



## Lineage

### Annual distribution of frostfish

FD0660\_1; FD0661\_1; FD0662\_1; FD0663\_1; FD0664\_1

1. Electronic databases were used to generate initial maps of species distribution.
  - a. Commercial fishing returns (larger vessels): **TCEPR** database. All records from 1 October 1989 to 30 September 2005 were extracted on 17 October 2005. Data were used to estimate mean annual catch and catch rate (kilograms per kilometre towed) in 0.25 degree rectangles. Only the top five species caught are reported on these forms so information on the absence of a species is not available.
  - b. Commercial fishing returns (smaller vessels): **CELR** database. All records from 1 October 1989 to 30 June 2003 were extracted on 15–17 July 2003. Data were used to estimate mean annual catch in statistical areas. Information from statistical areas 1–10 was down-weighted because of likely mis-recording of Fishstock instead of statistical area. Only the top five species caught are reported on these forms so information on the absence of a species is not available.
  - c. Scientific observer records from larger vessels: **obs** database. All records from 1 March 1990 to 30 September 2005 and stored in the new data format were extracted on 20 October 2005. Data were used to estimate mean annual catch and catch rate (kilograms per kilometre towed), and proportion of tows that caught the species, in 0.25 degree rectangles.
  - d. Research bottom trawl records: **fish\_comm** database. This database is a groomed version of the research trawl database **trawl**. All records from 2 September 1978 to 30 September 2005 were extracted on 19 May 2006. Data were used to estimate total catch, proportion of tows that caught the species, and catch rate (kilograms per kilometre towed) in 0.25 degree rectangles.
  - e. Russian research bottom trawl records: **trawl** database. These data are a subset of the research trawl database **trawl**. All records were extracted on 9 August 2003. Data were used to determine the presence of this species north of 37 °S. Because the data are old (the most recent record was 1987), and there are problems with species identifications, these data were given low weighting.
  - f. Museum of New Zealand Te Papa records of this species based on voucher specimens held in their collection were searched for distributional information that added to the distributional ranges determined from other databases.
  - g. NORFANZ voyage: **biods** database. Records from a research trawling and dredging survey of the Norfolk Ridge and Lord Howe

Rise carried out in May–June 2003 were extracted on 9 January 2006.

- h. Databases of commercial tuna longline catches (**TLCER**), observer records from tuna longlines (**I\_line**), recreational fishing (**rec\_data**), and aerial sightings (**aer\_sight**) were not used as they contained no records of this species, or the number of records was too small to provide useful additional distributional information.
2. Literature sources were searched for distributional information that added to the distributional ranges determined from databases.
    - a. Unpublished electronic bibliography of New Zealand fishes compiled by L. J. Paul and held on a NIWA computer.
    - b. Aquatic Sciences and Fisheries Abstracts.
    - c. *New Zealand Professional Fisherman* and *Seafood New Zealand* for 1986–2002.
    - d. *New Zealand Fishing News* for 1998–2002.
    - e. Scientific papers, unpublished reports and university theses available to the expert who prepared the distributional layers.
  3. Other sources.
    - a. Nil.
  4. Summary
    - a. Maps generated from the electronic databases were provided to an expert scientist who integrated this information with other information from the literature, and expert opinion, and produced hand-drawn distributional zones on a template map containing depth contours at 250 m, 500 m, and 1000 m. These maps were then digitised and imported into a GIS software package as layers. The areas of the zones were calculated, and the layers were linked to attribute and metadata files.
    - b. The primary sources of distributional data for frostfish were TCEPR, CELR, obs, and fish\_comm databases.
    - c. Frostfish is widely distributed, occurring throughout the northern and eastern Atlantic, in the Mediterranean Sea, and from southern Africa to southern Australia and New Zealand (Nakamura and Parin 1993). In the New Zealand region they occur from the Kermadec Islands to the Campbell Plateau, mainly between depths of 50 and 400 m (but sometimes as shallow as 10 m or as deep as 800 m), and are most abundant off the central west coast of New Zealand.
    - d. Museum of New Zealand specimens confirm the presence of frostfish near the Kermadec Islands and on the Bounty Plateau, and in oceanic waters west of Fiordland. Although some database records of frostfish could have been mis-identified specimens of the similar-looking false frostfish (*Paradiplospinus gracilis*) or slender scabbardfishes (*Benthodesmus* spp.), frostfish appear to occur widely throughout the New Zealand region. Their northern limit is not known.

## 5. References

The following sources provided useful information on the distribution of this species. This is not an exhaustive list of all references to the species.

Anderson, O.F.; Bagley, N.W.; Hurst, R.J.; Francis, M.P.; Clark, M.R.; McMillan, P.J. (1998). Atlas of New Zealand fish and squid distributions from research bottom trawls. *NIWA Technical Report 42*. 303 p.

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Nakamura, I.; Parin, N.V. (1993). FAO species catalogue vol. 15. Snake mackerels and cutlassfishes of the world. *FAO Fisheries Synopsis, No. 125*. 136 p.

Roberts, C.D. (1991). Fishes of the Chatham Islands, New Zealand: a trawl survey and summary of the ichthyofauna. *New Zealand Journal of Marine and Freshwater Research* 25: 1-19.

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