



Lineage

Winter distribution of blue warehou

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 June 2003 were extracted on 16 July 2003. 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. Records of blue warehou (species code WAR) may include other warehou species either through mis-identification or because WAR was used as a generic code for warehou species in the past. Records from the Chatham Islands, the Auckland Islands, the deeper area to the east of the Auckland Islands gap, and the northern Challenger Plateau are uncertain. Some of these areas are outside the normal depth range or geographic range determined for the species from research surveys. Some are supported by scientific observer records but records were only included in the annual 100% distribution if they were substantiated by research or Museum of New Zealand records. On the seasonal plots, these records are classified as unknown.
 - 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. Records of blue warehou from the Kermadecs Ridge are unconfirmed and were ignored.
 - c. Scientific observer records from larger vessels: **obs** database. All records from 1 March 1990 to 30 June 2003 and stored in the new data format were extracted on 28 July 2003. 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. Records of blue warehou (species code WAR) may include other warehou species either through mis-identification or because WAR was used as a generic code for warehou species in the past. Records from the Chatham Islands, the Auckland Islands, and the deeper area to the east of the Auckland Islands gap are uncertain. Some of these areas are outside the normal depth range or geographic range determined for the species from research surveys. They are supported by TCEPR records but were only included in the annual 100% distribution if

they were substantiated by research or Museum of New Zealand records. On the seasonal plots, these records are classified as unknown.

- 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 3 September 1997 were extracted on 15–16 July 2003. Further surveys have been added to **trawl** and **fish_comm** since 1997, but were not used because they have not been properly groomed for species identification and positional errors. 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. There were records of WAR but this code appears to include a mixture of warehou species and the data were ignored.
 - 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. There were three separate reports of blue warehou from areas that need verification: northern Challenger Plateau (in 527–539 m depth), Chatham Islands (0–3 m depth), and north-west Chatham Rise (north of Mernoo Bank in 464 m depth). These occurrences are included in the extreme range on the annual map.
 - g. 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 blue warehou were TCEPR, CELR, and fish_comm databases. Museum of New Zealand data confirmed some unknown locations.
- c. Blue warehou occur off southern Australia and New Zealand. Off New Zealand, they are distributed throughout mainland waters from North Cape to the southern edge of the Snares shelf. There are a few records from the northern Challenger Plateau and the Chatham Islands. Reports of the species from the Antipodes and Bounty islands (Francis 1996, 2001) were based on specimens that actually came from the Chatham Islands (C. Paulin, Museum of New Zealand, pers. comm.). The known depth range for blue warehou is 0–540 m.
- d. The species identification of commercial catch records from Auckland Islands and deeper water off the Chatham Islands and to the east of the Snares shelf is uncertain. The species code for blue warehou (WAR) may also have been used as a generic code for other warehou species.
- e. Data from TCEPR, CELR, obs, and fish_comm databases were examined for seasonal variations in distribution. Blue warehou aggregate for spawning mainly during late winter and spring and for feeding during summer and autumn. This produces the main spawning-associated hotspots on the east coast of the North Island and the west coast of the South Island from July to September, and Cook Strait and coastal Southland from October to December. Other hotspots (east coast South Island, Stewart–Snares shelf, west coast South Island and Cook Strait area) in summer and autumn are associated mainly with feeding but some autumn spawning schools have also been found in some areas.
- f. In winter, the 100% distribution is the same as the annual distribution except that there are no records from the northern Challenger Plateau and occurrences of blue warehou at the Chatham Islands and around Mernoo Bank are unknown. The 90% distribution is the same as the annual distribution except that the southern limit has moved north to lie between Stewart and Snares islands. Hotspots occur off the south-east coast of the North Island, the west coast of the South Island, south of Dunedin and east of Stewart Island. These hotspots are associated with spawning or pre-spawning activity.
- g. Winter, for the purposes of NABIS, is defined as being the months of July, August and September. This definition is based on research regarding the spatial and temporal variability of sea surface temperature in the New Zealand region (Uddstrom and Oien 1999).

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.

Francis, M. (2001). Coastal fishes of New Zealand. An identification guide. Third edition. Reed Books, Auckland. 103 p.

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Hurst, R.J.; Bagley, N.W.; Anderson, O.F.; Francis, M.P.; Griggs, L.H.; Clark, M.R.; Paul, L.J.; Taylor, P.R. (2000a). Atlas of juvenile and adult fish and squid distributions from bottom and midwater trawls and tuna longlines in New Zealand waters. *NIWA Technical Report 84*. 162 p.

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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.

Uddstrom, M.J.; Oien, N.A. (1999). On the use of high-resolution satellite data to describe the spatial and temporal variability of sea surface temperatures in the New Zealand region. *Journal of Geophysical Research. Oceans* 104 C9: 20729-20751.