

The logo for NABIS (New Zealand Aquatic Biodiversity Information System) features the word "NABIS" in a bold, blue, sans-serif font. To the right of the text is a stylized map of New Zealand, with a magnifying glass icon overlaid on it, symbolizing search and exploration.

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Lineage – Scientific methodology

Annual distribution of juvenile frostfish lineage

1. Electronic databases were used to generate initial maps of species distribution.

- a. Scientific observer records from larger vessels: **obs_ifs** database. All records from 1 October 1989 to 31 March 2005 and stored in the new data format were extracted on 3 August 2005. Data were used to estimate mean annual catch of juveniles, proportion of juveniles in the catch of the species, and proportion of tows that caught juveniles of the species, in 0.25 degree rectangles.
- b. Research bottom trawl records: **trawl** database. All records from 1 October 1961 to 5 July 2005 were extracted on 25 August 2005. Data were used to estimate mean annual catch of juveniles, proportion of juveniles in the catch of the species, and proportion of tows that caught juveniles of the species, in 0.25 degree rectangles.

2009 update: An examination of the observer (**cod**) and research (**trawl**) databases was repeated for the period 31 Mar 2005 to 1 May 2009. New records were found in the observer database and resulted in slightly extended ranges for the map of the known distributional range of juvenile frostfish.

2. Literature sources were searched for usable biological and distributional information to add to the distributional range of juvenile frostfish determined from databases.

- a. O'Driscoll et al. (2003). Areas of importance for spawning, pupping or egg-laying, and juveniles of new Zealand deepwater fish, pelagic fish, and invertebrates. *NIWA Technical Report 119*.
- b. Hurst et al. (2000b). Areas of importance for spawning, pupping or egg-laying, and juveniles of New Zealand coastal fish. Final Research Report for MFish Project ENV199903.

- c. Unpublished electronic bibliography of New Zealand fishes compiled by L. J. Paul and held on a NIWA computer.
- d. Aquatic Sciences and Fisheries Abstracts.
- e. *New Zealand Professional Fisherman* and *Seafood New Zealand* for 1986–2005.
- f. *New Zealand Fishing News* for 1998–2005.
- g. Scientific papers, unpublished reports and university theses available to the expert who prepared the distributional layers.
- h. Other online sources such as Fishbase, Google, and the ISI Web of knowledge.

2009 update: Searches of ASFA, Fishbase, and Google Scholar on 20 May 2009 returned no additional material that would alter the known distribution of juvenile frostfish in New Zealand waters.

- 3. Other sources.
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 juvenile frostfish were the **observer** and **trawl** 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 & 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.
- e. Juvenile frostfish appear to be patchily distributed in New Zealand waters north of about 44 °S. Their main concentrations are off the northwest coast of the South Island and in the Bay of Plenty (there are hotspots off Hokitika and Whakatane), but they have also been

recorded of west Northland, the Wairarapa coast, and north of the Chatham Islands.

- f. Most juvenile frostfish are found at depths between 50 and 450 m.

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.

Bagley, N.W.; Schofield, K.A.; Colman, J.A. (1998). A summary of biology and commercial landings, and a stock assessment of the frostfish, *Lepidopus caudatus* Euphrasen, 1788 (Pisces: Trichiuridae), in New Zealand waters. *New Zealand Fisheries Assessment Research Document 98/23*. 28 p.

Beentjes, M.P.; Bull, B.; Hurst, R.J.; Bagley, N.W. (2002). Demersal fish assemblages along the continental shelf and upper slope of the east coast of the South Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 36: 197–223.

Francis, M.P.; Hurst, R.J.; McArdle, B.H.; Bagley, N.W.; Anderson, O.F. (2002). New Zealand demersal fish assemblages. *Environmental Biology of Fishes* 65: 215–234.

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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.

Stewart, A. (1996). Frostfish — in from the cold. *Seafood New Zealand* 4(10): 98–100.