

## MARINE BIODIVERSITY

## New Zealand sea anemone survey reveals high diversity

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*A diving and intertidal survey of the New Zealand sea anemone fauna reveals that it may be one of the richest in the world.*

SEA ANEMONES are well known to New Zealanders of all ages who are familiar with the sea shore. So it is surprising to realise that the New Zealand sea anemone fauna is not well known scientifically. Many species are still undescribed and details of their biology are sparse. A recent compilation by Wellington naturalist Elliot Dawson of all known species in the New Zealand region from the published literature tallied about 70 species. In fact the true diversity may be more than twice this number.

**New sea anemone collection**

In winter 1996, using a campervan as a mobile laboratory, I made a representative collection of intertidal and shallow-water sea anemones (or “soft hexacorals” — see panel below) from several localities in both North Island and South Island, assisted by students or staff of universities and marine laboratories. An important part of the project was photographing live animals because their colour fades rapidly in preserving fluids. I also made notes on habitat, substratum, reproductive state and other details helpful in making formal descriptions of the species. Additionally, I studied museum collections in Auckland, Wellington, Christchurch and Dunedin.

A preliminary assessment of these field collections, museum specimens and the literature has resulted in a new list of about 110 species. All five orders of soft hexacorals are represented (see panel), including the Ptychodactylaria which has not previously been recorded in New Zealand. After further field visits and completion of the survey of the huge NIWA collection, at least 50 more species could be added. This means that the soft-hexacorals fauna of the New Zealand region may be one of the richest in the world, paralleling the trend indicated by some other groups of marine organisms (e.g., Bryozoa, stylasterid and azooxanthellate corals, and glass sponges).

**Why study soft hexacorals?**

Species of sea anemones, like other plant and animal groups, are liable to become extinct through, for example, pollution or habitat



destruction. But we cannot avoid species extinctions unless we know that they existed in the first place — hence the importance of an inventory. Some marine species have very small ranges so are susceptible to total extermination. Others are patchily distributed over a wide area and may be liable to local extinction, and this can have a wider impact on food webs and the ecosystem.

Worldwide there may be only 1500–3000 soft-hexacorals species, ranging from intertidal to deep sea habitats and showing diverse ways of feeding and reproducing. Some species can be useful indicators of environmental quality, some play an important part in seafloor ecology, and others have significant potential in medicine and pharmacology owing to the biochemicals they produce. The latter is a growing field of study that requires accurate identification of species, hence the need for competent taxonomists. Finally, anemones and corals are of considerable evolutionary interest because the Class Anthozoa to which they belong is considered by some authorities to be ancestral to jellyfish and hydroids.

**An improved classification scheme**

Gwyneth Parry, a New Zealand actinian specialist, pointed out in the 1950s that actinians were a neglected group in the New Zealand fauna, mainly because of inadequate descriptions in historic literature and the lack of a reliable classification scheme — problems not unique to New Zealand.

Of all the sea anemone species recorded in New Zealand up to the first decade of this century, the internal anatomy had been described for only one. These days an anatomical description is crucial for proper systematic placement, and some species recorded in those early days are currently unrecognisable. The 1924–50 studies of Australasian soft hexacorals by Danish specialist Oscar Carlgren, however, provided a good foundation for Parry's 1951/52 compilation, which summarises the contributions of other minor contributors along with her own new discoveries. Since then other papers have appeared sporadically, slowly adding additional species to the fauna.

Unfortunately there are still major problems in actinian taxonomy resulting from inadequate or inappropriate descriptions and little discussion on the systematic relationship between species. As a result existing soft-hexacorals systematics is somewhat chaotic and many of the suborders of



above: *Epizoanthus* sp.  
(Milford Sound).

upper right: *Diadumene neozelanica* (Milford Sound).

**What are sea anemones?**

SEA ANEMONES and corals together make up a class (Anthozoa) in the phylum Cnidaria whose members are characterised by their radial symmetry, amongst other features. Technically, the sea anemones belong to five orders of “soft hexacorals”:

- Actiniaria (commonly known as Actinians) are sea anemones in the strict sense, from the Greek word for ray, *aktis*, *aktinos*, referring to the radiating neck region of the animal;
- Ceriantaria are sea anemones which have a burrowing habit;
- Corallimorpharia are somewhat coral-like but completely uncalcified;
- Ptychodactylaria are “aberrant” anemone-like forms;
- Zoantharia are colonial anemones.

Actiniaria may become invalidated. To improve this situation it is crucial that, where possible, studies of live and properly preserved material be undertaken. Morphological and anatomical information can be supplemented later by biochemical and molecular data.

### Why such high species diversity?

There is no simple explanation for New Zealand's high diversity of soft hexacorals. The following may be contributing factors.

- New Zealand spans a wide latitude range in which a number of biogeographical provinces have been recognised. Overall, the distribution of actinians may match that of some corals for which there are two main areas: from 34°S in the far north to approximately 45°S, and from around 45°S to 50°S. Certain actinian species occur only in one or other of these areas. Also there may be species groupings associated only with archipelagoes within the larger areas, e.g., there are striking differences between the sea anemone fauna of the cold-temperate Bounty, Antipodes, Auckland, Campbell and Macquarie islands and that of south-east South Island. These are not easily explained by latitude but rather by the isolation between the two areas.
- Some genera are extremely widespread. For example, the viviparous genera *Actinia* and *Cricophorus* occur on the mainland and the cooler offshore islands; both also occur in southern Australia. *Actinia* also occurs in South Africa and South America. This suggests that either these genera are very old or their young are long-lived and dispersible on seaweeds and other floating material. Such vectors could explain the wide but localised distribution of *Cricophorus nutrix* and *Gonactinia* sp. Generally, actinian larvae disperse passively by ocean currents and shipping. The latter may explain the distribution of certain environmentally tolerant species like cosmopolitan *Haliplanella lineata* found in ports and harbours.
- High species diversity can result in areas of high habitat diversity where reproduction by anemones in one habitat occurs in isolation from that in neighbouring habitats, resulting in a high degree of endemism (species found only in that area). New Zealand has a long coastline with many different habitats — mangrove, *Zostera* beds, rock pools, reefs, estuarine muds and gravels, boulder beaches, black coral trees, etc. A high diversity of seafloor relief should also be correlated with a significant number of continental-shelf species, which appear to be well represented in the NIWA collection. The huge variety of seafloor features in the New Zealand region arises from New Zealand's position across a major plate boundary and from its long geological isolation. The latter certainly appears correlated with the occurrence of some archaic faunal types among the Bryozoa, Mollusca, Brachiopoda and sponges.

### A centre of diversity

Of particular interest to soft-hexacoral specialists is the high vicariance of the New Zealand species, i.e., many belong to genera found in other parts of the world widely separated from New Zealand by natural biogeographical barriers. This was recognised early this century for several genera and I have found additional such genera during my visit.

On the other hand, there are some interesting novelties in this part of the world. For example, around the world the common *Actinia equina* (*sensu lato*) has a range of colour (red, blue, green, brown), whereas the New Zealand *Actinia* is always red. Newly recorded *Ptychodactis* species clasp to gorgonian stems by a ring-shaped clasping arrangement of the basal disc, a phenomenon previously unknown in soft hexacorals. The common wandering sea anemone, *Phlyctenactis tuberculosa*, closely related to the family Actiniidae, has the bodily form and behaviour of the Aliciidae, a good example of evolutionary convergence. *Cricophorus nutrix* is the only member of its family to incubate live young.

It is difficult to speculate on the origin and diversity of any actinian faunas because of the lack of a fossil record, but if supposed centres of diversity are characterised by high species richness, then New Zealand may be one.

The number of soft-hexacoral species currently recorded in New Zealand is double or more than in other regions such as the Mediterranean, northeastern Atlantic, northwestern Atlantic, Caribbean, central Macronesia (Canary Islands and Madeira), Japan and the northwestern Pacific. So, either New Zealand is a speciation centre or, more plausibly, part of one that included the adjacent lands of former Gondwana. The present Gondwana-wide distribution of *Bolocera kerguelensis*, *Condylanthus magellanicus*, *Corynactis* spp., *Epiactis* spp., *Helianthella* spp., *Parantheopsis cruentata*, and *Phellia aucklandica* support the latter idea.

There is still much to learn about sea anemones worldwide — especially the fascinating relationships between the faunas of the former lands of Gondwana. ■

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*Anthopleura amoradiata*  
(Leigh Harbour).



#### Further reading

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