

MONOGRAPH OF
SHALLOW-WATER INDO-WEST PACIFIC
ECHINODERMS

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ECHINODERMS

By

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AND

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British Museum (Natural History)

With thirty-one plates
and one hundred text-figures



Top left: *Comatula* sp., Queensland (Photo K. Gillett).

Top right: *Ophiolepis superba* H. L. Clark, Queensland (F. G. Myers).

Centre: *Choriaster granulatus* Lütken, Eilat, Gulf of Akaba (L. Fishelson).

Lower left: *Echinodiscus auritus* Leske, Zanzibar (M. V. Angel) (specimen showing a median posterior bite from a predator).

Lower right: *Stichopus variegatus* Semper, Queensland (K. Gillett).

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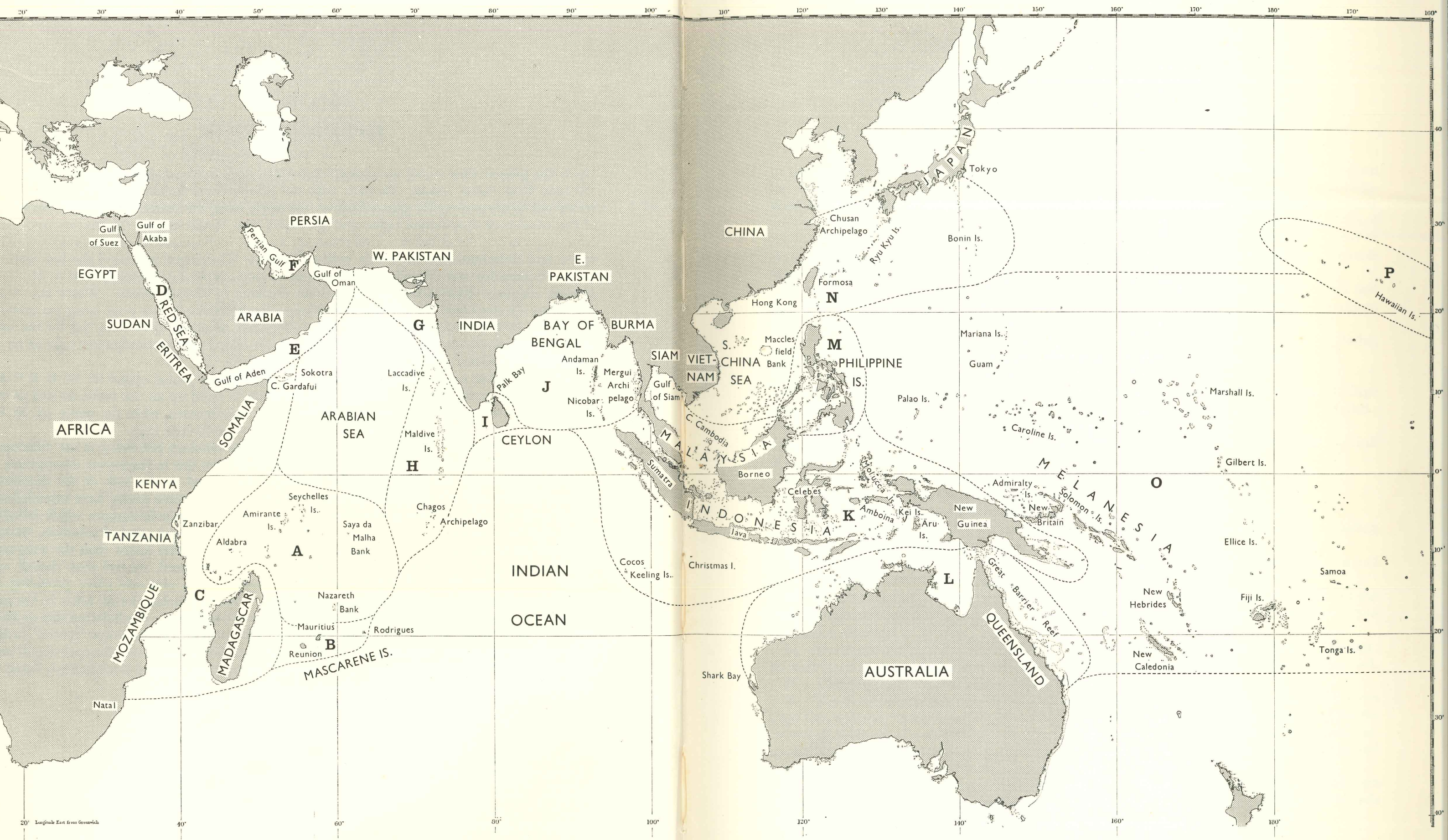
INTRODUCTION

Up to the present time (1969) no comprehensive key work to the shallow-water echinoderms of the Indo-West Pacific exists. In 1962, with the International Indian Ocean Year impending, we set out to try and rectify this deficiency, the result being the present work. The main part of this consists of distribution tables and annotated keys to the species, the limitations of both being explained in detail below. Unfortunately no large monographs on the Asteroidea, Ophiuroidea and Holothurioidea have been written since the 'Challenger' reports of the last century, but for Echinoidea and Crinoidea the fine series of monographs by Mortensen and A. H. Clark provide adequate information for the double checking of identifications. Where the Holothurioidea are concerned the problems are greater, the literature on this class being particularly confused. At first we intended to omit them altogether, as others have done, but for the sake of consistency finally decided to include them, though taking the holothurian key only as far as subgenus, not species.

As for individual responsibility for the various sections, the junior author (F. W. E. R.*) did the preliminary work, searching through the literature to build up all the tables as well as the reference list and went on to complete the section on holothurians, while the senior (A. M. C.) reshaped the tables to the remaining four classes and prepared their keys.

We have attempted to be as consistent as possible in terminology but owing to the differences in orientation of several of the classes it is difficult to achieve this in taxonomic descriptions of echinoderms without departing from the familiar terms found in the bulk of the literature. Hyman, Nichols and others, mostly in general rather than taxonomic works, have extended the use of 'aboral' and 'oral' from echinoids to the other classes except holothurians, which defeated them, and we have followed this for describing the upper and lower sides of asteroids, though retaining the terms 'abactinal' and 'actinal' for the superficial plates (other than the marginals and adambulacrals). Where ophiuroids and crinoids are concerned, we feel that 'dorsal' and 'ventral' cannot be discarded without confusion, terms such as 'oral arm plate' providing an apparent contradiction. It should be noted, however, that in crinoids 'dorsal' refers to the side which is lowermost in life, their orientation being relatively inverted. For holothurians we have followed the accepted practice of calling the upper side 'dorsal' and the lower 'ventral' rather than reviving the terms 'bivium' and 'trivium', which are little used now; the oral-aboral axis in holothurians is greatly elongated and horizontal rather than vertical in alignment, being at right angles to that of the other four classes.

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EXPLANATION OF TABLES

In the tables we have attempted to give as complete a list as we can discover of the echinoderm species likely to occur from the shore line down to 20 metres or about 10 fathoms in the Indo-West Pacific. This depth limit should cover collecting on shore and with schnorkel or shallow dredging equipment; it was also used by H. L. Clark in his survey of the littoral echinoderms of the West Indies. Space restrictions have allowed only two references at most to be included in the various columns of the table; where multiple records exist we have selected the more reliable ones in such a way as to give as wide a selection as possible.

The area covered by the tables ranges from Natal in South Africa, north to the Red Sea and east to India, the East Indies, northern Australia, Polynesia, the Hawaiian Islands and southern Japan. For the purposes of the tables the whole area has been subdivided as follows—

A. Minor islands of the western Indian Ocean, including the Nazareth Bank, Saya da Malha, the Seychelles, Amirantes and other islands north of but not including Madagascar.

B. The Mascarene Islands—Mauritius, Réunion and Rodrigues.

C. East Africa and Madagascar, extending from Natal to the island of Sokotra off Cape Gardafui; species endemic to Natal or for which it is the northern limit of range are excluded.

D. The Red Sea, including the Gulfs of Suez and Akaba.

E. The Arabian coast, including both shores of the Gulf of Aden in the south and of the Gulf of Oman in the north.

F. The Persian (Iranian) Gulf.

G. West Pakistan and the west coast of India.

H. The Maldivé and Laccadive Islands and the Chagos Archipelago to the south.

I. Ceylon and the opposing Indian shores of the Gulf of Manaar and Palk Bay including Tuticorin, Ramesvaram and Mandapam.

J. The Bay of Bengal from the Palk Strait to southern Burma, including the Andaman and Nicobar Islands and the Mergui Archipelago.

K. Siam (Thailand), Malaysia and Indonesia (the East Indies), including both sides of the Malay peninsula, the Gulf of Siam, New Guinea and Christmas and the Cocos-Keeling Islands in the Indian Ocean.

L. The north of Australia, from Shark Bay in the west to southern Queensland in the east; as with Natal, species of southern origin but which just extend north into the area are omitted.

M. The Philippine Islands, including the Sulu Sea.

N. The South China Sea, including Macclesfield Bank, to southern Japan, extending from Cape Cambodia in the south to the Chusan Archipelago in China and east to the vicinity of Tokyo, including Formosa (Taiwan), the Ryu Kyu and Bonin Islands; as with Natal and Australia, species known only from the outlying parts—in this case China north of the Formosa Strait and southern Japan (but not the Bonin Islands) are omitted.

O. The South Pacific Islands from Melanesia (New Britain, the Admiralty and Solomon Islands in the west) east to Pitcairn Island, north to Christmas, Fanning and Palmyra Islands and west to the Mariana and Palao (Pelew) Islands and Guam.

P. The Hawaiian Archipelago.

The same letters are used in the Bibliography wherever possible, while the numbers in the tables correspond to those in the Bibliography. The numbers in brackets in the tables are for depth records beyond 20 metres; those in bold type are for the original description of the holotype and those in italics are for references to the species under another name—either as a synonym or by mistake. When the type-locality is indefinite or outside the range covered by the tables, the reference number is given alongside the name. The asterisks in the tables (*) are positive records based on specimens in the British Museum collections. When the locality is unknown the asterisk is put by the specific name. The daggers (†) alongside the specific names indicate that the British Museum possesses type-material of that species.

The sequence of families in the tables is the generally accepted systematic one, while those of the genera and species within each family are alphabetical.

In the compilation of the tables, as well as of the keys, much information has been derived or modified from the monographs of A. H. Clark on crinoids and of Mortensen on echinoids; these important works are recommended for cross-checking. H. L. Clark's *Catalogue of Ophiurans* (1915) is another important source book but no comprehensive recent works on asteroids and holothurians exist at present (1969).

CRINOIDEA

INTRODUCTION AND GLOSSARY

Elementary accounts of this class are given by A. M. Clark (603 in reference list) and Nichols (645), also a more detailed one by Hyman (626). For specialized information on the systematics of the group the introductory parts 1 and 2 of A. H. Clark's 'Monograph of the existing crinoids' (*Bull. U.S. natn. Mus.* **82**; 1915 and 1921) should be consulted. These include a detailed glossary of terms used in describing crinoids, the most essential of which are reproduced in modified form here and illustrated in figure 1.

Brachials—the calcareous ossicles of the arms (excluding the division series—q.v.).

Centrodorsal—the large plate occupying the centre of the dorsal or aboral side, in shape discoidal, hemispherical or sometimes conical and usually bearing cirri except on its apex or dorsal pole.

Cirri—the jointed appendages arising from the centrodorsal, for temporary attachment to the substrate.

Division series—the ossicles between the radials and the first brachials of the undivided arms, absent only in five-armed genera; the distalmost ossicle of the division series is an axillary.

Pinnules—the slender jointed appendages arising from the brachials on alternate sides, the proximal one or more of which are modified as oral pinnules. The pinnules on the outer (inter-radial) side of the arm are designated P_1 , P_2 , etc. and on the inner side P_a , P_b , etc.

Radials—the five plates from which the division series (or arms) arise; superficially they are only narrowly visible in adults of most species of comatulids or feather-stars.

Syzygy—a rigid breaking-joint occurring at intervals in division series and arms, often regularly placed; the articulation is by ligaments rather than muscles and the joint-faces bear numerous fine radiating ridges so that externally the suture may appear discontinuous or undulating.

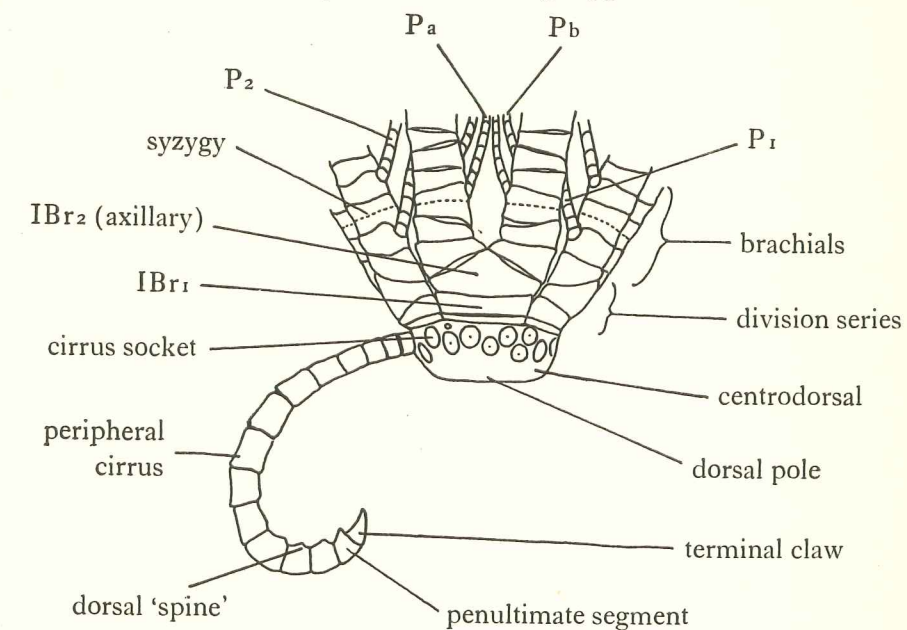


FIG. 1. Introductory figure of crinoid, omitting most of the arms, showing the parts mentioned in the glossary.