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SEABIRDS IN THE BANDA SEA IN FEBRUARY/MARCH 1985

by

G.C. CADEE *)

ABSTRACT

Quantitative seabird data were collected in February/March 1985 in the Banda Sea. Comparison with similar data for August 1984 indicated no monsoonal influence on seabrid abundance ; the median for both periods falls within the 1–5 birds per hour class.

The area around the breeding island Manuk was relatively rich in both periods. Birds breeding here are "blue ocean" seabirds, foraging over large areas. Apparently, not food abundance but suitable breeding place determines their abundance here. Manuk has an enormous importance for the seabird population in the Banda Sea area, fortunately, it is a nature reserve since 1981. The breeding period on Manuk is not short and related to the NE monsoon, but extended over a larger period of the year. Manuk was known already as a breeding island in the 17th cnetury, but this knowledge was lost and only recently Manuk was "rediscovered" as such.

A second relatively rich area occurred again south of Irian Jaya. Migrating birds dominated here. They probably visit this area because of relatively high food availability. Species differed for both periods. Streaked Shearwaters which breed on the northern hemisphere had in February/ March replaced the antarctic Wilson's Stormpetrel which abounded here in August 1984, but had now returned to its breeding area.

INTRODUCTION

A great deal is known about the ecology of seabirds yet, paradoxically, alomost all this information has been collected at the birds breeding sites on land. Remarkably little is known about the 50% or more of their lives that seabirds spend at sea (BROWN 1980). Pelagic aspects of seabird ecology usually fall in the gap existing between ornithology and oceanography. However, distribution of seabirds at sea is linked with oceanography e.q. with distribution of different water masses (POCKLINGTON 1979; JOIRIS 1983; AINLEY & BOEKELHEIDE 1983), with fronts at sea (BEEBE 1926, ASHMOLE & ASHMOLE 1967, KINDLER *et al.* 1983, HANEY & Mc GILLIVARY 1985) or with upwelling (BAILEY 1966, JEHL 1973, BROWN 1979, ABRAMS & GRIFFITHS 1981).

The first systematic study of pelagic seabird distribution was undertaken as part of a marine biological survey of the Nort Atlantic by JESPERSEN (1924, 1929). Since that time the study has expanded particularly due to the increase in number of oceanographic expeditions since 1950. A recent upsurge in studies of seabirds at sea is related to the need to assess the potentially negative impact of the exploitation of offshore hydrocarbon resources (e.g.BLAKE *et al.* 1984).

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Seabirds in the Banda Sea in February/March 1985.

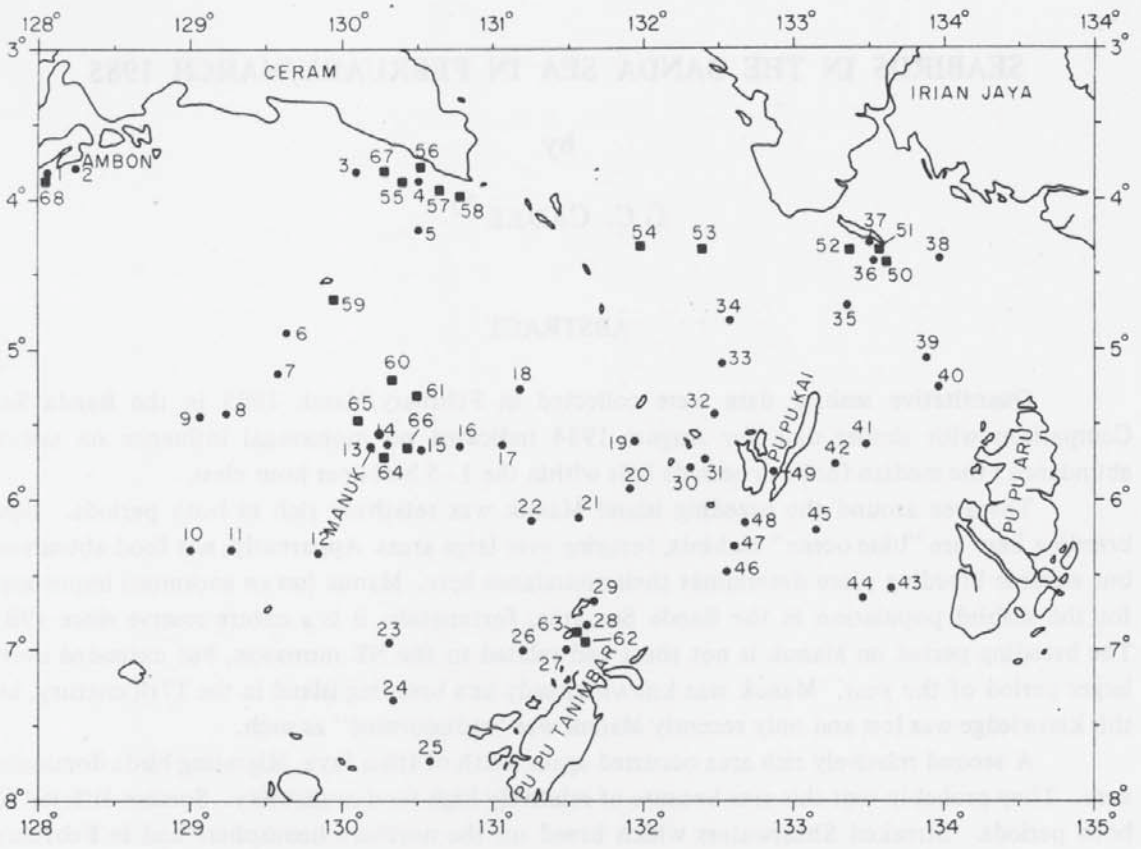

Fig. 1. Location and numbering of stations.
(o) 9 to 21 February, (o) 23 February to 10 March

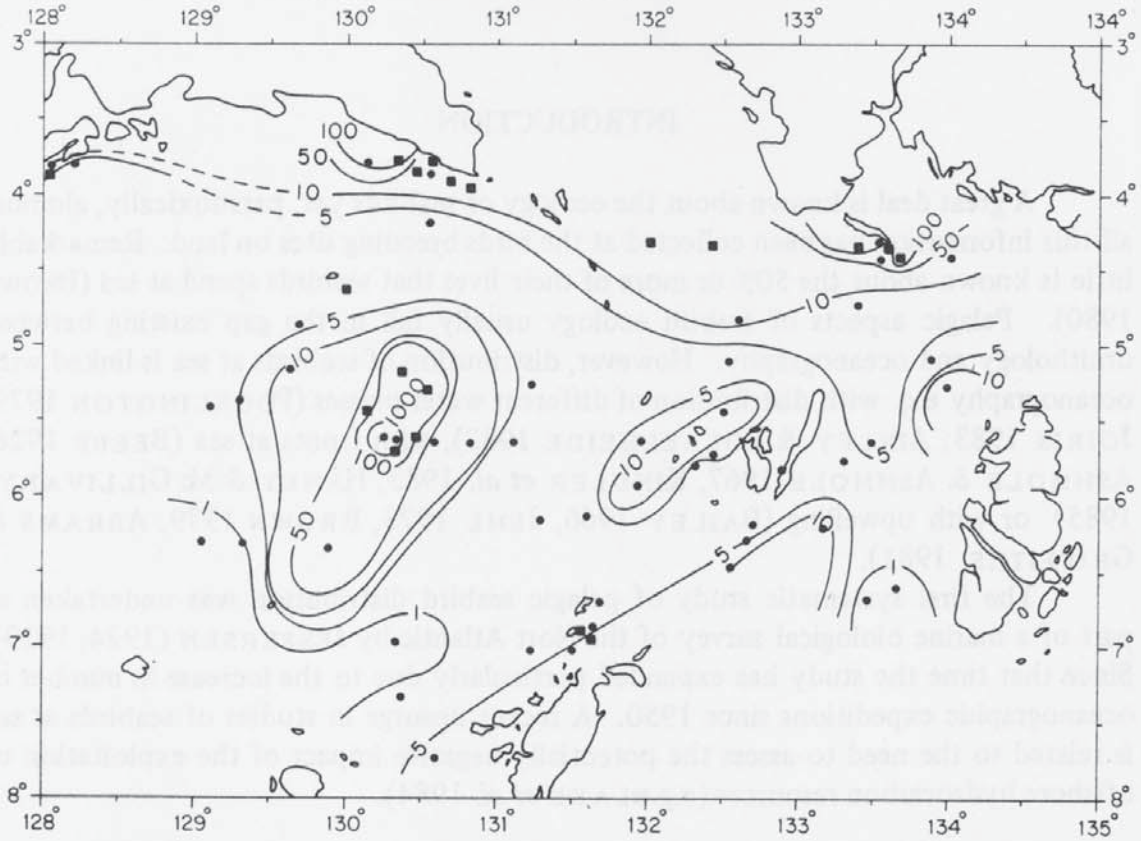

Fig. 2. Isolines for number of seabirds observed per hour, stations as in Fig. 1.

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Very few studies concern the seabirds in Indonesian waters, some data are included in avifaunal lists (VAN BEMMEL 1948, VAN BEMMEL & VOOUS 1953, MEES 1982). Many biologists have travelled in Indonesia by sea, but only few reported on seabirds (see DE KORTE 1984 and CADÉE 1985 for references). Even WALLACE (1874 : 413) only once mentions a seabird (a Red-footed Booby) and only because it landed on his ship, although he travelled extensively in the Banda Sea and 'Bird Island' for Manuk appears on the map accompanying his book. From Indonesian names and names on old maps (BLAEU 1648) we can decide however, that the presence of seabird breeding islands was well known for a long time already. Recently our knowledge of these seabird colonies has been compiled by DE KORTE (1984).

The Indonesian-Dutch Snellius II expedition for marine research in East Indonesian waters (DE WITTE 1984), offered an excellent opportunity to increase our scanty knowledge on seabird distribution at sea in Indonesian waters. The author published already data on seabird abundance in July/August 1984 in Java Şea and Banda Sea (CADÉE 1985). This paper gives data on seabird densities as observed in February/March 1985 in the Banda Sea.

METHODS

To facilitate comparison with my earlier data, methods used were the same as published in CADÉE (1985). They are virtually identical to "method III" of TASKER *et al.* (1984), but longer than 10 min watch periods were used because of usual low numbers of birds. Seabirds were counted approximately 3 hr per day, distributed regularly over the day, from the deck above the bridge of the R. V. "TYRO", 14.5 m above sealevel with a 360° observation radius. A total of 93 hr were spent observing birds at 68 stations (see Fig. 1). Station positions are based on satelite navigation (Magnavox) aboard "TYRO", positions given are those of approximately halfway the observation period. Number of stations and total observation time was about equal to that in August 1984 in the same area. For identification mainly HARRISON (1983) was used, identifications were not always possible to species level, but identification to the groups indicated in Table I posed no problems.

BIRDS OBSERVED

A review of all observations is given in Table I.

Shearwaters observed mostly were Streaked Shearwaters *(Calonectris leucomelas,* Fig. 2a), a migrant that breeds in the NW Pacific, where it returns in February/March, the main wintering area is off Irian Jaya (HARRISON 1983). They were observed all in the eastern part of the area visited, with highest numbers south of Irian Jaya, where they were either feeding or flying westward, apparently on their return to the breeding area. Those observed between Aru and Kai islands were flying

Seabirds in the Banda Sea in February/March 1985.

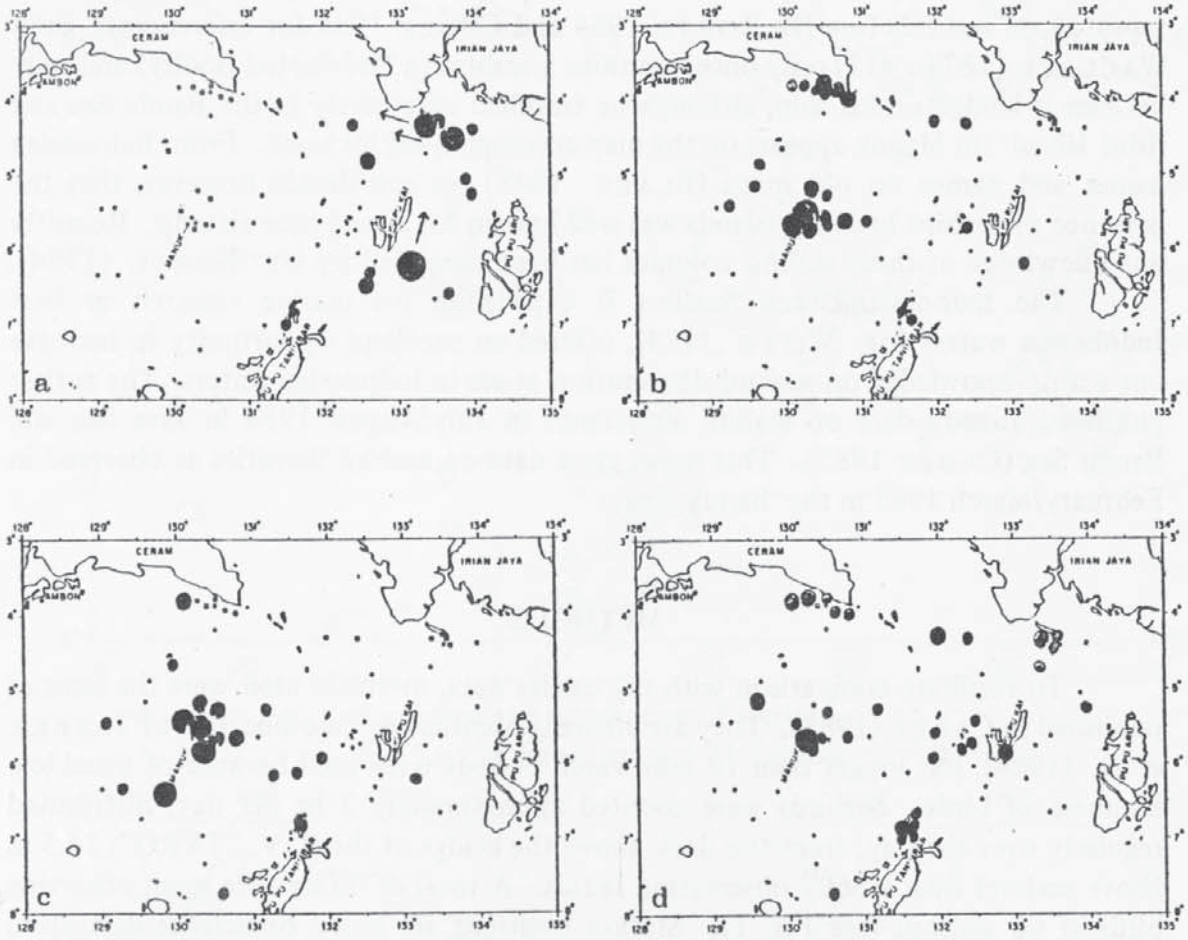

Fig. 3. Distribution of some seabirds. a) Streaked Shearwater, arrows indicate direction of migratory flight, b) Brown Booby, c) Red-footed Booby, d) Frigatebirds.
• = 0–10, ● = 10–50 and ● = > 50 specimens seen, stations with no observations indicated as in Fig. 1.

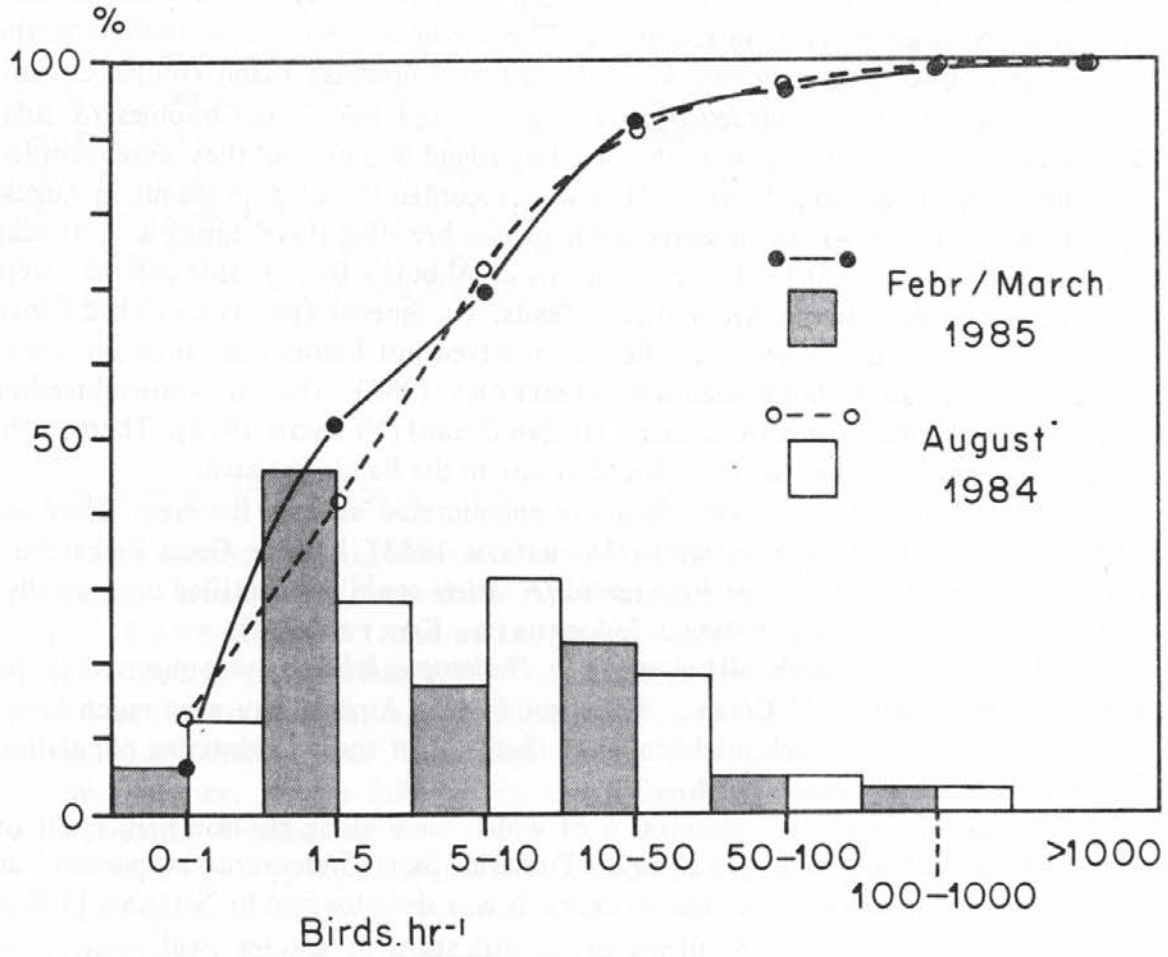

Fig. 4. Comparison of relative surface areas of the different seabird abundance categories of the isolinemaps (Fig. 3 and Cadee, 1985 Fig.3) for the two cruises, as percentage of area (histograms) and as cumulative percentage.

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northward (Fig. 3a). Tahiti Petrels *(Pterodroma rostrata)* were identified in low numbers at 6 stations all near the Kai Islands and between these islands and Irian Jaya.

The white-tailed Tropicbird *(Phaeton lepturus)* was seen at 2 stations. This species breeds in tropical oceans, DE KORTE (1984) cites only one locality (Rongkop, S. coast of Java) in Indonesia. The specimens seen did not belong to the golden apricot subspecies *fulvus,* which breeds on Christmas Island (Indian Ocean).

Brown Boobies (*Sula leucogaster,* Fig. 3b) and Red-footed boobies *(S. sula,* Fig. 3c) were most numerous near the breeding island Manuk, but they were recorded in lower numbers all over the area. They were recorded breeding on Manuk in August by DE KORTE (1984), we observed both species breeding there during a short visit on March 6 (Figs 5a, 5b). Three specimens of Abbott's Booby *(Sula abbotti)* were observed at st. 40 between Aru and Kai islands. Dr. Smeenk (pers.comm.) had drawn my attention to this species, which he had observed just before this cruise on several localities in the eastern Indonesian waters (SMEENK 1985). The only known breeding site of *Sula abbotti* is Christmas Island (Indian Ocean) (NELSON 1978). There might be another up to now undiscovered breeding site in the Banda Sea area.

Frigatebirds (Fig. 3d) were regularly encountered all over the area. They are difficult to identify to species level (HARRISON 1983), but the Great Fregatebird *(Fregata minor)* and the Lesser Frigatebird *(F. ariel)* could be identified occasionally. Both species are recorded breeding in Indonesia (DE KORTE 1984).

Phalaropes, probably all belonging to *Phalaropus lobatus,* were observed in the Bay of Ambon and S off Ceram. Their numbers in Ambon Bay were much lower than in August 1984, which might indicate that part of the overwintering population had already left towards the north.

Skuas, observed at 7 stations, 6 of which were along the southern coast of Ceram, most probably belonged all to the Pomarine Skua *(Stercorarius pomarinus),* an arctic species that winters in southern oceans. It was also observed by SMEENK (1985).

Terns posed serious problems in identification to species level, most were lumped in Table I. The Crested Tern *(Sterna bergii)* was one of the easier species to identify, it was observed at 9 stations all near to the coast (of Ceram, Irian Jaya, Tanimbar and Kai islands). Brown terns in Table I probably all belonged to the Bridled Tern *(Sterna anaethetus),* which could be identified on some occasions when near enough to the ship. They usually occurred in large flocks fishing amongst shoals of tuna and in association tith boobies, other terns and Frigatebirds. They breed at a number of locations in Indonesia (DE KORTE 1984). Noddies, probably all Brown Noddies *(Anous stolidus)* were observed at three stations around Manuk, one of their breeding sites in Indonesia (DE KORTE 1984).

QUANTITATIVE ASPECTS OF DISTRIBUTION

Seabird abundance varied considerably from station to station from 0 to nearly 1000 per hr (Table I, Fig. 2). Rich areas were found around the seabird

breeding island Manuk (Boobies, Frigatebirds, Noddies). At south of Ceram different species of (feeding) terns were abundant, indicating this place to be rich in food. In the area south of Irian Jaya, near Adi, migrating Streaked Shearwaters far outnumbered the terns and Frigatebirds.

Other research during this cruise indicated relatively high chlorophyll a values south of Irian Jaya, although not as high as during August, (GIESKES *et al.* 1987), also zooplankton displacement volumes were relatively high : 10 – 20 $cm^3.m^2$ for the upper 150 m, (Baars pers. comm.). This might indicate a relatvely good feeding area. Data collected for the area south of Ceram and around Manuk do not indicate these areas to be richer than elsewhere in the Banda Sea, so apparently nearness to the breeding site (particularly for Manuk) causes here higher densities of seabirds at sea.

DISCUSSION

COMPARISON WITH THE AUGUST 1984 CRUISE

RUMPHIUS (1741) already observed seasonal differences in the Banda Sea, particularly around Banda island. He mentioned annual recurring "milky sea" (mare album), for which he gave a more appropriate name "mare noctilucans" because of its most peculiar phosphorescence. It occurs from June to August, differs in strength from year to year and may last some years to October. This was probably a recurrent zooplankton bloom, but Rumphius failed to collect organisms causing the phosphorescence. It was followed by the presence of numerous Portuguese-man-of war *(Physalia,* "bezaantjes").

WYRTKI (1958) compared hydrographical data for the Banda Sea of the first Snellius Expedition collected at the end of the SE monsoon (October, 1929) with data collected by RV Samudera at the end of the NW monsoon (March, 1957). The latter showed a mixed layer to a depth of 60m, whereas this mixed layer was absent at the end of the SE monsoon. He postulated that between March and October the upper 60m was driven away by the SE monsoon and deeper water appeared at the surface (upwelling).

During the Snellius II Expedition it was found that primary production, chlorophyll a, macrozooplankton, micronekton, acoustic backscattering of "fish" all were higher during the August 1984 cruise (SE monsoon, upwelling period) than during the February/March 1985 cruise (NW monsoon, downwelling period) (BAARS & ZIJLSTRA 1987). Biomass and respiration activity of organisms < 50 um, as measured by ATP and ETS did not differ on average between the two seasons (VOSJAN & NIEUWLAND 1987 and pers.comm.). According to BAARS & ZIJLSTRA (1987), this might suggest that a foodweb of relatively small organisms characteristic for tropical oligotrophic seas present in the Banda Sea during the NW monsoon, is partly replaced by a short foodchain of larger organisms typical for upwelling areas during the SE monsoon. A considerable increase in fishstocks

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observed during the SE monsoon could be related to this upwelling.

Seabirds, apparently, do not respond to this increase in food during the SE monsoon. The number of birds observed during both cruises was about equal as can be judged from the distribution maps of total number of birds observed. Also the average number observed does not differ between the two cruises (about 50.hr-1), but this number is of course strongly influenced by the few stations with numbers near 1000.hr-1. and non-random distribution of the stations (too many stations in areas with high numbers). A better method to compare seabird abundance for the two cruises is to measure the areas between the isolines in Fig. 2 (this paper) and Fig.3 in CADÉE (1985). This comparison is given in Fig.4, it indicates only a slight difference in seabird abundance for the two periods, the median falls within the 1–5 birds per hour class during both periods.

Also the breeding cycle of seabirds at Manuk seems not to be influenced by a higher food availability in August. Eggs of Frigatebirds and Brown and Red-footed Boobies were observed in August (DE KORTE 1982, 1984) as well as during our short visit on March 6, 1985. This might indicate that food is not a limiting factor for the seabird abundance, nor a factor triggering egg laying.

The area with high bird abundance around Manuk was observed during both cruises and is due to the presence of a still rich breeding colony on Manuk. The rich area south of Irian Jaya has shifted more to the coast in February/March, here migrating birds form the majority. However, migrants present differed between the two cruises. In August the antarctic Wilson's Stormpetrel was encountered in high numbers, they return to the Antarctic region in November/December (HARRISON 1983). During February/March migrating birds from the northern hemisphere were dominant e.q. the Streaked Shearwater. Also part of the terns observed as well as the Phalaropes and Skuas were overwintering northern hemisphere seabirds. The rich area south of Ceram was not present in August 1984.

MANUK

Manuk was already for a long time known to seamen as a breeding island as it appears on old maps as "Vogel Eylandt" (birds island). In fact, also in the local language the word Manuk means the same. Blaeu's map of 1648 was prepared for the Spanish ambassador during the Spanish Dutch peace treaty negotiations in Munster, it particularly had to show the new Dutch discoveries to impress the Spanish counterparts. On the different Blaeu atlasses (1642–1655, 1664–1665), the name of this island does not occur. These atlasses had a wider distribution, and were probably less detailed in this area for political reasons : they might give too much information to rival nations. Manuscript maps, which were given by the Dutch East-Indian Company (VOC) to captains for use in Indonesian waters, did contain more information (VOORBEIJTEL CANNENBURG 1952). On such maps "Vogel Eylandt" for Manuk was indicated (BLAEU 1666, 1669). This knowledge, however, was lost

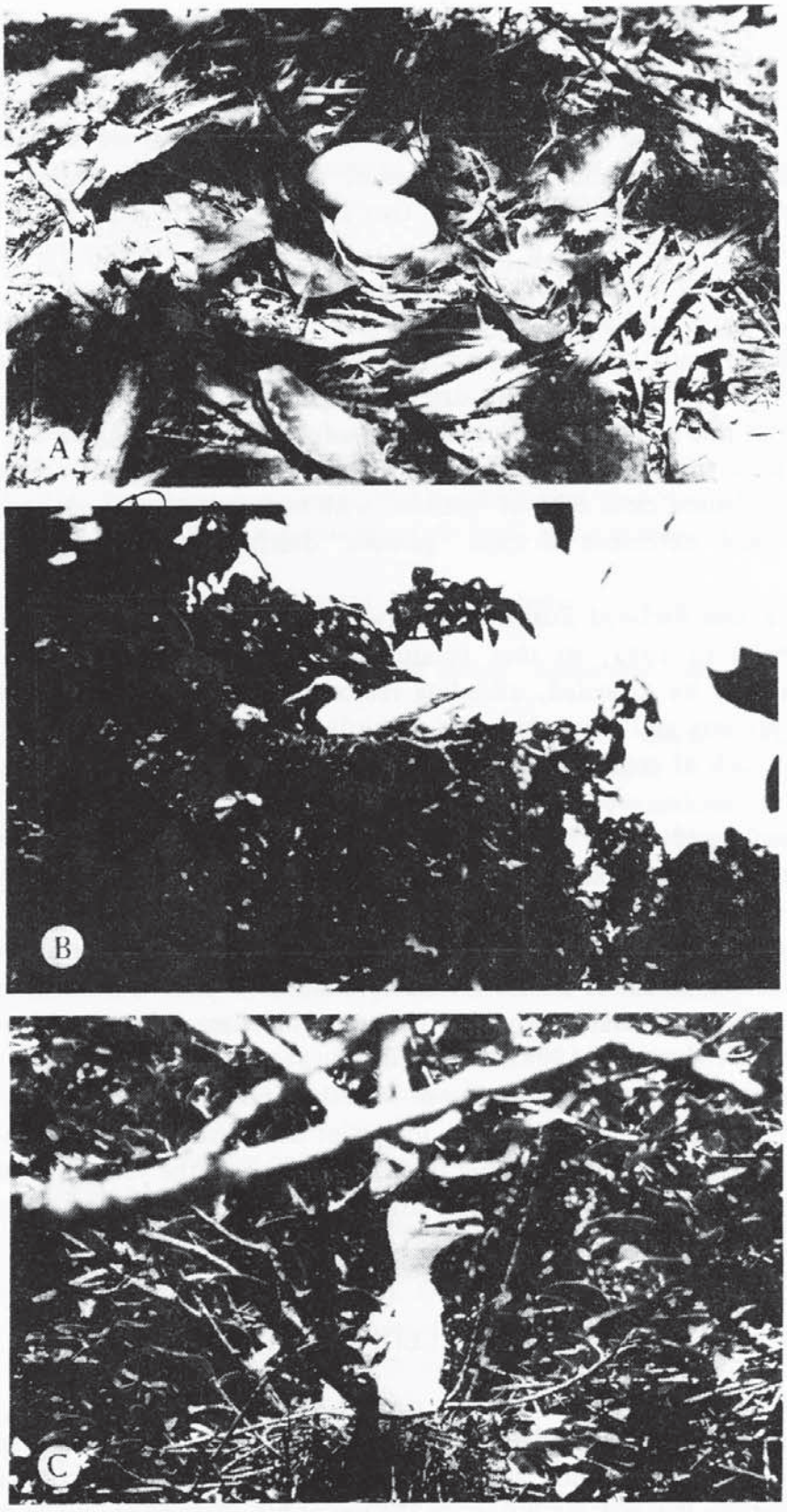

Fig. 5. Some photographs taken on March 6 during our short visit to Manuk by P.A.W.J. de Wilde : a. nest of Brown Booby, b. nest of Red-footed Booby, c. young Great Frigatebird in nest.

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and only recently Manuk has been rediscovered as a seabird breeding site (SIMPSON 1971, BOURNE 1974).

During both cruises August 1984 (CADÉE 1985) and February/March the influence of the breeding island Manuk on seabird abundance at sea is remarkable : at least 60 miles around Manuk higher densities occur of birds breeding on Manuk (Boobies, Frigatebirds). It is well known that seabirds may feed far away from their breeding site. (e.q. ASHMOLE & ASHMOLE 1967). According to DE KORTE (1984) the breeding populations of Boobies and Frigatbirds are still the largest in Southeast Asia, but probably since 1970 a great decline has started. Manuk has no resident human population (there is no fresh water), but fisherman occassionaly stay here to fish among the reefs and to dry and smoke fish ashore. This has led to the introduction of rats and cats, which will effect a further decline. Egg or bird collecting occurs but on a small scale (DE KORTE 1984), and is at present no great threat. However, the planted circa 3 ha of "garden" with bananas and coconut and especially a possible further extension of these "gardens" destroys potential seabird breeding sites.

Manuk was declared Suaka Margasatwa (nature reserve for the protection of certain animals) in 1981, so that measures to maintain Manuk as an important breeding site may be expected, including removal of the gardens and an eradication programme for rats and cats. Manuk's seabirds are very valuable indicators of fish shoals and as such of great economic importance to fishermen over a large part of the Banda Sea.

No prolonged study has ever been made of the seabirds breeding on Manuk, nor of other seabird islands in Indonesia. It would be very interesting to study breeding cycle and feeding distance (from length of incubation shifts and time between successive visits to feed a chick). This could supplement our data on seabird distribution at sea, which of course are still preliminary. Also the breeding cycle can than be compared with that in other better studied breeding colonies (ASHMOLE & ASHMOLE 1967, NELSON 1978), and regulating factors ascertained. The statement by DE KORTE (1982) that egg-laying in Manuk is confined to one season viz. the northern summer is probably incorrect. In part of their distribution area boobies have restricted breeding seasons but in other parts they have eggs the year round e.q. Brown Boobies in Christmas Island (Indian Ocean) and Red-footed Boobies on some west-pacific islands (NELSON 1978).

ACKNOWLEDGEMENTS

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Table I. Number of birds observed of the different groups discerned with date, station umber, position and observation time. (on 4 pages).

Stat. nr.	date 1985	position S	position E	total birds	observ. time	birds /hr.	Shearwaters	– Streaked	Tahiti Petrels	White-tailed Tropic birds	Boobies	– Brown	– Red-footed	– Aboott's	Frigatebirds	Phalaropes	Skuas	Terns	– Crested	– Brown	Noddies	Indet
1	0–2	3°45'	128°07'	78	1	78										72	3	3				
2	9–2	3°47'	128°12'	2	1	2												2				
3	10–2	3°48'	130°10'	214	2	107					9	2	17		16		18	2		150		
4	10–2	3°49'	130°32'	19	1	19						1			1		11	6				
5	10–2	4°13'	130°31'	2	1	2											1	1				
6	11–2	4°54'	129°43'	2	1	2						2										
7	11–2	5°06'	129°40'	12	1	12						1			11							
8	11–2	5°21'	129°17'	5	1	5						5										
9	11–2	5°20'	129°10'	2	1	2							2									
10	12–2	6°09'	129°02'	0	1.5	0																
11	12–2	6°13'	129°21'	1	1	1							1									
12	12–2	6°19'	129°55'	214	2.5	86							74							140		
13	13–2	5°31'	130°17'	>350	0.5	>700						55	203		>100							
14	13–2	5°32'	130°22'	140	1	140						56	84									
15	13–2	5°35'	130°36'	15	0.5	30						3	11								?1	
16	13–2	5°37'	130°49'	29	1	29						15	11		3							
17	13–2	5°39'	131°09'	1	1	1						1	.									

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Stat. nr.	date 1985	position S	position E	total birds	observ. time	birds /hr.	Shearwaters	– Streaked	Tahiti Petrels	White-tailed Tropic birds	Boobies	– Brown	– Red-footed	– Aboott's	Frigatebirds	Phalaropes	Skuas	Terns	– Crested	– Brown	Noddies	Indet
18	13–2	5°16'	131°15'	7	1.5	4.7							6		1							
19	14–2	5°34'	131°59'	9	1	9	1								7				1			
20	14–2	5°50'	131°59'	12	1	12							7		5							
21	14–2	6°06'	131°36'	2	1	2	1						1									
22	14–2	6°06'	131°18'	4	1	4			1				3									
23	15–2	6°50'	130°21'	0	1.5	0																
24	15–2	7°14'	130°20'	2	0.75	2.7							2									
25	15–2	7°36'	130°38'	6	1	6	2						3		1							
26	16–2	6°58'	131°13'	3	1.5	2			1				2									
27	16–2	6°55'	131°30'	5	1	5		1							1			2				1
28	16–2	6°52'	131°38'	3	0.75	4							1		2							
29	16–2	6°46'	131°36'	5	1.25	4									4				1			
30	17–2	5°44'	132°19'	3	1	3									2				1			
31	17–2	5°40'	132°21'	6	1	6						1			4							
32	17–2	5°28'	132°30'	17	1	17									7			10				
33	17–2	5°09'	132°34'	2	1	2	2															
34	17–2	4°51'	132°38'	24	1.5	16	3	18	2						1							

Stat. nr.	date 1985	position S	position E	total birds	observ. time	birds /hr.	Shearwaters	– Streaked	Tahiti Petrels	White-tailed Tropic birds	Boobies	– Brown	– Red-footed	– Aboott's	Frigatebirds	Phalaropes	Skuas	Terns	– Crested	– Brown	Noddies	Indet
35	18–2	$4^{\circ}43'$	$133^{\circ}24'$	15	2	7.5	4		1	1					7					2		
36	18–2	$4^{\circ}27'$	$133^{\circ}32'$	48	1	48	11								7			30				
37	18–2	$4^{\circ}19'$	$133^{\circ}38'$	144	1	144		48										71		25		
38	18–2	$4^{\circ}24'$	$134^{\circ}00'$	18	1	18	5	6										2	1	2		
39	19–2	$5^{\circ}05'$	$134^{\circ}21'$	2	1	2		1	1													
40	19–2	$5^{\circ}17'$	$133^{\circ}59'$	15	1.5	10		6						3	6							
41	19–2	$5^{\circ}34'$	$133^{\circ}29'$	5	0.75	6.7			5													
42	19–2	$5^{\circ}40'$	$133^{\circ}24'$	4	1	4	1		3													
43	20–2	$6^{\circ}35'$	$133^{\circ}43'$	1	1.5	0.7		1														
44	20–2	$6^{\circ}36'$	$133^{\circ}28'$	0	1	0																
45	20–2	$6^{\circ}11'$	$133^{\circ}09'$	77	1.75	44		76					1									
46	21–2	$6^{\circ}29'$	$132^{\circ}32'$	10	1	10		10														
47	21–2	$6^{\circ}24'$	$132^{\circ}37'$	5	1	5		5														
48	21–2	$6^{\circ}13'$	$132^{\circ}43'$	2	1	2	1		1													
49	21–2	$5^{\circ}43'$	$132^{\circ}53'$	13	1.5	9.3									13							
50	24–2	$4^{\circ}25'$	$133^{\circ}35'$	125	1	125		125														
51	25–2	$4^{\circ}19'$	$133^{\circ}33'$	83	2.25	34.2									3			58		22		

Seabirds in the Banda Sea in February/March 1985

Stat. nr.	date 1985	position S	position E	total birds	observ. time	birds /hr.	Shearwaters	– Streaked	Tahiti Petrels	White-tailed Tropic birds	Boobies	– Brown	– Red-footed	– Aboott's	Frigatebirds	Phalaropes	Skuas	Terns	– Crested	– Brown	Noddies	Indet
52	25–2	4°21'	133°24'	734	4	184		720				3			11							
53	26–2	4°20'	131°54'	17	1.5	11.3		1				3			8		1	4				
54	26–2	4°19'	131°30'	12	0.75	16						2			10							
55	27–2	3°50'	130°29'	46	2.5	18.4						8					3	35				
56	28–2	3°45'	130°33'	48	3	16						11			2	9	1	5	20			
57	28–2	3°45'	130°38'	50	1	50						10			1					40		
58	1–3	3°58'	130°46'	33	1	33						21			1				11			
59	2–3	4°36'	130°00'	3	1	3							3									
60	2–3	5°08'	130°24'	315	1	315						20	30								265	
61	2–3	5°16'	130°31'	168	1	168						7	36		1						123	
62	3/5–3	6°57'	131°38'	34	5	6.8						5			4			25				
63	4–3	6°51'	131°36'	20	2.5	8						1			17				1			
64	6–3	5°37'	130°20'	106	0.75	141						15	90		1							
65	7–3	5°25'	130°07'	222	2.5	89						75	140		7							
66	8–3	5°32'	130°28'	84	1	84						17	62		5							
67	9–3	3°46'	130°19'	158	1	158						5			26		5	42		80		
68	10–3	3°45'	128°07'	14	1	14										12		1	1			