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A SURFACE ALBACORE SURVEY IN THE CENTRAL AND WESTERN SOUTH PACIFIC OCEAN

by

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Important stocks of surface albacore (*Thunnus alalunga*) exist in the Atlantic and the North Pacific Oceans, where they support substantial fisheries (on average, 35 000 and 80 000 tonnes respectively). In the South Pacific, surface albacore are fished around New Zealand coasts during the summer season. The size of this fishery is still small but increasing (1468 tonnes for the 1979-80 season and 2085 tonnes for 1980-81). Between 10°S and 25°S, as in the North Pacific, albacore larvae are abundant in plankton net tows. Surface albacore are probably numerous at these latitudes from New Zealand's east coast to the eastern South Pacific and an important stock may therefore exist in these waters. However, very little information is available on the possible extent to which surface albacore occur in this part of the Pacific Ocean. Taking into account this lack of data within its tuna stock assessment programme for the entire region, ORSTOM (Office de la Recherche Scientifique et Technique Outre-Mer) organised a surface albacore survey in the Central and Western South Pacific.

The objectives of this survey were :

(1) to check for the presence of surface albacore using trolling lines;

(2) to describe the oceanographic conditions of the area surveyed and identify favourable conditions for concentration of surface albacore;

(3) to assess the importance of the subtropical convergence upon surface albacore concentration, and the usefulness of satellite SST charts for locating favourable albacore waters.

1. The survey

The survey prepared by the ORSTOM Centres of New Caledonia and French Polynesia, took place from 12 February to 4 March 1982 on board the *R.V. Coriolis* from Papeete to Noumea via 40°S. The area surveyed for albacore occurrence extended from 157°W to 180° between 38° and 42°S. The vessel track is shown in Figure 1.

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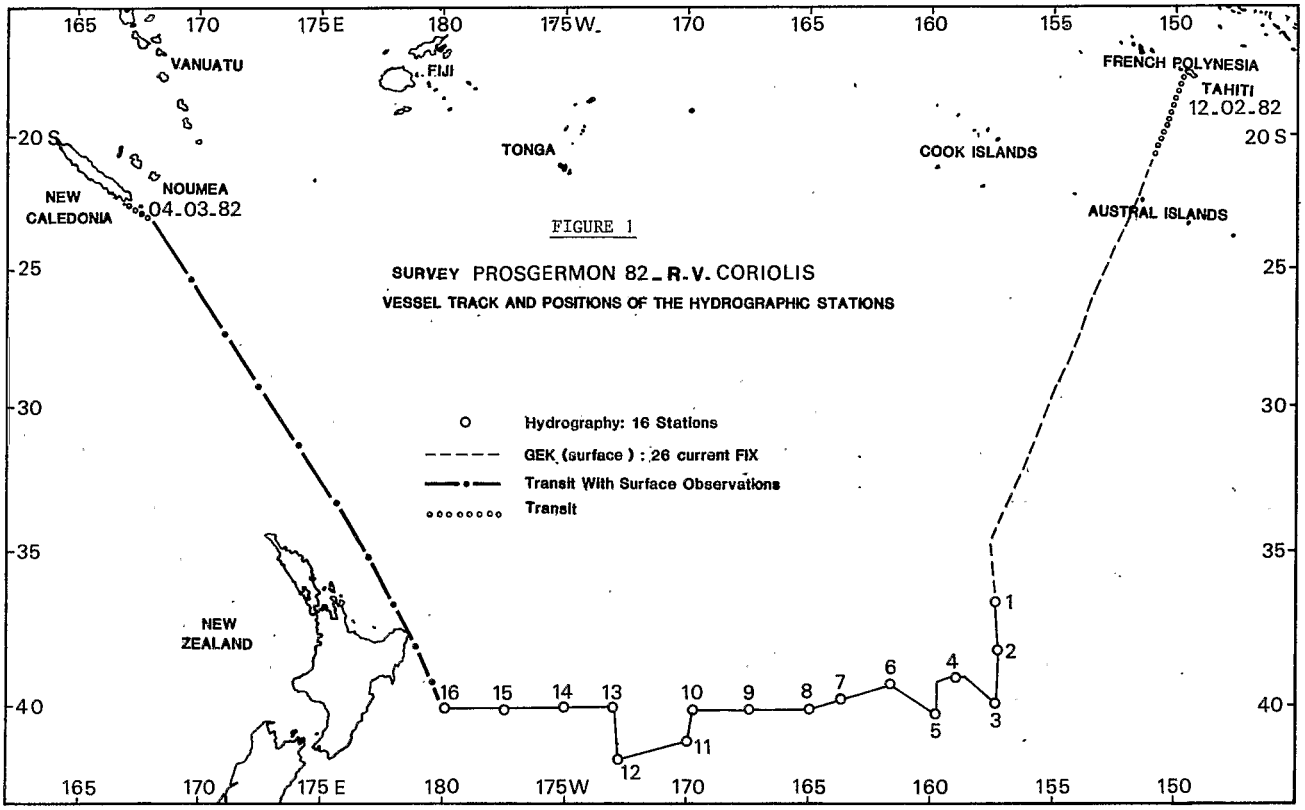


FIGURE 1

SURVEY PROSGERMON 82 - R.V. CORIOLIS

VESSEL TRACK AND POSITIONS OF THE HYDROGRAPHIC STATIONS

2. The vessel and fishing gear

Coriolis, a 37 metre research vessel, was fitted with two outriggers and 9 to 10 trolling lines. Three lines of between 50 and 75 metres length were set on each trolling pole and 3 or 4 lines were fixed at the stern of the vessel. This rigging is similar to that employed by the French albacore surface fishery in the North Atlantic Ocean.

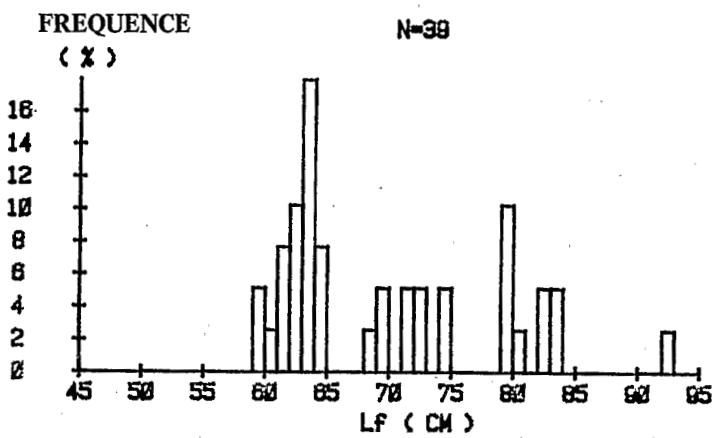
Trolling was performed from dawn to dusk at a speed of between 6 and 8 knots. The 21 cruising days were rather short for the completion of the 3925 nautical miles of the vessel track. Therefore the survey was not extended further than 42°S, and places where albacore were caught were not worked twice or in circle as they would have been by a commercial fishing vessel.

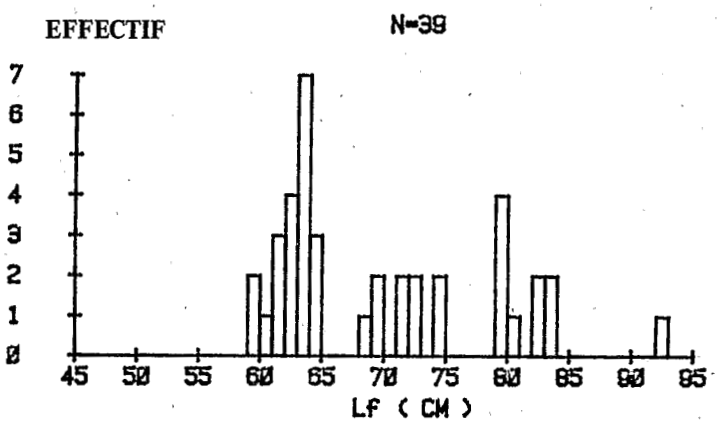
3. Scientific procedure

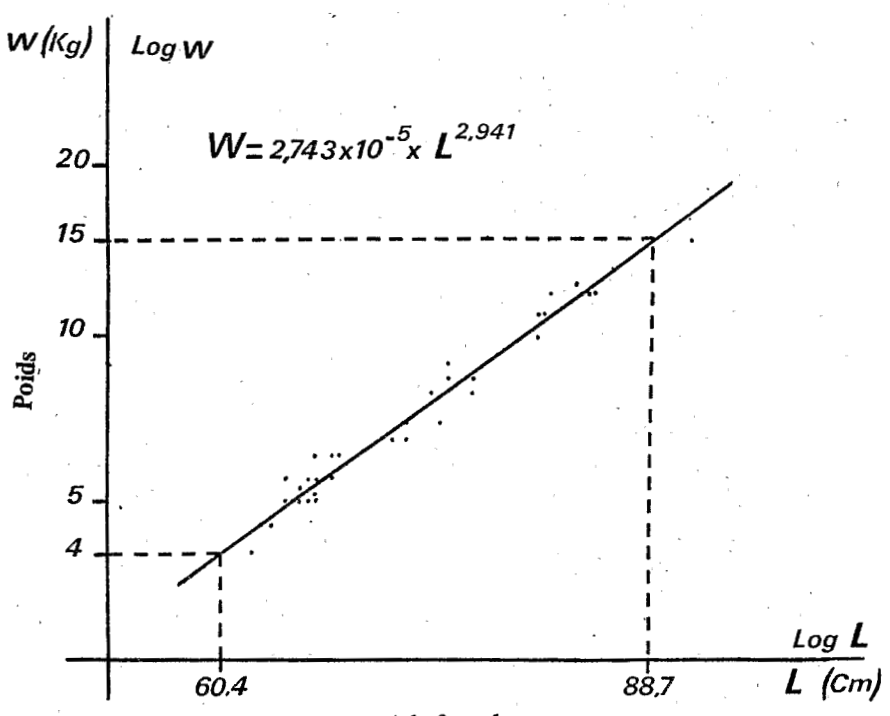
Hydrographic data were collected at 16 different stations. Recorded measures include temperature (°C), salinity (°/₀₀) and oxygen (ml/l) at twelve different levels between the surface and 500 metres deep, and chlorophyll 'a' (mg/m^3) at 8 levels between 0 and 200 metres. To obtain a better assessment of the hydrographic conditions of this area, scientists on board had also at their disposal all the oceanographic data of a previous cruise (19-01 to 08-02-82) which had surveyed the area from Papeete as far south as 37°S.

Ordinary biological data were recorded for each fish hauled on board : fork length ± 0.5 cm, weight ± 0.1 kg, sex, maturity, stomach contents and parasite occurrence.

FIGURE 2. Length frequency distribution and length-weight relationship for Albarore (*Thunnus alalunga*) caught during PROSGERMON 82 survey in the South Pacific Ocean.







Once the first albacore was caught, the track of the vessel was set so as to keep it in waters favourable to the occurrence of surface albacore. The track was also designed to obtain sufficient data to describe the hydrographic conditions of the area surveyed.

4. Results

4.1 Exploratory fishing

Trolling for fish commenced on the morning of 18 February at 38°S, but no albacore were caught until sea surface temperature was below 18°C (39°S). Owing to the lack of time and the fact that trolling for albacore can be performed only during day time, no more than 45 hours were spent fishing in favourable waters. During these 45 hours, 39 fish were caught and landed on board and about 30 more were hooked but lost.

Expressed per 100 line-hours, these catches represent a rate of 17 fish which is comparable with the rate of 19.3 fish per 100 line-hours obtained by the New Zealand albacore surveys from 1972 to 1975 (Roberts, 1980). No other species but albacore were captured, and no fish or bird schools were spotted during the time the vessel spent in "albacore waters".

4.2 Fish size

Albacore length frequency distribution as well as the length-weight relationship are given in Figure 2.

Albacore are from four different age groups, probably from two to five years. All fish but one (a female of 15 kg) were immature. Fish size distribution is similar to those of the New Zealand albacore fishery except for the lack of fish under 60 centimetres. This could be due either to the real lack of this size class fish at this time of the year in the area surveyed or to the selectiveness of our fishing technique (different trolling speed or gear).

4.3 Hydrographic conditions

Hydrographic data collected during this cruise confirmed that albacore are present in the surface or sub-surface layers of the sea when temperature is generally below 19°C. Albacore were caught in the subtropical convergence zone. This particular area represents the frontal zone between the tropical water to the north (sea surface temperature (SST) over 20°C and salinity over 35.35 °/₀₀) and the temperate or sub-antarctic water to the south (S.S.T. cooler and salinity constant and around 34.75₀/₀₀) (Figure 3). On the surface, the main characteristic of this convergence is the organisation of the 16°C to 19°C isotherms in a front (isotherms close together) (Figure 4)

In these waters, the thermocline is well marked. It is located between 50 and 75 metres deep and this could account for the lack of fish activity at the surface. The thermocline acts as a barrier to the fish: when it is shallow fish are close to the surface; when it is rather deep, as was the case here, they spread out in the entire water volume between the surface and the thermocline. Primary productivity in the frontal zone was much higher than further north in the tropical waters. This higher primary production is the base of a food chain and albacore stomachs were filled with small fish and crustaceans. These general conditions are similar to those prevailing in the North Pacific and Atlantic surface albacore fisheries.

Hydrographic data also showed that the subtropical convergence in the South Pacific Ocean does not exactly parallel lines of latitude and is located further south when moving west.

5. Conclusion and discussion

This survey demonstrates that hydrographic structures favourable to the occurrence of albacore at the sea surface are present in the central and western South Pacific Ocean during the summer season. Albacore were caught in these waters using surface trolling. The subtropical convergence induces the concentrations of albacore and the localisation of this convergence on satellite sea surface temperature charts corresponds to the 15°C to 19°C surface isotherms when they are organised in a front.

The small number of days spent in this area and the small size of the albacore sample do not allow any indication of the size of the stock available to a surface fishery.

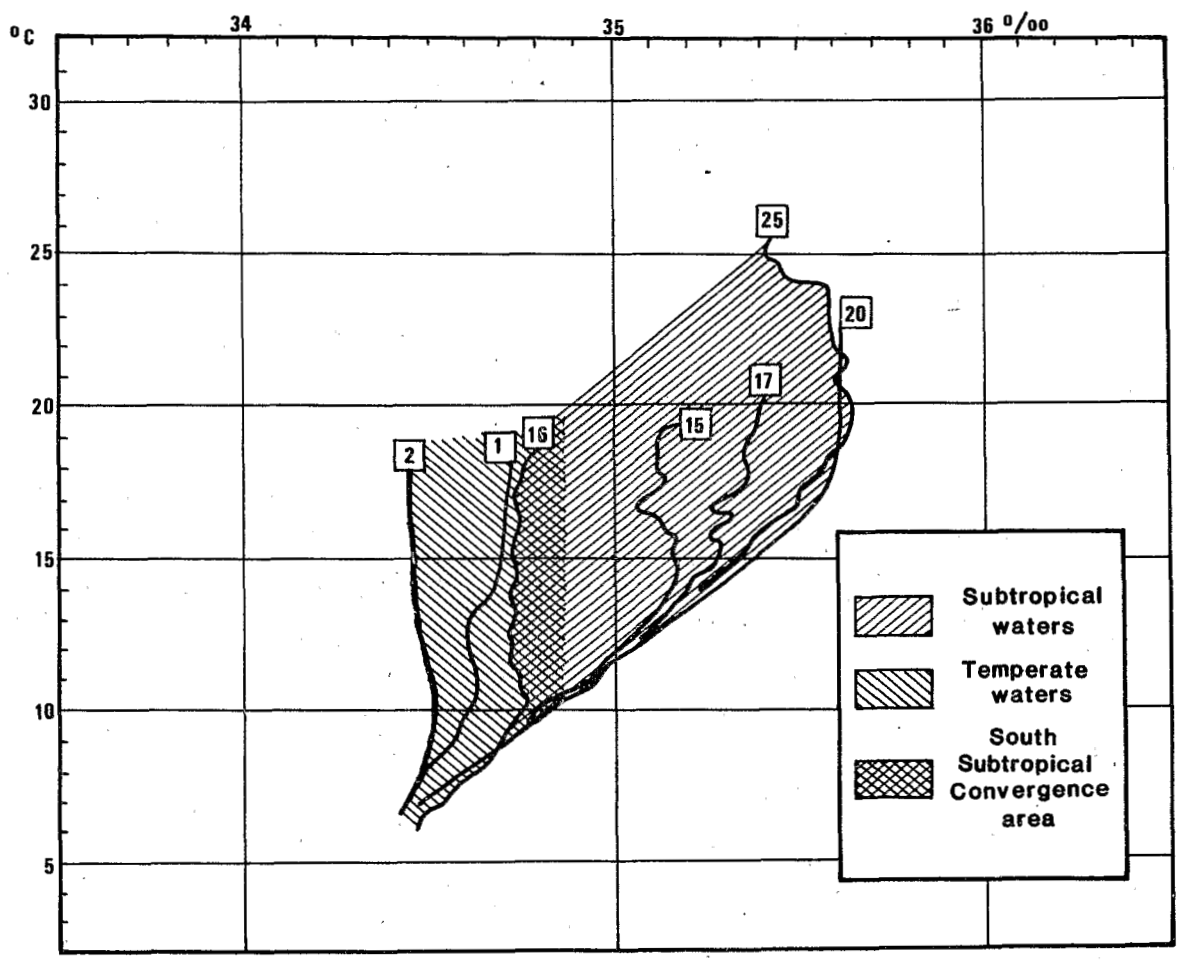


FIGURE 3. Temperature-Salinity diagrams which show the progression from the tropical waters (POLYDROTHON Stations 20 & 25) to the temperate waters (POLYDROTHON Station 16 and PROSGERMON Stations 1 & 2) meridian band 157-159°W - latitude 15-40°S.

The lack of fish and bird activities at the surface could certainly make trolling more difficult and less productive. However, the use of depressors to keep the lines under the surface would probably increase the hook rate as albacore seem to stay in subsurface waters. Line pullers to haul the lines in would also make fishing more efficient. Albacore gillnet fishing recently developed by the Japanese in the Central North Pacific could well be used in the South Pacific.

An offshore summer albacore fishery in the South Pacific Ocean should be based on the east coast of New Zealand or on Rapa Island, the southernmost island of French Polynesia in the Australs group. Easter Island from Chile could also be used as a base for such a fishery. These two islands are within two to four steaming days from the albacore waters.

From New Zealand the present albacore fishery can extend its activities eastwards. A gillnet fishery could work also to the east of the coastal fishing grounds in the Central South Pacific.

Of course, more scientific and exploratory surveys are necessary before any commercial fishery can be developed in this area. The first results on this cruise need to be confirmed and more data need to be collected, and ORSTOM therefore plans to conduct another survey by the beginning of 1984. This second survey will cover the same area, to confirm the results of the 1982 survey, and will extend further east, up to the south of Easter Island (Figure 4).

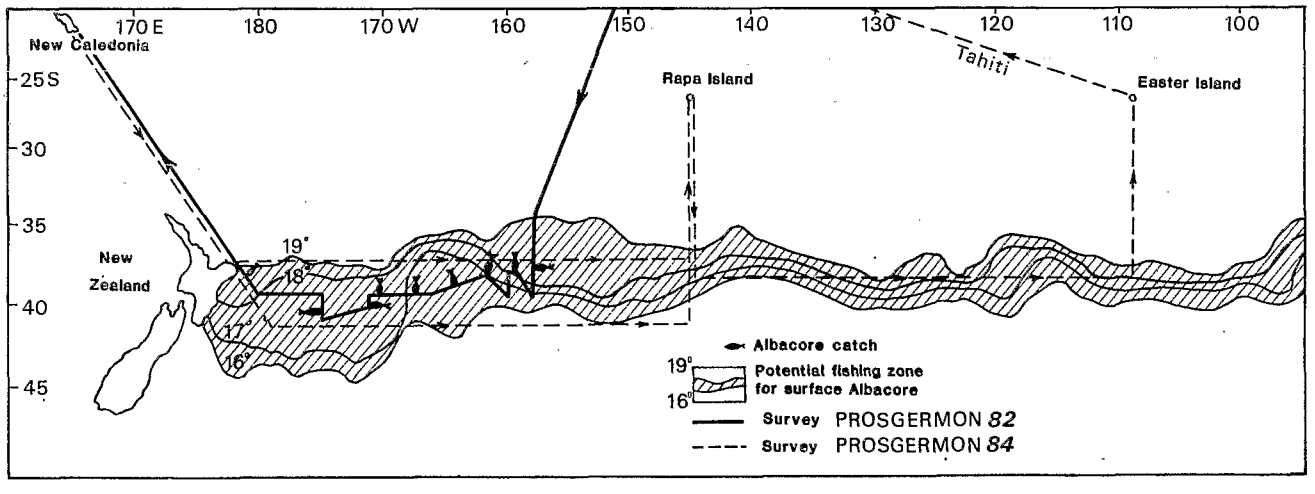


FIGURE 4./ Potential fishing zone for surface Albacore in the Central South Pacific Ocean.

References

ROBERTS, P.E., 1980. Surface distribution of albacore tuna, *Thunnus alalunga* Bonnaterre, in relation to the Subtropical Convergence Zone east of New Zealand. Fisheries Research Division Publication 418. New Zealand Journal of Marine and Freshwater Research, 1980, 14(4) : 373-380.