



Annual distribution of *Ecklonia radiata* lineage

In New Zealand waters *Ecklonia radiata* (C.Agardh) J.Agardh is found from the Three King Islands in the north (Adams & Nelson 1985) to Stewart Island in the south (Adams 1994). It is not found on the subantarctic islands or on the Chatham Islands, although individuals have been found east of the South Island on the Mernoo Bank at 30 m (WELT, Te Papa). *E. radiata* is also found in southern Africa, in the cold water upwelling zones of Oman, in western and southern Australia, Tasmania, and on the east coast of Australia north to northern New South Wales. An endemic New Zealand species, *Ecklonia brevipes* is considered by some authors to be distinct from *E. radiata* although there is the suggestion that it is a growth form restricted to areas of low water movement and illumination (Adams 1994). The distribution of *E. brevipes* overlaps with that of *E. radiata*.

1. Literature sources

The literature was searched for distributional information for the brown kelp *E. radiata*.

- a. A search was carried out of the following databases: Te Puna using the keywords "*Ecklonia radiata* +zealand +geograph? +distributed?" Keyword Relevance Search = "*Ecklonia radiata*" +thesis (16/09/2005); Aquatic Sciences and Fisheries Abstracts "*Ecklonia radiata* and zealand and (geograph* or distributed*)" (16/09/2005); Web of Science "TS=(*Ecklonia radiata* and zealand and (geograph* or distributed*))" (15/09/2005); Scopus "TITLE-ABS-KEY("*Ecklonia radiata*" AND zealand AND (geograph* OR distributed*))" (16/09/2005); Google Scholar "zealand geographic OR distributed OR distribution "*Ecklonia radiata*" (19/09/2005). From all these sources 6 theses, a number of paper citations were located (ASFA = 9; Web of Science = 5; Scopus = 5; Google scholar = 173).
- b. Using subject indices, *Seafood New Zealand* was checked for articles dealing with *Ecklonia radiata* and research.
- c. A search of NIWACAT in September 2005 produced no records that contributed additional distribution information for this species.

2. Ministry of Fisheries electronic databases

Data are recorded as ECK or *Ecklonia radiata*. The data on landings do not contribute information on the distribution of this species that is not also available (more accurately) from other sources.

3. Museum holdings

Holdings of *E. radiata* were examined at WELT, the herbarium of the Museum of New Zealand Te Papa Tongarewa, CHR (Landcare Research herbarium), AK (Auckland Museum herbarium, including the herbarium of Auckland University), and in the algal research collections at NIWA. Data were used to help estimate presence/absence.

4. Summary

Ecklonia radiata grows subtidally on rocky shores, from moderate shelter through to exposed coasts and from the low intertidal zone to depths greater than 25 m (Schiel & Nelson 1990). In northern North Island *E. radiata* has a bimodal distribution, stands sharing the 2–8 m depth range with fucal species, and then often dominant again (except in sheltered waters) at 10–20 m depth (Choat & Schiel 1982, Schiel 1990). The echinoid-dominated intermediate depth is rare south of East Cape (Schiel & Nelson 1990).

The fertility of thalli and the appearance of recruits are seasonal. *Ecklonia* is winter fertile and in northeastern North Island shallow populations have sori from May to November (Novaczek 1984b) and recruits appear from September to late December (Schiel 1981). Schiel also observed that recruitment in *Ecklonia* is temporally limited and closely linked to reproductive periodicity, suggesting that the microscopic phase does not remain viable for very long. He also noted a spatial element to recruitment success, as canopy species are the ones most likely to recruit into cleared patches. Schiel (1981) found that in the northeast of the North Island, 75% of recruits of *E. radiata* occurred within 8 m distance from adult thalli.

The importance of *E. radiata* to coastal marine communities is well documented. This species plays a major role as habitat for other species—providing shade for sub-canopy species, supporting a diverse fauna of invertebrates on the convoluted blades—and is a source of food for various herbivorous fishes and invertebrates. It also contributes carbon into the particulate and dissolved carbon food webs.

Within the past 15 years there have been several episodes of mass die back of *Ecklonia* in northeastern New Zealand (e.g. Cole & Babcock 1996). The causes remain unclear: the death of some stands has been associated with periods of warm water and nutrient stress; a virus-like pathogen has been found on dying plants; and the die-back episodes have also been associated with extensive blooms of phytoplankton that reduced the light available to kelp canopies (Schiel 2003).

The above information on the distribution of *E. radiata*, derived primarily from herbarium collections, was reviewed by Dr Murray Parsons, former Keeper Landcare Herbarium, and then integrated by hand onto a large-scale map of New Zealand. The 90% and 100% distributions were extended to link headlands or subtidal reef areas where this species has been recorded and/or where equivalent habitats occur. The rounded lines were then digitised and imported into a GIS software package as layers.

The areas of each distribution class were calculated and the layers were linked to attribute and metadata files. The map, because of its scale, cannot be taken to accurately define the local distribution of this species.

5. References

The following publications were the key references and/or the ones most useful in describing the recent/current annual distribution of *E. radiata*. The list is not intended to be an exhaustive bibliography of publications about this species.

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