# Review of Present Status of Knowledge of Pacific Echinoderms[1]

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Inevitably most work in the Pacific on echinoderms has been done intertidally and in the upper 20 meters or so of water. The fauna of the tropical area, excepting the East Pacific, has been reviewed comprehensively by Clark and Rowe (1971) who give a fauna list/distribution table for the sub-areas of the Indo-West Pacific and annotated keys to the species (except for holothurians which are dealt with to genus or subgenus only). Since that date, notable contributions on the taxonomy of the Asterozoa of south-east Polynesia by Devaney and by Marsh have appeared and Devaney's revision of the dominant family of coral reef ophiuroids—the Ophiocomidae (to be concluded) includes many relevant species.

Owing to their limited economic interest (apart from the use of a few holothurians and echinoids as food), surprisingly little was found to be known of the biology of even the commonest and earliest-described species of echinoderms when the *Acanthaster* problem arose in the 1960s (Devaney and Randall, 1973; Endean and Chesher, 1973; Pearson and Endean, 1969; Weber and Woodhead, 1970). This stimulated a considerable amount of work in various parts of the Indo-West Pacific in the ecology, life histories, and interplay with associated fauna of some other echinoderms besides *Acanthaster* itself, such as Yamaguchi's on life-histories of some micronesian asteroids and Bakus's on the biology of tropical holothurians (both in Jones and Endean, 1973). Much of this work remains to be completed and published but some of the recent papers are mentioned in a review of the echinoderms of tropical reefs by A.M. Clark (1976). Owing to the extension of most of the commonest species throughout the Indian Ocean, studies from that area are also relevant, notably a very recent one by Fishelson (1974) on ecology of Red Sea crinoids. Also most of the common West Indian echinoids recently subjected to intensive biological study, mainly in Miami, are congeners of common Pacific species.

As for studies on the benthic fauna of deeper water, since the work of the 'Albatross' and the 'Siboga', mainly in the north-west and north-east Pacific and around the Philippines and Indonesia more than fifty years ago, biological collecting has been restricted either quantitatively or geographically or collections made have yet to be worked up. Japan and the U.S. territories are probably the most active potential contributors but Australia too may be expanding study of off-shore re-

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sources. The main center of echinoderms with the highest number of species—namely the East Indies (Malaysia-Indonesia) has afforded only minimal opportunities for biological work on relatively uneconomic animals such as echinoderms but, hopefully, with the Rumphius memorial expeditions this may be alleviated.

From the geographical point of view the more important references dealing in depth with echinoderm species include the following, details of which can mostly be found in the full bibliography in Clark and Rowe (1971) if omitted here for reasons of space. The letters given in brackets refer to the classes or subclasses, asteroids (A), ophiuroids (O), crinoids (C), echinoids (E) and holothurians (H). The paucity of local echinoid studies may be attributable to Mortensen's virtual monopoly of this class for about fifty years since his studies (apart from the 'Albatross' Philippine collection) were mostly incorporated in his monumental echinoid monograph.

HAWAIIAN ISLANDS. Ely, 1942 (A, O); Fisher, 1906 (A); A. H. Clark, 1949 (O); H. L. Clark, 1912, 1914, 1917 (E); Fisher, 1907 (H); Edmondson, 1933, 1946 (general).

OTHER PACIFIC SMALL ISLAND GROUPS. Fisher, 1925 (A); Hayashi, 1939 (A); Marsh, 1974 (A); Murakami, 1943 (O); Devaney, 1974 (O); H. L. Clark, 1917 (O), 1925 (O, E, H); A. H. Clark, 1952, 1954.

PHILIPPINES. Fisher, 1919 (A); Koehler, 1922 (O); Mortensen, 1927, 1940, 1948 (E), Semper, 1868 (H).

MALAYSIA-INDONESIA. Döderlein, 1917, 1920, 1921, 1924, 1935, 1936 (A, still uncompleted); Koehler, 1904, 1905 (O); A. H. Clark, 1918 (C, unstalked); Döderlein, 1907 (C, stalked); Sluiter, 1901 (H).

JAPAN. Goto, (1914) (A); Hayashi, 1938, 1939, 1940, 1975 (A); Matsumoto, 1917 (O); Murakami, 1942, 1943, 1944 (O); Utinomi and Kogo, 1965 (C); Gislén, 1922, 1927 (C); Nisiyama, 1966, 1968 (E); Mitsukuri, 1912 (H); H. L. Clark, 1908 (general).

AUSTRALIA. Livingstone, 1932 (A); H. L. Clark, 1921, 1932, 1938, 1946 (general); Endean, 1953, 1956, 1961, 1965 (general).

To sum up, taxonomically the echinoderms of the Pacific are reasonably well known. In my estimate, over 90 per cent of existing species to be found in shallow water to ca. 20 meters have already been described, though from greater depths the proportion must be somewhat less, possibly about 75 per cent and the literature covering these deeper species has yet to be correlated. From the viewpoints of ontogeny, functional morphology, and ecology, a great deal remains to be done.

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[2] The full citation for the majority of references can be found in Clark and Rowe (1971).

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