SCIENTIFIC COMMITTEE
SEVENTH REGULAR SESSION

9-17 August 2011
Pohnpei, Federated States of Micronesia

Analysis of purse seine set type behaviour in 2009 and 2010

WCPFC-SC7-2011/MI-WP-01

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Abstract

This paper describes the purse seine fishery in 2009 and 2010, with particular reference to the FAD closures that occurred in both years. Both raised logsheet and observer data were used in the analysis. The main findings of the paper are:

- The incidence of reported activity related to use of drifting FADs was considerably lower in 2010 (5.1%) compared to 2009 (13.5%);
- The use of fish aggregation lights was observed on some vessels with a similar incidence in 2009 (2.2%) and 2010 (2.9%);
- Total catch was below average during the 2009 closure and in September of the 2010 closure, although effort remained at around normal levels throughout both closures;
- The catches of bigeye tuna were strongly reduced during both closure periods compared to the other months of those years;
- The impacts of the closures on skipjack and yellowfin catches are more moderate;
- The proportions of associated sets conducted during the 2010 closure were close to zero, and compliance with the measure appears to have improved somewhat;
- In 2010, the proportions of catch and effort associated with FAD usage outside the closure period, particularly the months immediately before and after the closure, had lower FAD usage than is typically the case. This may be associated with the retrieval and re-deployment of FADs, although this needs to be verified by other data;
- While catches were reduced during the closures, the average size of the catch was higher for all species, particularly yellowfin, during the closures because of the larger average size of fish caught in unassociated sets. These larger average sizes may offset to some extent the loss of catch that occurs as a result of the closures.

Introduction

A key measure adopted by WCPFC as part of CMM 2008-01 is the closure of purse seine fishing in association with fish aggregation devices (FADs). In 2009, the FAD closure was for 2 months, August and September, while in 2010 it was extended to 3 months, covering July, August and September. Information on the implementation of the 2009 FAD closure has been previously reported (Harley et al. 2010 – WCPFC-SC6-2010-MI-WP-03; SPC-OFP 2010 – WCPFC-TCC6-2010-09a; Hampton and Harley 2010 – WCPFC7-2010-15). The key findings of these papers were:

- On the basis of logsheet data, most vessels (~70% of the vessels that fished at any time during 2009, which is about average) continued to fish during the months of the 2009 FAD closure, recording moderate catches of skipjack tuna in particular in unassociated sets;
- Catches of skipjack in FAD sets in the months following the closure were very high, with October 2009 recording the highest ever monthly catch of skipjack in the history of the WCPO purse seine fishery;
- Overall, 2009 was a record year for both skipjack and total tuna catch in the purse seine fishery, indicating that the FAD closure did not have an adverse effect on fishery performance;
- However, the rate of FAD usage during the 10 months of the year outside of the closure was high, with the number of FAD sets recorded overall in 2009 being the highest since 2004 and the second highest ever;
- Observers reported some activity of the vessel related to drifting FADs on approximately 10% of observed days, possibly due to misunderstanding by purse seine operators of what constituted FAD fishing. (The definitions of FAD fishing were subsequently more precisely specified in CMM 2009-02).
- Observer data indicated that the percentage of bigeye tuna in the purse seine catch during the 2009 closure was approximately 1.2%, which is reasonably typical of unassociated purse seine sets generally.

This paper extends this previous work to include updated data for 2009 as well as new data for 2010.

Data Sources

The sources of data for this analysis were:

- Raised monthly logsheet catch and effort data classified by set type – unassociated (= free-school sets) and associated (= drifting and anchored FAD sets, sets on logs, sets associated with dead or live animals); and
- Observer data, comprising independent estimates of catch and effort by set type classified as per logsheet data.

The observer data include both data provided as part of the WCPFC Regional Observer Programme (ROP), as well as data from Pacific Island national programmes that do not meet the ROP definition.

The monthly coverage rates of the observer data, currently received and processed by SPC, computed on the basis of observed sets : total sets and observed catch : total catch are shown in Figure 1. Coverage is in the range 30 – 50% for the first three quarters of 2010, but declines sharply for the final three months of the year. Additional observer data from throughout 2009 and 2010 are expected to be forthcoming in due course.

Results and Discussion

Update on Observed Purse Seine Vessel Behaviours During FAD Closures

Purse seine vessel behaviours in relation to FAD usage during the 2009 and 2010 closures, as reported by observers, are presented in Table 1. During the 2009 closure, observers reported some activity of the vessel related to drifting FADs on 13.5% of days. In addition, there was a 2.2% incidence of vessels drifting at night with fish aggregation lights on. During the 2010 closure, the incidence of reported activity related to use of drifting FADs was considerably lower (5.1%). However, some vessels (2.9% incidence) continued to use fish aggregation lights while drifting at night. Note that some domestic fleets fishing in their home EEZ may have been able to legitimately continue to conduct associated sets during the FAD closures, if their domestic laws so allowed. This may have contributed to the continued low incidence of FAD-related fishing activities reported by observers.

Further updates of these figures will be provided (to TCC7 and WCPFC8) as additional observer data becomes available.

Catch and Effort

Total monthly catch and effort, as well as days at sea from VMS data, over the period January 2009 to December 2010 are shown in Figure 2. Catch was below average during the 2009 closure and in September of the 2010 closure, although effort remained at around normal levels throughout both closures. The decline in effort and catch in the second half of 2010 is not mirrored by the VMS data; therefore, the logsheet data for this period may not represent 100% of purse seine fishing activity[2].

Catch by species (Figure 3) indicates that the catch of bigeye tuna was strongly reduced during the closure periods. The impacts of the closures on skipjack and yellowfin catches are more moderate. This differential effect of the FAD closures on bigeye tuna is expected given the species composition characteristics of purse seine associated and unassociated sets.

The proportions of total monthly catch and effort attributed to associated sets are shown in Figure 4. Similar patterns are seen in the raised logsheet and observer reported data. During the 2009 closure period, associated set activity was greatly reduced, but not entirely absent. This was due to some non-compliance with the measure and due to the fact that Japan opted to operate under the 'high seas alternative', which allowed the Japanese fleet to conduct associated sets on the high seas during the closure while limiting their catch of bigeye by purse seine to no more than 90% of the 2001-2004 average level. During the 2010 closure, the proportion of associated set activity was considerably lower, indicating better compliance with the measure in 2010. Interestingly, associated set activity in the months immediately before and after the 2010 FAD closure was also lower than normal. A possible reason for this might be that vessel operators are not willing to leave their satellite buoys in the water for three months and risk loss of the equipment; therefore the buoys are removed in the months prior

[2] While the logsheet data have been raised, annual raising factors have been used. Therefore, the coverage of the logsheet data by month may vary.

to the closure and re-deployed following the closure, at which point they need time to aggregate fish before effective sets can be made.

It would be useful to obtain feedback from the industry on this point, as it would be important to incorporate impacts of the FAD closure outside the actual closure period itself, if they are occurring, into management option evaluations.

The spatial characteristics of the purse seine fishery in 2009 and 2010 are shown in Figures 5 – 8. Figure 5 shows the distribution of total purse seine catch, classified by associated and unassociated sets, in 2009 for three different periods – pre FAD closure (Jan – Jul), the FAD closure (Aug – Sep) and post FAD closure (Oct – Dec). Figure 6 provides a similar series of maps for 2010, while Figure 7 and Figure 8 provide the same information for bigeye tuna only.

In 2009, associated and unassociated set catch was widely distributed across the equatorial WCPO, but with some concentration in the PNG EEZ, prior to the FAD closure. During the closure, unassociated set fishing moved to the east, with a large concentration in Kiribati and Tuvalu. As noted, associated set fishing continued during the FAD closure in the archipelagic waters of PNG and Solomon Islands, and in other areas in a more limited way. Post closure, catch remained widely distributed but with greater amounts of associated sets in most areas. In 2010 (Figure 6), catch remained widely distributed pre FAD closure, but with a considerable amount of unassociated set fishing in the northern PNG area. During the FAD closure, fishing contracted to the west (at the beginning of the *La Niña* period) and high levels of unassociated sets occurred in Nauru and PNG. Post FAD closure, fishing was highly concentrated in PNG and Solomon Islands, with a considerable amount of unassociated set fishing persisting.

The distribution of bigeye catch is shown in Figure 7 and Figure 8. Despite the contraction of overall purse seine effort to the west during 2010, the catch of bigeye pre and post FAD closure was widely distributed. This results because of their disproportionately high vulnerability to purse seining (and therefore high CPUE) in the eastern part of the WCPO.

Catch Size Composition

Purse seine set type, and therefore the FAD closure, also has an impact on the size composition of the catch. The effect is less marked for bigeye (Figure 9), due to the low catches taken in unassociated sets. However for skipjack (Figure 10) and yellowfin (Figure 11), substantially larger fish are caught in unassociated sets compared to associated sets. Therefore, catches of skipjack and yellowfin (and to a smaller extent, bigeye) within the FAD closure periods are substantially larger on average (Figure 12). The higher prices paid for larger skipjack and yellowfin would therefore offset to some extent the loss of catch that might occur as a result of the FAD closures.

References

Hampton, J., and S.J. Harley 2010. Review of the implementation and effectiveness of CMM 2008-01. WCPFC7-2010-15.

Harley, S.J., P. Williams, and J. Hampton. 2010. Characterization of purse seine fishing activities during the 2009 FAD closure. WCPFC-SC6-2010-MI-WP-03.

SPC-OFP. 2010. Supplementary information on the 2009 FAD closure from available observer data. WCPFC-TCC6-2010-09a.

Table 1. Summary statistics for various vessel behaviours documented by observers during the CMM 2008-01 FAD Closures in 2009 (1 Aug – 30 Sep) and 2010 (1 Jul – 30 Sep). Archipelagic waters, which are outside the scope of CMM 2008-01, are not included in the summary statistics.

	2009 (Aug – Sep)	**2010 (Jul – Sep)**
Number of observer trips processed to date	155	159
Number of observed fishing and searching days processed to date (Coverage rate)	3,045 (45.5%)	3,246 (32.5%)
Number of observed sets processed to date (Coverage rate)	3,100 (46.8%)	3,836 (32.2%)
Number of nights drifting with fish aggregation lights (activity = 14) (% of total)	68 (2.2%)	93 (2.9%)
Number of days setting or investigating Drifting FADs (SCH_ID = 4) (% of total)	118 (3.9%)	41 (1.3%)
Number of days reported with any activity related to a drifting FAD (Activity = 9,10,12,23,24,25,26) (% of total)	410 (13.5%)	165 (5.1%)
Number of days reported as “No fishing, drifting with floating object” (Activity = 12) (% of total)	170 (5.6%)	97 (3.0%)

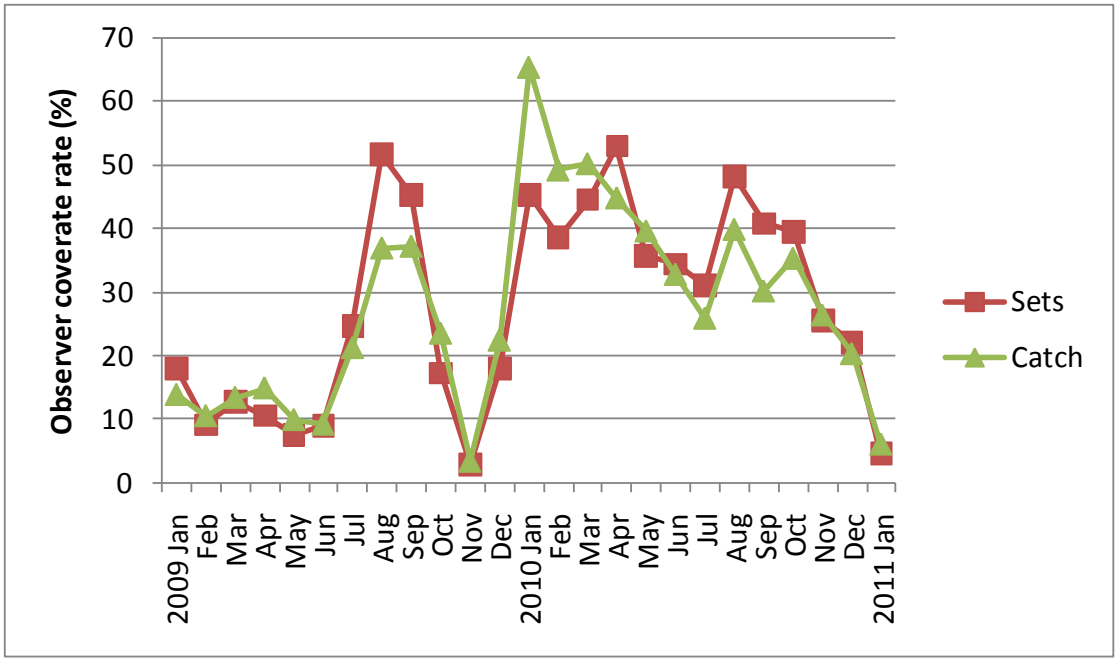

Figure 1. Coverage of purse seine observer data processed at SPC as at 4 July 2011, expressed as the percentage of observed to total sets (sets) and observed to total catch (catch). Activities in archipelagic waters and in the domestic purse seine fisheries of Indonesia and Philippines are excluded.

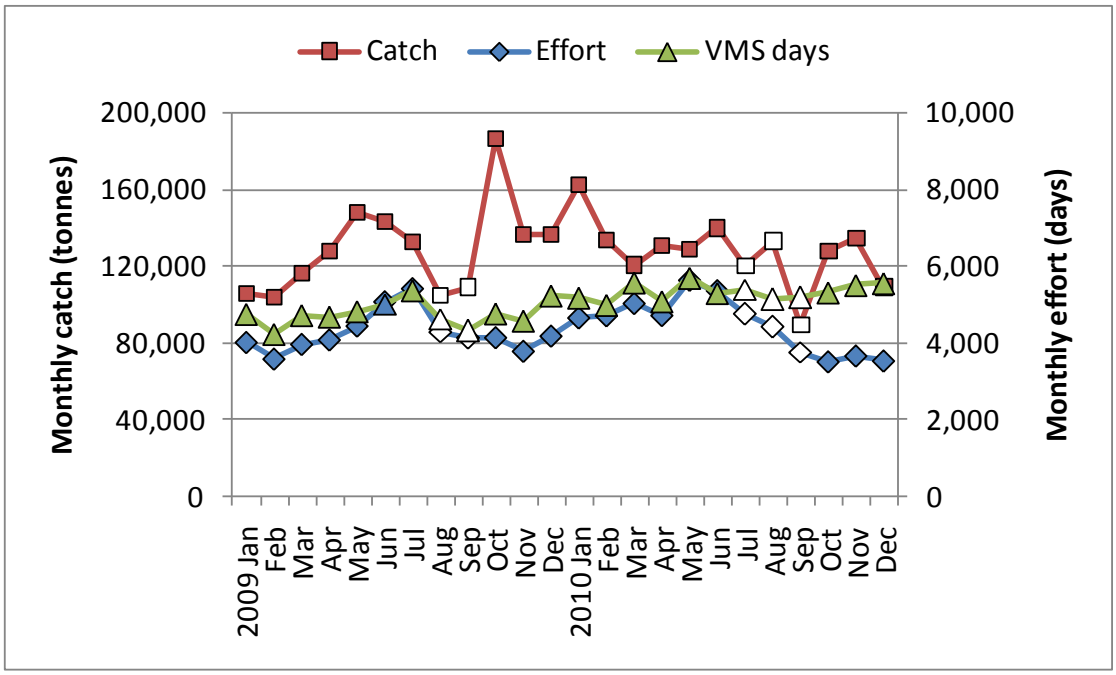

Figure 2. Monthly tropical purse seine catch and effort, 2009 and 2010 (raised logsheet data) and days at sea from VMS data. Data points for the FAD closure periods are shown as open symbols. Data excludes the domestic fisheries of Indonesia and Philippines.

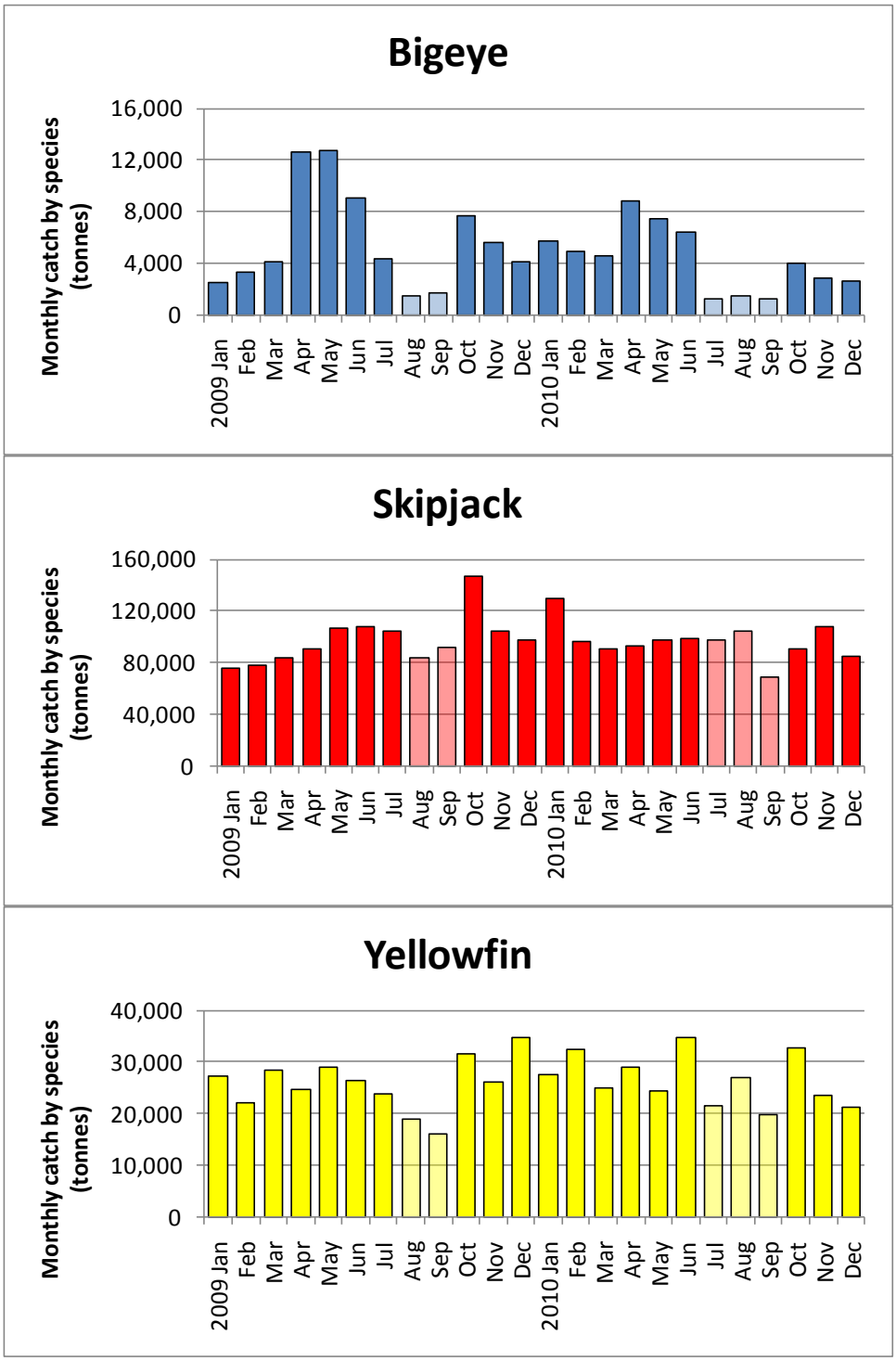

Figure 3. Monthly catch by species (raised logsheet data with species composition adjusted using observer sampling with grab sample bias correction). FAD closure months are shaded in lighter colour. Data excludes the domestic fisheries of Indonesia and Philippines.

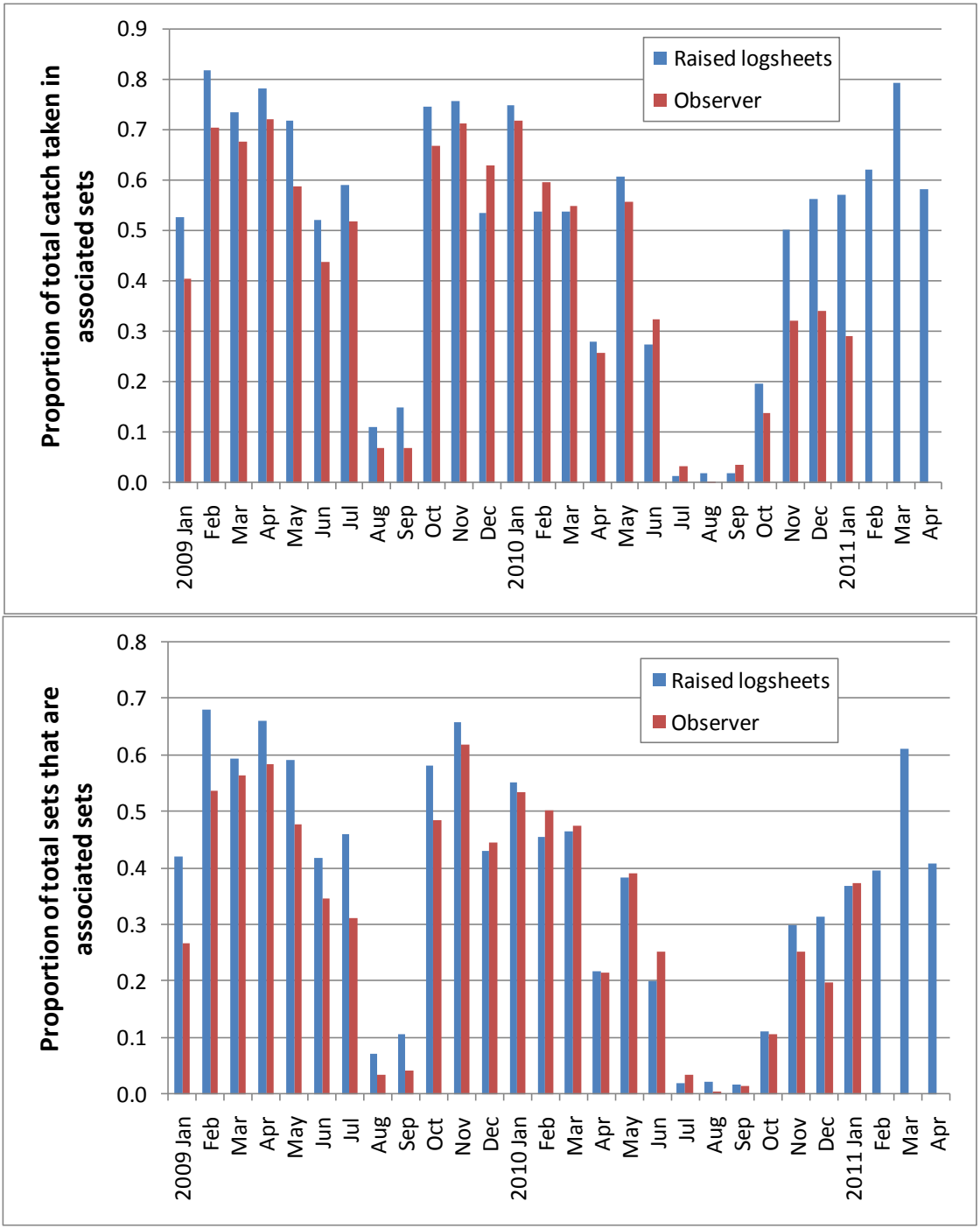

Figure 4. Proportion of the total purse seine fishing activity comprising associated sets, as indicated by logsheet and observer data. The upper panel is in terms of catch; the lower panel in terms of sets. Activities in archipelagic waters and in the domestic purse seine fisheries of Indonesia and Philippines are excluded.

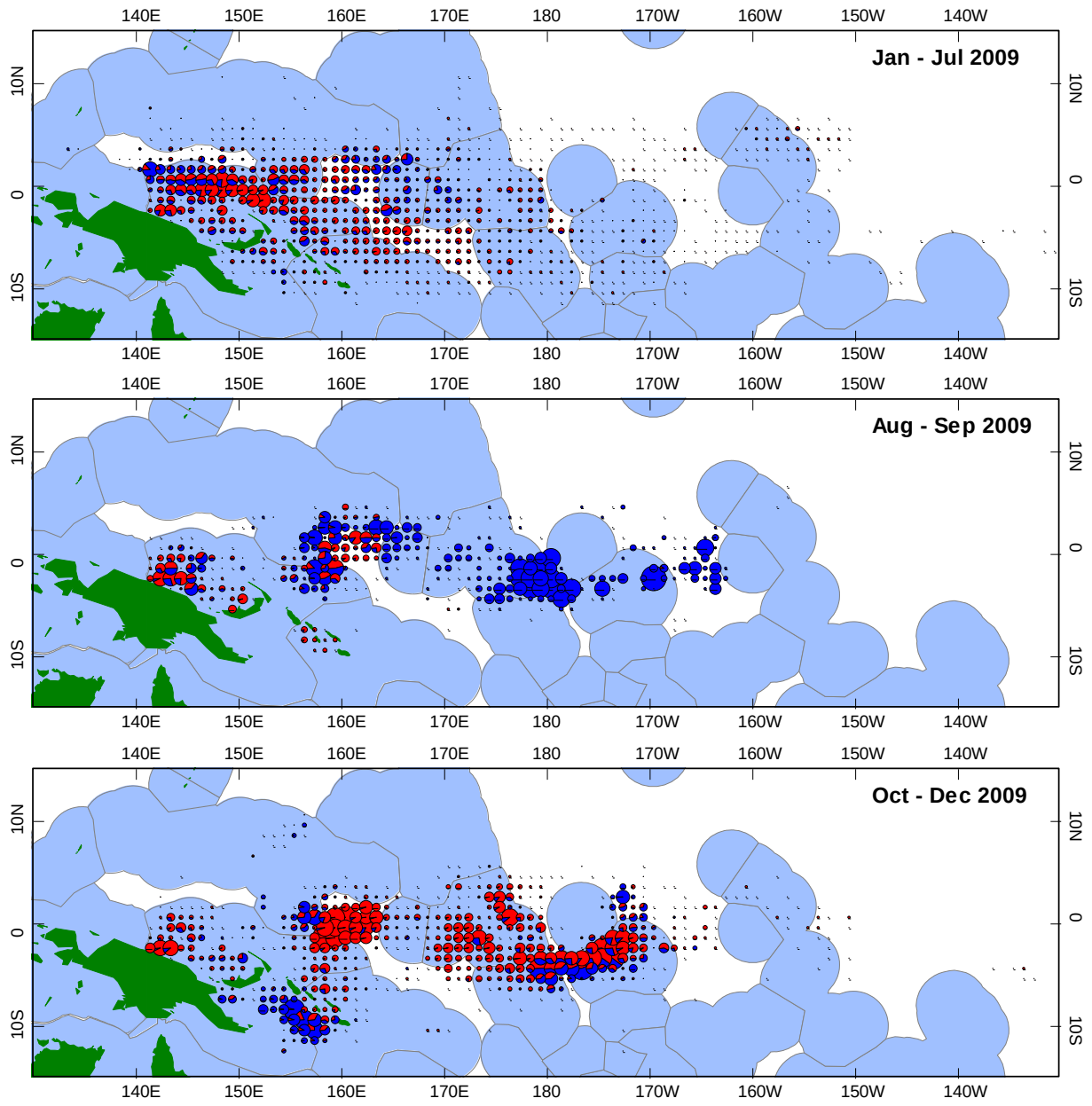

Figure 5. Distribution of TOTAL purse seine catch for associated (red) and unassociated (blue) sets pre-, during and post-FAD closure in 2009.

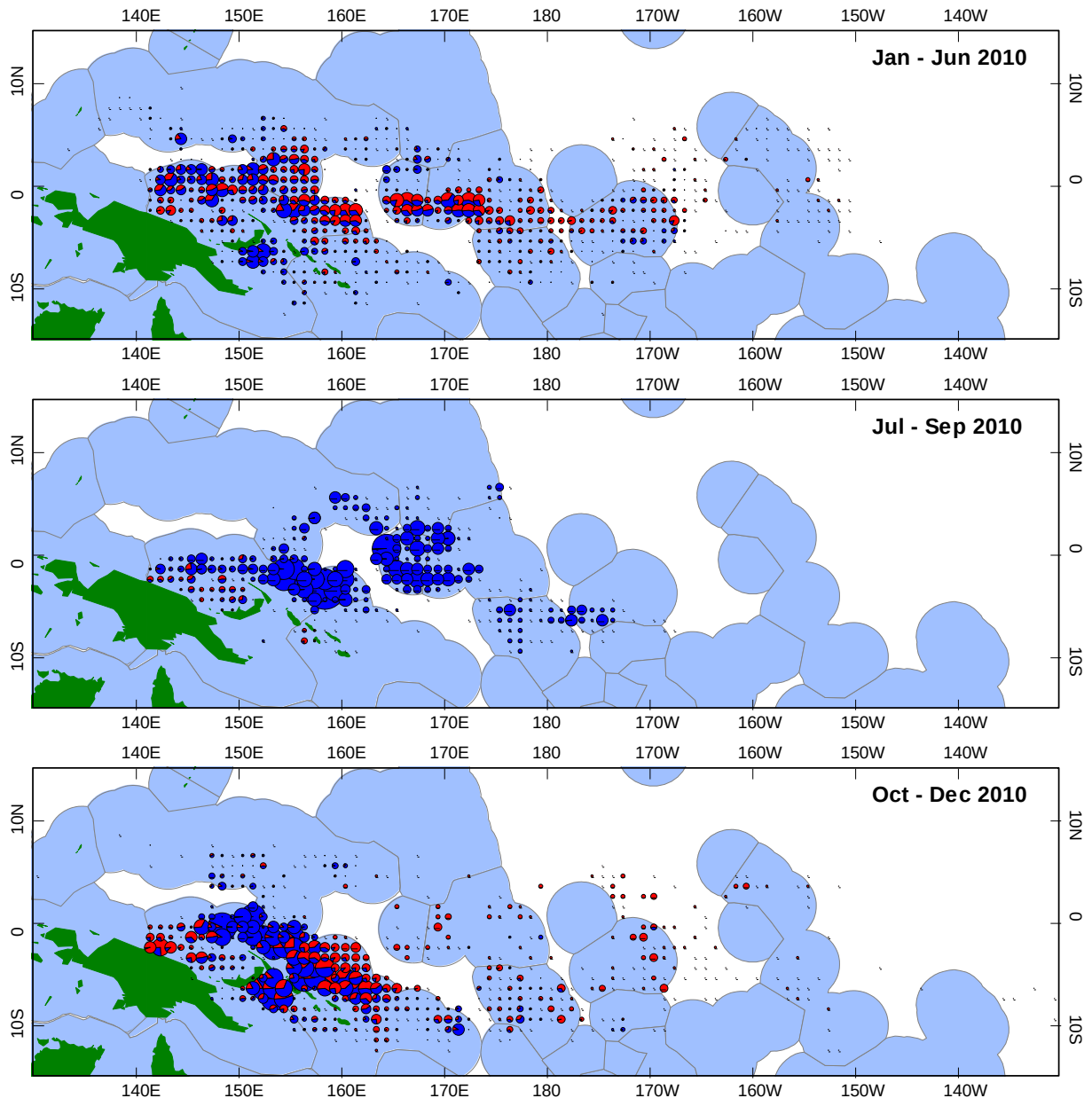

Figure 6. Distribution of TOTAL purse seine catch for associated (red) and unassociated (blue) sets pre-, during and post-FAD closure in 2010.

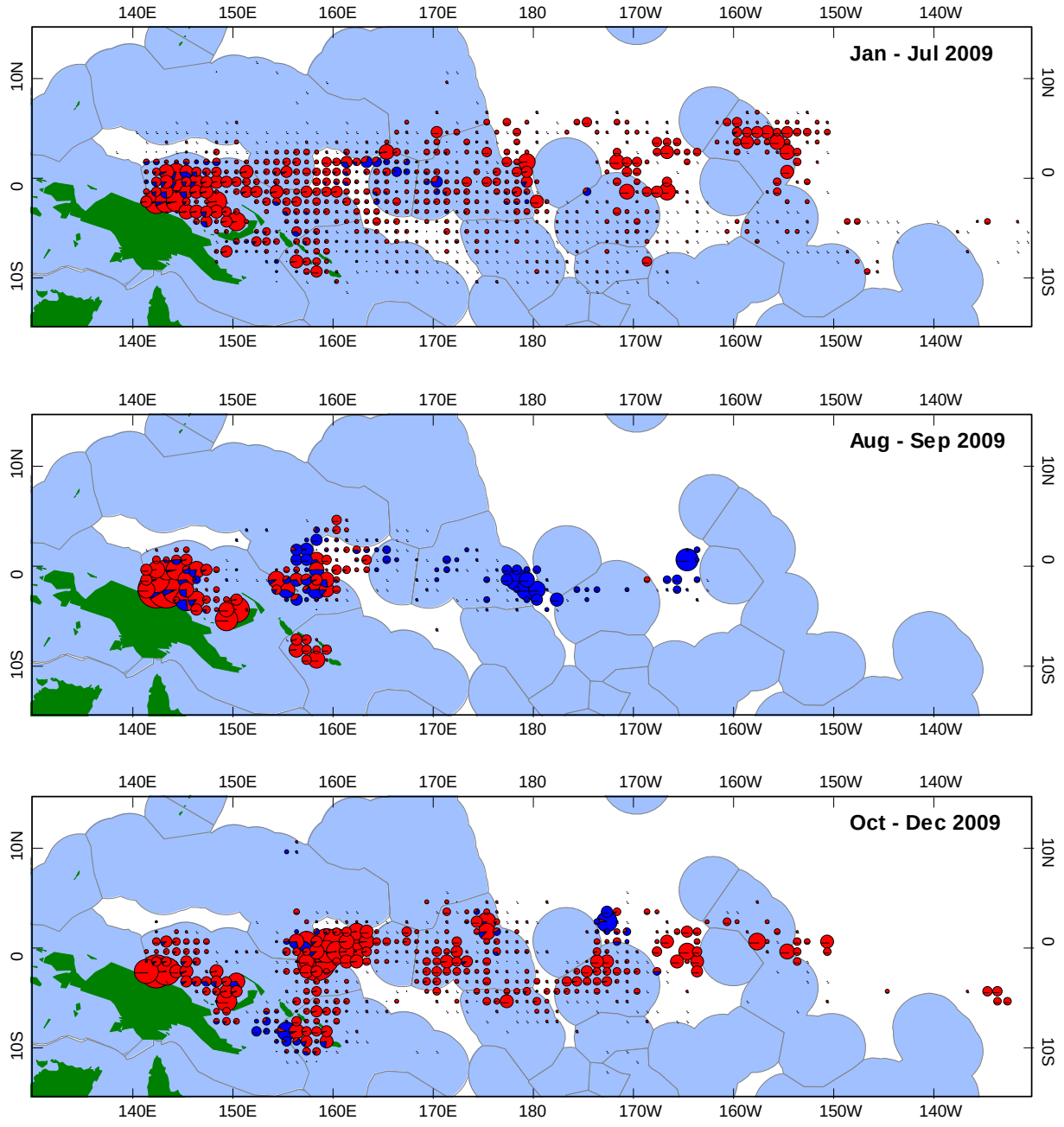

Figure 7. Distribution of purse seine catch of BIGEYE in associated (red) and unassociated (blue) sets pre-, during and post-FAD closure in 2009.

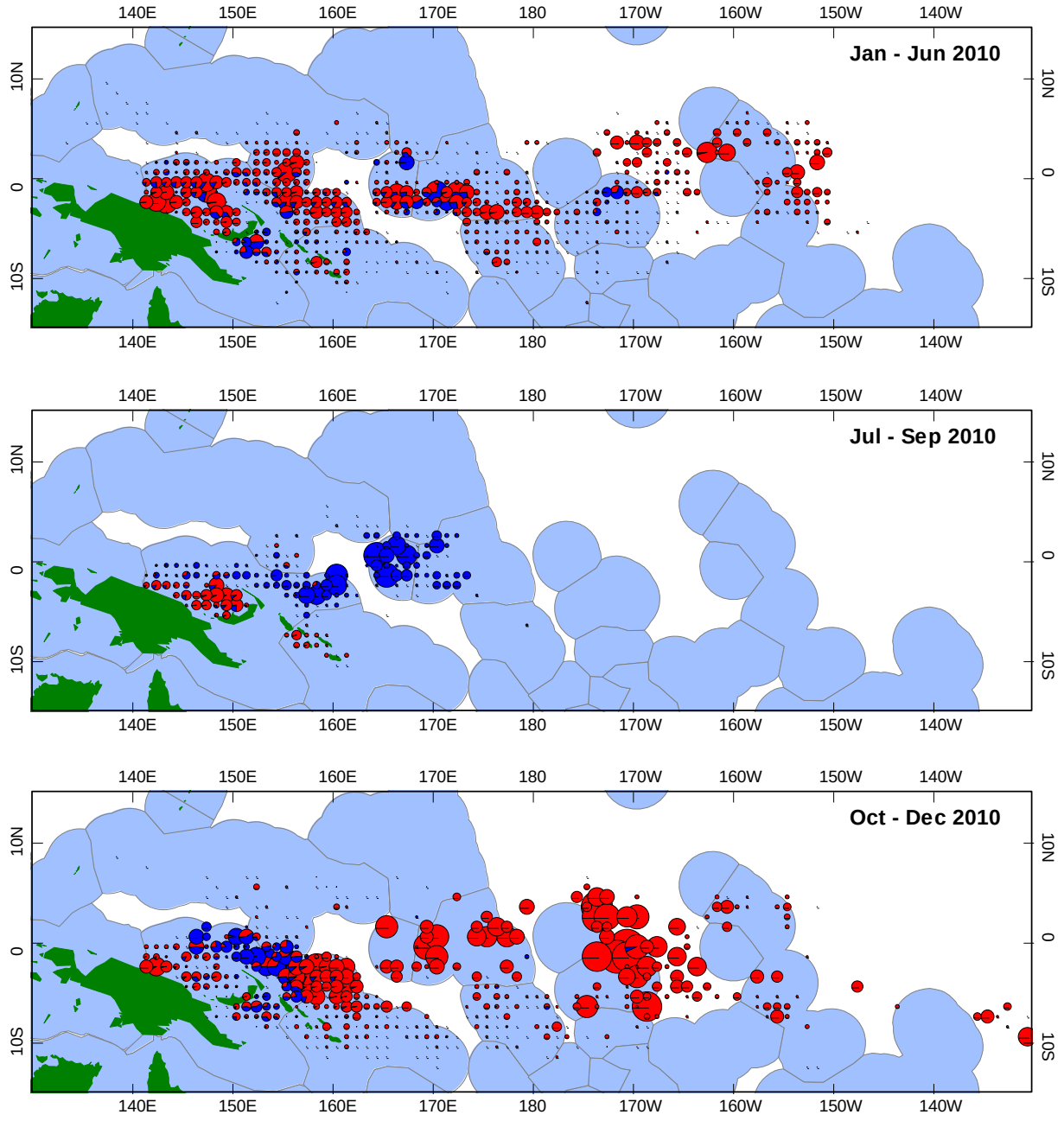

Figure 8. Distribution of purse seine catch of BIGEYE in associated (red) and unassociated (blue) sets pre-, during and post-FAD closure in 2010.

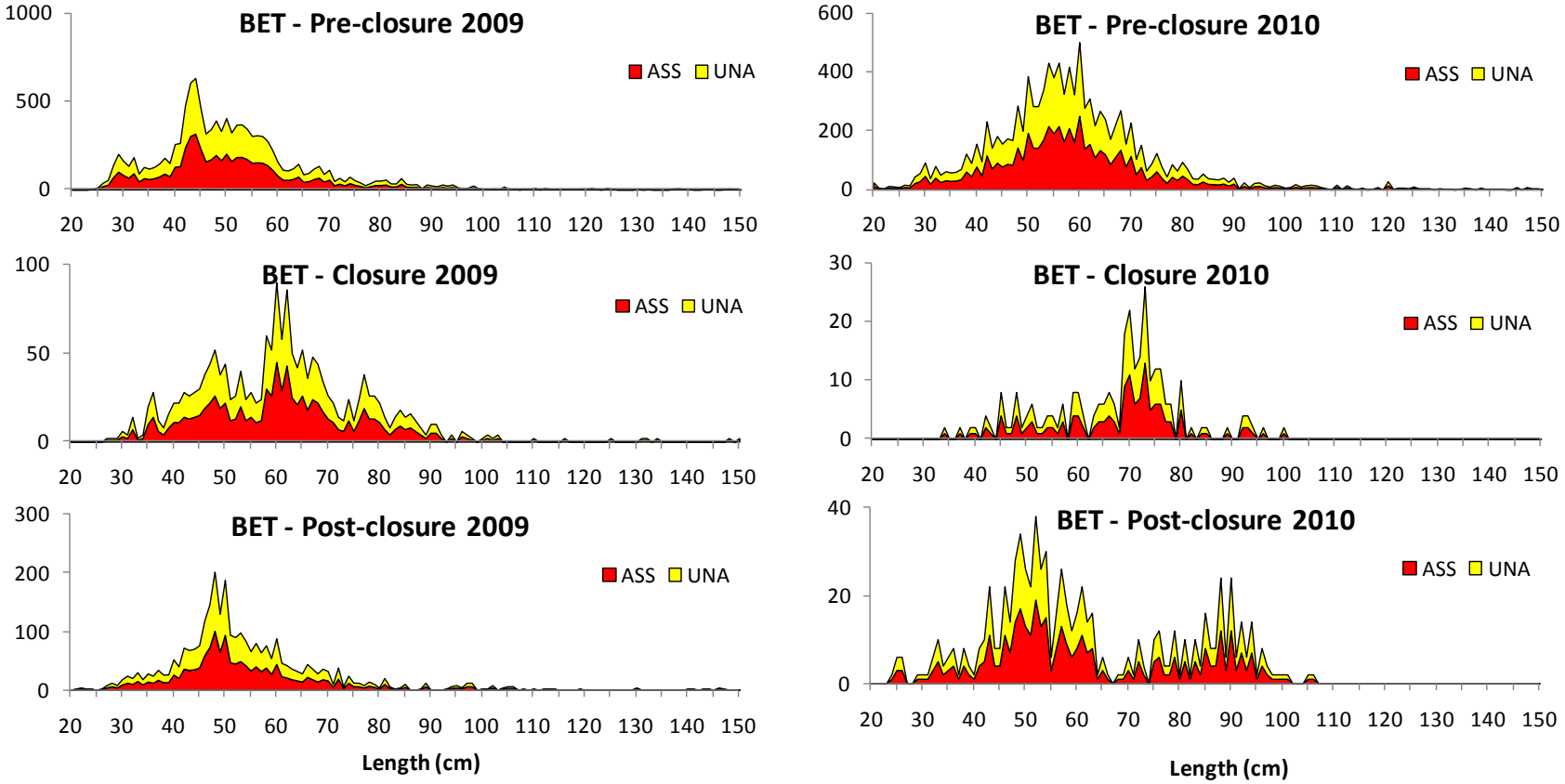

Figure 9. Size composition of BIGEYE tuna caught in 2009 and 2010, classified by associated and unassociated sets.

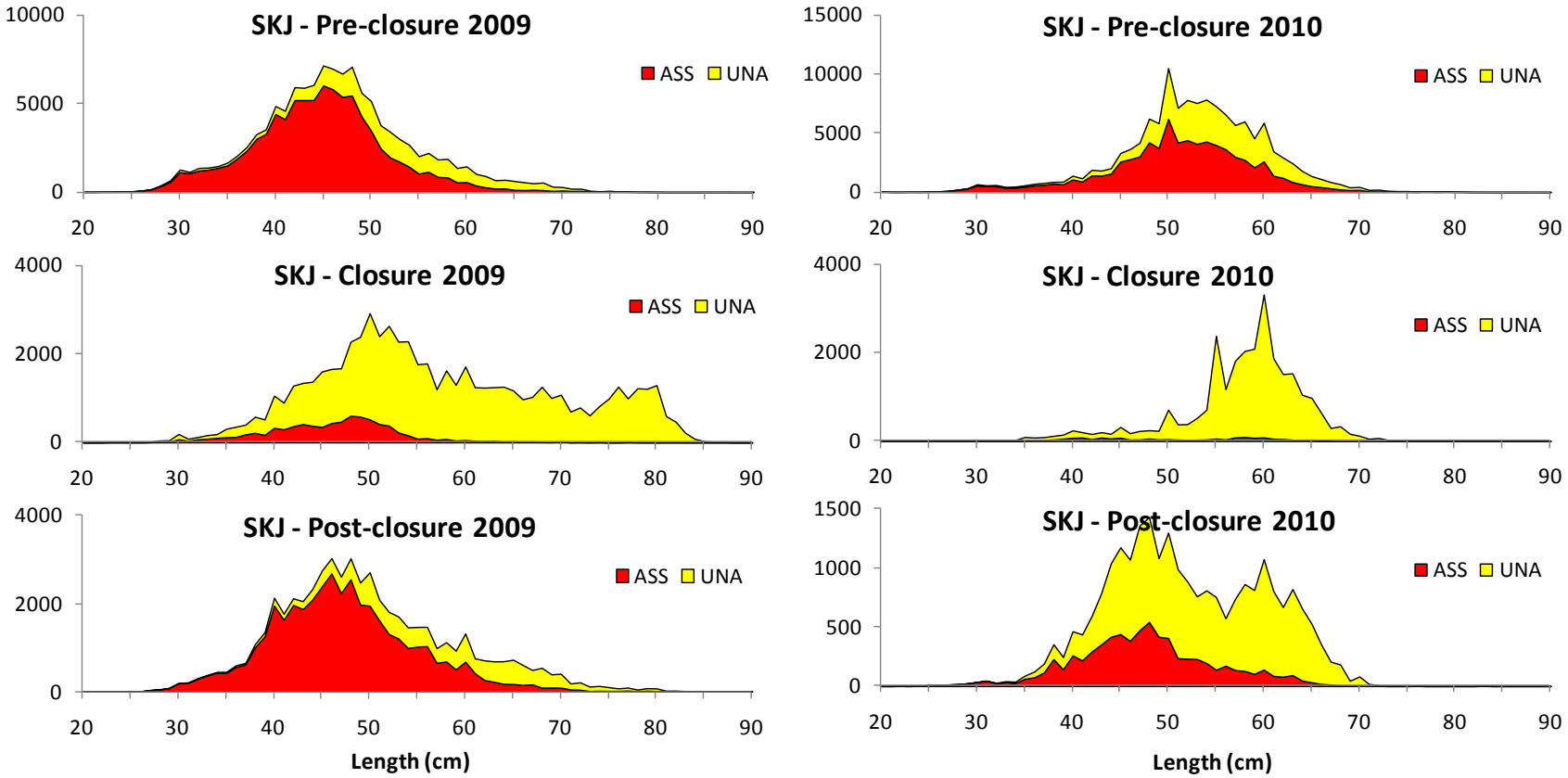

Figure 10. Size composition of SKIPJACK tuna caught in 2009 and 2010, classified by associated and unassociated sets.

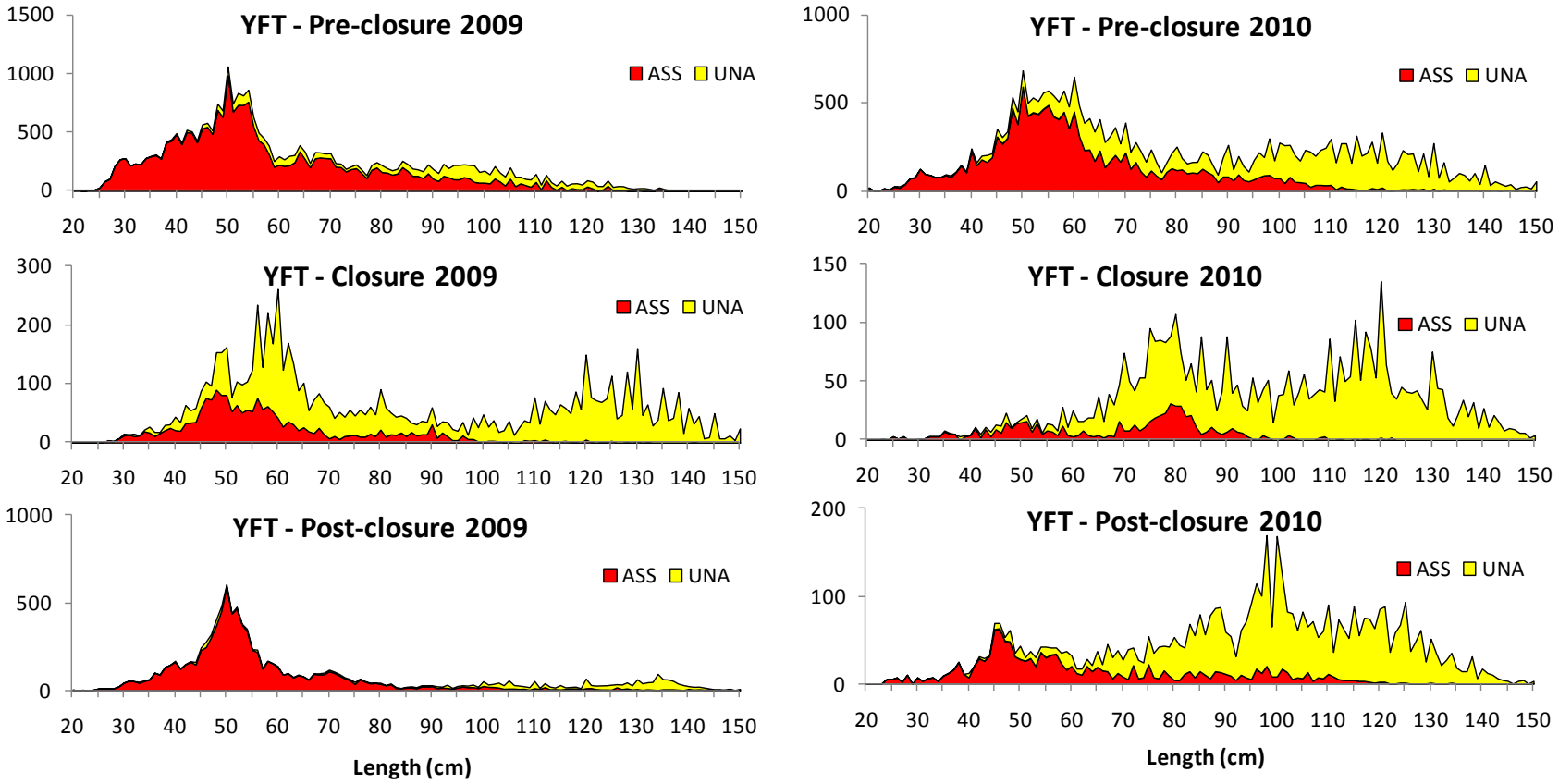

Figure 11. Size composition of YELLOWFIN tuna caught in 2009 and 2010, classified by associated and unassociated sets.

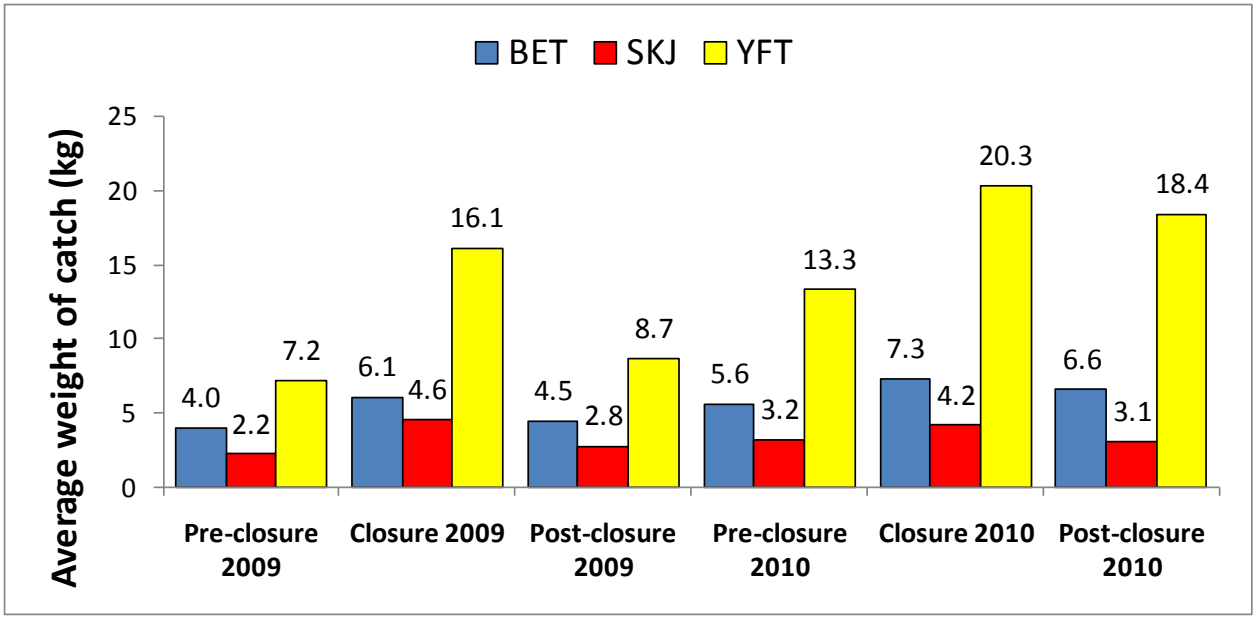

Figure 12. Average weight of bigeye, skipjack and yellowfin tuna, estimated from observer sampling data, during 2009 and 2010.