fully enjoy the spectacle provided by nature through these beautiful and captivating creatures. In this book, scuba divers, free divers or snorkelers will recognise marine life scenes they have been lucky enough to see for themselves on their underwater forays. They will find here some biological or ecological clarifications to better know, and thus better understand, the fragile balances in play in these sensitive ecosystems. Over many years devoted to studying the fish of the Indian Ocean and the Red Sea, we have had the opportunity to be in close contact with small-scale fishermen on numerous islands or shores. They have shared their passion for the sea with us. They are well aware that the short-term outlook for their activity is closely and vitally linked to the sustainable management of all marine ecosystems. In return, through this book, we hope to share with them a bit of our vision from underwater, of a world that they often see differently, through the surface of the looking glass.

This publication is also intended for scientists and particularly ecologists who study fish populations. To measure the impact of direct or indirect human activities on fish populations, scientists often rely on subsea visual censuses which require good ability to quickly identify the species encountered. We hope that this reference book will contribute to both basic and advanced training of scientific diving teams working on these projects.

Formal identification of a fish requires a thorough examination in the laboratory, in which the ichthyologist follows a step-by-step observation protocol based on identification keys. At each step in the process, anatomical and morphometric * criteria are checked, guiding the observer towards a dichotomous “either-or” choice. At the end of this path, which can prove to be rather long and complicated in some cases, identification is obtained with the greatest probability of success. The final step then consists in comparing the specimen studied with the available illustrations (drawings or photographs) to bear out this diagnosis, or not. Today, molecular biology* techniques like genetic analyses can complement the tools available to ichthyologists, to help determine a species’ phylogeny*. This scientific method is obviously the most reliable. It enables the various species to be described, in order to group them within a classification having several levels, i.e., within a given order, family and genus. However, it has a major disadvantage in that the fish must be caught and killed. When it is a question of identifying them in a fisheries science study, this is not generally a problem, since samples can be taken from landed catches. However, in ecology studies, sampling in the natural environment must be limited insofar as possible in order to avoid further disturbing ecosystems already subjected to overly strong anthropogenic pressure. In this case, to perform fauna censuses, scientists rely on visual identification on underwater dives.

To be effective, the visual identification of fish must follow a methodological approach based on a number of observational steps. In most cases, visual contact with the fish only lasts a few seconds, so it is crucial to learn to look immediately at the distinctive traits which will make it possible to reliably progress towards identifying the species observed. The general shape of the fish should be appraised by asking the following questions:

- What is its profile like? stocky, slender, snakelike?
- What shape is its body ? laterally compressed, cylindrical, box-shaped or flattened?

- Where is its mouth? terminal, inferior or other position?
- What is its tail like? pointed, rounded, truncated, crescent-shaped?
- How many dorsal fins has it got? What shape(s) are they? Where are they placed?

The sketches and nomenclature proposed in the section called “Visual quick-find of fishes” will help the reader to better characterise the species to be determined. Visual identification is also based on the fish’s colour pattern: the colours (number and distribution), the shape of spots and patches, bars, lines or other distinctive markings or patterns present. In some cases, a small detail, like a small spot or dot being present, is sufficient to distinguish between two species belonging to the same genus. However, the colouration of a given species can change, depending on regions, individuals, or for the same individual, on the environment and the circumstances. That is why it will sometimes be impossible to formally identify a fish using the visual method to the degree of precision desired, i.e., to accurately determine the species. In this case, it is often preferable to stop at the higher taxonomic level, by determining the genus or the family, which will already provide considerable information about the observed fish’s position in its ecosystem.

The reported observations and illustrations in this guide have been collected on several thousand dives in the Indian Ocean and the Red Sea, made by the authors over the past twenty-five years. Of course, it is impossible to cover such a vast geographical area exhaustively, but we have endeavoured to visit the widest possible range and diversity of diving sites and habitats. An orange dot indicates the main sites studied on the map at the beginning of the book. We have noted sometimes significant differences in size and behaviour in the same species, depending on the degree of anthropization* of the site studied. The indications of fish sizes correspond to the mean size (total length) of the fish when adult. When a reliable indication is available in the literature for the maximum size reached by a species, and this is quite different from the mean size observed, the maximum size is specified in the text.

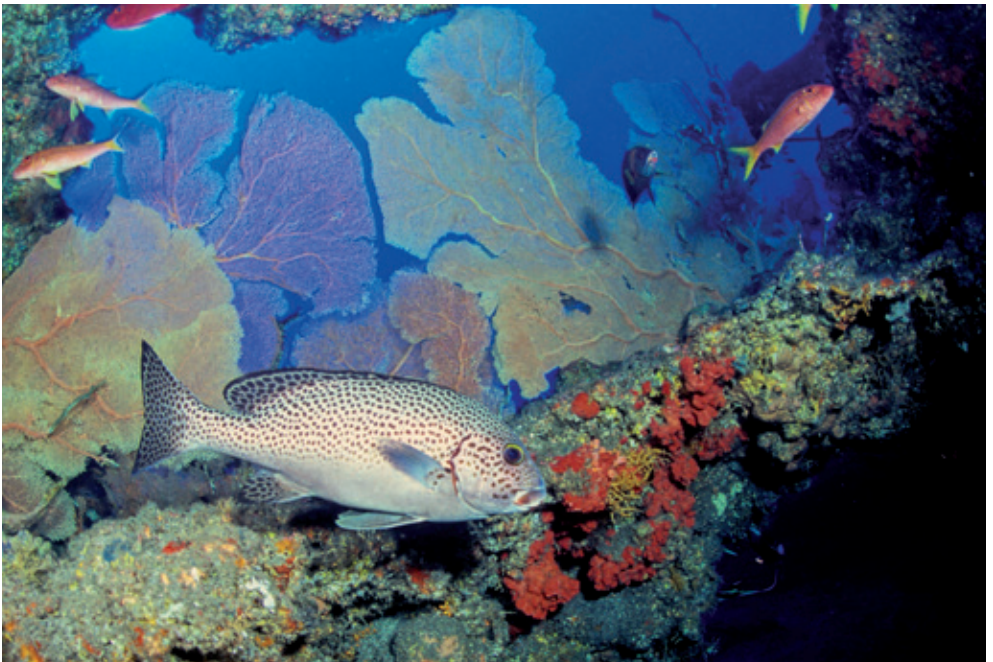
The accuracy of a species’ known geographical range of distribution is greatly dependent on the interest it has had for scientists. In the case of species of value to commercial fisheries, the networks for statistical data collection can help to better assess the geographical range of this distribution. For other species, knowledge is highly linked to the sampling efforts made by ichthyologists. For this reason, the scientific reviews of fish families or genera, like those published by the Bishop Museum in Hawaii, are extremely interesting, because they provide reliable summaries of all the sites where the various species have been found. However, although it is possible to confirm the presence of a species on a given site, it remains impossible to prove that a species is absent from an area. It may be rare there, or quite simply, the geographical area in question may not yet have been studied. In this guide, we have chosen to indicate the geographical distribution of each species based on the following eight categories:

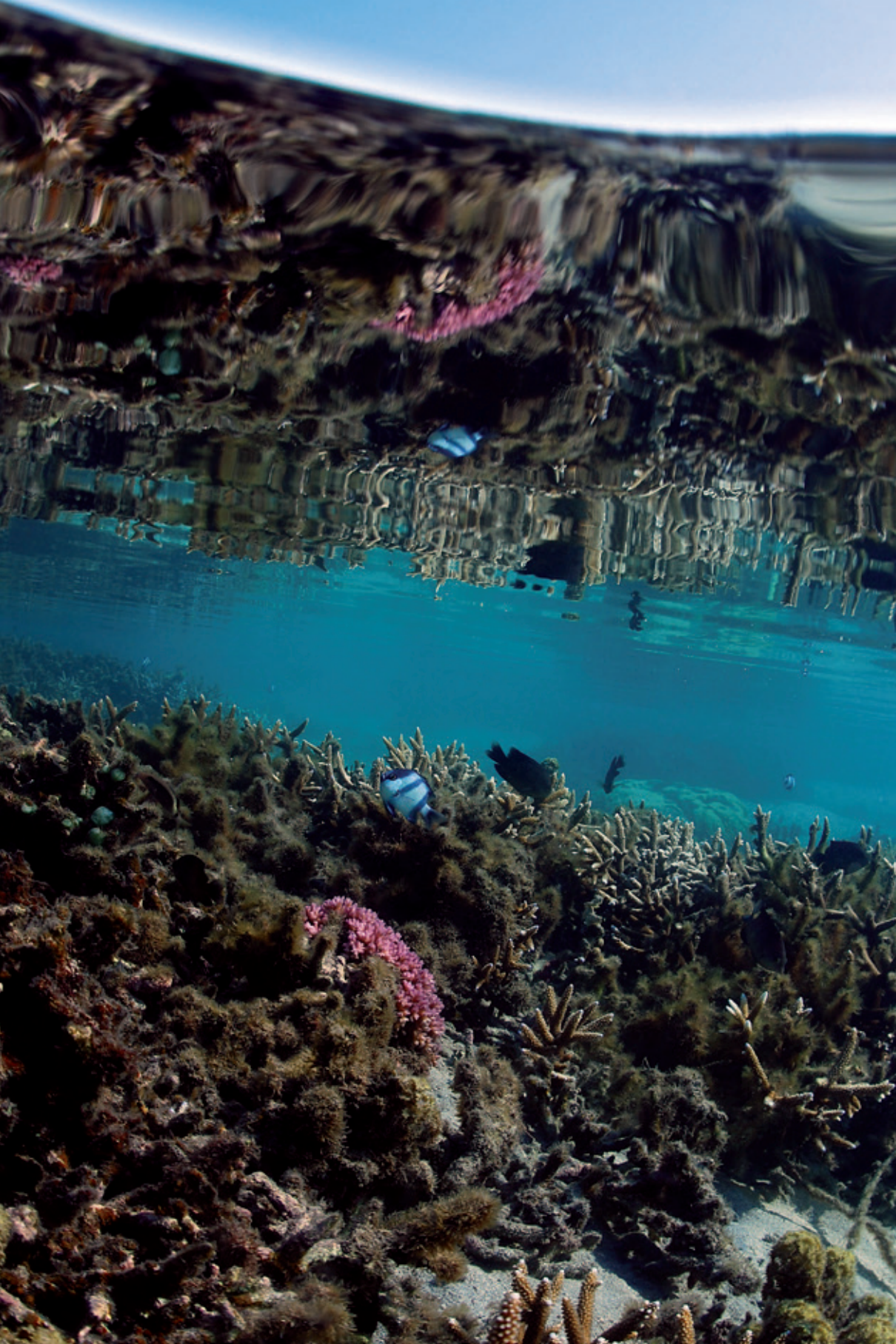
- | | |
|----------------------------|---------------------|
| ● Indian Ocean and Red Sea | ◐ East Indian Ocean |
| ○ Red Sea only | ◑ Indo-Pacific |
| ◑ Mascarene islands only | ◒ Circumtropical |
| ◒ North Indian Ocean | ◓ Australia |
| ◓ South Indian Ocean | ◔ South Africa |
| ◔ West Indian Ocean | |

In some cases, particularly for rare species which had not been recorded in the Indian Ocean, we have specified the place where it was seen.

As for the information about the geographical range, the indications of bathymetric* distribution for the same species sometimes varies from one reference book to another. This is in great part due to the notable differences in the way fishes behave depending on their environment. Sea temperature and availability of a type of food at a given depth are factors that will result in regional adaptations, which may lead to different bathymetric distributions from one region to another. The depth limits for species' ranges of distribution are often based on information collected in the framework of commercial or experimental fisheries and their reliability depends on the gear used. Effectively, a specimen may be caught in a trawl deployed in very deep water, but it is always possible that it was caught while the gear was being lowered or raised. To provide the reader with this information, we have compared the data from our own observations with those available in the literature.

The various habitats where they can be found are also indicated for each species. They correspond to observations made by the authors in the natural environment of the zones studied. The section on "Habitats", at the beginning of this guidebook will help the reader visualise the diversity of biotopes seen in the Indian Ocean and Red Sea.





Habitats

Coral environments

As a protective edifice in place for thousands of years, resisting the onslaught of waves, the coral barrier stands like a boundary between the immensity of the open sea and the peaceful waters of lagoons. Seen on this scale, it is hard to imagine that this amazing construction is actually made up of minute calcareous “bricks” secreted by such tiny polyps. The calcareous skeleton of coral is also the basic element of beaches. By scraping the coral as they feed, parrotfishes break off pieces of reef



that their specialised digestive system then quickly transforms into sand. Through this process, they play an active part in producing sandy areas and beaches. Whether branching, in massive clumps or like large parasols, corals offer fantastic shelters for numerous species of coastal fishes. Many of them opt for the quiet waters of lagoons and the protection afforded by the coral to make their nest and deposit their eggs. These sheltered areas serve as nurseries for many species in the tropical environment. For all these reasons, and because the coral environment is one of the most sensitive habitats to environmental imbalances, it is essential to protect it from any form of anthropogenic stress or attack.

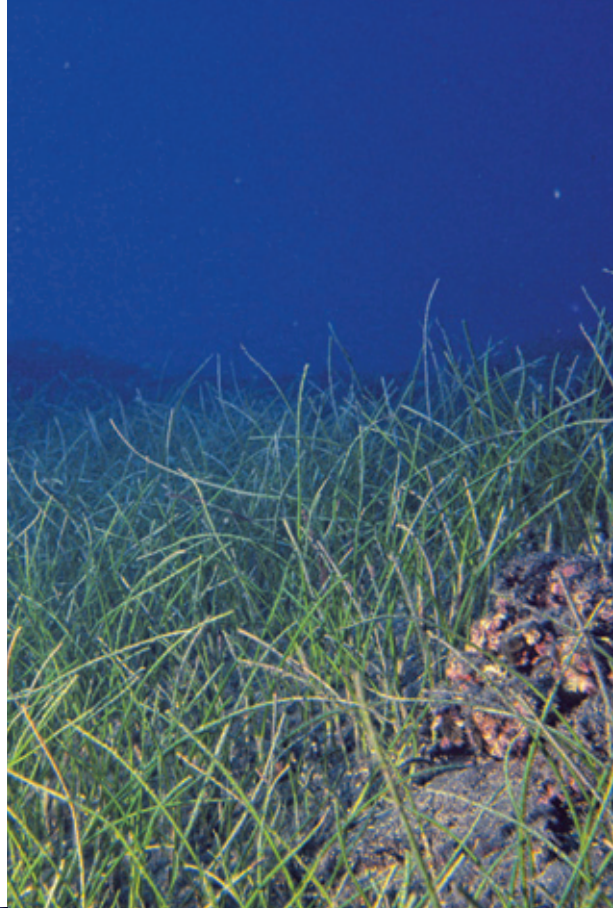


Sand

Seen from the surface, the great stretches of sand which line sheltered bays or border on reef areas can seem like barren deserts. And yet, they hold furtive, but intense, marine life. As great reservoirs of marine benthic* invertebrates, these sandy areas are the food-store of foragers like the goatfishes. During their evolution, some species, such as flatfish, have adapted their morphology to this specific habitat. Others have developed defence strategies like burying themselves partially or entirely, digging burrows or using exceptional mimicry techniques which make them practically invisible.

Seagrass meadows

At first glance, seagrass meadows look like monotonous prairies, rippling with the movements of waves. Even so, taking a closer look reveals a whole world of unusual fauna, curious creatures with unlikely shapes that are almost invisible as they laze or wait patiently. These are the leaf-fishes, seahorses, pipefishes and ghost pipefishes, all of them doing their best to look like aquatic plants. "Herds" of wrasse tirelessly graze in these meadows, moray eels thread their way through them, lionfish lurk there to ambush their prey. For millennia, sea turtles have found the right food there to store the energy reserves they need for their very long reproductive migrations*.



Wrecks

For marine life, recently sunk shipwrecks are new spaces to conquer. It's a matter of "first come, first served"! The mazes of gangways, cabins and holds provide all sorts of hideaways, where each species can take up residence and adapt, depending on its needs. For predators, it is the assurance of a hunting ground with abundant and varied prey, but requiring them to be clever enough to outwit their furtive victims. For divers, shipwrecks are always magical places where history and human folly mix. They are like shadow theatres where intriguing and mysterious shapes rule supreme. Wrecks are oases of marine life where incredible biodiversity thrives.