



Lineage

Summer Distribution of Trevally

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. Most trevally records were from the North Island and the northern South Island to about 43 °S. Some records from outside 500 m depth, particularly off east and west Northland and in the Bay of Plenty, were not supported by either the **fish_comm** or **obs** databases and were ignored.
 - 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 trevally largely reflected distributions from other data sources, but because summaries were by statistical area, little fine scale information could be derived. This source indicated low numbers of trevally all around the South Island.
 - 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 trevally were mainly from the west coast (approximately Raglan to Westport) and from East Cape to Hawke Bay. There is no observer cover of the purse-seine fleet, which is responsible for most trevally catch on the east coast of the North Island. Thus the **obs** database only provides partial information on distribution for this species.
 - 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. This

database provided similar coverage of trevally to the **TCEPR** data, but extended further south on the west coast South Island.

- 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. Recreational fishing database: **rec_data**. All records were extracted on 24 July 2003. Data were used to determine the presence of a species in a variety of statistical reporting areas.
 - g. Aerial sightings database: **aer_sight**. On 5 August 2003, data were extracted for 1976 onwards (for 0.5 degree squares) and for 1 January 1986 onwards (for actual positions). Data were used to estimate total tonnage, number of schools, and tonnes per hour of flying. These data provided good distributional information for trevally, particularly in areas where **fish_comm** and **obs** coverage was lacking (e.g., east Northland).
 - h. 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.
 - i. Databases of commercial tuna longline catches (**TLCER**) and observer records from tuna longlines (**I_line**) 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 their expert opinion to produce 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 mackerel were TCEPR, CELR, fish_comm, and aer_sight databases.
- c. Trevally occurs in the western Atlantic, eastern Atlantic, and Indo-Pacific oceans. The western Atlantic distribution is Bermuda, and North Carolina to southern Brazil. The eastern Atlantic distribution is the Mediterranean Sea, and the Azores, Madeira, Canary, Cape Verde, Ascension and Saint Helena islands. The Indo-Pacific distribution is South Africa, Japan, Hawaii (Randall 1996), Australia, Lord Howe Island, Norfolk Island, and New Zealand. It has been reported from New Caledonia (Wantiez 1993) and its occurrence in Taiwan needs verification.
- d. In New Zealand, trevally occurs throughout mainland waters from the Three Kings Islands to the Stewart–Snares Shelf. It is most abundant around the North Island and in the northern South Island to about Haast and Kaikoura. Francis (1993) reported it from Lord Howe, Norfolk, and Kermadec islands. The National Recreational Diary Survey (1996) provided records from Bluff and in Foveaux Strait, and other recreational surveys show records from Clarence River to Awarua Point, Sumner to Rakaia, and Rakaia to the Waitaki River. Trevally is also known from the Chatham Islands (Roberts 1991); based on this information, the species might also be expected occasionally at Mernoo Bank, but this requires confirmation. Hotspots are evident in east and west Northland, Bay of Plenty, North and South Taranaki bights, south of East Cape, west of Farewell Spit, and in Tasman Bay. Trevally range from the surface to at least 70 m depth. They probably extend deeper, to around 150 m, based on research trawl records, but it is possible that the fish from these deeper tows were caught while the net was travelling between the surface and the seabed.
- e. The summer distribution of trevally differed from the annual distribution in the absence of the hotspots on the east coast and in Tasman Bay. The continuous hotspot off Raglan and Kawhia Harbours in the annual distribution was broken into two smaller areas in the summer distribution.
- f. Summer, for the purposes of NABIS, is defined as being the months of January, February and March. 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.P. (1979). Checklist of the marine fishes of Kaikoura, New Zealand. *Mauri Ora* 7: 63-71.

- Francis, M.P. (1993). Checklist of the coastal fishes of Lord Howe, Norfolk, and Kermadec Islands, Southwest Pacific Ocean. *Pacific Science* 47: 136-170.
- Hardy, G.S.; Grace, R.V.; Francis, M.P. (1987). Fishes observed at the Three Kings Islands, northern New Zealand. *Records of the Auckland Institute and Museum* 24: 243-250.
- Hurst, R.J.; Bagley, N.W.; Anderson, O.F.; Francis, M.P.; Griggs, L.H.; Clark, M.R.; Paul, L.J.; Taylor, P.R. (2000). 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.
- James, G.D. (1984). Trevally, *Caranx georgianus* Cuvier: age determination, population biology, and the fishery. *New Zealand Ministry of Fisheries, Fisheries Research Bulletin* 25. 50 p.
- Randall, J.E. (1996). Shore fishes of Hawai'i. Natural World Press, Vida, Oregon. 216 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.
- 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.
- Wantiez, L. (1993). Les poissons des fonds meubles du lagon Nord et de la Baie de Saint-Vincent de Nouvelle-Calédonie: Description des peuplements, structure et fonctionnement des communautés. Ph.D. Thesis, Université d'Aix-Marseille II, France.