Whale Shark Migration Observed by Pelagic Tuna Fishery

Near Japan

H. Matsunaga, H. Nakano, H. Okamoto and Z. Suzuki

National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan
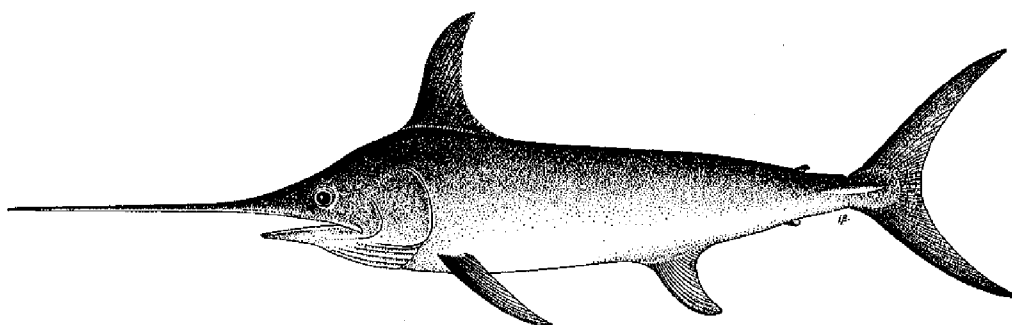
5-7-1 Shimizu-orido, Shizuoka, 424-8633 Japan

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【Introduction】

The Whale shark, *Rhincodon typus*, is a large species and widely distributed from tropical to the warm sea areas in the world. Concern about the ecology and population of this species have been grown up in recent years, and the proposal to add this species to the list of appendix II was passed in the 12th conference of the parties of the CITES held in Santiago, Chili, last year. In Japan, many Whale sharks migrate near the coast from spring to autumn and fishermen use them as the mark for skipjack schools by purse seine or pole and line fisheries. When fishermen catch skipjack schools by purse seine, Whale shark is also surrounded with the net. They treat Whale sharks politely and let them free. These facts show the close relation between the species and fisheries. But little is known about the migration of Whale shark in the world. So we study the appearance and migration of the Whale shark near Japan by the analysis of logbook data of pelagic fisheries.

【Materials and Methods】

The logbook data from the purse seine fishery during the period of 1967-2001 and the pole and line fishery during the period of 1996-2002 were used to analyze the occurrence, distribution and period of the operations in which fishermen used the Whale sharks as the mark to find the school of skipjack tuna or albacore. In Japan, these operations are called "same-tsuki", whose mean is shark set (operation for associated tuna school with shark).

【Result】

(1) Number of the shark set (Table 1)

There reported 88,350 operations of purse seine fishery near Japan and 162,580 ones in the tropical area from 1967 to 2000. In these operations, 1,561 (1.77%) and 579 (0.36%) shark set were included respectively. Many shark set were observed in 1995-2000 and 1991-94 respectively.

There were 21,935 operations of Pole and line fishery from 1996 to 2002, which included 3,214 shark set (14.7%).

(2) Distribution of the shark set (Fig. 1)

Purse seine fishery operations near Japan were conducted mainly in the area of 136-160E and 27-45N. The shark sets were concentrated in the area of 140-156E and 33-42N. Operations in the tropical area were conducted mainly in the area of 132-180E and 7S-12N. The shark sets were observed in the area of 138-168E and 5S-7N.

Pole and line fishery operations were conducted mainly in the area of 126-156E and

18-42N. The shark sets were concentrated in the more east area.

(3) Monthly distribution of the shark set (Fig. 2, 3)

The shark sets were observed a few in the area of 20-25N in March and April. They rapidly increased in the area of 30-40N and 140-150E in June. The peak of them was around July and August. After the shift of fishery ground to the north area in August, these operations were concentrated in the south of 40N. They decreased suddenly after October, and there were few observed in November.

【Discussion】

The number of the shark set of purse seine fishery near Japan fluctuated irregularly until 1990's and increased suddenly after then. The increase of the operations targeting skipjack tuna is estimated to be the main cause of it. Conversely, it is estimated that the rapid decrease of the shark set in the tropical area after the middle of 1990's was caused by the shift of the operation method to the use of FAD. Regarding the pole and line fishery, there were a lot of the shark sets in recent years. Though there supposed to be some multiple counts of the same individuals and the change of the targeting species, these values can be the abundance index of the Whale shark to some extent. Of course, it is necessary to identify how the same sharks are counted multiply. But judging from the shark sets to be 300-1,000 times a year, it is supposed that such many individuals of Whale shark migrate to the area near Japan every year, and there was not clear decreasing tendency of the appearance historically. It is recommended to verify these facts by accumulating the data of not only Japan but also other countries.

It is known that some Whale shark enter into the set nets near the coast of Japan from spring to autumn. It is estimated from the information described above that the Whale shark migrate from tropical area pursuing the food organisms in the Kuroshio current, and some of them enter into the set nets near the coast of Japan, but most of them arrive at the mixed area of Kuroshio and Oyashio current. They are supposed not to go through the boundary between the two currents into the north area where the temperature is too low and stay for some time in the warm area with a lot of food organisms. Whether they migrate eastward or southward after autumn is unknown. So, it is necessary to make clear the migration of whale shark in the whole year by the long-term tracking using the Argos transmitters or pop up archival transmitters.

【Reference】

Iwasaki Y. (1970): On the distribution and environment of the Whale shark, , *Rhincodon typus*, in skipjack fishing grounds in the western Pacific ocean.

Table 1 Number of the total and shark sets of purse seine and pole and line fisheries

| Year	purse seine (temperate)			purse seine (tropical)				pole and line		
	total	shark set	ratio(%)	total	shark set	ratio(%)	FAD	total	shark set	ratio(%)
1967				13						
1968				77						
1969				22						
1970	25			95	1	1.1				
1971	2,546	28	1.1	115	3	2.6				
1972	3,378	10	0.3	60	3	5.0				
1973	3,361	7	0.2	241	3	1.2				
1974	1,909	1	0.1	428	6	1.4				
1975	2,016	19	0.9	581	15	2.6				
1976	2,286	50	2.2	866	10	1.2				
1977	1,666	13	0.8	1,036	11	1.1				
1978	1,348	14	1.0	1,584	1	0.1				
1979	2,432	1	0.0	2,013	8	0.4				
1980	3,053	10	0.3	1,858	1	0.1				
1981	2,620	5	0.2	3,046		0.0				
1982	2,703	14	0.5	4,684	5	0.1				
1983	2,586	4	0.2	7,737	17	0.2	89			
1984	3,747	47	1.3	9,093	32	0.4	15			
1985	3,578	14	0.4	8,915	28	0.3	23			
1986	4,260	36	0.8	7,460	29	0.4	27			
1987	4,016	82	2.0	7,502	20	0.3	55			
1988	3,018	30	1.0	8,582	14	0.2	47			
1989	2,672	11	0.4	9,004	23	0.3	65			
1990	2,179	5	0.2	8,274	30	0.4	44			
1991	2,060	4	0.2	8,187	49	0.6	37			
1992	2,044	3	0.1	7,346	30	0.4	93			
1993	2,292	46	2.0	8,575	107	1.2	36			
1994	2,499	48	1.9	6,962	44	0.6	21			
1995	3,018	144	4.8	7,587	27	0.4	25			
1996	2,575	185	7.2	8,527	29	0.3	53	2,112	62	2.9
1997	3,591	207	5.8	7,202	12	0.2	494	2,862	644	22.5
1998	3,824	222	5.8	6,277	7	0.1	628	3,430	739	21.5
1999	4,071	177	4.3	6,567	7	0.1	1,928	3,056	682	22.3
2000	4,335	77	1.8	6,393	2	0.0	2,052	3,670	487	13.3
2001	2,642	47	1.8	5,671	5	0.1	1,627	2,932	277	9.4
2002	-	-		-	-			3,873	323	8.3
Total	88,350	1,561	1.8	162,580	579	0.4		21,935	3,214	14.7
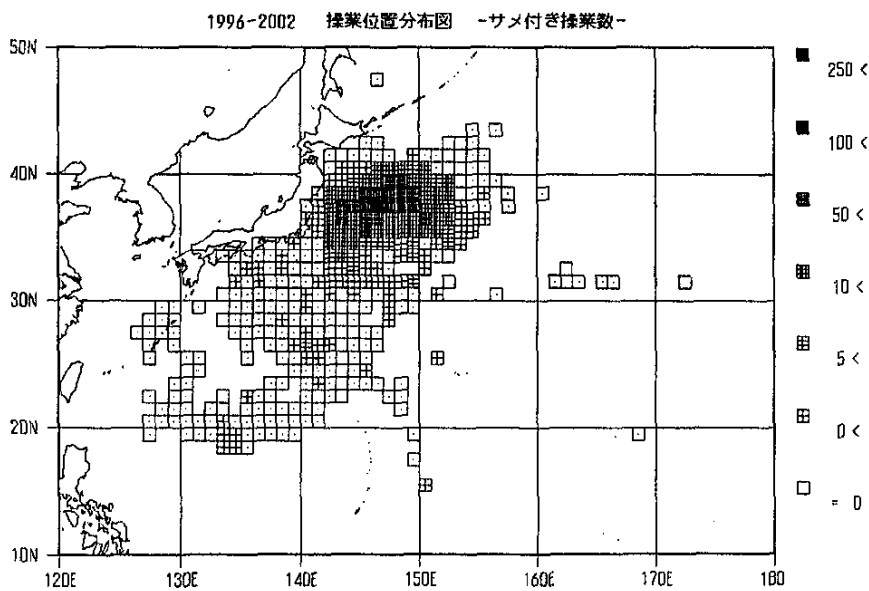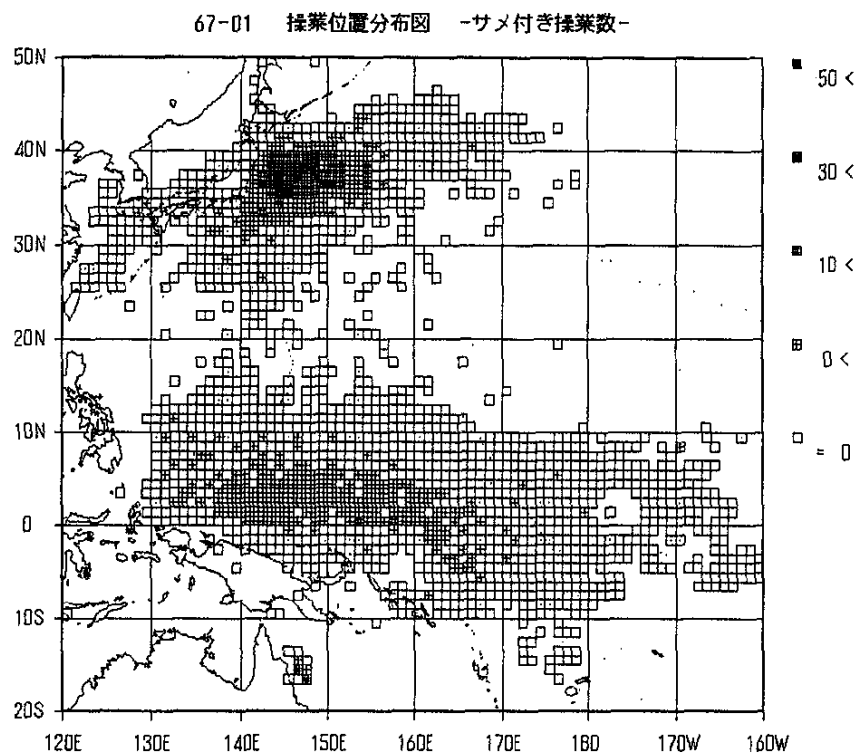
Fig. 1 Distribution of the shark sets in the purse seine (upper)
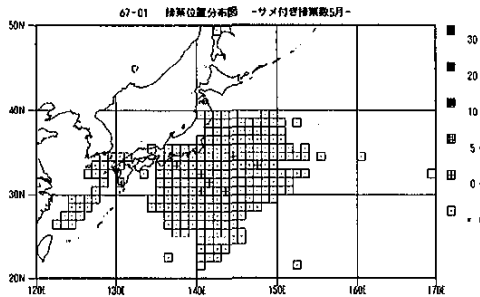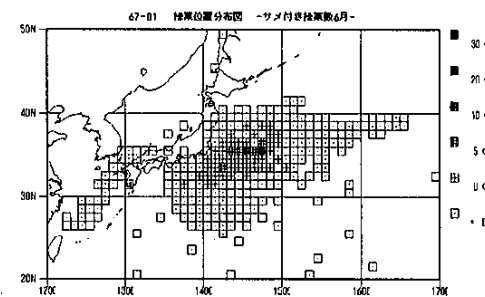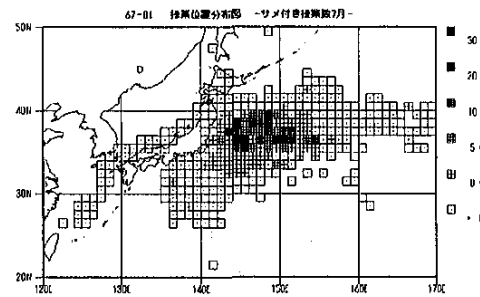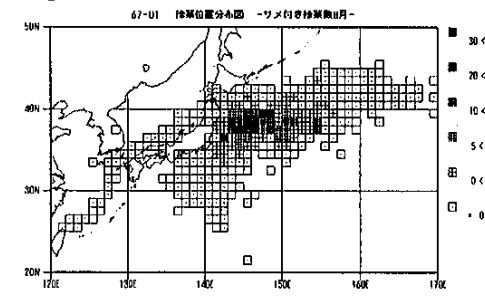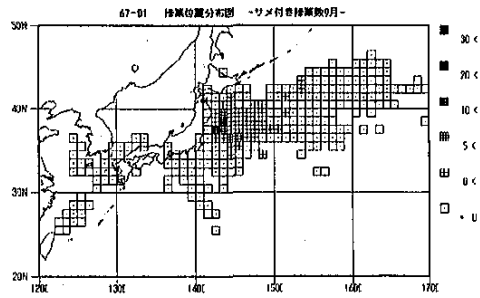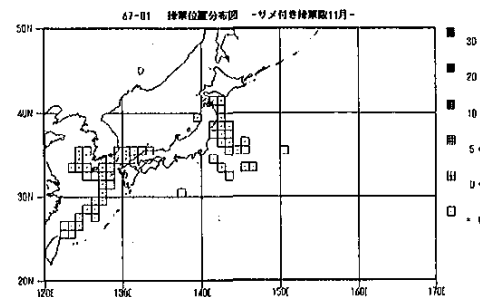and pole and line fishery (lower).

March

April
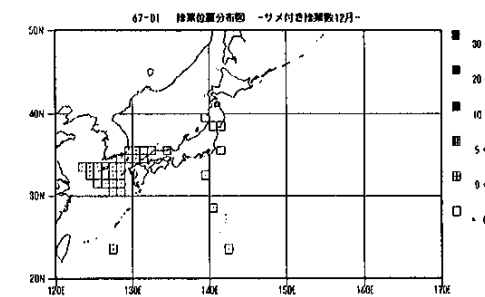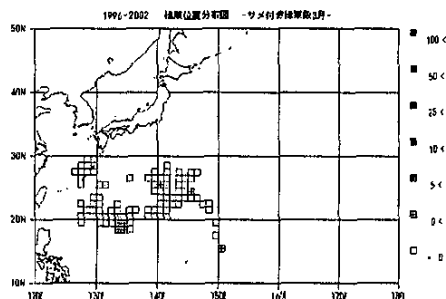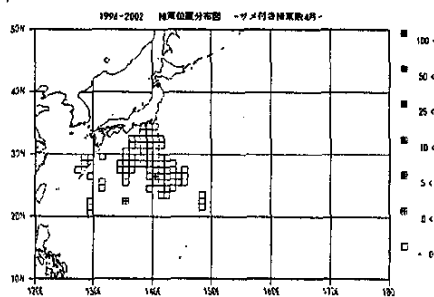
May

June

July

Aug.
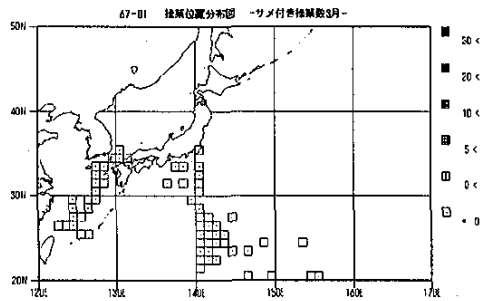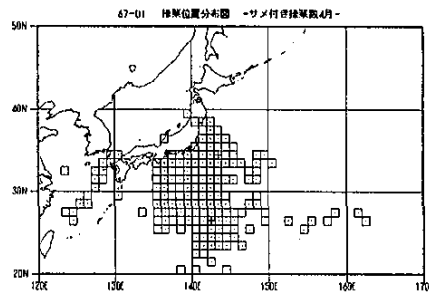
Sep.

Oct.
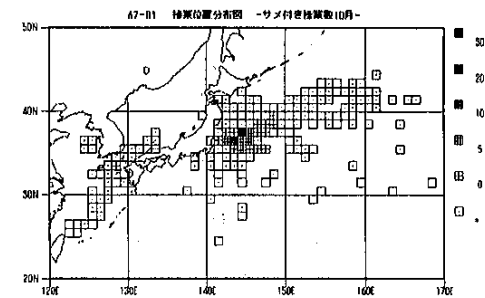
Nov.

Dec.

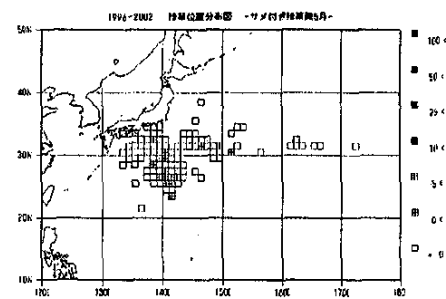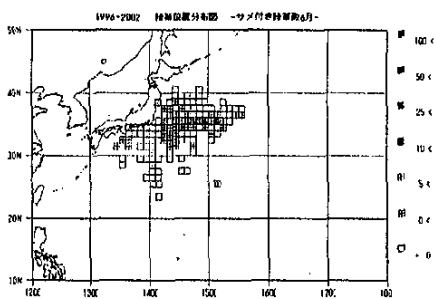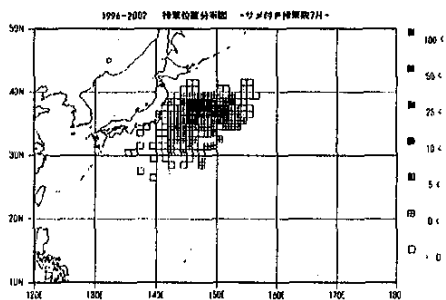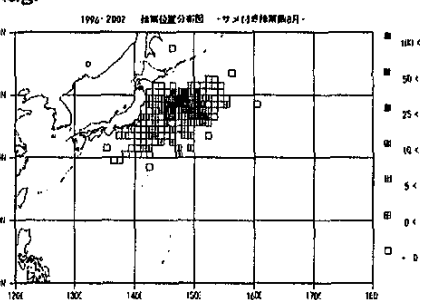Fig. 2 Monthly distribution of the shark sets in the purse seine.
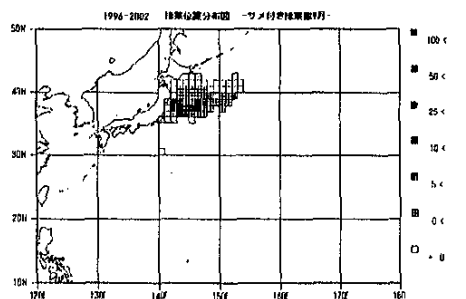
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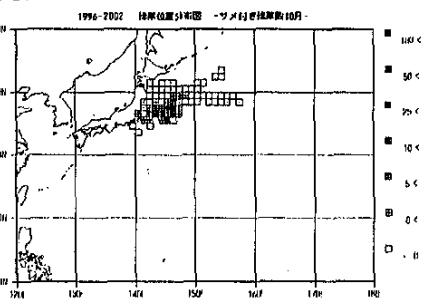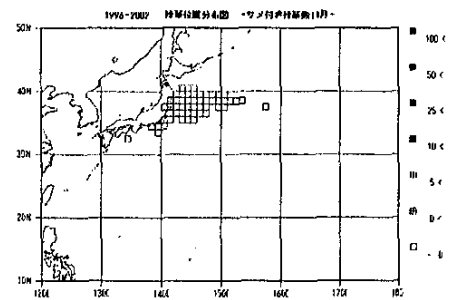
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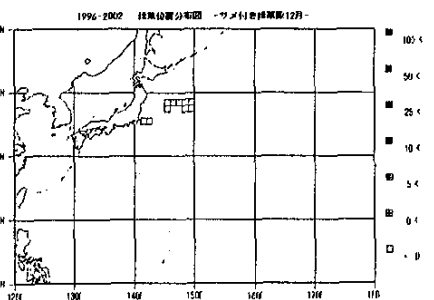
May

June

July

Aug.

Sep.

Oct.

Nov.

Dec.

Fig. 3 Monthly distribution of the shark sets in the pole and line.