



EIGHTH REGULAR SESSION

**TUMON, GUAM, USA
26-30 MARCH 2012**

**SUMMARY INFORMATION ON WHALE SHARK AND CETACEAN INTERACTIONS IN THE
TROPICAL WCPFC PURSE SEINE FISHERY**

WCPFC8 -2011-IP-01 (rev. 1)

18 January 2012

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1. Introduction

This paper provides an update of information presented in [WCPFC7-2011-IP-01](#) on whale shark and cetacean interactions in the tropical purse seine fishery.

2. Data sources and definitions

The data used in this paper comprise operational-level logsheet and observer data for the period 2007-2010¹ for purse seiners operating in the tropical (20°N-20°S) purse seine fishery. The domestic fisheries of Indonesia and the Philippines are excluded as key data are not available. It is assumed in the analyses that the currently processed observer data, representing 16% coverage of fishing days over the 2007-2009 period, and 45% coverage of fishing days in 2010, are representative of overall purse seine fishing operations during these periods.

Sets are classified as “whale” or “whale shark” by the purse seine operator and likewise by the observer if the tuna aggregation being set upon is considered to have been associated with these animals at the time that the aggregation was located. The classification is not dependent on whether or not the associated animals are ultimately encircled by the set. The whale-associated set type is primarily associations with baleen whales (suborder *Mysticeti* – filter-feeding whales) and occasionally the sperm whale (*Physeter macrocephalus*), but not the other toothed cetaceans (suborder *Odontoceti*), which are smaller and faster (e.g. dolphins and porpoises). Interactions with the smaller toothed cetaceans do occur in the purse seine fishery, although they do not appear to maintain persistent associations with tuna in the WCPFC Convention Area in the same way that they do with yellowfin tuna in the eastern Pacific Ocean (Bailey et al. 1996). Therefore, there is not a separate set type classification for toothed cetaceans in the regional purse seine logsheet or observer data forms.

The term “interaction” is used in this paper to describe situations where an animal interacts with the fishing gear. In the purse seine fishery, an interaction is understood to be an observation that an animal is fully or partially encircled in the net, even if it escapes before the net is completely closed. An interaction is therefore distinct to “a sighting” which is an observation of an animal that is not encircled or directly affected by the purse seine net.

3. Observations and Discussion

3.1 Animal-Associated set types and interactions

Table 1 provides a comparison of the proportion of purse seine sets by set type in the WCPFC tropical purse seine fishery for logsheet and observer data for the periods (a) 2007-2009 and (b) 2010. Observer data suggest that the numbers of whale- and whale shark-associated sets are severely under-reported on logsheets, although the extent of under-reporting was less in 2010 than in 2007-2009.

According to logsheet and observer data, the frequency of **tuna schools associated with “whales”** (i.e. whale-associated sets) is clearly higher than the frequency of whale shark-associated sets. Specifically, the number of whale-associated sets was up to four times the frequency of whale shark-associated sets (Table

¹ The years 2007-2010 were selected because observer coverage is higher in this period than in previous years and observers have more experience in recording large animal interactions and identifying marine mammals to the species level in more recent years.

1 for both logsheets and observer data). However, the observer-reported **interactions** of whale sharks in the net were much higher than interactions of baleen whales. One of the reasons for this situation may be that vessels tend to report the presence of either whales or whale sharks in association with tuna schools as “whale-associated” instead of differentiating between the two distinct animal-association categories.

3.2 *Whale shark interactions and mortalities*

Observers recorded 211 whale shark interactions in 168 sets from throughout the fishery in 2007-2009 (Table 2a; Figure 1a) and 186 interactions from 137 sets in 2010 (Table 2b; Figure 1b). The available information on interactions by set type (Table 3) suggests that the proportion of whale-shark associated sets should be higher than that reported by observers. This is because more than two-thirds (73% in both 2007-2009 and 2010) of the sets where whale sharks were encountered in the net (i.e. “interactions”) were not recorded as a “whale shark-associated” set type. One of the main reasons for this is that the whale shark may be not visible at the time of setting and so the set is recorded as another set type (e.g. “unassociated, feeding on baitfish”). Subsequently, the observer discovers the animal in the net during the brailing process, and records it as an interaction.

Typically, whale shark interactions were of solitary animals, although several cases of multiple whale sharks in single sets are recorded in the observer data. Whale sharks are relatively slow-moving animals and rarely escape unassisted before the net is closed and typically require crew intervention to be released. The mortality rate of interactions was estimated (based on observer data) at 12% for 2007-2009 (Table 2a) but was considerably lower at 5% in 2010 (Table 2b). The observed interaction and mortality rates imply a total whale shark mortalities in the purse seine fishery of approximately 56 animals in 2009 and 19 animals in 2010.

3.3 *Baleen whale interactions and mortalities*

In 2007-2009, observers reported 26 baleen whale interactions in 23 sets, mostly of solitary animals the majority (21 individuals in 18 sets) of which were unidentified baleen whales (*Mysticeti* –Table 2a). In 2010, the encounter rate was considerably lower (5 interactions in 3 sets) with the majority of interactions (4) being with the sei whale (*Balaenoptera borealis*). Whale-associated set types were recorded widely throughout the fishery, although observed interactions have occurred mainly in the western part of the region (Figure 2a, b). Baleen whales are more frequently sighted at the time of setting than whale sharks and are therefore more likely to be assigned to the correct set type (Table 3).

Observers report that whales often escape before the net is completely closed and at least larger whales are also known to punch holes through the net when closed. The observed mortalities in 2007-2009 and in 2010 are confined to Bryde’s whale. The observed interaction and mortality rates infer a total mortality of baleen whales of 5 and 2 animals in 2009 and 2010 respectively.

3.4 *Toothed cetacean interactions and mortalities*

Observers reported interactions with fifteen different species of toothed cetacean during the period 2007–2010, with false killer whales and several dolphin species (bottlenose, common, spinner and rough-toothed dolphins) the most frequently encountered (Table 2a, b). Interactions occurred across all of the common purse seine set types (Table 3a, b), but were more common in the associated set types (drifting and anchored FADs and logs). False killer whale (Figure 3a, b) and dolphin (Figure 4a, b) interactions have been observed widely throughout the WCPFC tropical purse seine fishery.

In 2007-2009, 798 toothed cetacean interactions were observed from 134 sets (Table 2a). Mortality rates were generally high (65% of interactions), with some reports indicating that they were not detected in the net early enough for release to be effected and had drowned. These interaction and mortality rates infer a total mortality of toothed cetaceans in the purse seine fishery in 2009 of 1,195 animals (Table 2a). In 2010, both the encounter and mortality rates were substantially lower than observed in the previous 3 years, leading to a much lower estimate of total mortality of toothed cetaceans of 110 (Table 2b).

4. Conclusion

The conclusions of this updated paper are the same as those in [WCPFC7-2011-IP-01](#) and are reiterated here for convenience.

It is clear that purse seine sets on whale sharks are a combination of both targeted sets and inadvertent capture. Interactions with toothed whales appear to be mainly incidental, rather than the result of sets specifically targeted at these animals. On the other hand, most sets on baleen whales do appear to be targeting a specific interaction, even if temporary, between the whales and tuna.

Any mitigation measure prohibiting the setting in the vicinity of whale sharks and marine mammals will need to consider that the animal may not be detected until the setting operation is at an advanced stage, particularly for whale sharks. There may also be a need for the development and dissemination of best-practice guidelines for releasing encircled animals.

5. References

Bailey, K.N., P.G. Williams & D.G. Itano. 1996. By-catch and discards in the western Pacific tuna fisheries: A review of SPC Data Holdings and Literature. Oceanic Fisheries Programme Technical Report 34. South Pacific Commission, Noumea, New Caledonia.

Table 1a. Proportion of sets by set type and source of data for the WCPFC tropical purse seine fishery, 2007-2009 (excludes sets “not specified”)

Set type	LOGSHEETS		OBSERVER	
	Sets	%	Sets	%
Unassociated	54,319	54.6%	10,821	56.5%
Natural Log	15,804	15.9%	1,623	8.5%
Drifting FAD	22,403	22.5%	3,487	18.2%
Anchored FAD	6,864	6.9%	2,600	13.6%
Whale (Marine mammal)	124	0.1%	485	2.5%
Whale shark	45	0.0%	120	0.6%

Table 1b. Proportion of sets by set type and source of data for the WCPFC tropical purse seine fishery, 2010 (excludes sets “not specified”)

Set type	LOGSHEETS		OBSERVER	
	Sets	%	Sets	%
Unassociated	31,289	74.7%	15,211	72.9%
Natural Log	3,166	7.6%	1,451	7.0%
Drifting FAD	5,626	13.4%	3,152	15.1%
Anchored FAD	1,646	3.9%	624	3.0%
Whale (Marine mammal)	80	0.2%	331	1.6%
Whale shark	64	0.2%	84	0.4%

Table 2a. Baleen whale, whale shark and toothed cetacean interactions in the WCPFC tropical purse seine fishery, 2007-2009 (Source: Observer data; total sets observed = 19,136 sets)

Species common name	Scientific name	Sets	% sets encountered	Number	Encounter rate (no. / 1,000 sets)	% Dead	Mortality rate (no. / 1,000 sets)	Estimated Mortality in 2009
BALEEN WHALES								
BRYDE'S WHALE	<i>Balaenoptera Edeni</i>	3	0.010%	3	0.15	67%	0.10	4
BALEEN WHALES NEI	Mysticeti	18	0.090%	21	1.04	0%	0.00	0
SEI WHALE	<i>Balaenoptera borealis</i>	2	0.010%	2	0.10	0%	0.00	0
BALEEN WHALES		23	0.120%	26	1.36	8%	0.10	5
WHALE SHARK								
WHALE SHARK	<i>Rhincodon typus</i>	168	0.830%	211	10.43	12%	1.29	56
TOOTHED CETACEANS								
DOLPHIN, BOTTLENOSE	<i>Tursiops truncatus</i>	18	0.090%	110	5.44	62%	3.36	148
DOLPHIN, COMMON	<i>Delphinus delphis</i>	8	0.040%	61	3.02	95%	2.87	126
DOLPHIN, INDO-PACIFIC BOTTLENOSE	<i>Tursiops aduncus</i>	14	0.070%	131	6.48	71%	4.60	202
DOLPHIN, LONG-BEAKED COMMON	<i>Delphinus capensis</i>	2	0.010%	40	1.98	8%	0.15	7
DOLPHIN, RISSO'S	<i>Grampus griseus</i>	9	0.040%	40	1.98	100%	1.98	87
DOLPHIN, ROUGH-TOOTHED	<i>Steno bredanensis</i>	15	0.070%	103	5.09	71%	3.61	158
DOLPHIN, SPINNER	<i>Stenella longirostris</i>	13	0.060%	68	3.36	82%	2.77	122
DOLPHIN, SPOTTED	<i>Stenella attenuata</i>	1	0.000%	6	0.30	100%	0.30	13
DOLPHIN, STRIPED	<i>Stenella coeruleoalba</i>	2	0.010%	8	0.40	100%	0.40	17
DOLPHINS / PORPOISES (UNIDENTIFIED)	Delphinidae	1	0.000%	1	0.05	100%	0.05	2
FALSE KILLER WHALE	<i>Pseudorca crassidens</i>	42	0.210%	216	10.68	51%	5.44	239
MELON-HEADED WHALE	<i>Peponocephala electra</i>	2	0.010%	2	0.10	50%	0.05	2
PYGMY KILLER WHALE	<i>Feresa attenuata</i>	1	0.000%	1	0.05	100%	0.05	2
SHORT-FINNED PILOT WHALE	<i>Globicephala macrorhynchus</i>	6	0.030%	11	0.54	27%	0.15	7
TOOTHED CETACEANS		134	0.700%	798	41.70	65%	27.23	1,195

1. **“Estimated Mortality in 2009”** has been determined by applying the mortality rate (observers) to the total number of sets undertaken during 2009.

Table 2b. Baleen whale, whale shark and toothed cetacean interactions in the WCPFC tropical purse seine fishery, 2010 (Source: Observer data; total sets observed = 20,853 sets)

Species common name	Scientific name	Sets	% sets encountered	Number	Encounter rate (no. / 1,000 sets)	% Dead	Mortality rate (no. / 1,000 sets)	Estimated Mortality in 2010
BALEEN WHALES								
BRYDE'S WHALE	Balaenoptera Edeni	1	0.000%	1	0.05	100%	0.05	2
SEI WHALE	Balaenoptera borealis	2	0.010%	4	0.18	0%	0.00	0
BALEEN WHALES		3	0.014%	5	0.24	20%	0.05	2
WHALE SHARK								
WHALE SHARK	Rhincodon typus	137	0.630%	186	8.54	5%	0.46	19
TOOTHED CETACEANS								
BEAKED WHALE - CUVIER'S	Ziphius cavirostris	1	0.000%	1	0.05	0%	0.00	0
BEAKED WHALES NEI	Mesoplodon spp	1	0.000%	1	0.05	0%	0.00	0
DOLPHIN, BOTTLENOSE	Tursiops truncatus	3	0.010%	10	0.46	70%	0.32	13
DOLPHIN, INDO-PACIFIC BOTTLENOSE	Tursiops aduncus	1	0.000%	1	0.05	0%	0.00	0
DOLPHIN, RISSO'S	Grampus griseus	1	0.000%	9	0.41	0%	0.00	0
DOLPHIN, ROUGH-TOOTHED	Steno bredanensis	5	0.020%	28	1.29	18%	0.23	10
DOLPHIN, SPINNER	Stenella longirostris	3	0.010%	31	1.42	81%	1.15	48
DOLPHIN, SPOTTED	Stenella spp.	2	0.010%	7	0.32	0%	0.00	0
DOLPHIN, STRIPED	Stenella coeruleoalba	2	0.010%	8	0.37	63%	0.23	10
FALSE KILLER WHALE	Pseudorca crassidens	18	0.080%	47	2.16	28%	0.60	25
SHORT-FINNED PILOT WHALE	Globicephala macrorhynchus	2	0.010%	3	0.14	0%	0.00	0
TOOTHED CETACEANS		39	0.187%	146	7.00	38%	2.64	110

1. *“Estimated Mortality in 2010”* has been determined by applying the mortality rate (observers) to the total number of sets undertaken during 2010.

Table 3a. Whale shark, baleen whale and toothed cetacean interactions in the WCPFC tropical purse seine fishery by set type, 2007-2009 (Source: Observer data)

Set type	Whale Shark			Baleen Whales			Toothed Cetaceans		
	Sets	Number	%	Sets	Number	%	Sets	Number	%
Unassociated	93	125	59%	6	6	23%	26	129	16%
Natural Log	0	0	0%	0	0	0%	23	158	20%
Drifting FAD	10	12	6%	0	0	0%	28	125	16%
Anchored FAD	2	2	1%	0	0	0%	39	296	37%
Whale (Marine Mammal)	11	11	5%	17	20	77%	10	28	4%
Whale shark	48	57	27%	0	0	0%	0	0	0%
(Not specified)	4	4	2%	0	0	0%	5	62	8%

Table 3b. Whale shark, baleen whale and toothed cetacean interactions in the WCPFC tropical purse seine fishery by set type, 2010 (Source: Observer data)

Set type	Whale Shark			Baleen Whales			Toothed Cetaceans		
	Sets	Number	%	Sets	Number	%	Sets	Number	%
Unassociated	80	104	57%	3	3	43%	6	20	14%
Natural Log	7	7	4%	0	0	0%	7	42	29%
Drifting FAD	5	5	3%	0	0	0%	17	73	50%
Anchored FAD	2	3	2%	0	0	0%	4	9	6%
Whale (Marine Mammal)	3	8	4%	2	4	57%	2	2	1%
Whale shark	32	50	27%	0	0	0%	0	0	0%
(Not specified)	6	6	3%	0	0	0%	1	1	1%

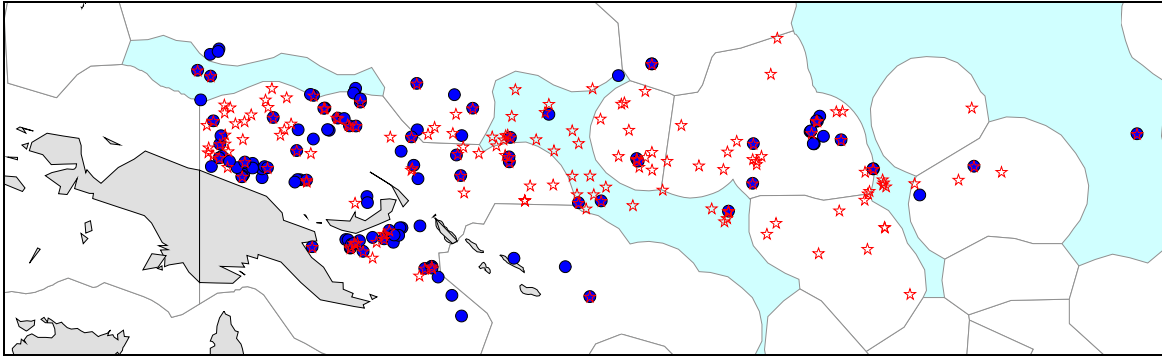


Figure 1a. Locations of observed whale shark interactions (red stars) and whale shark-associated sets (blue circles) in the WCPFC tropical purse seine fishery, 2007-2009 (Source: Observer data)

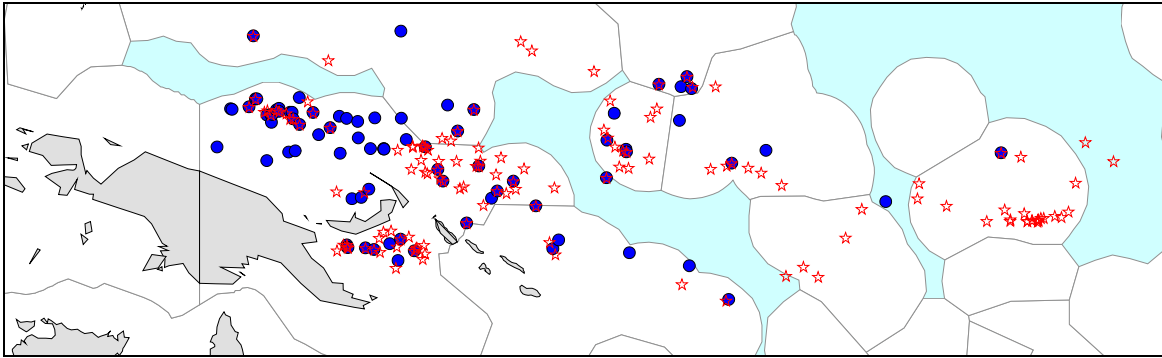


Figure 1b. Locations of observed whale shark interactions (red stars) and whale shark-associated sets (blue circles) in the WCPFC tropical purse seine fishery, 2010 (Source: Observer data)

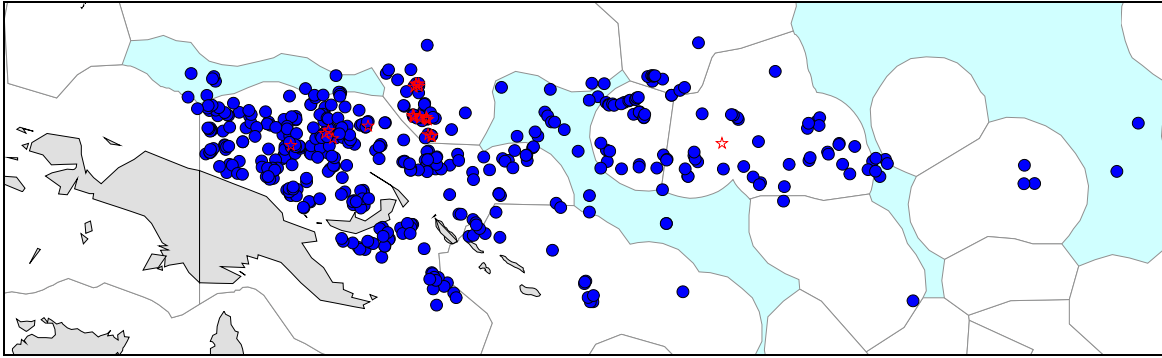


Figure 2a. Locations of observed baleen whale interactions (red stars) and baleen whale-associated sets (blue circles) in the WCPFC tropical purse seine fishery, 2007-2009 (Source: Observer data)

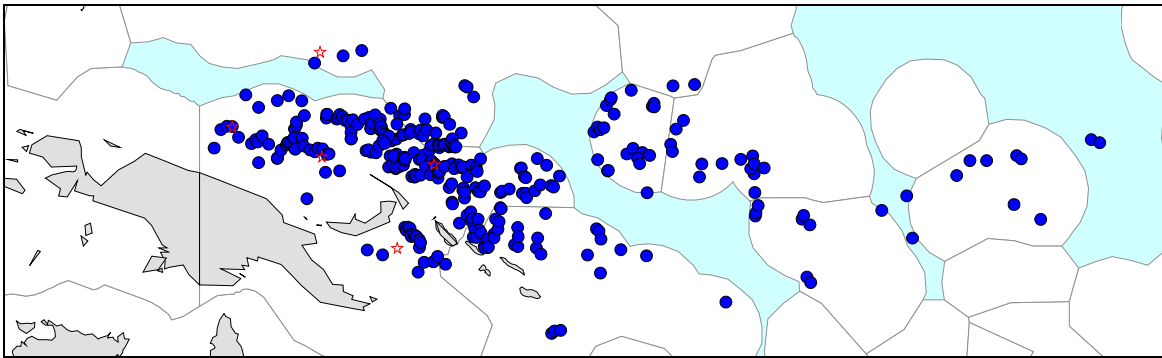


Figure 2b. Locations of observed baleen whale interactions (red stars) and baleen whale-associated sets (blue circles) in the WCPFC tropical purse seine fishery, 2010 (Source: Observer data)

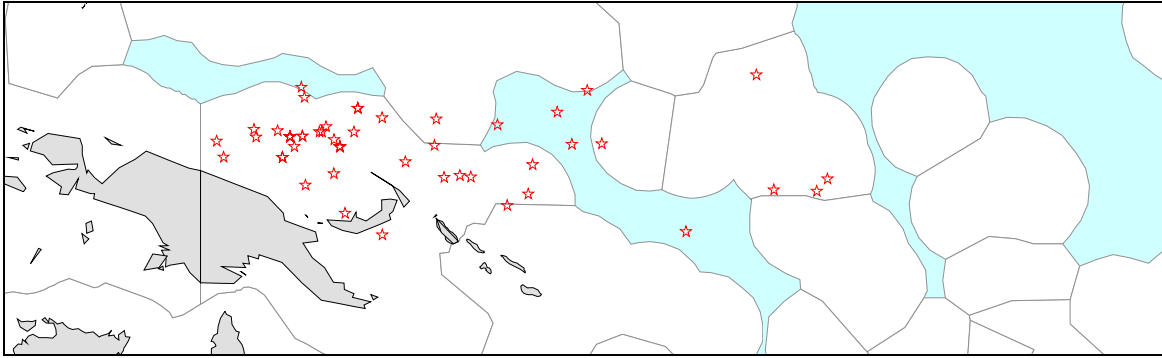


Figure 3a. Locations of observed false killer whale interactions (red stars) in the WCPFC tropical purse seine fishery, 2007-2009 (Source: Observer data)

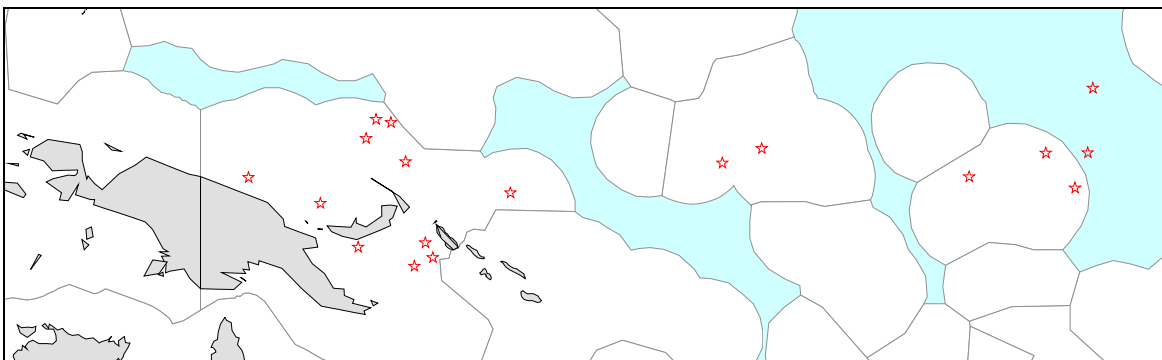


Figure 3b. Locations of observed false killer whale interactions (red stars) in the WCPFC tropical purse seine fishery, 2010 (Source: Observer data)

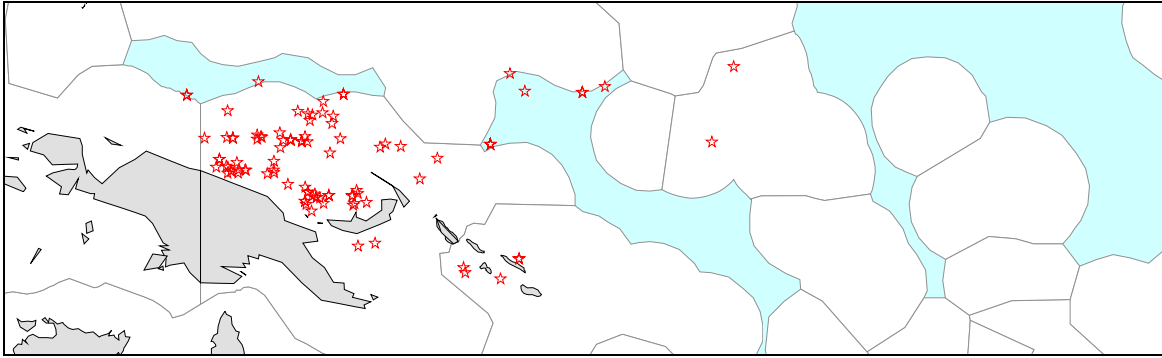


Figure 4a. Locations of observed dolphin species interactions (red stars) in the WCPFC tropical purse seine fishery, 2007-2009 (Source: Observer data)

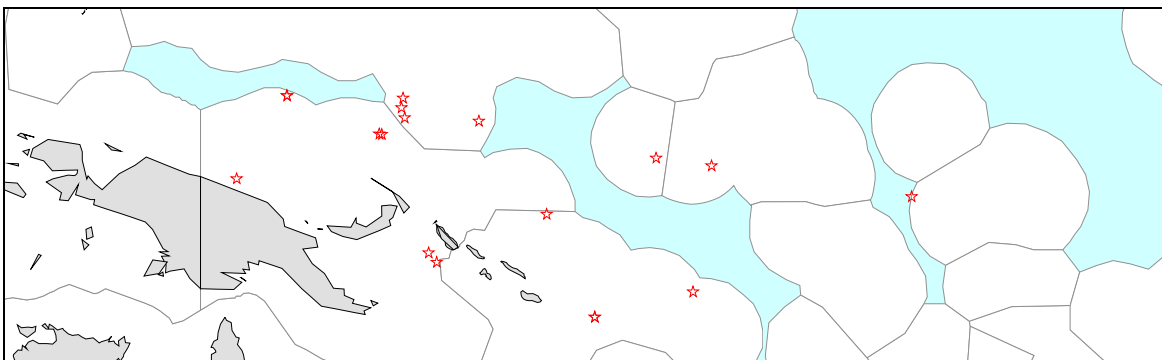


Figure 4b. Locations of observed dolphin species interactions (red stars) in the WCPFC tropical purse seine fishery, 2010 (Source: Observer data)