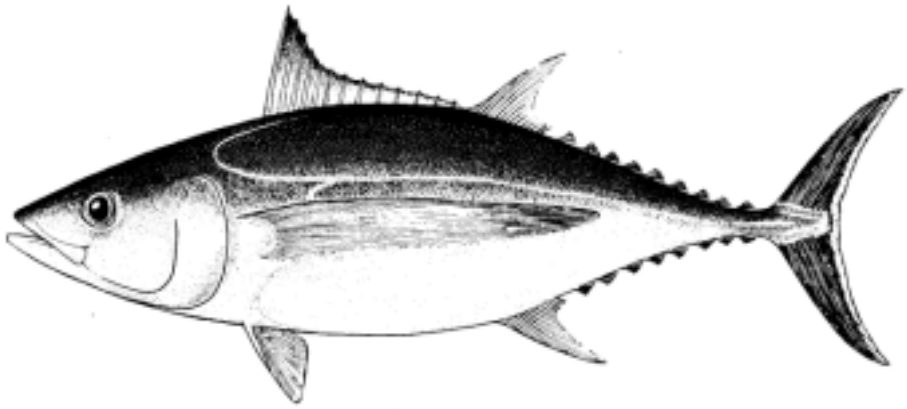
SCTB16 Working Paper

ALB–6

Preliminary review of information available on the fishing depth of longline vessels targeting albacore



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July 2003

1. Introduction

The fifteenth meeting of the Standing Committee on Tuna and Billfish (SCTB15) recommended a review of *"…information on the fishing depth of longline gear…*" in order to determine (i) the role this factor plays in fleets actively targeting albacore, and (ii) whether this factor affects the level of albacore catch, and therefore should be accounted for in future stock assessments on south Pacific albacore. It is acknowledged that other factors of the fishing strategy may also be important to consider and some reference is made where information is available.

This brief paper attempts to (i) describe the information on fishing depth currently available, (ii) where possible, provide some interpretation of the available information and (iii) suggest where future work might be directed.

2. Area of interest

Figure 1 shows the distribution of albacore catch in the south Pacific region for the past five years and Figure 2 shows the average depth of the 15°C isotherm in the south Pacific Ocean.

This review considered only information available from the "central" stock assessment area (10°–30°S) for the following reasons:

- Most of the south Pacific albacore catch comes from the "central" area. In this area, Pacific Island fleets and the Taiwanese distant-water fleets are perceived to be targeting albacore, while the Australia domestic fleet targets bigeye, yellowfin and swordfish. Bigeye and yellowfin tuna often constitute a reasonable proportion of the catch by PIC fleets and it is not clear to what degree factors in the fishing strategy are affecting the tuna species composition (for example, fishing depth may make albacore more or less available to the gear).
- Albacore are taken by longline fleets in the northern area, but in far fewer quantities than the other areas, and there is no evidence that they are targeted in this area. Since the northern area is already distinct from the others in the assessment of south Pacific albacore, any differences in targeting with the other areas have therefore assumed to have been catered for.
- A review of albacore targeting in the Taiwanese distant-water longline fleet (Millar and Williams, 2002) indicated that the proportion of albacore in the southern area was close to 100%. The thermocline in this area is much shallower than the more northern areas (Figure 2) and the range of hooks between floats understood to be much smaller than the central area (and mostly less than 10 hooks between floats), therefore a comparison of fishing depth is not considered to be useful.

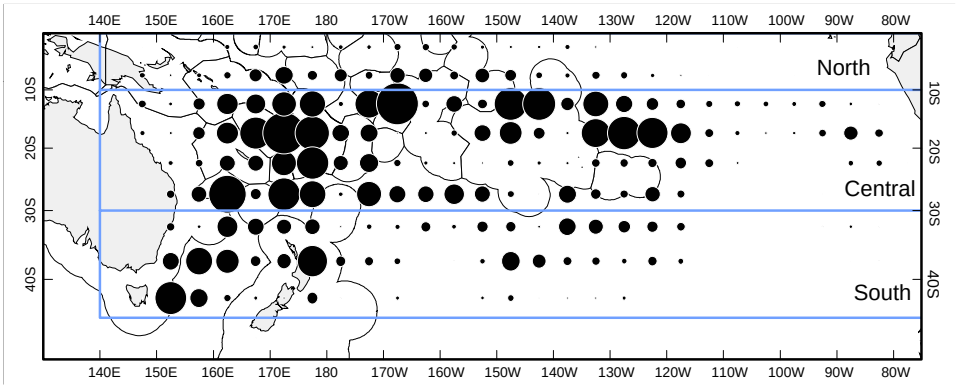

Figure 1. Distribution of albacore catch in the south Pacific Ocean, 1998–2002. The three-region spatial stratification used in stock assessment for the WCPO is shown.

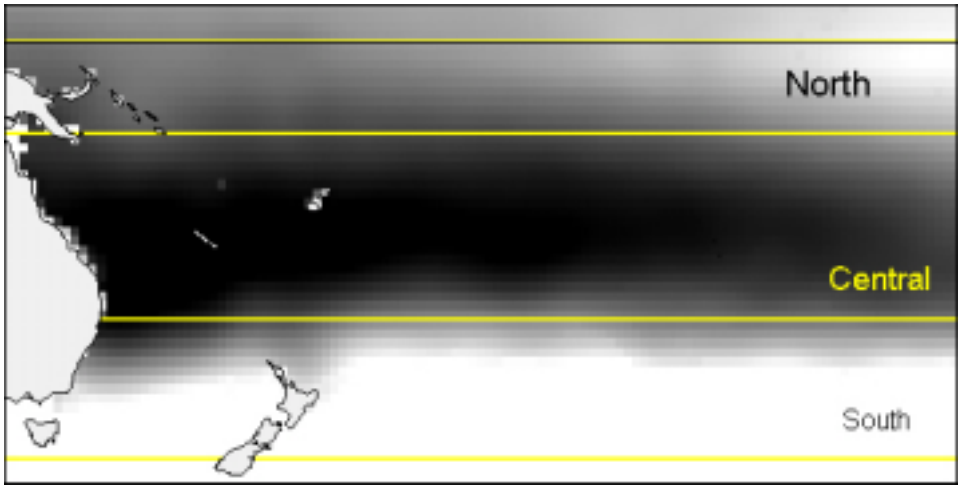

Figure 2. Distribution of the mean depth of the 15°C isotherm (black indicates a depth greater than 350 metres; dark grey: 250–350 metres; light grey: 100–250 metres; white: < 100 metres)

3. Description of available information

Information on the relationship between catch and fishing depth has been collected from several different sources.

- **Time-depth recorders**. This type of information is by far the most accurate. It records the exact depth of baited hooks and records the exact time of capture and subsequent vertical movement in the water column of the capture. Unfortunately, this type of data collection occurs extremely very infrequently on commercial vessels. There are no data currently available from this source.
- **Longline gear setting characteristics collected by observers**. Observers collect detailed information on the characteristics used to set the gear. An indication of relative fishing depth then can be obtained from these characteristics (in fact the fishing vessel uses these characteristics to target a depth for fishing). The information collected by the observer can be used to calculate the catenerary curve, an approximation for fishing depth for each hook. However, it does not take into account the effect of ocean currents, for example, in distorting the layout of the gear. Observer coverage is currently less than 1%, so obtaining representative indications for the entire fleet from this type of data is not currently possible.
- **Longline catch by hook number collected by observers.** Some observers record the hook number (between successive floats) for individual catch. Some indication of the depth at which certain species are available can therefore be determined from this type of data. However, as mentioned, observer coverage is very poor and not all observers are able to record this type of information.
- **The number of "hooks set between floats" and set -start time from logsheet data available at the trip level.** "Hooks between floats" information provides a relative indication of the depth targeted (i.e. the more hooks set between floats, the deeper the gear) and can be used to determine relative success by combining with catch data. These data are collected on catch logsheet forms, although many forms collected from fleets operating in the area of interest have catered for the recording of hooks between floats in the past. Set-start time is the only other variable directly related to fishing strategy that is regularly collected on some catch logsheet forms.

The Japanese distant-water longline fleet have historically fished throughout the central area, but available logsheet data for this fleet do not include "hooks between floats" information and hence can not be used in this preliminary review.

3. Presentation of available information

Table 1 and Figure 3 show a profile of the fishing strategy for longline fleets operating in the area of interest based on available logsheet and observer data. Coverage of "hooks between floats" data from logsheets is considered very good for the Australia domestic fleet, good for Tonga and Fiji, but poor for the other fleets. The extent to which vessels fish outside the ranges listed is not yet known for some fleets but will hopefully be resolved with future fleet-wide data collection of this type of information. This information suggests that the Pacific Islands fleet almost exclusively fish with more than 20 hooks between floats. In contrast, the Australian and Taiwanese distant-water fleets almost always fish with less than 15 hooks per basket.

Figures 4–9 show the average albacore species composition and CPUE (respectively) for categories of "hooks between floats" for (i) Pacific Islands longline fleets, (ii) Taiwanese distant-water longline fleet and (iii) the domestic Australia longline fleet, fishing in the central albacore area. These figures provide some insight into the effect fishing depth has on the albacore species composition and CPUE for fleets operating in the central area. The trends in these figures suggest that fishing depth does not have a marked effect on albacore catch within fleet. The Pacific Islands and Taiwanese distant-water fleets appear to have a high proportion of albacore in their catch and a relatively high CPUE regardless of fishing depth. In contrast, the Australian domestic fleet catch far fewer albacore even though the fishing depth range (inferred to by "hooks between floats") is similar to that of the Taiwanese longline fleet.

In order to possibly explain the differences in species composition and CPUE by depth between the Australian fleet and the other fleets presented in Figures 4–9, Figure 11 shows a comparison of the frequency of longline set-start hour for (i) the Australian domestic longline, (ii) Pacific Islands fleets, and (iii) the Taiwanese distant-water fleet. Set-start time infers soak time and may be a determinant in the availability of albacore to the longline gear. Australian longline vessels generally set their gear late in the afternoon/early evening, presumably to have their gear soaking during night hours. In contrast, the Pacific Island fleets and the Taiwanese distant-water fleet soak their gear in the early morning and therefore would have a predominately day-time soak period.

Figure 11 shows the albacore CPUE for categories of "hooks between floats" for the domestic Australian longline vessels setting prior to 09:00, which is the period of set start commonly used by Pacific Islands and Taiwanese distant-water longline fleets, but not the majority of Australian longline vessels. While albacore CPUE in this figure is slightly higher than in Figure 7, it is not at the same level as the other fleets, but may suggest that a day-time soak period has some positive effect on albacore availability to the gear.

Figure 12 shows the albacore CPUE for categories of "hooks between floats" for vessels in the Pacific Islands longline fleets that set after 16:00, which is the period of set start commonly used by Australian longline vessels (fishing in the central albacore area), but not the majority of Pacific Islands and Taiwanese distant-water longline fleets. The trend in this figure suggests that albacore are less available in deeper sets with a night-time soak period, although there are very few data currently available to confirm this hypothesis.

Figures 13–14 show the tuna species composition by hook number and quarter for selected Pacific Islands longline fleets fishing in the central albacore area, based on observer data. These figures provide some insight into the availability of each species of tuna to the gear by (relative) depth and season for selected Pacific Islands fleets. Albacore tuna appear to be consistently less available to shallowest (i.e. the first 2–3) hooks for these fleets. Albacore catch beyond the shallowest hooks is higher and reasonably consistent, although there are some instances of variation in the catch by hook depth and season (for example, albacore observed in French Polynesia in the fourth quarter tended to be more available to deeper hooks). In contrast to albacore, there are instances that suggest yellowfin are generally taken on shallower hooks and bigeye taken on deeper hooks. This is generally in line with the results from studies conducted under the ECOTAP (*Etude du Comportement des Thonides par l"Acoustique et la Peche*) project using time-depth recorders in the longline fishery in French Polynesia. In any event, more observer data would be required before considering more rigorous review in this area.

4. Observations and Conclusions

The following are observations based on the information presented herein.

- There are no marked trends in the albacore catch by fishing depth (inferred by hooks between floats) for the fleets targeting albacore in the central area. The Pacific Island fleets use at least 20 hooks between floats throughout the central area; this may range to more than 40 hooks between floats, but the range used doesn't appear to greatly effect the species composition of albacore in the catch.
- The distant-water Taiwanese fleet generally use 9–12 hooks between floats and soak their gear during daylight hours. The Australian domestic fleet target different species with a similar depth range as the Taiwanese fleet but generally soak their gear during the night (as the strategy for targeting). The few vessels in the Australian longline fleet that have soaked their gear during the day do not have the same albacore catch rates as the Taiwanese fleet. This suggests that there are other factors involved, for example the different areas fished or the bait used by each fleet.
- The differences between the Australian domestic fleet and the Pacific Islands longline fleets in the central area suggests that these should be separate fisheries in the stock assessment of south Pacific albacore.
- It would be prudent to continue efforts to monitor and improve the coverage of this type of information in the future with appropriate data collection. For example, there is a need to ensure these fleets are using the regional standard logsheet form that has the provision of recording hooks between floats. It is important to note that future analyses of fishing strategy from logsheet data will be restricted to the only two variables collected from this source of information, namely, hooks between floats and start set time.
- Future reviews would no doubt benefit from additional information. For example, "hook between float" data in relation to albacore catch for the historical Japanese longline fleet and the French Polynesian fleet are currently not available. Also, it would be useful to review information available on the relationship of fishing depth (and other attributes of the fishing strategy) obtained from studies on north Pacific albacore. Finally, anecdotal information from fishermen provides a very good basis for identifying what type of information should be analysed.

Table 1. Profile of a fishing strategy (range of hooks between floats) for longline fleets fishing in the latitude band 10°S–30°S

Fleet	Range of Hooks between floats	% coverage of catch/effort logsheet data with "Hook between float" data	Source of information and Notes
Australia	5–20	92.8%	Logsheet data provided to SPC by AFMA. Vessels target bigeye and yellowfin, but in more recent years swordfish with shallow sets. A few vessels have deployed relatively deeper gear to target bigeye. (SCTB15 Working Paper NFR–2)
Cook Islands	20–40	29.2%	Logsheet data. Few data currently available.
Fiji	19–36	40.9%	Logsheet data. Confirmed by observer data.
French Polynesia	32–45	0%	Observer data. Most sets recorded 40 hooks between floats.
New Caledonia	25–30	8.7%	Logsheet data. Predominantly 30 hooks between floats according to data available. (Confirmed by available observer data).
Samoa	26–36	0.2%	Logsheet and port sampling data. (Confirmed by available observer data).
Taiwan	9–12	12.1%	Logsheet data. Available data also include hooks between floats up to 40. Observer data confirms the 9–12 hook range.
Tonga	12–32	63.1%	Logsheet data. Most trips (more than 70%) recorded 30 hooks between floats. Observer data also includes one trip with 8–9 hooks between floats

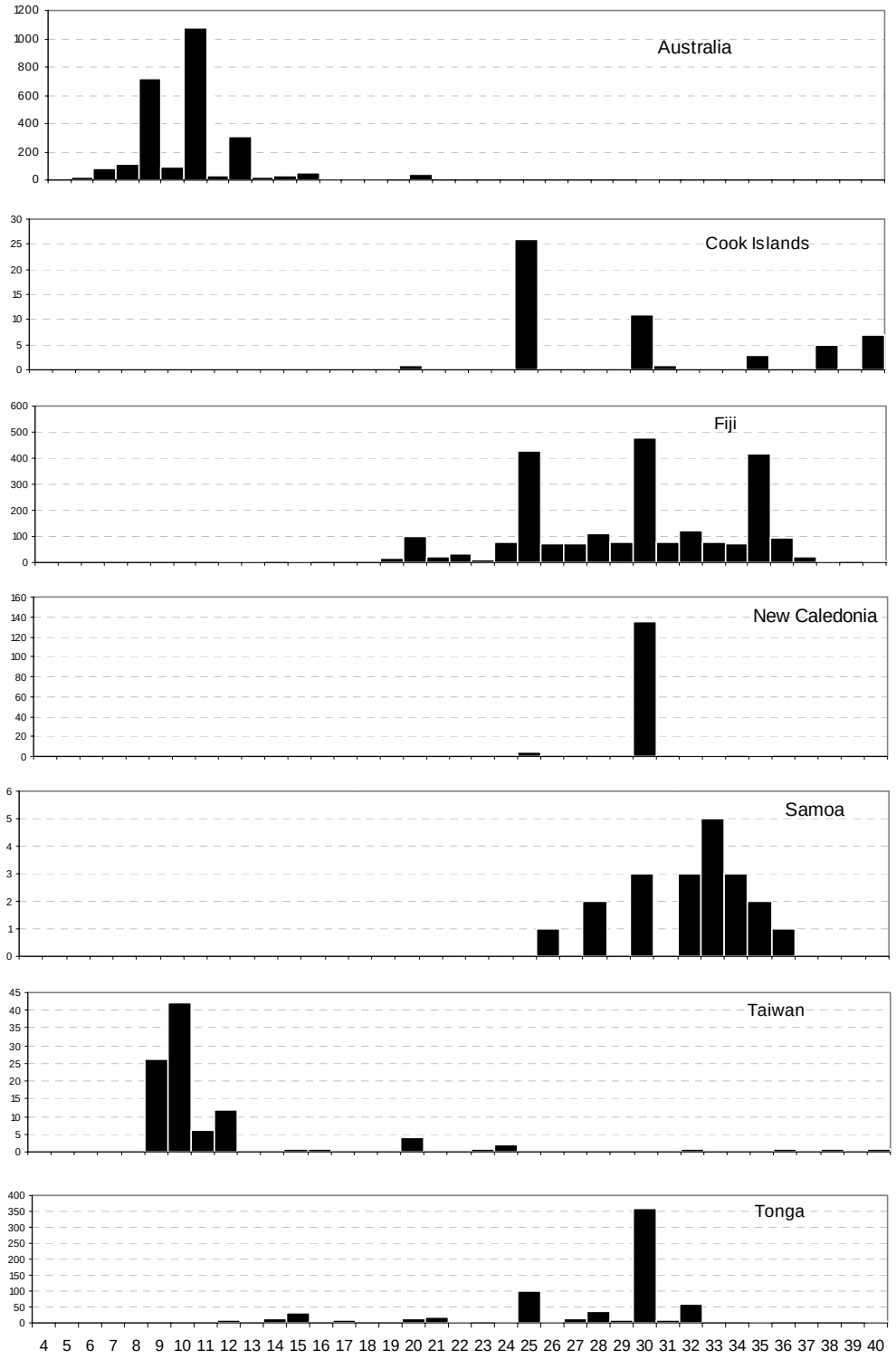

Figure 3. Frequency of trips broken down by hook between floats category for fleets fishing in the latitudinal band 10°–30°S. (Source of data : logsheets)

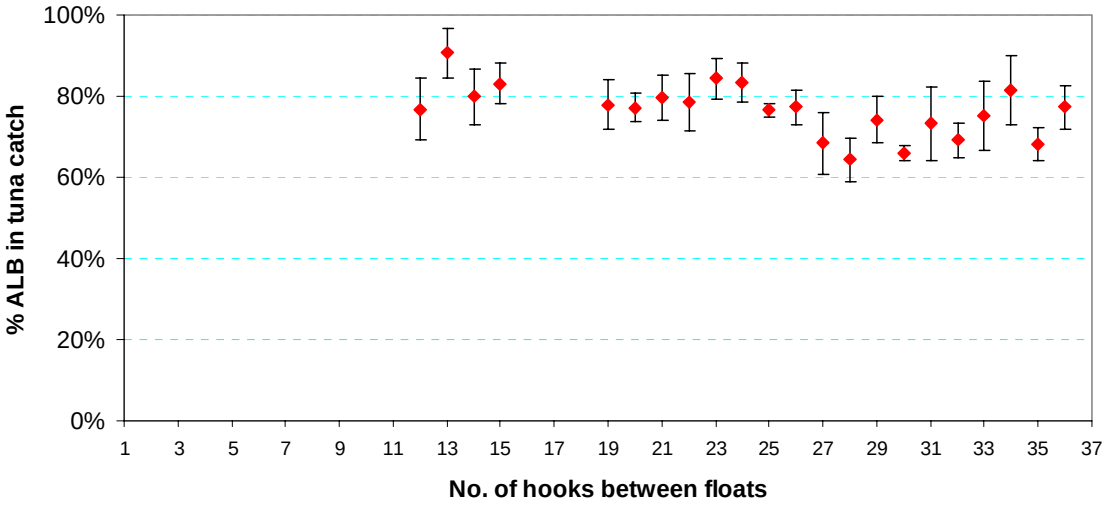

Figure 4. Average albacore species composition (as a % of total tuna catch) for categories of hooks between floats for Pacific Islands longline fleets fishing in the latitude band 10°–30°S. Source of data is logsheets where "hooks between float" information has been recorded for the following fleets : **Cook Islands, Fiji, Tonga, Samoa, New Caledonia**. Replicates are ALB species composition for each vessel trip where hooks between floats have been recorded. Categories of hook between float with less than 10 trips have not been included. The 95% confidence intervals are shown.

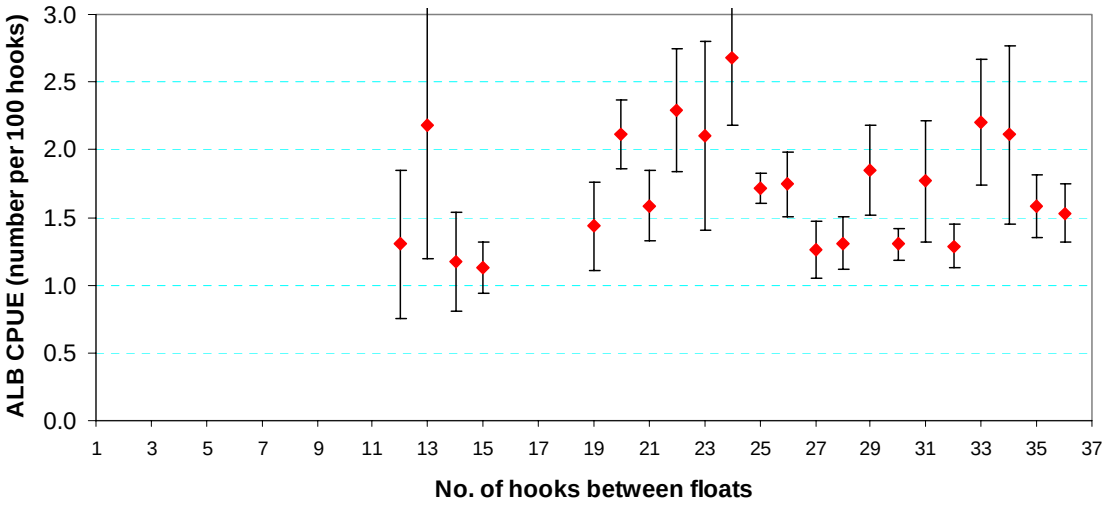

Figure 5. Average albacore CPUE (number of fish per 100 hooks) for categories of hooks between floats for Pacific Islands longline fleets fishing in the latitude band 10°–30°S. Source of data is logsheets where "hooks between float" information has been recorded for the following fleets : **Cook Islands, Fiji, Tonga, Samoa, New Caledonia**.. Replicates are ALB species composition for each vessel trip where hooks between floats have been recorded. Categories of hook between float with less than 10 trips have not been included. The 95% confidence intervals are shown.

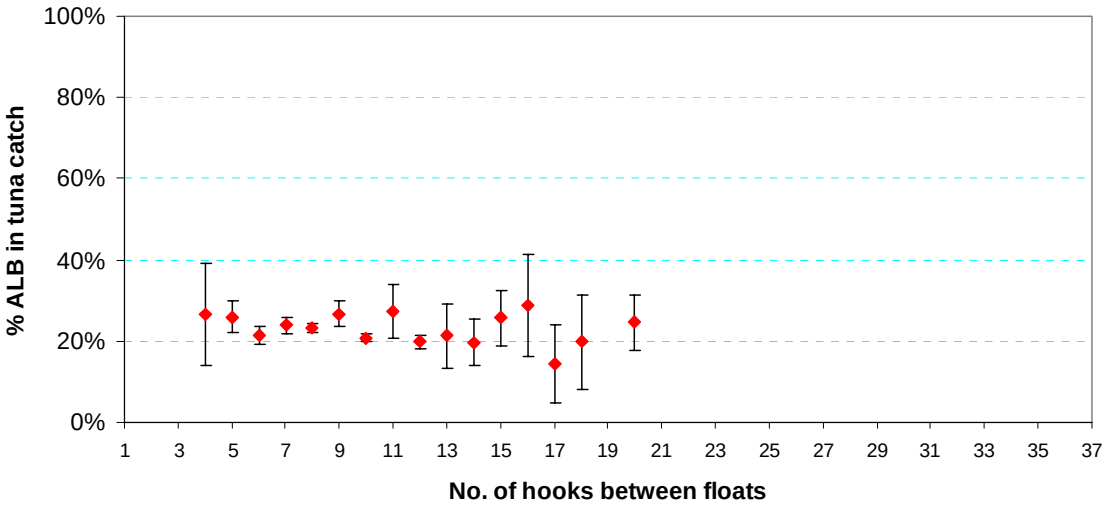

Figure 6. Average albacore species composition (as a % of total tuna catch) for categories of hooks between floats for the Australian longline fleet fishing in the latitude band 10°–30°S. Source of data is logsheets where "hooks between float" information has been recorded. Replicates are ALB species composition for each vessel trip where hooks between floats have been recorded. Categories of hook between float with less than 10 trips have not been included. The 95% confidence intervals are shown.

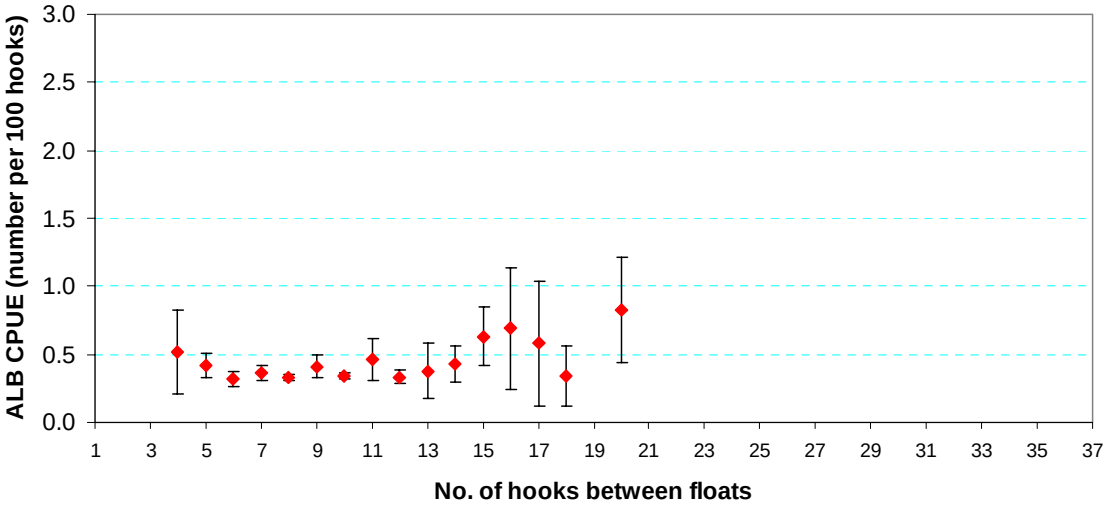

Figure 7. Average albacore CPUE (number of fish per 100 hooks) for categories of hooks between floats for the Australian longline fleet fishing in the latitude band 10°–30°S. Source of data is logsheets where "hooks between float" information has been recorded. Replicates are ALB species composition for each vessel trip where hooks between floats have been recorded. Categories of hook between float with less than 10 trips have not been included. The 95% confidence intervals are shown.

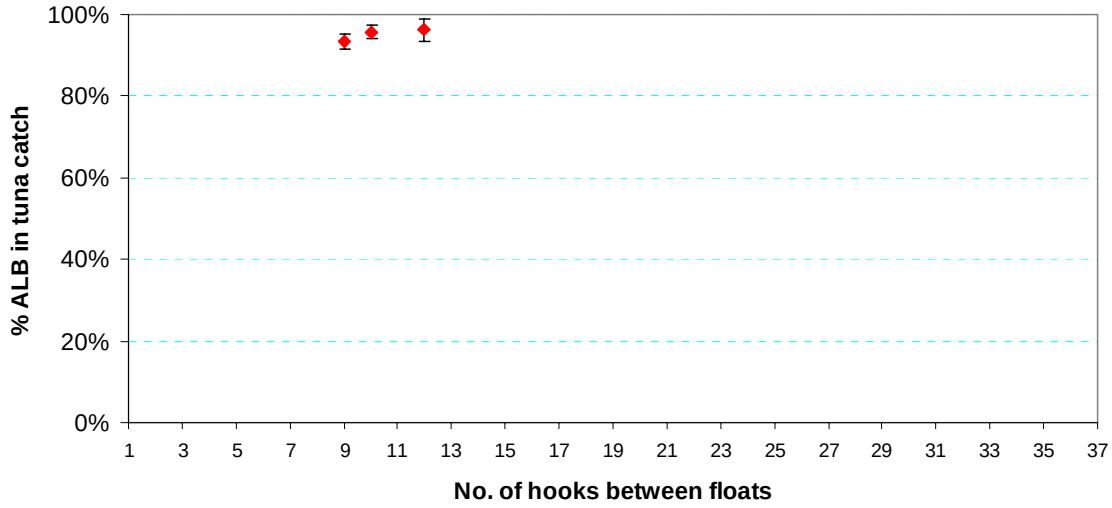

Figure 8. Average albacore species composition (as a % of total tuna catch) for categories of hooks between floats for the Taiwanese distant-water longline fleet fishing in the latitude band 10°–30°S. Source of data is logsheets where "hooks between float" information has been recorded. Replicates are ALB species composition for each vessel trip where hooks between floats have been recorded. Categories of hook between float with less than 10 trips have not been included. The 95% confidence intervals are shown.

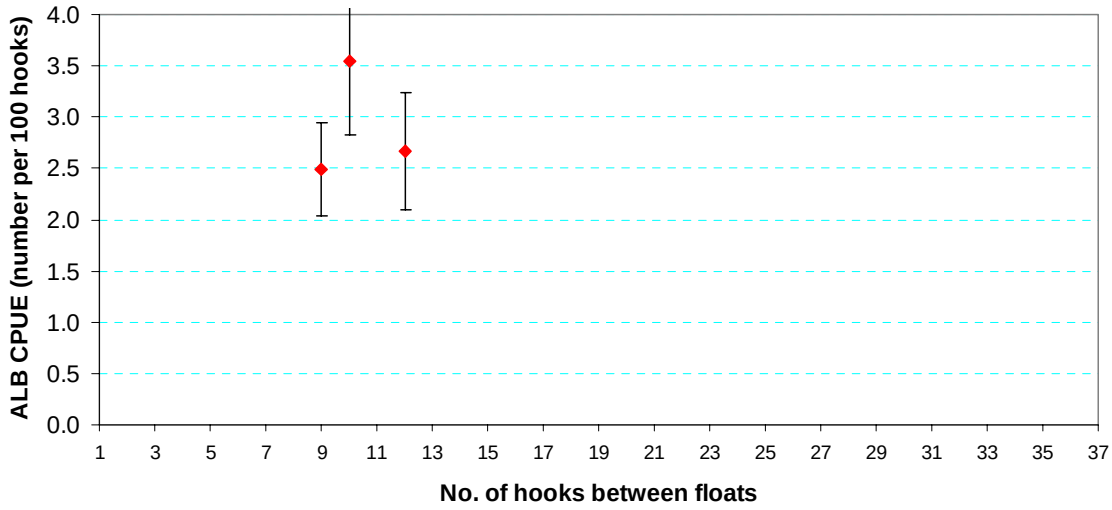

Figure 9. Average albacore CPUE (number of fish per 100 hooks) for categories of hooks between floats for the Taiwanese distant-water longline fleet fishing in the latitude band 10°–30°S. Source of data is logsheets where "hooks between float" information has been recorded. Replicates are ALB species composition for each vessel trip where hooks between floats have been recorded. Categories of hook between float with less than 10 trips have not been included. The 95% confidence intervals are shown.

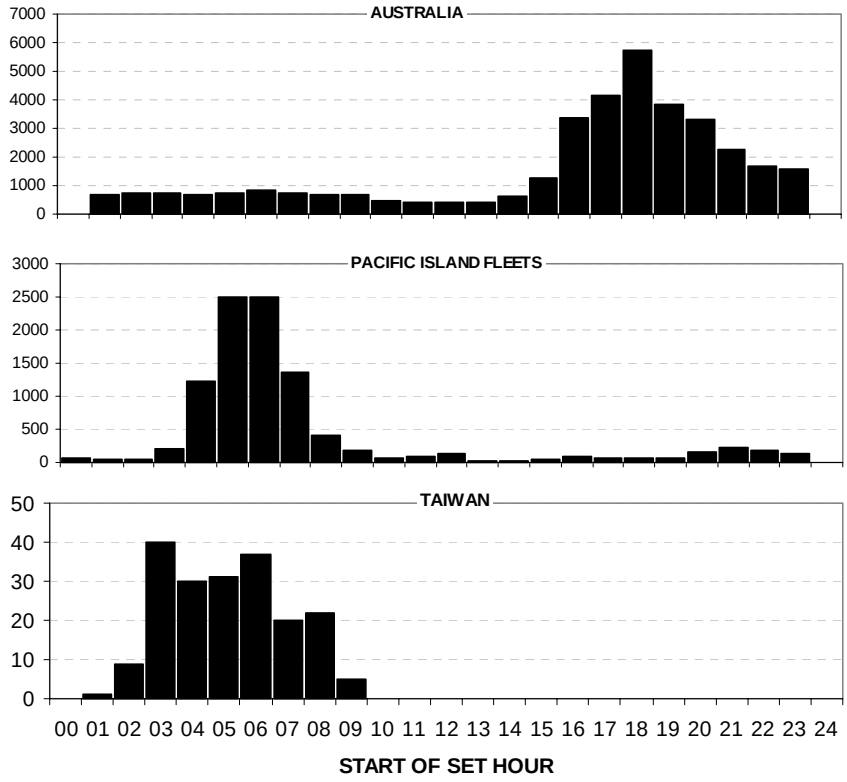

Figure 10. Frequency of set start hour for the Australian domestic longline fleet (top), the Pacific Islands fleets (middle) and the Taiwanese distant-water fleet (bottom).

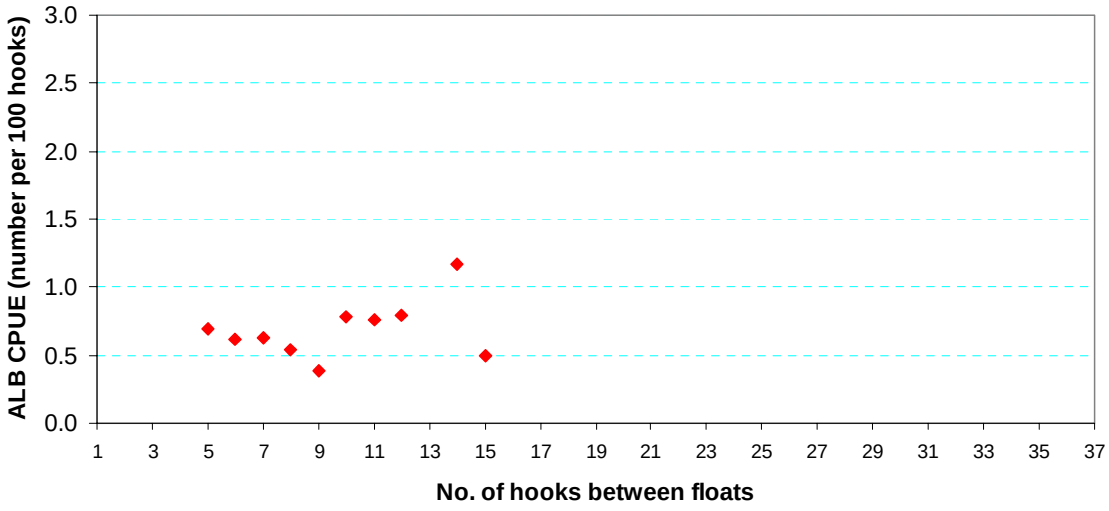

Figure 11. Average albacore CPUE (number of fish per 100 hooks) for categories of hooks between floats for the Australian longline fishing in the latitude band 10°–30°S for sets where setting start time is before 09:00. Source of data is logsheets where "hooks between float" information has been recorded. Categories of hook between float with less than 10 trips have not been included.

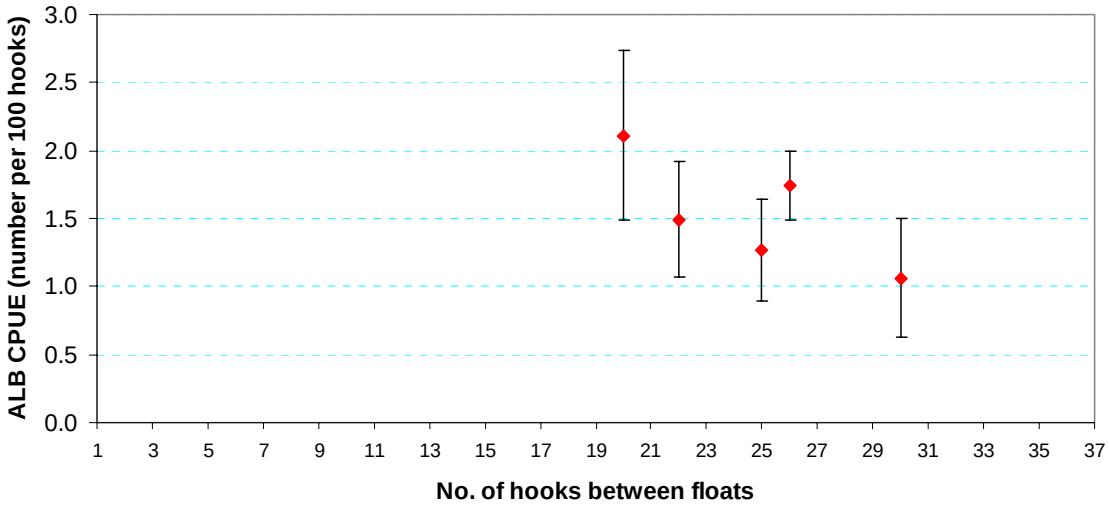

Figure 12. Average albacore CPUE (number of fish per 100 hooks) for categories of hooks between floats for Pacific Island longline fleets fishing in the latitude band 10°–30°S for sets where setting start time is after 16:00. Source of data is logsheets where "hooks between float" information has been recorded for the following fleets : **Cook Islands, Fiji, Tonga, Samoa, New Caledonia**. Replicates are ALB species composition for each vessel trip where hooks between floats have been recorded. Categories of hook between float with less than 10 trips have not been included. The 95% confidence intervals are shown.

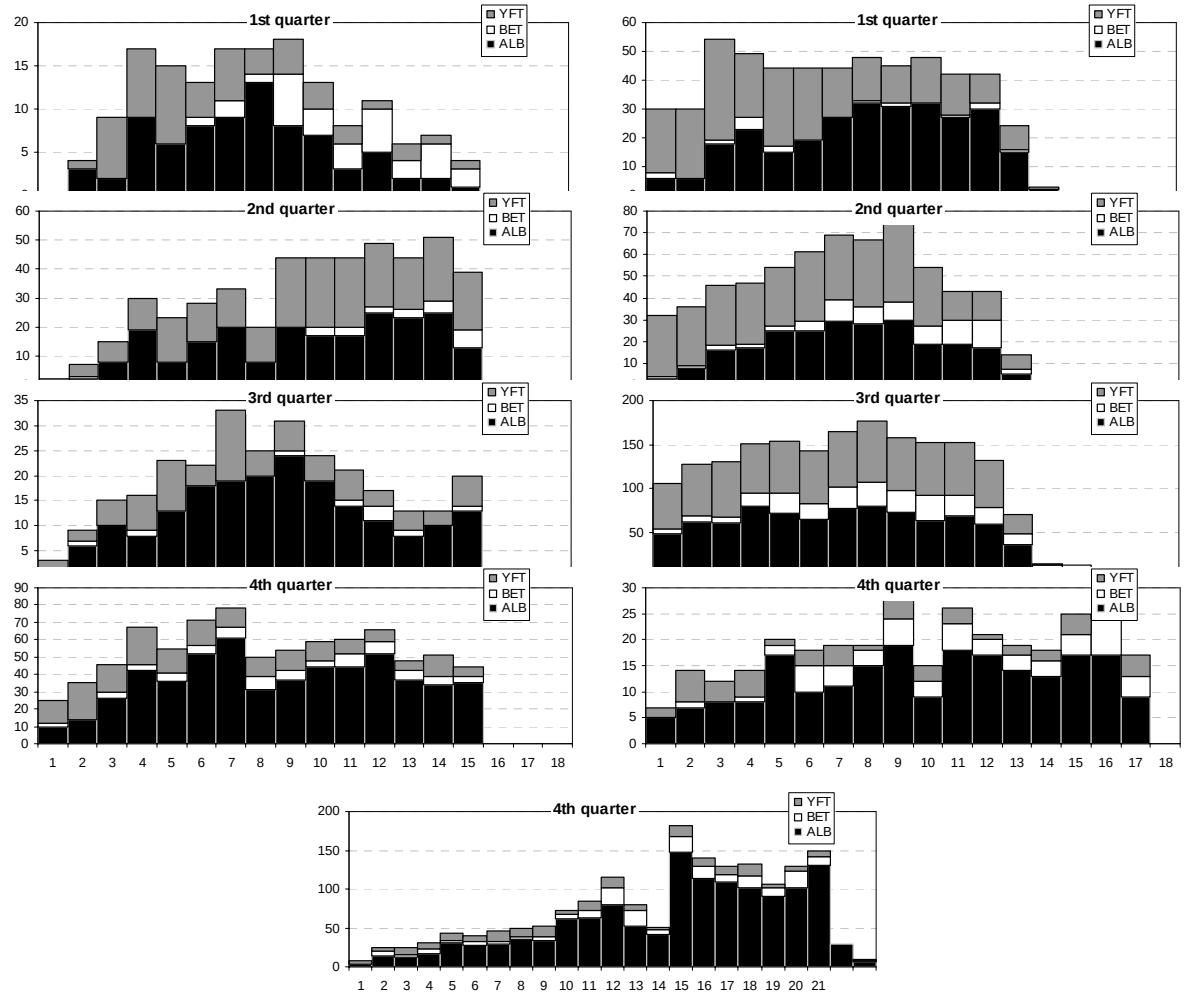

Figure 13. Tuna species composition (number of fish) by hook number and quarter for the New Caledonia longline fleet (left), Fiji longline fleet (right) and the French Polynesia longline fleet (bottom–4th quarter only). Source : Observer data. "Hook number" is a relative measure of depth; for example, 1 is the shallowest and 23 is the deepest hook.

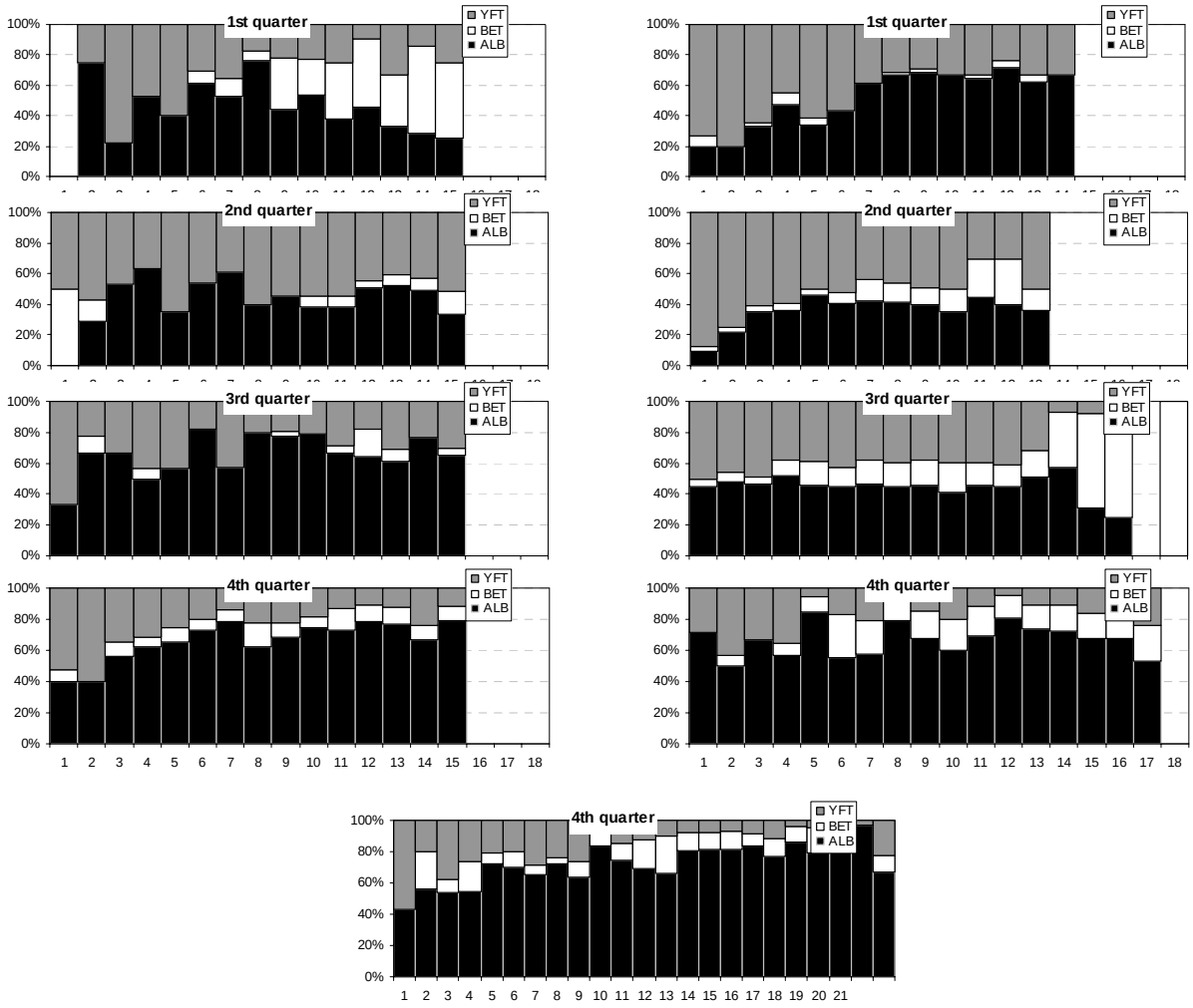

Figure 14. Tuna species composition (number of fish) by hook number and quarter for the New Caledonia longline fleet (left), Fiji longline fleet (right) and the French Polynesia longline fleet (bottom–4th quarter only). Source: Observer data. "Hook number" is a relative measure of depth; for example, 1 is the shallowest and 23 is the deepest hook.

REFERENCES

Millar, C. & P. Williams (2002) **Further information on targeting in the south Pacific albacore fishery.** WP ALB–4**.** Fifteenth Meeting of the Standing Committee on Tuna and Billfish (SCTB15) Honolulu, Hawaii. 22–27 July, 2002.