Annual distribution of albacore tuna lineage

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. Albacore are not usually caught by trawl so records are almost certainly the result of accidental captures during setting or retrieving gear. The relatively few records essentially duplicate information in other data sets.
    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. Tuna longline fishing returns: **TLCER**. All records were extracted on 17 July 2003. Data were used to estimate mean annual catch and catch rate (kilograms per hook) in 0.25 degree rectangles. However, the latitudes and longitudes used were for the set start position, and because longline length is often greater than 140 km, the resolution of the data is about 1 degree square.
    e. Scientific observer records from tuna longline vessels: **l_line** database. All records between 1 October 1992 and 30 September 2005 were extracted on 9 December 2005. Data were used to estimate catch rate (number per 1000 hooks) in 0.25 degree rectangles. However, the latitudes and longitudes used were for the set start position, and because longline length is often greater than 140 km, the resolution of the data is about 1 degree square.
    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. 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.

h. Databases of New Zealand and Russian research bottom trawl records (**fish_comm, trawl)**, and aerial sightings **(aer_sight)** were not used because they had few or no records.

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 albacore were TLCER, CELR, and l_line databases.
    c. Albacore is endemic to the surface waters of the South Pacific Ocean south of 5 ^{o}S, including oceanic near-shore waters of New Zealand (Murray 1994). It occurs throughout mainland New Zealand waters and rarely as far south as the Auckland Islands. Hot spots for this species occur north of the Three Kings Islands, from Kaipara to Kawhia, East Cape to the Wairarapa, and the waters off Westland. The known depth range of albacore is 0–380 m.
    d. Data from TLCER, CELR, and l_line databases were examined for seasonal variations in distribution. Juvenile albacore migrate to temperate waters of the South Pacific in summer and remain in New Zealand waters until April–May. Adults, however, occur throughout the year. The distribution of juveniles after they leave temperate waters is unknown but they do not appear to return to tropical spawning areas before they reach 85 cm fork length (Jones, 1991). The seasonal movement of albacore is southward in summer with most albacore occurring north of about 45 ^{o}S on the west coast and north of about 41 ^{o}S on the east coast. The southern extent of the distribution retracts northward as surface waters cool and reach their northernmost extent in winter.

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.

Bagley, N.W.; Anderson, O.F.; Hurst, R.J.; Francis, M.P.; Taylor, P.R.; Clark, M.R.; Paul, L.J. (2000). Atlas of New Zealand fish and squid distributions from midwater trawls, tuna longline sets, and aerial sightings. *NIWA Technical Report 72*. 171 p.

Collette, B.B; Nauen, C.E. (1983). FAO Species Catalogue, Volume 2. Scombrids of the world. *FAO Fisheries Synopsis 125(2)*. 137 p.

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.

Jones, J.B. (1991). Movements of albacore tuna (Thunnus alalunga) in the South Pacific: evidence from parasites. *Marine Biology 111*: 1-9.

Murray, T. (1994). A review of the biology and fisheries for albacore in the South Pacific Ocean. *FAO Fisheries Technical Paper 336/2*: 188-206.