

PRELIMINARY REPORT

NON-GRID PELAGIC OBSERVATIONS  
SOUTHERN ISLANDS CRUISE

November 4 to December 23, 1966

prepared by  
Richard Chandler

PRELIMINARY AT-SEA  
SURVEY REPORT  
SIC # 16  
NON-GRID AREAS

Survey Period: 4 November through 23 December 1966.

Support Vessel: U.S.N.S. SHEARWATER (T-AG 177)

Survey Personnel: Richard Crossin (Biologist-in-Charge), Kenneth Balcomb (Assistant leader-of-islands), Richard Chandler (Assistant leader-pelagic work), F. Thompson, Robert Tuxson, John Fitch, Larry Huber, Richard Heiden, Dr. Robert L. Pyle (1st-half only).

Introduction:

This report summarizes non-grid pelagic bird observations and collections made by POBSP personnel on Southern Island Cruise #16. During the survey period 13,384 birds of 42 species were recorded over 3,126 miles and 356.45

hours of observation. Eighty-three specimens of 16 species were collected. In November, a porpoise of genus Stenella (probably roseiventris or coeruleoalba) traveling in a large school was chased by K. Balcomb in the Whaler, and finally shot and collected.

Methods:

In all non-grid areas, two-man watches were maintained from sunrise to sunset. Watches were discontinued when in proximity (ca. 3-5 miles) to study islands. Bathythermograph casts were made at 4 hour intervals throughout the day. Rough weather necessitated discontinuance of B.T. casts after December 16.

Western Extension:

A major objective of this cruise was the survey of an area known as "5°N". Due to delays for mechanical repairs only part of the proposed area was investigated. The vessel sailed SW from Johnston Atoll to approximately 178°05'E; 7°25'N. then sailed SE on a course to Howland Island. The area under question is evidently a boundary zone between the equatorial current and the equatorial counter current. A correlation exists between this current situation and the bird abundance. The extent and nature of this

correlation was the object of this phase of the cruise.

Dr. Robert Pyle has prepared a summary of B.T. information and plotted the information against the bird abundance. This information is included in this report as Appendix I.

Discussion:

Non-grid observation has been divided into 4 sections comparable to the analysis presented in the previous report. See Table #9.

- "A" Oahu to Johnston Atoll.
- "B" Johnston Atoll to S.I. Grid #1, via western extension.
- "C" S.I. Grid #1, to Pago Pago American Samoa and return to grid via Phoenix Islands.
- "D" Southern Grid to Oahu.

Section "A"- Oahu to Johnston Atoll.

Overcast skies with scattered showers and moderate seas followed us to Johnston Atoll where a repair stop was made. Migrating Slender-billed Shearwaters were the major species (70%), Wedge-tails were second most abundant comprising 7% of the observations. Pomarine Jaegers were concentrated near Oahu.

Section "B"- Western Extension-Johnston Atoll to Southern Grid.

Fair weather with occasional light showers and light seas made good observing. The skiff was put into the water on November 13, 14, and 15 when collecting conditions were good. Birds showed good variety, but concentrations and feeding flocks were not common. (See Appendix #1 for analysis of B.T. data and bird abundance).

Section "C"-Grid to Samoa to grid.

Moderate weather prevailed in this leg of the survey. Birds in this section were dominated by the breeding birds in the Phoenix Islands. Large Tern flocks were seen near Enderbury, Canton and American Samoa.

Section "D"-Grid to Oahu.

High winds 35-40 nts. and high seas 25', made observations difficult on this last leg. Individual birds were infrequent and accounted for 178 (27%) of the 667 birds observed.

Flocks:

Of the 329 flocks observed, 57 (17%) were "feeding", 37 (11%) were "searching", and 235 (72%) were "traveling". (See Tables 7 and 8)

SPECIES ACCOUNTS-DIURNAL OBSERVATIONS

Laysan Albatross ( <u>Diomedea laysanensis</u> )	Total	-1
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A single individual of this species was seen ca. 400 miles SW of Oahu.

Black-footed Albatross ( <u>Diomedea nigripes</u> )	Total	-1
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The single observation was made 50 miles south of Oahu.

Wedge-tailed Shearwater ( <u>Puffinus pacificus</u> )	A=	-274
	B=	-113
	C=	-157
	D=	-73

Wedge-tails accounted for 12% of the Shearwater-petrel observations and were second in abundance to the Slender-billed Shearwater. Thirty-one per cent of the non-Slenderbill Shearwater-Petrels were Wedge-tails. In the vicinity of 8°N., 178°E., on 15 November, both color phases were present in relatively equal numbers. This broad zone of color phase overlap is not noted as strongly in the usual N-S transect further to the east. In December the clear disjunction of the color phase populations occurred roughly at 9°N (167°W).

Sooty Shearwater ( <u>Puffinus griseus</u> )	Total	-32
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Lingering Sooty Shearwaters were generally seen either in association with Slender-bills in the higher latitudes or alone between Samoa and the Phoenix Islands. The high density in the southern area was also noted in the September-October survey.

Slender-billed Shearwater ( <u>Puffinus tenuirostris</u> )	Total	-2,996
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The high number observed in the first week of November 15 evidently a tertiary migration peak. Two poorly defined peaks were noted in the first and third weeks of October (see previous non-grid report). On 6 November, 2,578 birds (86% of the species total) were recorded. The average flock size this day was 45.

Pale-footed Shearwater ( <u>Puffinus carneipes</u> )	Total	-3
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Two of the 3 observations of this straggler were in the westward extension. This species usually is recorded in the early morning or toward dusk.

Newell's Shearwater ( <u>Puffinus puffinus</u> )	Total	-1
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A single Newell's Shearwater was seen on December 18.

Audubon's Shearwater ( <u>Puffinus lherminieri</u> )	Total	-13
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As in previous surveys, all observations were from representative island populations in the Phoenix group.

New Zealand Shearwater ( <u>Puffinus bulleri</u> )	Total	-1
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One individual of this uncommon species was observed over a pod of false killer whales north of the Phoenix Islands.

Christmas Island Shearwater ( <u>Puffinus nativitatis</u> )	Total	-1
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The single bird was seen off of Phoenix Island where it breeds.

<u>Pterodroma externa</u>	A=	-73
	B=	-54
	C=	-1
	D=	-45

Of the P. externa identified to race 8 (6%) were P. e. cervicalis. Half of these were seen at the western most leg of the westward extension.

Kermadec/Herald's Petrel	Total	-12
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These two species are enough alike and poorly enough known in our area that field identification is tentative at best. Eight Kermadec's and 4 Herald's are included in the above total. Birds were seen most frequently in area "A".

Phoenix Island (?) Petrel ( <u>Pterodroma (alba?)</u> )	Total	-16
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Field identification usually allows for the possibility of the rarer Tahiti Petrel and hence the designation Phoenix Island/Tahiti Petrel. Just how frequent the Tahiti Petrel occurs is not clear, but my feeling is that it is lower than 10%.

Mottled Petrel ( <u>Pterodroma inexpectata</u> )	Total	-11
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Eight of the 11 birds recorded were seen on November 6, the same day a large number of migrating Slender-bills were moving through. A late bird was seen on 1 December, north of Samoa.

Dark-rumped Petrel ( <u>Pterodroma phaeopygia</u> )	Total	-1
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A single bird was seen ca. 300 miles south of the main Hawaiian chain.

Black-winged Petrel ( <u>Pterodroma hypoleuca</u> )	A=	-109
	B=	-124
	C=	-59
	D=	-23

Abundance and distribution of this species has remained essentially the same as in October.

White-winged Petrel ( <u>Pterodroma leucoptera</u> )	A=	-1
	B=	-23
	C=	-6
	D=	-0

Again this species caused some confusion in identification. In the extreme west part of the westward extension collecting revealed that many birds we had been recording as Black-wings were in fact P. leucoptera. There was a definite increase of White-wings to the west and at 178°E. the 2 small Pterodroma were present at about equal numbers. Under wing and belly color of P. leucoptera is highly variable and of little use in field identification. The dark head of the White-wing seems to be the best character for separating it from its pale-headed con-gener.

Bulwer's Petrel ( <u>Bulweria bulwerii</u> )	A=	-2
	B=	-17
	C=	-18
	D=	-8

Collecting from the skiff has pointed out the fact that Bulwer's Petrel is consistently not seen from bow observations. One day of skiff work resulted in 7 Bulwer's collected, while none were recorded from the bow post.

Leach's Storm Petrel ( <u>Oceanodroma leucorhoa</u> )	A=	-2(+16)
	B=	-16(+29)
	C=	-6(+27)
	D=	-1(+8)

Birds recorded as White-rumped storm Petrel or Storm Petrel species (numbers in parentheses) are surely mostly of this species. Heaviest concentrations were found in the south-western and western areas of the survey area.

Wilson's Storm Petrel ( <u>Oceanites oceanicus</u> )	Total	-2
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Two birds of this species were seen together on December 1.

White-throated Storm Petrel ( <u>Nesofregata albigularis</u> )	Total	-1
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The single bird was seen just offshore of Phoenix Island.

White-tailed Tropicbird ( <u>Phaethon lepturus</u> )	A=	-5
	B=	-8
	C=	-4
	D=	-7

White-tails were conspicuously absent in the region between Samoa and the Phoenix Islands where peak concentrations have been noted previously.

Red-tailed Tropicbird ( <u>Phaethon rubricauda</u> )	A=	-4
	B=	-7
	C=	-23
	D=	-5

Blue-faced Booby ( <u>Sula dactylatra</u> )	A=	-2
	B=	-0
	C=	-117
	D=	-2

Sixty-eight per cent of the Blue-faced Boobies were encountered in the large feeding flock northwest of Enderbury on 7 December.

Brown Booby ( <u>Sula leucogaster</u> )	A=	-5
	B=	-8
	C=	-29
	D=	-0

Twenty-four (70%) Brown Boobies were in with the large feeding flocks northwest of Enderbury.

Red-footed Booby ( <u>Sula sula</u> )	A=	-29
	B=	-3
	C=	-52
	D=	-18

Sub-adults and immatures were regularly seen far at sea on the final leg from the grid to Oahu.

Frigatebird ( <u>Fregata sp.</u> )	A=	-48
	B=	-12
	C=	-70
	D=	-0

No Frigates were recorded between the Southern Grid and Oahu in December.

Golden Plover	Total	-3
Ruddy Turnstone	Total	-9
Erolia sp?	Total	-1

Shorebirds were less common at-sea than in the September, October survey (60), a flock of 5 Ruddy Turnstones was seen off Enderbury Island.

Long-tailed Jaeger	Total	-3
Pomarine Jaeger	Total	-74
Jaeger sp.	Total	-7

In general, Pomarine Jaegers were seen in the north, close to Oahu and Longtails in the Southern Islands. An immature Pomarine was collected in the western extension.

Skua ( <u>Catharacta skua</u> )	Total	-1
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One Skua was observed in the western extension.

Sooty Tern ( <u>Sterna fuscata</u> )	A=	-20
	B=	-271
	C=	4,832
	D=	-339

The overall linear density of Sooty Terns increased two fold (from .95 birds/mile to 2.02) over the Sept.-Oct. survey. This coincides with the initiation of breeding on a number of the islands in the Phoenix group.

On December 7 over 3,000 birds were recorded in large flocks north of Enderbury. These flocks were of a peculiar nature in that the birds were in most cases circling at very exaggerated heights; up to 800-9000 feet in some cases. The flocks had the appearance of a swirl over an island before initial egg-laying. The same type of flocking behavior has been seen in the vicinity of McKean Island.

An immature Sooty Tern, banded as a local on Sand/Johnston in July, 1966 (no. 943-23575) was collected November 13 at 11 57' N., 175 49' W., some 900 miles southwest of Johnston Atoll.

Gray-backed Tern ( <u>Sterna lunata</u> )	A=	-0
	B=	-0
	C=	-171
	D=	-0

Ninety-five per cent of the Gray-backs were observed between Enderbury and Canton Islands.

Common Noddy Tern ( <u>Anous stolidus</u> )	A=	-41
	B=	-11
	C=	1,495
	D=	-15

Over 1,000 birds were congregated into several flocks in sight of Samoa on November 29th.



Hawaiian Noddy	A=	-1
	B=	-0
	C=	-14
	D=	-0
Blue-gray Noddy ( <u>Procelsterna cerulea</u> )	A=	-0
	B=	-0
	C=	-7
	D=	-0
Fairy Tern ( <u>Gygis alba</u> )	A=	-1
	B=	-18
	C=	-207
	D=	-15
Pintail ( <u>Anas acuminata</u> )	Total	-1

An immature or adult female was flushed from the surface of the water on the third day out of Oahu on November 6th.

TABLE #1. Summary of Non-Grid Pelagic Observations, SIC 16, 4 November-  
23 December 1966

Section "A". Oahu to Johnston Atoll, 4 to 8 November.

Date	Time	No. Miles	DIURNAL		
			No. Hours	No. Birds	No. Species
4 Nov.	1435-1754	28	3.32	531	10
5 Nov.	0538-1708	108	11.50	396	17
6 Nov.	0555-1729	106	11.57	2686	20
7 Nov.	0604-1742	109	11.63	343	13
8 Nov.	0615-0950	40	3.58	34	8
		<u>391</u>	<u>41.60</u>	<u>3990</u>	<u>25</u>
			NOCTURNAL		
7-8 Nov.	1742-0615	121	12.55	29	4

Section "B". Johnston Atoll to Southern Grid, via westward extension to 178°E.  
11-17 November.

			DIURNAL		
			No. Hours	No. Birds	No. Species
11 Nov.	1520-1744	22	2.36	37	8
12 Nov.	0615-1802	120	11.71	163	6
13 Nov.	1637-1819	113	11.70	61	10
14 Nov.	0646-1835	118	11.81	46	9
15 Nov.	0655-1846	103	11.85	163	20
16 Nov.	0655-1843	117	11.81	318	15
17 Nov.	0638-1837	90	11.98	265	12
		<u>683</u>	<u>73.22</u>	<u>1053</u>	<u>26</u>
			NOCTURNAL		
11-12 Nov.	1744-0615	125	12.51	25	6
15-16 Nov.	1846-0655	95	12.15	21	4
		<u>220</u>	<u>24.66</u>	<u>46</u>	<u>10</u>

Section "C". Southern Grid to Pago Pago, American Samoa and return via Phoenix Is.

			DIURNAL		
			No. Hours	No. Birds	No. Species
22 Nov.	0620-1836	121	12.26	1161	16
23 Nov.	0612-1835	125	12.38	478	17
24 Nov.	0557-1830	105	11.13	122	12
25 Nov.	0546-1345	74	7.98	111	11
29 Nov.	1620-1836	24	2.26	1288	11
30 Nov.	0550-1835	78	8.50	41	7
1 Dec.	0554-1836	113	12.70	141	14
2 Dec.	0600-1545	95	9.75	135	14
5 Dec.	0800-1100	41	3.00	146	10
7 Dec.	0810-1830	88	10.33	3921	18
8 Dec.	0622-1200	55	5.63	55	5
		<u>919</u>	<u>95.92</u>	<u>7599</u>	<u>32</u>

TABLE #1. (continued)

Section "D". Southern Grid to Oahu, 15-23 December.

Date	Time	No. Miles	DIURNAL		
			No. Hours	No. Birds	No. Species
15 Dec.	0632-1823	92	11.85	38	7
16 Dec.	0629-1809	105	11.67	28	11
17 Dec.	0625-1759	76	11.57	73	5
18 Dec.	1620-1749	68	11.48	64	7
19 Dec.	0619-1740	62	11.25	21	6
20 Dec.	0616-1734	66	11.30	200	7
21 Dec.	1615-1724	77	11.15	20	8
22 Dec.	0612-1713	86	11.02	183	7
23 Dec.	0713-1758	107	10.75	40	5
	TOTALS	739	102.14	667	20
			NOCTURNAL		
15-16 Dec.	1823-0045	53	6.36	0	0
GRAND TOTAL:					
	Diurnal:	2732	312.88	13309	
	NOCTURNAL:	394	43.57	75	

TABLE # 2. Diurnal Abundance of Species, Non-Grid Portion of SIC #16  
 -4 November - 23 December.

SPECIES	TOTAL		DENSITY: BIRDS PER/LIN. MILE			
	No. Obs.	TOTAL	"A"	"B"	"C"	"D"
Laysan Albatross	1	+	0	0	0	.001
Black-footed Albatross	1	+	0	0	0	.001
Albatross sp.	1	+	0	0	0	.001
Wedge-tailed Shearwater	617	.226	.698	.169	.171	.096
Sooty Shearwater	32	.012	.028	.001	.021	0
Slender-billed Shearwater	2996	1.11	7.21	.205	.038	0
Sooty/Slender-billed Shearwater	271	.100	.307	.137	.062	0
Pale-footed Shearwater	3	.001	.002	.003	0	0
Newell's Shearwater	1	+	0	0	0	.001
Audubon's Shearwater	13	.005	0	0	.014	0
New Zealand Shearwater	1	+	0	0	.001	0
Christmas Is. Shearwater	1	+	0	0	.001	0
Shearwater sp.	3	.001	0	.004	0	0
Juan Fernandez Petrel	138	.051	.148	.099	0	.043
White-necked Petrel	8	.003	.007	.006	.001	0
<u>Pterodroma externa</u>	14	.005	.030	.003	0	0
Kermadec Petrel	8	.003	.012	.003	0	.001
Herald's Petrel	4	.001	0	.001	.001	.003
Phoenix Is./Tahiti Petrel	16	.006	.002	.006	.008	.006
Mottled Petrel	11	.005	.025	0	.001	0
Dark-rumped Petrel	1	+	0	0	0	.001
White-winged Petrel	30	.011	.002	.034	.006	0
Small <u>Pterodroma</u> sp.	28	.010	0	.013	.003	.022
Large <u>Pterodroma</u> sp.	13	.005	0	0	0	.017
<u>Pterodroma</u> sp.	110	.041	.063	.069	.018	.031
Bulwer's Petrel	45	.016	.005	.024	.019	.011
Shearwater/Petrel	291	.107	.644	.022	.014	.015
Leach's Storm Petrel	25	.009	.005	.023	.006	.001
Wilson's Storm Petrel	2	.001	0	0	.002	0
White-throated Storm Petrel	1	+	0	0	.001	0
Storm Petrel sp.	80	.029	.041	.042	.029	.011
White-tailed Tropicbird	24	.009	.012	.012	.004	.010
Red-tailed Tropicbird	39	.015	.010	.010	.024	.007
Tropicbird sp.	5	.001	.007	0	.002	0
Blue-faced Booby	121	.044	.005	0	.116	.003
Brown Booby	42	.015	.012	.012	.030	0
Red-footed Booby	102	.037	.072	.004	.056	.024
Booby sp.	1	+	0	0	0	.001
Great Frigatebird	71	.026	.115	.013	.018	0
Lesser Frigatebird	2	.001	0	.001	.001	0
Frigatebird sp.	134	.050	.007	.004	.139	0
Golden Plover	3	.001	.002	.003	0	0
Ruddy Turnstone	9	.003	0	0	.010	0
Sharp-tailed Sandpiper	1	+	0	.001	0	0

TABLE #2. (continued).

SPECIES	-12- TOTAL		DENSITY: BIRDS PER/LIN. MILE			
	no. obs.	TOTAL	"A"	"B"	"C"	"D"
Long-tailed Jaeger	3	.001	0	.001	.002	0
Pomarine Jaeger	74	.027	.100	.001	.001	.004
Jaeger sp.	7	.003	.010	.004	0	0
Skua	1	+	0	.001	0	0
Sooty Tern	5462	2.02	.051	.398	5.26	.460
Gray-backed Tern	171	.063	0	0	.187	0
Common Noddy Tern	1562	.580	.104	.016	1.61	.020
Hawaiian (White-capped) Noddy	15	.005	.002	0	.015	0
Blue Gray Noddy	7	.003	0	0	.008	0
Fairy Tern	241	.089	.002	.027	.225	.020
Tern sp.	66	.023	0	0	.044	.034
Pintail	1	+	.002	0	0	0
Bird sp.	80	.030	.160	.018	.001	.004
TOTAL	13309	4.92	10.2	1.54	8.27	.902

TABLE #3. Nocturnal Abundance of Species, Non-Grid Portion of SIC #16  
 -4 November - 23 December 1966.

Species	No. Observed	Linear Density	
		Birds/Mile	
Slender-billed Shearwater	2	.005	
Sooty/Slenderbilled Shearwater	2	.005	
Juan Fernandez Petrel	5	.012	
Black-winged Petrel	7	.018	
Small <u>Pterodroma</u> sp.	5	.012	
Large <u>Pterodroma</u> sp	2	.005	
<u>Pterodroma</u> sp.	7	.018	
Shearwater/Petrel	14	.038	
Leach's Storm Petrel	1	.003	
Tropicbird sp.	1	.003	
Jaeger sp.	1	.003	
Sooty Tern	16	.040	
Tern sp.	3	.003	
Bird	9	.023	
	*		
Total	75	.190	

TABLE # 4. Diurnal Abundance by Species Group, Non-Grid Portion of SIC #16.

Group	No. Obs.	Total % Obs.	Total	Linear Density			
				A.	B.	C.	D.
Albatrosses	3	+	.001	0	0	0	.004
Shearwaters	4011	30.2	1.19	10.1	.555	.308	.100
<u>Pterodroma</u> sp.	680	5.1	.251	.702	.401	.103	.134
Shearwater/Petrels	5053	38.0	1.87	11.9	.991	.455	.260
Storm Petrels	108	0.8	.040	.056	.065	.041	.012
Procellariiformes	5161	38.8	1.91	11.9	1.09	.486	.272
Tropicbirds	68	.5	.025	.037	.023	.031	.016
Boobies	266	2.0	.098	.112	.016	.215	.029
Frigates	207	1.6	.077	.150	.019	.160	0
Shorebirds	13	.1	.005	.003	.004	.009	0
Terns	7524	56.6	2.79	.94	.459	7.36	.547
Jaegers	77	.5	.028	.122	.003	.003	.004
Unidentified	82	.6	.029	.200	.019	.002	.004

TABLE #5. Specimens Collected At-Sea, Non-Grid, SIC #16.

Wedge-tailed Shearwater	7
Juan Fernandez Petrel	13
Herald's Petrel	2
Black-winged Petrel	16
White-winged Petrel	6
Bulwer's Petrel	9
Leach's Storm Petrel	7
Red-tailed Tropicbird	3
White-tailed Tropicbird	2
Brown Booby	2
Red-footed Booby	1
Pomarine Jaeger	1
Long-tailed Jaeger	1
<u>Erolia</u> sp.	1
Sooty Tern	20
Common Noddy Tern	1
Blue-grey Noddy	1
Blue-faced Booby	1
Sanderling	1
Lesser Frigatebird	1

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TOTAL 92

Porpoise, Stenella sp? 1  
-complete measurements; skeleton preserved.

TABLE #6. Color Marked Birds Observed, SIC #16 Non-Grid.

<u>Species</u>	<u>Date</u>	<u>Location</u>	<u>Marking</u>	<u>Miles from Ork.</u>
Great Frigatebird	11 Nov.	Channel Johnston Atoll	Orange-Streamer	5
Brown Booby	11 Nov.	Offshore Johnston Atoll	Orange-Streamer	5
Brown Booby	11 Nov.	Offshore Johnston Atoll	Orange-Streamer	5
Brown Booby	11 Nov.	Offshore Johnston Atoll	Orange-Streamer	5
Brown Booby	11 Nov.	Offshore Johnston Atoll	Orange-Streamer	5
Common Noddy	11 Nov.	Offshore Johnston Atoll	Orange-Streamer	5



TABLE #7. Composition of Flocks by Species - Diurnal, Non-Grid SIC 16.

SPECIES	No. Birds in Flocks	% of Species Occurring in Flocks
Wedge-tailed Shearwater	419	.68
Sooty Shearwater	1	.03
Sooty/Slender-billed Shearwater	3050	.93
Juan Fernandez Petrel	33	.24
White-necked Petrel	1	.13
Kermadec Petrel	2	.25
Black-winged Petrel	56	.19
Large Pterodroma sp.	12	.92
Small Pterodroma sp.	15	.54
Pterodroma sp.	32	.29
Bulwer's Petrel	1	.02
Shearwater/Petrel	233	.78
Storm Petrel	11	.10
Blue-faced Booby	66	.55
Brown Booby	24	.57
Red-footed Booby	62	.61
Lesser Frigatebird	1	.5
Great Frigatebird	48	.68
Frigate sp.	124	1.00
Ruddy Turnstone	5	.55
Pomarine Jaeger	24	.32
Long-tailed Jaeger	1	.33
Jaeger sp.	2	.29
Sooty Tern	5088	.93
Gray-backed Tern	152	.88
Common Noddy Tern	1529	1.02
Hawaiian Noddy Tern	11	.73
Blue-gray Noddy	1	.142
Fairy Tern	179	.742
Tern sp.	65	.98
Bird sp.	50	.63
Total	11295	100%

TABLE # 8. Composition of Flocks by Groups - Diurnal Non-Grid SIC 16.

SPECIES	No. Birds In Flocks	% of Species Occurring in Flocks
Shearwaters	3470	.87
Pterodroma sp.	151	.22
Shearwater/Petrel	3855	.76
Storm Petrel	11	.10
Booby	152	.57
Frigatebird	173	.83
Jaeger	27	.35
Tern	7022	.93
Misc.	55	.55
TOTAL	11295	84%

TABLE #9. Area Comparison SIC #15 - SIC #16.

Section	No. Birds	No. Miles	Lin. Density	No. Species
A Sept.	899	397	2.72	21
A Nov.	3990	391	10.2	25
B Sept.	1498	332	4.51	21
B Nov.	1053	683	1.54	26
C Sept.-Oct.	3752	1097	3.42	31
C Nov.-Dec.	7599	919	8.27	32
D Oct.	1190	865	1.38	27
D Dec.	667	739	.902	20

## APPENDIX I

### BATHYTHERMOGRAPH OBSERVATIONS

-by Robert Pyle

Bathythermograph (BT) casts were taken at 4-hour intervals in sectors A, B, and C of the cruise, except when in port or anchored off islands. BT instrument number KK09297 was lost during the night of November 5-6; number KK09299 was used for the remainder of the cruise. The calibrated grid supplied with the instrument was used to determine temperature values at various depths. From these, a running plot was kept of the thermal structure of the sea along the cruise track. The BT casts regularly reached 200 meters depth, and frequently reached 250 meters.

The surface layer of the ocean normally is well-mixed and isothermal, or nearly so. This mixed layer usually has a sharply defined base below which is the thermocline where the temperature cools abruptly with depth.

When leaving Johnston Island (near 17°N) November 11, the base of the mixed layer was found at 75 meters depth. As the ship proceeded southwestward, the mixed layer became shallower. Its base rose gradually but steadily to a depth of only 30 meters between 10° and 9° north latitude. As the cold water below the mixed layer rose closer to the surface, the temperature at 150 meters depth cooled steadily from 22.5°C near Johnston to 13.5° at 10°N. (see Figure 1). This region where the base of the surface mixed layer tilts upward toward the south, and the underlying water cools toward the south, is the region of the westwardly flowing North Equatorial Current (NEC).

At about 10°N, the ship passed out of the NEC into the eastwardly flowing Equatorial Countercurrent (ECC). The surface mixed layer immediately began to thicken. Its base sank steadily to 180 meters depth, and the temperature at 150 meters rose correspondingly, reaching a high of 27.2° at 4°N (Figure 1).

At this latitude, the ship crossed the southern boundary of the ECC into the westwardly flowing South Equatorial Current (SEC). The temperature at 150 meters began to cool again, the deeper portions of the mixed layer were replaced by cooler water, and a new base to the surface mixing formed near 75 meters depth, gradually rising to 50 meters as the ship entered the Southern Grid at 2°N.

Figure 1 also shows a plot of total birds sighted each day, for comparison with sea temperature at the surface and at 150 meters depth. Bird numbers were moderate from Johnston Island to 14°N, then dropped significantly in the NEC and the northern edge of the ECC. However, the birds then increased southward to a peak value near the southern boundary of the ECC, and dropped off again as the ship passed into the SEC and approached the Southern Grid. Bird numbers show a very good correlation with the 150 meter temperature, but do not correlate well with surface temperature. The 150 meter temperature itself is not the property of significance to the birds. Rather, the temperature at this depth is probably a good indicator of differing water masses, whose differences in food content at the surface are the more likely reason why birds are concentrated in favored zones.

The temperature plots in Figure 1 are based on a preliminary analysis of the BT data performed at sea. A refined analysis will be performed by the Honolulu Laboratory, Bureau of Commercial Fisheries, which may be expected to modify the temperature data negligibly if at all.

SOUTHERN GRID

PRELIMINARY REPORT AT-SEA SURVEY NO. 12

18-21 November 1966

by

Richard S. Crossin

SOUTHERN GRID  
PRELIMINARY REPORT AT-SEA SURVEY NO. 12  
18-21 November 1966

This report is based upon the observations and collections made within the Southern Grid during the period 18-21 November 1966. Considerable loss of time at Johnston Atoll for ship repair necessitated a shortened grid survey. Attempts were made to cover as much area in all major directions from the central islands as possible during the time available. Distal portions of the east and northeast sectors were not adequately covered by diurnal observations (see Figure 1).

The Smithsonian survey party included Richard Crossin (Biologist in Charge), Dr. Robert Pyle, Kenneth Balcomb, Richard Chandler, Lawrence Huber, John Fitch, Richard Heiden, Chris Thompson, and Robert Tuxson. The grid cruise was made aboard the U.S.N.S. SHEARWATER (T-AG 177). Excellent cooperation and assistance were received from the officers and crew members.

Diurnal observations were maintained from sunrise to sunset, except during the process of unloading and picking up personnel and equipment at Howland and Baker Islands. During the grid survey a total of 407 miles and 43 hours of diurnal observations was completed (Table 1). During this period 2,568 birds of 22 species

were recorded and 13 specimens of three species were collected. A combination of rough seas and mechanical failures prevented use of the skiff for collecting purposes. It was run only on 20 November for a period of 2¼ hours, but 92 % of the total birds collected were taken during this short span. Attempts to enter mixed feeding flocks with the ship in order to view streamered birds this month proved fruitless. Most flocks encountered were not feeding intensely and the birds usually scattered upon approach of the ship. An estimate of the percentage of Sooty Terns which were glassed throughout the grid period is difficult to make, but twenty-five percent does not seem improbable. No streamered terns were recorded. Although no terns are breeding on Howland at this time, considerable numbers are still present over the island. A flock estimated at 3,000 birds which was carefully scanned as they hovered over the beach contained no streamered birds. Apparently birds which formed the breeding colony during July and August which were heavily streamered have already moved out of the grid area. The Baker Island area utilized by Howland based birds since last spring is still attracting large numbers of terns, boobies and frigates, but the lack of marked birds leaves their origin in doubt. However, the sighting of most large, mixed feeding flocks within 20 miles distance of the islands indicates that grid birds might be Howland based.

Nocturnal observations were ordinarily maintained from sunset to sunrise. A total of 512 miles and 56 hours were completed in

the grid, during which 351 birds of 11 species were observed. No nocturnal collecting was attempted during the cruise. Most sightings were of Sooty Terns recorded on the night of 20-21 November southeast of Howland. Sightings were almost continuous from about 45 miles from Howland to the island; most birds were headed southeast and apparently coming from the island. Gray-backed Terns were recorded during nocturnal observations but not seen during the day.

Density (birds/linear mile) was slightly higher than last month (6.31-4.86) and considerably higher than November 1965 when a density of only 1.15 was recorded. Sooty Terns were the dominant species during the present cruise and accounted for 60 % of total birds. Boobies and frigates were also abundant and represented 13 and 7 % of total birds respectively. Sooty/Slender-billed Shearwaters, apparently terminating their fall migration, made up only 13 % of total birds.

SPECIES ACCOUNTS

Wedge-tailed Shearwater ( 66 + 3 nocturnal)

From an almost total absence in August 1966 (1 sighting), this species has steadily increased. Throughout this period, however, dark phase birds have consistently been noted north of the grid area. All sightings during the present cruise were of dark phase southern hemisphere birds. The majority were recorded in mixed feeding flocks south of Baker Island on 20 November. Approximately the same density was recorded for the species during November 1965.

Sooty Shearwater (6 + 1 nocturnal)

Slender-billed Shearwater (222 + 4 nocturnal)

Sooty/Slender-billed Shearwater (106 + 1 nocturnal)

Without much doubt the vast majority of birds of this bi-species complex were Slender-billed Shearwaters. These were predominant throughout the entire fall 1966 migration with only a few individuals referable to Sooty Shearwaters. After a great migration influx of these species during September, a lull seemingly occurred during October when less than 100 birds were recorded. The considerable rise in numbers during the present cruise is unusual compared to the 1965 migration in that after the great September 1965 horde passed through, numbers decreased steadily until the migration period ended. Only small to medium-sized flocks were noted during the present cruise and a considerable number of single birds were recorded. A few individuals were noted feeding.



Newell's Shearwater (2)

This species has been recorded irregularly in very low numbers. Apparently only a few stragglers pass through and the grid area is not considered to be a regularly frequented area of the species.

New Zealand Shearwater (1)

Good observations were made of a single individual and represent the first evidence of this species in the grid area. Birds moving from northern waters to the southern hemisphere breeding grounds apparently pass through the equatorial area eastward of the grid.

Little Shearwater (1)

Good observations were made of a single bird tentatively identified to this species. There exists considerable possibility of confusing this species with Audubon's Shearwater.

Juan Fernandez Petrel (4)

This species is irregularly recorded in the grid in low numbers except during migration. Unlike the Sooty/Slender-billed Shearwater migration, movement is unhurried with birds advancing in a broad front with continuous foraging along the route. During the present cruise south from the Hawaiian Islands, birds were numerous to 10° N, with only occasional scattered sightings from there southward.

Phoenix Island/Tahitian Petrel (5)

Since these two species cannot be satisfactorily separated in the field, all sightings must remain referable to either species. Closeness of the breeding grounds and a greater number of collected specimens of Phoenix Island Petrels indicate that this species is the more abundant one in the area.

Black-winged Petrel (37)

This form is common in the grid from July through December and absent from January through May. Small numbers utilize the grid as a "wintering" area, with greater numbers passing through northward in July. Sightings are invariably of single birds. The majority of 34 birds recorded only to Pterodroma species during the present cruise are probably referable to this species, but easy confusion is possible between this and Cook's and White-winged Petrels.

White-winged Petrel (5 + 1 nocturnal)

Birds of this species presently utilizing the grid area belong to the race P.l. brevipes, an exceedingly variable form in regards to amount of melanism present in individual birds. This race was found to be more abundant northwest of the grid area and largely replaced the Black-winged Petrel in that area. The grid appears to be within the eastward limits of its wintering range. A lighter race, either P.l. leucoptera or P.l. masafueræ, has also been collected in the grid.

Bulwer's Petrel (1)

This species has been consistently recorded in very low numbers except for a large migration movement through the area during March 1966.

Leach's Storm Petrel (2)

white-rumped storm petrels (18 + 8 nocturnal)

Comparatively very low numbers of storm petrels were encountered in the grid during the present survey. Until the present cruise the distribution of white-rumped storm petrels in the grid seemed fairly predictable. To begin with, during the first grid survey in September 1965 no white-rumped storm petrels were recorded. During the following month all three species known to frequent the grid (Wilson's, Harcourt's and Leach's) were represented, Harcourt's and Wilson's in low numbers. Birds increased greatly during the November-December and January 1966 surveys; the vast majority of birds referable to Leach's. Numbers remained fairly uniform through spring 1966 when an expected drop occurred as Leach's moved back to the Aleutians with the advent of the breeding season. A small population of presumed pre-breeding birds remained throughout the summer and early fall of 1966. A rather early influx of post-breeding Leach's (judging by 1965 movements) moved into the area during September 1966 and numbers remained at the same density through October. As expected, a small number of Wilson's were noted during both months. Instead of the expected increase

in the group for November, a 62 % decrease in density occurred. The reasons for this unexpected decrease are unknown at present.

Red-tailed Tropicbird (6 + 1 nocturnal)

Low density comparable to that of November-December 1965 was noted during the present cruise. Higher numbers have been recorded consistently during the breeding season on Howland from July through October 1966. A high percentage of the birds utilizing the grid, however, are from other areas as shown by collection of banded birds. Only three such birds have been collected at sea, all in the Southern Grid, and respectively from Jarvis Island, Christmas Island and Enderbury Island.

Blue-faced Booby (285 + 6 nocturnal)

Density rose from 0.26 during October 1966 to 0.70 during the present cruise. This is considered to be primarily the result of increased cruise activity in the vicinity of the islands, and in part to a buildup in the breeding population on Howland. The majority of sightings were within 10 miles of Howland. A total of 15 Howland blue-streamered birds were recorded during the cruise, at distances of up to 20 miles from Howland. The majority of these were immature birds which are greatly attracted to the ship.

Brown Booby (9)

Numbers of this species are consistently low and correspond to the small stable population on Howland. As suggested in previous reports, fluctuation in number of sightings are usually the result of increased or decreased cruise activity near the islands.

Red-footed Booby (47 + 4 nocturnal)

Eighty -five percent of total sightings were recorded in a large feeding flock approximately 20 miles southwest of Baker Island. Sightings of this species at distances of more than a few miles from the islands are usually in mixed feeding flocks.

Great Frigatebird (1)

Lesser Frigatebird (45)

frigatebird species (131 + 1 nocturnal)

Frigatebird density has been decreasing constantly since the peak reached in August 1966 at the height of the nesting season. Frigatebirds were uniformly abundant each day during the present cruise; the vast majority of birds in close association with mixed feeding flocks. The greatest portion of unidentified birds are considered to be Lesser Frigatebirds according to both the ratios of identified birds and the numbers of each species presently breeding on Howland Island.

Ruddy Turnstone (6)

All six individuals were seen in one flock just north of Baker Island on 21 November. Numbers of shorebirds greatly decreased from last month and most birds are considered to be on their respective wintering islands by this time.

Sanderling (1)

The single individual was collected just offshore Baker Island on 20 November. This represents the first at-sea record in the grid, although a few individuals are recorded each winter on the islands and must logically pass through the grid area.

Sooty Tern (1532 + 280 nocturnal)

Sooty Terns were by far the dominant species in the grid and accounted for 60 % of total birds. A total of 11 specimens was collected between Baker Island and 20 miles to the southeast. None of these were banded. A very few immatures and one subadult bird were noted among feeding flocks. Sooty Terns comprised 68.4 % of total flocks including migrating Sooty/Slender-billed Shearwater flocks. A slightly greater density was recorded during the present cruise than last month, but is not considered to be great enough to suspect influxes from other breeding islands. Birds presently swirling over Howland Island apparently are not part of the larger colony which nested during the summer because of the total lack of marked birds. Those now present likely represent a portion of the island population which has recently come into the area. The scarcity of immature birds in the grid this month also indicates that the summer population has moved out. No important changes in the feeding areas used are apparent from last summer; the area about Baker is still being heavily utilized.

Common Noddy (1)

This species has always been recorded in low numbers which are not indicative of the population based on Baker, where considerable cruise activity takes place.

Gray-backed Tern (12 nocturnal)

Birds were recorded only at night, and many of these were identified by the distinctive call. The species is probably overlooked during the day because of the similarity to the abundant Sooty Terns.

TABLE 1. Summary of Southern Grid observations during the period 18-21 November 1966.

<u>Date</u>	<u>DIURNAL</u>			
	<u>No. Miles</u>	<u>No. Hours</u>	<u>No. Birds</u>	<u>No. Species</u>
18 November	90	10.6	659	14
19	127	11.0	878	13
20	90	11.2	630	17
21	<u>100</u>	<u>10.0</u>	<u>401</u>	<u>11</u>
TOTALS	407	42.8	2,568	22 (13.8/day)
	<u>NOCTURNAL</u>			
17-18	90	11.3	18	5
18-19	105	11.9	23	6
19-20	109	11.8	19	5
20-21	116	11.9	265	6
21-22	<u>92</u>	<u>9.4</u>	<u>26</u>	<u>4</u>
TOTALS	512	56.3	351	11 (5.2/night)
GRAND TOTALS	919	99.1	2,919	23

Red-footed Booby (47 + 4 nocturnal)

Eighty -five percent of total sightings were recorded in a large feeding flock approximately 20 miles southwest of Baker Island. Sightings of this species at distances of more than a few miles from the islands are usually in mixed feeding flocks.

Great Frigatebird (1)

Lesser Frigatebird (45)

frigatebird species (131 + 1 nocturnal)

Frigatebird density has been decreasing constantly since the peak reached in August 1966 at the height of the nesting season. Frigatebirds were uniformly abundant each day during the present cruise; the vast majority of birds in close association with mixed feeding flocks. The greatest portion of unidentified birds are considered to be Lesser Frigatebirds according to both the ratios of identified birds and the numbers of each species presently breeding on Howland Island.

Ruddy Turnstone (6)

All six individuals were seen in one flock just north of Baker Island on 21 November. Numbers of shorebirds greatly decreased from last month and most birds are considered to be on their respective wintering islands by this time.

Sanderling (1)

The single individual was collected just offshore Baker Island on 20 November. This represents the first at-sea record in the grid, although a few individuals are recorded each winter on the islands and must logically pass through the grid area.



TABLE 2. Diurnal density of Species Groups in the Southern Grid,  
18-21 November 1966.

<u>Species Group</u>	<u>No. Birds</u>	<u>Birds/Sq. Mi.</u>	<u>-Est. Pop. for 67,000 Sq. Mi.</u>	<u>% Total Birds</u>
Shearwater-Petrel	484	0.59	39,900	18.9
Storm Petrel	20	0.05	3,400	0.8
Tern	1,533	1.26	85,200	59.7
Tropicbird	6	0.01	700	0.2
Booby	341	0.42	28,400	3.2
Frigatebird	177	0.11	7,500	6.9
Shorebird	<u>7</u>	<u>0.02</u>	<u>1,400</u>	<u>0.3</u>
TOTALS:	2,568	2.46	166,500	100.0 %

TABLE 3. Diurnal abundance of Species in the Southern Grid, 18-21 November 1966.

<u>Species</u>	<u>No. Birds</u>	<u>Birds/Lin. Mi.</u>	<u>No. Coll.</u>	<u>Status over last Month</u>
Wedge-tailed Shearwater	66	0.14		+
Sooty Shearwater	6	0.01		+
Slender-billed Shearwater	222	0.55		+
Sooty/Sl.-billed Shearwater	106	0.26		+
Newell's Shearwater	2	0.005		+
New Zealand Shearwater	1	0.002		+
Little Shearwater	1	0.002		+
Juan Fernandez Petrel	4	0.01		+
Phoenix Island/Tahitian Petrel	5	0.01		+
Black-winged Petrel	37	0.09		+
White-winged Petrel	5	0.01		-
<u>Pterodroma species</u>	21	0.05		+
Bulwer's Petrel	1	0.002		-
shearwater-petrel	7	0.01		-
Leach's Storm Petrel	2	0.005	1	-
white-rumped storm petrels	18	0.04		-
Red-tailed Tropicbird	6	0.01		-
Blue-faced Booby	285	0.70		+
Brown Booby	9	0.02		-
Red-footed Booby	47	0.12		+
Great Frigatebird	1	0.002		-
Lesser Frigatebird	45	0.11		-
frigatebird species	131	0.32		-
Ruddy Turnstone	6	0.01		-
Sanderling	1	0.002	1	+
Sooty Tern	1532	3.76	11	-
Common Noddy	<u>1</u>	<u>0.002</u>	<u>1</u>	<u>-</u>
TOTALS	2568	6.31	13	+

TABLE 4. Nocturnal abundance of Species in the Southern Grid, 17-18....  
21-22 November 1966.

<u>Species</u>	<u>No. Birds</u>	<u>Birds/Lin. Mi.</u>	<u>No. Coll.</u>
Wedge-tailed Shearwater	3	0.006	
Sooty Shearwater	1	0.002	
Slender-billed Shearwater	4	0.01	
Sooty/Slender-billed Shearwater	1	0.002	
White-winged Petrel	1	0.002	
<u>Pterodroma species</u>	13	0.03	
shearwater-petrel	11	0.02	
white-rumped storm petrels	8	0.02	
Red-tailed Tropicbird	1	0.002	
Blue-faced Booby	6	0.01	
Red-footed Booby	4	0.01	
frigatebird species	1	0.002	
Sooty Tern	280	0.55	
Gray-backed Tern	12	0.02	
bird species	<u>5</u>	<u>0.01</u>	<u>    </u>
TOTALS	351	0.69	0

TABLE 5. Color-marked birds observed in the Southern Grid, 18-21 November 1966.

<u>Species</u>	<u>Age</u>	<u>Date</u>	<u>Color Mark</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Distance from Origin</u>
Blue-faced Booby	Ad.	18 Nov.	Blue Streamer		offshore Howland	---
Blue-faced Booby	Ad.	18	Blue Streamer		offshore Howland	---
Blue-faced Booby	Ad.	19	Blue Streamer	0°-46' N	176°-22' W	16
Blue-faced Booby	Ad.	19	Blue Streamer	0°-47' N	176°-32' W	6
Blue-faced Booby	Imm.	19	Blue Streamer	0°-47' N	176°-32' W	6
Blue-faced Booby	Imm.	19	Blue Streamer	0°-47' N	176°-33' W	5
Blue-faced Booby	Imm.	19	Blue Streamer	0°-47' N	176°-33' W	5
Blue-faced Booby	Imm.	19	Blue Streamer	0°-46' N	176°-46' W	8
Blue-faced Booby	Imm.	19	Blue Streamer	0°-45' N	176°-48' W	10
Blue-faced Booby	Imm.	19	Blue Streamer	0°-44' N	176°-50' W	12
Blue-faced Booby	Ad.	19	Blue Paint	0°-44' N	176°-52' W	14
Blue-faced Booby	Imm.	21	Blue Streamer	0°-45' N	176°-32' W	3
Blue-faced Booby	Imm.	21	Blue Streamer	0°-45' N	176°-39' W	2
Blue-faced Booby	Imm.	21	Blue Streamer	0°-31' N	176°-35' W	17
Blue-faced Booby	Imm.	21	Blue Streamer	0°-28' N	176°-34' W	20

TABLE 6. Diurnal abundance of Flocks\* in the Southern Grid, 18-21 Nov. 1966.

<u>Date</u>	<u>No. Flocks</u>	<u>No. Birds</u>	<u>% Shearwater- Petrel</u>	<u>% Tern</u>	<u>% Booby</u>	<u>% Frigate</u>
18 November	22	515	32.4	37.1	20.6	9.7
19	26	744	4.3	85.9	6.3	3.5
20	8	540	12.0	68.3	9.5	10.0
21	15	278	1.5	78.8	12.2	7.0
TOTALS	71	2077	11.9	68.4	10.5	7.2

Average flock size = 29

\* Includes Sooty and Slender-billed Shearwater flocks.

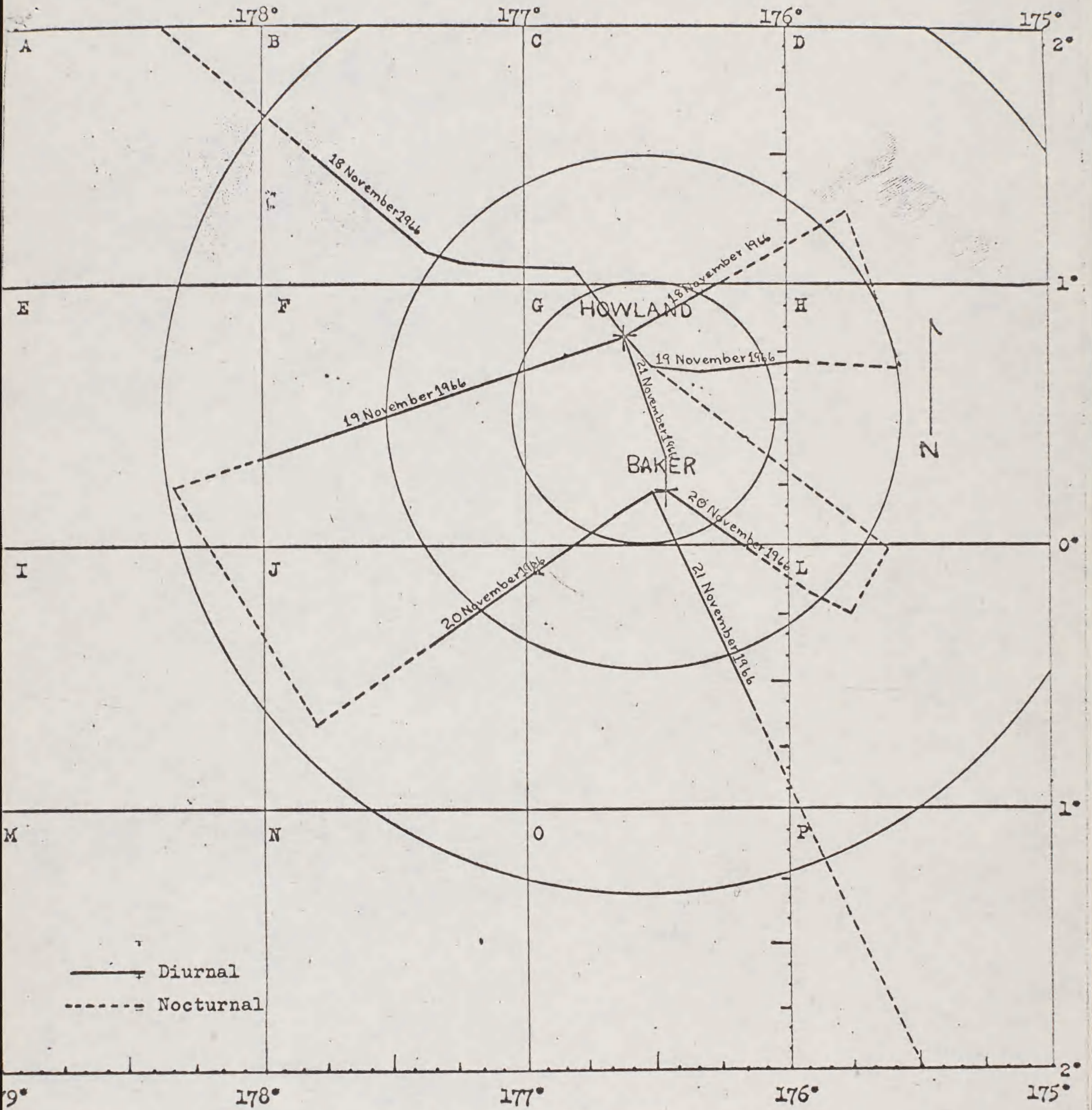


Figure 1. Southern Grid No. 12 cruise track, 18-21 November 1966.

Scale: 2 inches = 60 miles at 0° latitude.

RIP (2)

SOUTHERN GRID

PRELIMINARY REPORT AT-SEA SURVEY NO. 13

8-14 December 1966

by

Richard S. Crossin

## SOUTHERN GRID

### PRELIMINARY REPORT AT-SEA SURVEY NO. 13

8-14 December 1966

This report is based upon the observations and collections made within the Southern Grid during the period 8-14 December 1966. Considerably more time was available than during November 1966 and a more thorough survey was conducted during December. As usual, the immediate area about Howland and Baker received the greatest coverage during the process of unloading and picking up island survey teams. The peripheral areas, distal from the two islands, were more adequately surveyed than during a number of previous cruises (see Figure 1).

The Smithsonian survey party included Richard Crossin (Biologist-in-Charge), Kenneth Balcomb, Richard Chandler, Lawrence Huber, John Fitch, Richard Heiden, Chris Thompson and Robert Tuxson. Balcomb, Huber and Tuxson were on Howland during much of the grid survey. The grid cruise was made aboard the U.S.N.S. SHEARWATER (T-AG 177). Differences of opinion existed between the ship's master and everyone else concerned regarding the conditions of the sea for skiff operation and surf conditions at Baker for an island landing. At any rate, neither operation was performed during the survey.

Diurnal observations were maintained from sunrise to sunset while in the grid area, except during the process of unloading and picking up personnel and equipment at Howland Island. A total of 665 miles and 73.8 hours of diurnal observations was completed during the grid survey (Table 1). During this period 3,950 birds of 23 species were recorded and 11 specimens of five species were collected. Flocks were abundant, especially near the islands, during most of the survey, but broke up and scattered



easily upon approach of the ship. Without the use of the skiff, effective collecting cannot be performed, except under unusual conditions. Flocks consisted primarily of Sooty Terns with lesser numbers of boobies and frigates. The Wedge-tailed Shearwater was the only procellariid present in any numbers; the majority of these were irregularly encountered in mixed flocks. One blue-streamered Sooty Tern was sighted ca. 11 miles north of Howland and another was collected at night 26 miles west of Howland. These few individuals still in the area which were streamered in the spring-summer Howland breeding colony might not have raised young at that time and are about to renest with the colony presently building up about the island. A total of 35 blue-streamered Blue-faced Boobies were recorded throughout the grid at distances of up to 96 miles from Howland. The vast majority, however, were within 25 miles of the island. Return data from Howland indicate that a considerable changeover of Blue-faced Boobies takes place on that island; thus the number of birds moving through or utilizing the grid may be higher than suspected (see Howland report).

Nocturnal observations were maintained from sunset to sunrise throughout the survey. A total of 547 miles and 71.3 hours of nocturnal observations were completed and 636 birds of 11 species were recorded. Nocturnal collecting was performed only on the night of 9-10 December. A drift station was begun about 13 miles west of Howland at sunset and continued until 0300 during which time the ship had drifted to about 35 miles distance from the island. Small groups of from 1-10 Sooty Terns were recorded every few minutes throughout the entire observation period; all were moving in an easterly direction towards the island. A total of 444 were recorded and 27 were collected including 3 Howland banded birds. An occasional Lesser Frigatebird was also noted moving eastward; one was collected. Balcomb did not observe any buildup of terns on the island on this particular night, but a considerable buildup occurred on the evening of 11 December.

Diurnal density (birds/linear mile) was slightly under that of November (5.94-6.31). Considering the extensive remote areas covered during the present cruise where densities are always low, the two months are probably quite comparable. Sooty terns were again the dominant species, comprising 83 % of the total birds. Boobies, predominantly Blue-faced, accounted for 6.5 % and frigatebirds made up 4.9 %. Sooty/Slender-billed Shearwaters have completed their migration through the area; only one individual was recorded. All other procellarids were absent or present in very low numbers except Wedge-tailed Shearwaters.

SPECIES ACCOUNTS

Wedge-tailed Shearwater (109)

A slight increase in density of this species was recorded over the November survey. Practically all birds were recorded on 8, 9, and 10 December in conjunction with mixed feeding flocks. Only two light phase birds were noted, about the expected percentage in dark phase southern hemisphere populations.

Sooty/Slender-billed Shearwater (1)

With the migration over, these species should not be expected again in the grid until the post-breeding migrations beginning about April.

Audubon's Shearwater (1 + 2 nocturnal)

Irregularly recorded in low numbers, a few stragglers are expected from the Phoenix Island population.

Phoenix Island/Tahiti Petrel (3)

Individuals of this bi-species complex have consistently been recorded in low numbers during all surveys to date. Both species are known to occur in the grid, but always to<sup>be</sup> expected in low numbers.

Black-winged Petrel (2)

If past surveys are indicative of this species movements, it should be absent or very scarce in the grid until May.

White-winged Petrel (3)

Two races occur in the grid, but racial field identification is unreliable except under unusual circumstances. The species movements in the grid area are imperfectly known as yet because of the confusion of these birds during early grid surveys with the seasonally more abundant Black-winged Petrel.

Bulwer's Petrel (1)

Only a single individual was recorded last month. Always recorded in low numbers to date except for a migration movement through the area during March 1966.

Wilson's Storm Petrel (2)

The two individuals were noted in a single sighting on 10 December northwest of Howland. Very erratic flight and dangling legs are good field characters at close range. This species has been irregularly recorded in low numbers during the fall and winter months.

Leach's Storm Petrel (2)

white-rumped storm petrels (47 + 6 nocturnal)

Density was up to 0.07 during the present survey and is fairly comparable with that of 0.09 recorded during October. A drop to 0.04 during the November survey is difficult to interpret because the wintering populations should be fairly stable. Most birds seen at close range during the present survey appeared to be Leach's. One Leach's was collected.

Red-tailed Tropicbird (14)

Density was above that of November, but within the expected range for this time of year. Low numbers of this species can be expected year-round, but origin may be from any of the south Pacific breeding islands. Of the three specimens collected during the present cruise, one was a Jarvis banded bird. Four banded birds have been collected to date in the grid; two from Jarvis, one from Christmas and one from Enderbury.

Blue-faced Booby (229 + 20 nocturnal)

Density dropped to one half that recorded during November. As previously explained, density figures fluctuate widely depending upon the amount of cruise time near the islands. This can be shown very clearly using the present cruise as an example. Of

the 229 total birds recorded, 220 were recorded on the 9, 10, 12 and 13 of December when cruise activity was largely confined to within 50 miles of Howland. Only nine birds were recorded on 8, 11 and 14 December when cruise activity was largely 50-150 miles from Howland. Large numbers of Howland-streamered birds (mostly immatures) were again recorded this cruise. Immatures especially are attracted to the ship and afford easy sighting.

Brown Booby (13 + 1 nocturnal)

Consistent with the results of all cruises to date, numbers of this species are always low with the vast majority of sightings in close proximity to the two central islands.

Red-footed Booby (14 + 2 nocturnal)

Fifty percent (7) of the birds were recorded in a large mixed feeding flock east of Howland on 13 December. Sighting of the majority of birds recorded in any particular cruise in one or a few mixed feeding flocks has shown a fairly consistent pattern for this species. Thus, depending upon whether or not a few major feeding flocks are encountered can greatly alter the density for this species in any particular cruise. In comparison Blue-faced Boobies have a more uniform distribution in the grid, at least near the islands.

Great Frigatebird (1)

Lesser Frigatebird(46 + 2 nocturnal)

frigatebird species (148 + 2 nocturnal)

As usual most frigatebirds were recorded in conjunction with mixed feeding flocks near the islands. No frigatebirds were recorded on 11 December in the southwest corner of the grid, although Sooty Tern flocks were recorded throughout the day. Nearby foraging and increase in numbers of roosting birds on Howland at night indicate that grid birds are based on that island.

Ruddy Turnstone (2 +1 nocturnal)

Bristle-thighed Curlew (1)

Scarcity of shorebirds in the grid at this time is expected as wintering birds should have reached relative stability on their respective islands by this time.

Sooty Tern (3276 + 591 nocturnal)

Density increased from 3.76 in November to 4.93 during the present cruise. Since considerable current cruise activity was undertaken in areas remote from the concentrated feeding grounds near the islands, the rise in density is considered to represent a valid increase in birds. The population over Howland does not appear to be any closer to settling down behavior-wise than it was in November, but numbers have about tripled from last month. Only one streamered bird was seen and three banded birds collected, but these were all from Howland. To date there is little evidence to suggest that the grid birds are other than a population of Howland pre-breeders. An occasional immature bird is noted in feeding flocks, but these could be part of the spring-summer 1966 breeding colony from Howland.

Gray-backed Tern (3 +1 nocturnal)

The three diurnal sightings were recorded on 11 December in the southwest portion of the grid. This species has been irregularly recorded in low numbers on all cruises to date.

Common Noddy (14 + 1 nocturnal)

Twelve (90%) of the birds were recorded in a mixed feeding flock about 100 miles south of Baker on 8 December. This species has always been recorded in low numbers or even absent during some cruises. Its occurrence in the grid is unpredictable, but the Baker Island population must logically utilize the grid for feeding.

Blue-gray Noddy (2)

This species has been irregularly recorded in very low numbers. Grid sightings likely represent stragglers from the Phoenix Islands. One was collected in the southeast corner of the grid on 8 December.

Fairy Tern (10)

This species is an irregular visitant to the grid, probably from breeding areas in the Phoenix group. Eighty percent of the birds on the present cruise were recorded in two mixed feeding flocks south of Baker on 9 December.

Pomarine Jaeger (2)

This species has been irregularly recorded in very low numbers or absent on all cruises to date. Individuals are invariably associated with mixed feeding flocks and usually predaceous on terns.

TABLE 1. Summary of Southern Grid observations during the period 8-14 December 1966.

<u>DIURNAL</u>				
<u>Date</u>	<u>No. Miles</u>	<u>No. Hours</u>	<u>No. Birds</u>	<u>No. Species</u>
8 December	67	6.7	371	9
9	97	9.6	1012	12
10	107	10.8	579	10
11	105	12.1	157	11
12	95	10.4	1282	10
13	97	12.1	405	10
14	97	12.1	144	10
TOTALS	<u>665</u>	<u>73.8</u>	<u>3950</u>	<u>23 (10.3/day)</u>
<u>NOCTURNAL</u>				
8-9	119	11.9	46	3
9-10	44	11.6	491	6
10-11	106	12.0	21	4
11-12	87	11.8	9	2
12-13	86	12.2	26	4
13-14	105	11.8	43	3
TOTALS	<u>547</u>	<u>71.3</u>	<u>636</u>	<u>11 (3.7/night)</u>
GRAND TOTALS	1212	145.1	4586	23



TABLE 2. Diurnal density of Species Groups in the Southern Grid,  
8-14 December 1966.

<u>Species Group</u>	<u>No. Birds</u>	<u>Birds/Sq.Mi.</u>	<u>Est. Pop. for 57,600 Sq. Mi.</u>	<u>% Total Birds</u>
Shearwater-Petrel	123	0.09	5,200	3.1
Storm Petrel	51	0.08	4,600	1.3
Tern	3305	1.66	95,600	83.7
Tropicbird	14	0.01	575	0.3
Booby	256	0.20	11,500	6.5
Frigatebird	195	0.07	4,000	4.9
Shorebird	3	0.004	230	0.1
Jaeger	3	0.002	115	0.1
TOTALS	3950	2.12	121,800	100.0

TABLE 3. Diurnal abundance of Species in the Southern Grid,  
8-14 December 1966.

<u>Species</u>	<u>No. Birds</u>	<u>Birds/Lin. Mi.</u>	<u>No. Coll.</u>	<u>Status over last Month</u>
Wedge-tailed Shearwater	109	0.16		+
Sooty/Sl.-billed Shearwater	1	0.002		-
Audubon's Shearwater	1	0.002		+
Phoenix Island/Tahiti Petrel	3	0.004		-
Black-winged Petrel	2	0.003		-
White-winged Petrel	3	0.004		-
<u>Pterodroma</u> species	1	0.002		-
Bulwer's Petrel	1	0.002		0
shearwater-petrel	2	0.003		-
Wilson's Storm Petrel	2	0.003		+
Leach's Storm Petrel	2	0.003	1	-
white-rumped storm petrel	47	0.07		+
Red-tailed Tropicbird	14	0.02	3	+
Blue-faced Booby	229	0.34	1	-
Brown Booby	13	0.02		0
Red-footed Booby	14	0.02		-
Great Frigatebird	1	0.002		0
Lesser Frigatebird	46	0.07		+
frigatebird species	148	0.22		-
Ruddy Turnstone	2	0.003		-
Bristle-thighed Curlew	1	0.002		+
Sooty Tern	3276	4.93	5	+
Gray-backed Tern	3	0.004		+
Common Noddy	14	0.02		+
Blue-gray Noddy	2	0.003	1	+
Fairy Tern	10	0.02		+
Pomarine Jaeger	2	0.003		+
jaeger species or skua	1	0.002		+
TOTALS	3950	5.94	11	-

TABLE 4. Nocturnal abundance of Species in the Southern Grid,  
8-9...13-14 December 1966.

<u>Species</u>	<u>No. Birds</u>	<u>Birds/Lin.Mi.</u>	<u>No. Coll.</u>
Audubon's Shearwater	2	0.004	
shearwater-petrel	3	0.005	
white-rumped storm petrel	6	0.01	
tropicbird species	2	0.004	
Blue-faced Booby	20	0.04	
Brown Booby	1	0.002	
Red-footed Booby	2	0.004	1
frigatebird species	2	0.004	
Lesser Frigatebird	2	0.004	1
Ruddy Turnstone	1	0.002	
Sooty Tern	591	1.08	27
Gray-backed Tern	1	0.002	
Common Noddy	1	0.002	1
tern species	2	0.004	
TOTALS	<u>636</u>	<u>1.16</u>	<u>30</u>

TABLE 5. Banded and/or Color-marked birds observed and/or collected in the Southern Grid, 8-14 December 1966.

<u>Species</u>	<u>Age</u>	<u>Date</u>	<u>Color Mark or Band No.</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Distance from Origin</u>
Blue-faced Booby	Imm.	9 Dec.	Blue Streamer	00°41'N	176°-38'W	7
Blue-faced Booby	Imm.	10	Blue Streamer	00°-44'N	176°-41'W	5
Blue-faced Booby	Imm.	10	Blue Streamer	00°-44'N	176°-41'W	5
Blue-faced Booby	Imm.	10	Blue Streamer	00°-44'N	176°-41'W	5
Blue-faced Booby	Imm.	10	Blue Streamer	00°-44'N	176°-41'W	5
Blue-faced Booby	Imm.	10	Blue Streamer	00°-48'N	176°-50'W	12
Blue-faced Booby	Ad.	12	Blue Paint	00°-24'N	176°-32'W	25
Blue-faced Booby	Ad.	12	Blue Streamer	00°-30'N	176°-34'W	19
Blue-faced Booby	Imm.	12	Blue Paint	00°-30'N	176°-34'W	19
Blue-faced Booby	---	12	Blue Streamer Blue Paint	00°-32'N	176°-34'W	17
Blue-faced Booby	---	12	Blue Streamer	00°-35'N	176°-35'W	12
Blue-faced Booby	Imm.	12	Blue Streamer Blue Paint	00°-37'N	176°-35'W	10
Blue-faced Booby	Imm.	12	Blue Streamer Blue Paint	00°-37'N	176°-35'W	10
Blue-faced Booby	Imm.	12	Blue Streamer Blue Paint	00°-38'N	176°-36'W	10
Blue-faced Booby	Imm.	12	Blue Streamer Blue Paint	00°-45'N	176°-38'W	3
Blue-faced Booby	Imm.	12	Blue Streamer Blue Paint	00°-45'N	176°-38'W	3
Blue-faced Booby	Imm.	12	Blue Streamer Blue Paint	00°-45'N	176°-38'W	3
Blue-faced Booby	Subad.	13	Blue Streamer Blue Paint	01°-00'N	176°-15'W	27
Blue-faced Booby	Imm.	13	Blue Streamer	00°-50'N	176°-14'W	24
Blue-faced Booby	Imm.	13	Blue Streamer	00°-48'N	176°-14'W	24
Blue-faced Booby	Imm.	13	Blue Streamer	00°-48'N	176°-14'W	24
Blue-faced Booby	Imm.	13	Blue Paint	00°-48'N	176°-14'W	24
Blue-faced Booby	Imm.	13	Blue Streamer Blue Paint	00°-47'N	176°-14'W	24

TABLE 5. Banded and/or Color-marked birds observed and/or collected in the Southern Grid, 8-14 December 1966. Continued

<u>Species</u>	<u>Age</u>	<u>Date</u>	<u>Color mark or Band No.</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Distance from Origin</u>
Blue-faced Booby	Imm.	13 Dec.	Blue Streamer	00°-34'N	176°-15'W	29
Blue-faced Booby	Imm.	13 Dec.	Blue Streamer 568-70052 (N.L.)	00°-24'N	176°-15'W	35
Blue-faced Booby	Imm.	14	Blue Paint	01°-26'N	175°-20'W	88
Blue-faced Booby	Imm.	14	Blue Pain	01°-34'N	175°-19'W	96
Sooty Tern	Ad.	10	Blue Streamer 863-80697 (Howland-May-'66)	00°-48'N	177°-03'W	26
Sooty Tern	Ad.	12	Blue Streamer	00°-58'N	176°-39'W	11
Sooty Tern	Ad.	9	793-72680 (Howland-July-'64)	00°-48'N	176°-59'W	21
Sooty Tern	Ad.	9	953-01140 (Howland-July-'66)	00°-48'N	176°-56'W	18
Red-tailed Tropicbird	Ad.	10	625-87418 (Jarvis-Nov.-'64)	01°-17'N	177°-44'W	1060
Red-footed Booby	Ad.	9	747-59002 (Howland-Oct.-'64)	00°-48'N	176°-52'W	14

TABLE 6. Diurnal abundance of Flocks in the Southern Grid, 8-14 Dec. 1966.

<u>Date</u>	<u>No. Flocks</u>	<u>No. Birds</u>	<u>%Shearwater- Petrel</u>	<u>% Tern</u>	<u>% Booby</u>	<u>% Frigate</u>
8 December	5	342	05.3	91.5	0.3	2.9
9	22	936	2.7	91.3	3.0	3.0
10	19	523	9.2	78.2	4.4	8.2
11	7	137	0.7	99.3	---	---
12	29	1212	0.3	92.5	4.3	2.9
13	12	310	0.3	67.1	15.5	17.1
14	8	106	4.7	87.7	1.9	5.7
TOTALS	<u>102</u>	<u>3566</u>	<u>2.8</u>	<u>87.9</u>	<u>4.3</u>	<u>5.0</u>

Average Flock size = 35

TABLE 7. Diurnal abundance of Species in Flocks in the Southern Grid,  
8-14 December 1966.

<u>Species</u>	<u>No. Birds in Total Flocks</u>	<u>% of Total Population*</u>
Wedge-tailed Shearwater	92	84.4
Black-winged Petrel	1	50.0
<u>Pterodroma</u> species	1	100.0
white-rumped storm petrel	7	15.0
Blue-faced Booby	136	59.4
Brown Booby	7	54.0
Red-footed Booby	11	80.0
Lesser Frigatebird	41	89.1
frigatebird species	135	91.2
Sooty Tern	3110	94.9
Grey-backed Tern	3	100.0
Common Noddy	14	100.0
Fairy Tern	8	80.0
TOTALS	<hr/> 3566	<hr/> 90.3

\* Total population of each respective species.

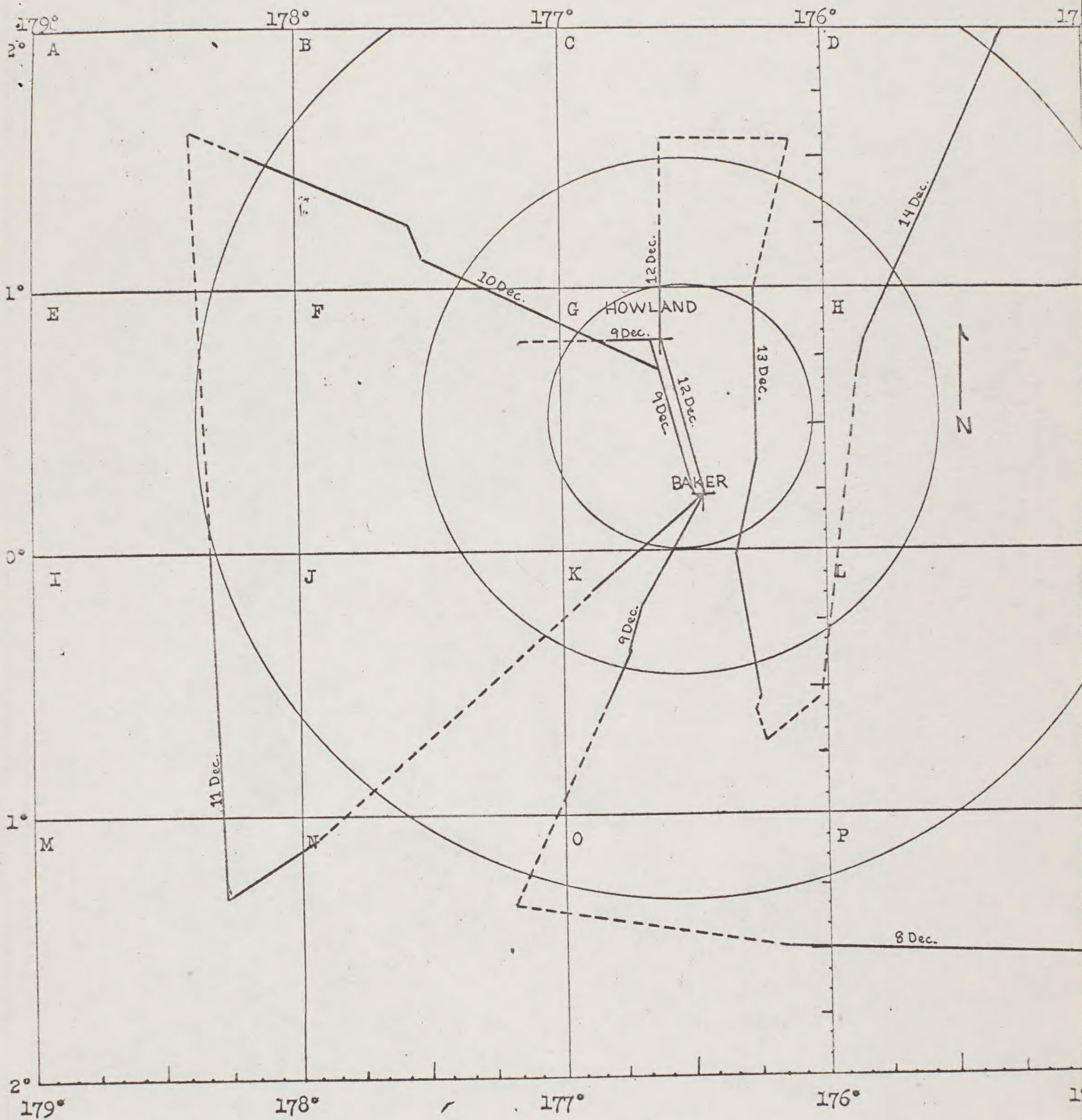


Figure 1. Southern Grid cruise track, 8-14 December 1966.  
 scale : 2 inches = 60 miles at 0° latitude.



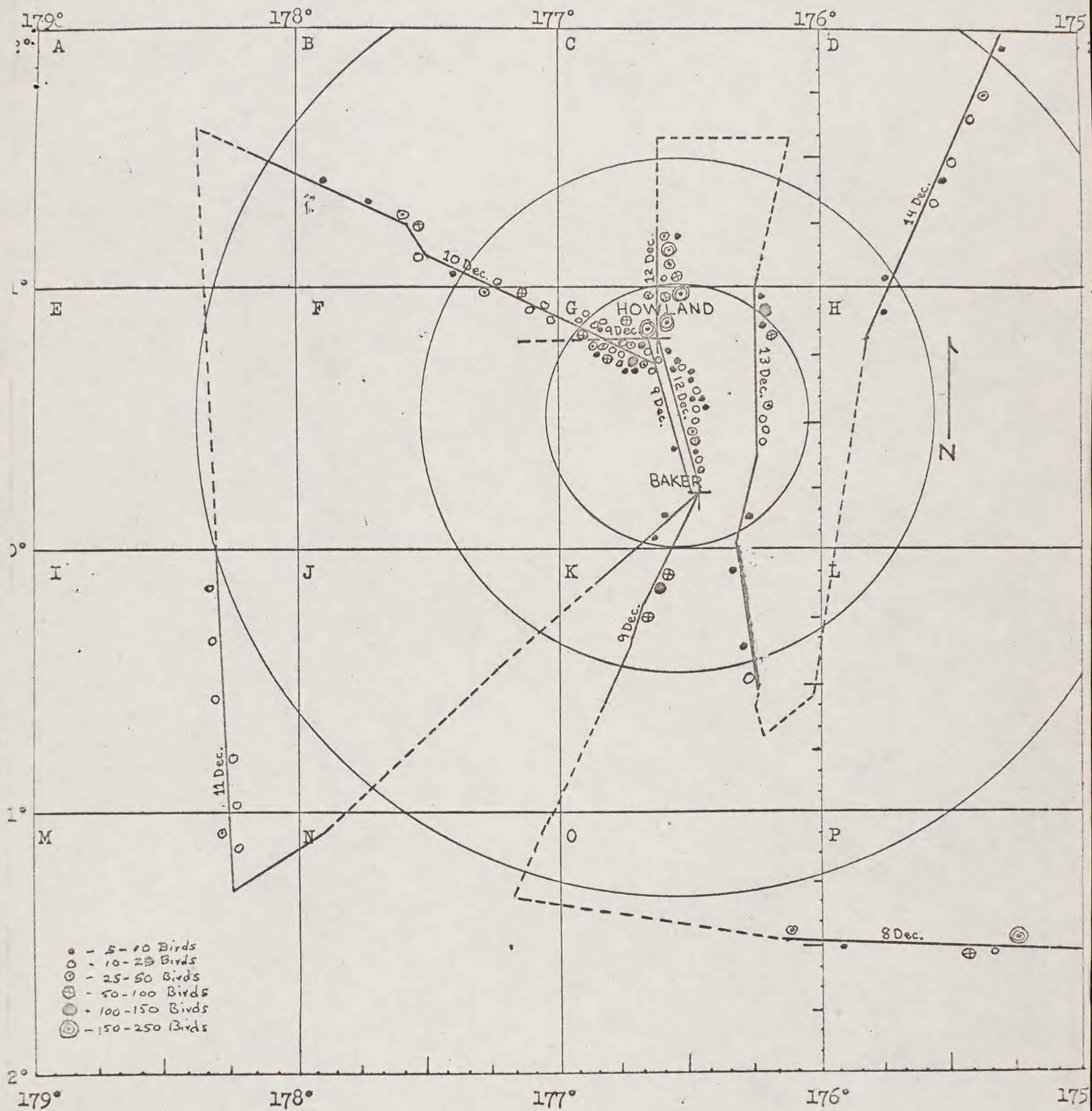


Figure 2. Distribution of flocks in the Southern Grid, 8-14 December 1966.

NORTHERN GRID  
PRELIMINARY REPORT AT-SEA SURVEY NO. 33  
11-12 NOVEMBER 1966

by  
Richard S. Crossin

NORTHERN GRID  
PRELIMINARY REPORT AT-SEA SURVEY NO. 33

11-12 November 1966

This brief report covers the observations conducted in the Northern Grid during the night of 11-12 November and throughout the day of 12 November 1966. The U.S.N.S. SHEARWATER (T-AG 177), enroute to the south on Southern Island Cruise # 16, entered the Northern Grid at  $16^{\circ} 03' N$ ;  $170^{\circ} 26' W$  at 2212 hours on 11 November and proceeded southwest, departing the grid at  $13^{\circ} 55' N$ ;  $173^{\circ} 10' W$  at 1739 hours on 12 November (see Fig. 1). The Smithsonian POBSP observation party included Richard Crossin (Biologist in Charge), Dr. Robert Pyle, Kenneth Balcomb, Richard Chandler, Lawrence Huber, Richard Heiden, Chris Thompson, John Fitch and Robert Tuxson.

Diurnal observations amounted to 11.8 hours covering 123 miles during which 163 birds of 6 species were observed and 4 specimens of 3 species were collected. Nocturnal observations amounted to 8.3 hours covering 81 miles during which 25 birds of 6 species were observed. Only one specimen (a Leach's Storm Petrel which flew aboard ship) was collected during nocturnal observations.

Bird numbers were unusually low; November has shown the highest average density for the grid area over the past three years. An almost complete reversal of major species composition has occurred since September 1966 when a similar short grid survey was made. At that time Wedge-tailed Shearwaters and Sooty Terns were the two dominant species, comprising 81 % of total birds. Only three Sooty/Slender-billed Shearwaters were noted. During the present survey no Wedge-tailed Shearwaters nor Sooty Terns were noted\*, and the dominant species was Sooty and/or Slender-billed Shearwaters. The second most numerous species was the Black-winged Petrel of which

\* Three Sooty Terns were noted during nocturnal observations.

TABLE 1. Summary of Northern Grid observations, November 1966.

<u>DIURNAL</u>				
<u>Date</u>	<u>No. Miles</u>	<u>No. Hours</u>	<u>No. Birds</u>	<u>No. Species</u>
12 November	123	11.8	163	6
<u>NOCTURNAL</u>				
11-12 November	81	8.3	25	6
GRAND TOTAL	204	20.1	188	7

TABLE 2. Diurnal density of species groups in the Northern Grid, November 1966.

<u>Species Group</u>	<u>No. Birds</u>	<u>Birds/ Square Mile</u>	<u>Estimated Pop./ 50,000 Sq. Mi.</u>	<u>% Total Birds</u>
Shearwater-Petrel	147	0.60	30,000	90.2
Storm Petrel	10	0.08	4,000	6.1
Tropicbird	1	0.01	500	0.6
Frigatebird	4	0.01	500	2.5
Miscellaneous	1	0.004	200	0.6
	163	0.66	35,200	100.0 %

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Frigatebird	4	0.01	500	2.5
Miscellaneous	1	0.004	200	0.6
	163	0.66	35,200	100.0 %

TABLE 3. Diurnal abundance of species in the Northern Grid,  
November 1966.

<u>Species</u>	<u>No. Birds</u>	<u>Birds/ Linear Mile</u>	<u>No. Collected</u>
Slender-billed Shearwater	30	0.24	
Sooty/Slender-billed Shearwater	34	0.28	
Juan Fernandez Petrel	29	0.24	1
Black-winged Petrel	50	0.41	
<u>Pterodroma species</u>	4	0.03	
Leach's Storm Petrel	4	0.03	2
unidentified white-rumped storm petrels	— 6	0.05	
Red-tailed Tropicbird	1	0.01	1
Great Frigatebird	4	0.03	
Miscellaneous	1	0.01	
TOTALS	<hr/> 163	<hr/> 1.33	<hr/> 4

TABLE 4. Nocturnal abundance of species in the Northern Grid, November, 1966.

<u>Species</u>	<u>No. Birds</u>	<u>Birds/ Linear Mile</u>	<u>No. Collected</u>
Black-winged Petrel	1	0.01	
unidentified small <u>Pterodroma</u>	5	0.06	
unidentified large <u>Pterodroma</u>	2	0.02	
shearwater-petrel	9	0.11	
Leach's Storm Petrel	1	0.01	1
Sooty Tern	3	0.04	
Miscellaneous	4	0.05	
TOTALS	25	0.31	1

TABLE 5. Flock composition by species in the Northern Grid, November 1966.

<u>Species</u>	<u>No. in Total Flocks</u> *	<u>% in Total Flocks</u>
Slender-billed Shearwater	28	23.0 %
Sooty and/or Slender-billed Shearwater	31	25.4 %
Juan Fernandez Petrels	20	16.4 %
Black-winged Petrels	36	29.5 %
white-rumped storm petrels including Leach's Storm Petrel	7	5.7 %
	122	100.0 %

\* Total flocks = 7, with average flock size of 17.4.

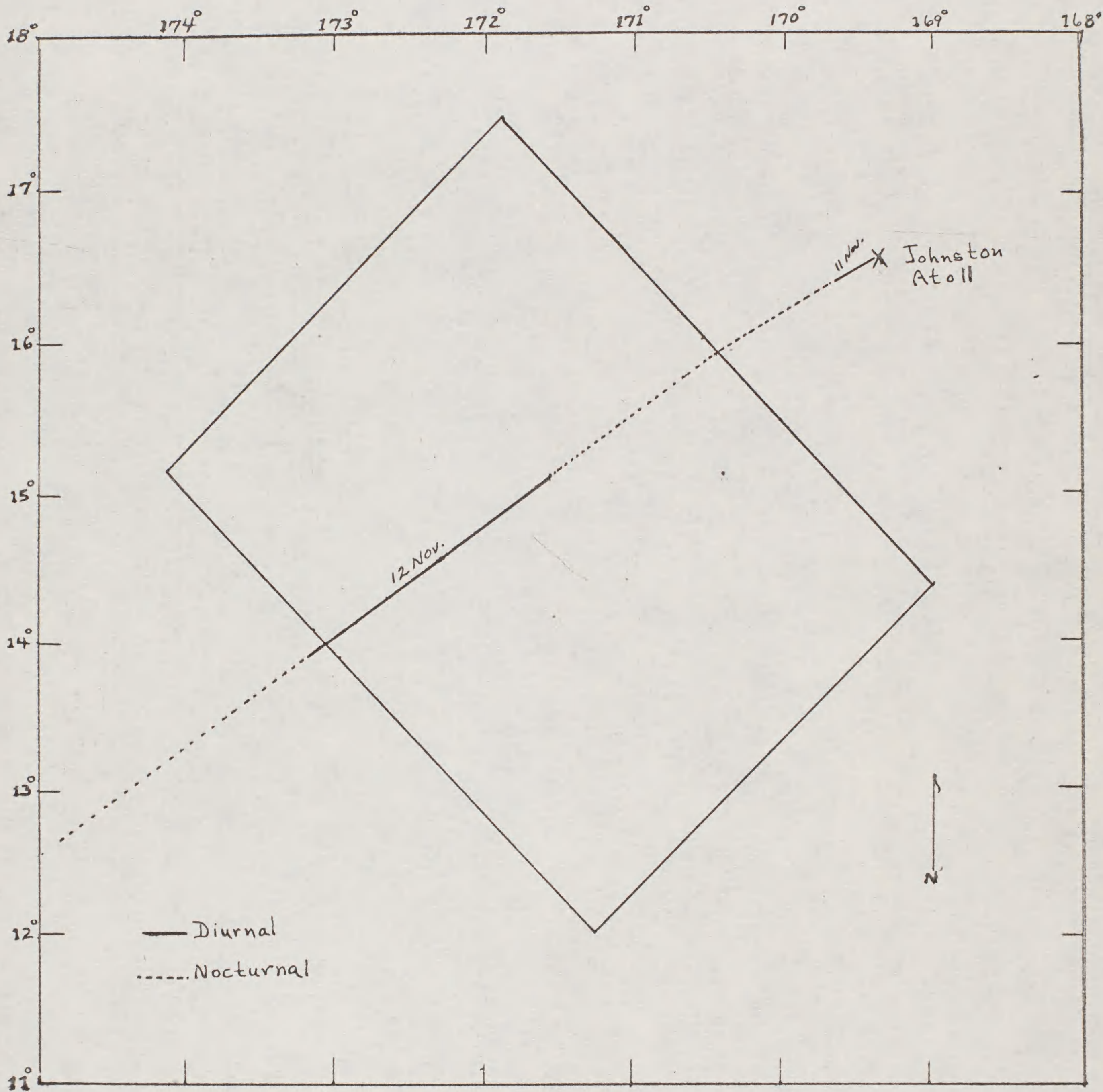


Figure 1. SIC 16 Cruise track through the Northern Grid, November 1966.



SIC 16 - Southern Grid - Nocturnal (8-9 - 13-14 Dec. 1966)

TOTALS	8-9	9-10	10-11	11-12	12-13	13-14
636	46	491	21	9	26	43
2 Audubon's Shearwater			2			
3 shearwater - petrel			2			1
6 white-rumped storm petrel	1	1	1		2	1
2 tropicbird species					2	
20 Blue-faced Booby	1	19				
1 Brown Booby				1		
2 Red-footed Booby		2				
2 frigatebird species		2				
2 Lesser Frigate bird		2				
1 Ruddy Turnstone			1			
591 Sooty Tern	44	464	15	8	19	41
1 Gray-backed Tern					1	
1 Common Noddy		1				
2 tern species					2	

# SIC 16- SOUTHERN GRID - Part 2 (8-14 December 1966)

		8	9	10	11	12	13	14
<b>3950</b>	<b>TOTALS</b>	<b>371</b>	<b>1012</b>	<b>579</b>	<b>157</b>	<b>1282</b>	<b>405</b>	<b>144</b>
109	Wedge-tailed Shearwater	19	29	48	6	1	1	5
1	Sooty/Slender-billed Shearwater		1					
1	Audubon's Shearwater				1			
3	Phoenix Island/Tahiti Petrel				1	1		1
2	Black-winged Petrel			1				1
3	White-winged Petrel							3
1	<u>Pterodroma</u> species		1					
1	Bulwer's Petrel				1			
2	shear water - petrel		2					
2	Wilson's Storm Petrel			2				
2	Leach's Storm Petrel					1	1	
47	white-rumped storm petrels	2	12	6	4	5	16	2
14	Red-tailed Tropicbird	2	4	2	1	1	2	2
229	Blue-faced Booby	1	36	28		80	76	8
13	Brown Booby	1		6		5	1	
14	Red-footed Booby		3			2	9	
1	Great Frigatebird						1	
46	Lesser Frigatebird	2	1	17		8	18	
148	frigatebird species	9	31	29		36	37	6
2	Ruddy Turnstone		1	1				
1	Bristle-thighed Curlew		1					
3276	Sooty Tern	322	882	439	135	1141	242	115
3	Gray-backed Tern				3			
14	Common Noddy	12			1			1
2	Blue-gray Noddy	1				1		
10	Fairy Tern		8		2			
2	Pomarine Jaeger				2			
1	jaeger species or Skua						1	

SIC 16 - SOUTHERN GRID - Part 1 - (18-21 NOVEMBER 1966)

DIURNAL

NOCTURNAL

TOTALS	18	19	20	21	17-18	18-19	19-20	20-21	21-22	TOTALS
<b>2568</b>	<b>659</b>	<b>878</b>	<b>630</b>	<b>401</b>	<b>18</b>	<b>23</b>	<b>19</b>	<b>265</b>	<b>26</b>	<b>351</b>
66 Wedge-tailed Shearwater	8	5	45	8	2		1			3 WT
6 Sooty Shearwater	2	3	1		1					1 SS
222 Slender-billed Shearwater	147	14	54	7	2	1	1			4 SB
106 Sooty/Slender-billed Shearwater	78	21	5	2	1					1 S/SB
2 Newell's Shearwater		1	1							
1 New Zealand Shearwater			1							
1 Little Shearwater			1							
4 Juan Fernandez Petrel	4									
5 Phoenix Island/Tahitian Petrel	1	1	3							
37 Black-winged Petrel	9	5	6	17						
5 White-winged Petrel	3		2			1				1 WWP
21 Pterodroma sp.	5	9	2	5	6	3	2	2		13 Pp
1 Bulwer's Petrel		1								
7 Shearwater-petrel	1	3	1	2			3	5	2	11 S-P
2 Leach's Storm Petrel			1	1						
18 white-rumped storm petrel	1	8	7	2		1	1	5	1	8 WRSP
6 Red-tailed Tropicbird	2	3	1			1				1 RTTB
285 Blue-faced Booby	131	72	9	73				6		6 BFB
9 Brown Booby	2	3	1	3						
47 Red-footed Booby	1	2	44			1		3		4 RFB
1 Great Frigatebird				1						
45 Lesser Frigatebird	2	17	23	3						
131 frigatebird sp.	51	17	35	28				1		1 Fsp
6 Ruddy Turnstone				6						
1 Sanderling			1							
1532 Sooty Tern	211	693	386	242	3	14	10	242	11	280 ST
1 Common Noddy				1						
Gray-backed Tern									12	12 GBT
bird sp.					3		1	1		5 Bsp.

SIC 16 NON-GRID SOUTHERN GRID TO OAHU  
15 DEC - 23 DEC 1966

"D" 739 mi.

15 16 17 18 19 20 21 22 23

		15	16	17	18	19	20	21	22	23
1	LAYSAN ALB						1			
1	BFA									1
1	ALB. SP.								1	
73	WTS	8	8	11	3	7	30	5	1	
74	NEWALLS				1					
1	KERM P		1							
32	JFP	5	3	4	10	4	2	4		
1	DRP							1		
4	PI/T P		4							
2	HERALDS		1							1
7	BWP		2	1	1		2	1		
16	SMALL PTERO SP.			16						
13	LARGE PTERO SP.			13						
23	PTEROSP.	1			15	1	6			
8	BULWERS	3	3	2						
11	SHEAR/PET	4		1	3		1	1	1	
1	LEACH'S							1		
8	STORM PET SP.	5				2		1		
7	WTTB								4	3
5	RTTB	1	2				2			
2	BFB				2					
18	RFB	1	2		1	1	6	2	4	1
1	BOOBY SP.									1
339	SOOTY TERN	9	1		26	1	150	1	151	
15	CNT		1						14	
15	FT					5		3	7	
25	TERN SP.			25						
33	POM J.									33
3	BIRD SP.	1			2					
667		38	28	73	64	21	200	20	193	40

SIC 16

Oahu to SOUTHERN GRID via Johnston Atoll (4-17 November 1966)

TOTALS		4	5	6	7	8	11	12	13	14	15	16	17
	"A" 391 mi.	"B" 683 mi.											
<b>5043</b>		<b>531</b>	<b>396</b>	<b>2686</b>	<b>343</b>	<b>34</b>	<b>37</b>	<b>163</b>	<b>61</b>	<b>46</b>	<b>163</b>	<b>318</b>	<b>265</b>
387	Wedge-tailed Shearwater	274 .698	47	12	10	11 <sup>13</sup> .169	5		1	3	39	33	32
12	Sooty Shearwater	11 .028	2	4	5	1 .001							1
2961	Slender-billed Shearwater	2821 7.21	42	2578	198	3 <sup>140</sup> .205		30			1	48	61
214	Sooty/Slender-billed Shearwater	120 .307	116			4 <sup>99</sup> .137	1	34			2	29	28
3	Pale-footed Shearwater	1 .002		1		2 .003			1		1		
3	Shearwater species	3327				3 .004					3		
106	Juan Fernandez Petrel	58 .148	3	15	34	3 <sup>48</sup> .029	1	29	15	1		1	1
7	White-necked Petrel	3 .007		1	2	4 .006						2	2
14	<i>Pterodroma externa</i>	12 .030	2	7	3	2 .003		1			1		
7	Kermadec Petrel	5 .012	2	1	2	2 .003					1	1	
1	Herald's Petrel					1 .001					1		
5	Phoenix Island/Tahitian Petrel	1 .002		1		4 .006					1	1	2
10	Mottled Petrel	10 .025	1	8		1							
233	Black-winged Petrel	109 .276	32	19	51	4 <sup>124</sup> .181		50	19	24	8	9	14
24	White-winged Petrel	1 .002		1		23 .039				1	9	9	4
9	small <i>Pterodroma</i> species					9 .013						9	
70	<i>Pterodroma</i> species	25 .063	3	11	8	1 <sup>45</sup> .069		3	2	7	10	11	12
19	Bulwer's Petrel	2 .005	1	1		17 .024				4	6	4	3
267	shearwater-petrel	252 .644	57	5	5	4 <sup>15</sup> .022	2		6			2	5
		3205				(247)							
18	Leach's Storm Petrel	2 .005		1	1	16 .023	1	4		2	3	1	5
45	white-rumped storm petrel	16 .041	4	5	6	29 .042		6	3			12	7
11	Red-tailed Tropicbird	4 .010		1	3	7 .010		1	1	1	1		3
13	White-tailed Tropicbird	5 .012	2	1	2	8 .012					5	3	
3	tropicbird species	3 .007		1	2								
2	Blue-faced Booby	2 .005	2										
13	Brown Booby	5 .012	1			1 <sup>8</sup> .012	7				1		
32	Red-footed Booby	29 .072	2	2	1	3 .004					1	2	
1	Lesser Frigatebird					1 .001							1
54	Great Frigatebird	45 .115	2	1	3	1 <sup>9</sup> .013	5	4					
6	frigatebird species	3 .007		2		3 .009					2		1
3	Golden Plover	1 .002		1		2 .003			2				
1	Sharp-tailed Sandpiper					1 .001				1			
40	Pomarine Jaeger	39 .0039				1 .001					1		
1	long-tailed Jaeger					1 .001						1	
7	Jaeger species	4 .010	2		2	3 .009			1		2		
1	Skua					1 .001						1	
291	Sooty Tern	20 .051	15	3	1	1 <sup>271</sup> .398	2		9	1	58	121	80
52	Common Noddy	41 .104				11 .016	8				3		
1	Hawaiian Noddy	1 .062	1										
19	Fairy Tern	1 .002	1			19 .027					1	17	
1	Pintail Duck	1 .002		1									
76	bird sp.	63 .160				13 .018	4		1 (noddy sp.)	1	1 (rem sp.)	2	3

SIC 16

Southern Grid to Samoa and return via Phoenix Islands. (22 Nov. -

"C"  
919 mi

November

TOTALS		22	23	24	25	29	30	1	2	5	7	8
157	WTS	.171	17	3	11	1	6	3	4	7	1	104
20	SOOTY SH.	.021		1	1		1	2	15			
35	SB. SH.	.038	10	2	4	5	1	7	1	5		
57	S/SB SH	.062	1	1	26	3	1	6	11	7		1
13	AUD. SH	.014	1				1			4	4	3
1	NEW Z. SH.	.001										1
1	WNP	.001				1						
7	PI/T PET	.008	1	1	2				1	1		1
1	HERALDS P.	.001		1								
1	MOT P.	.001							1			
59	BWP	.064	17	10	12	11	2	2	3	2		
6	WWP	.006		3	1	1			1			
3	WW/BW P	.003			2		1					
17	PTERO. SP.	.018	4	2	4	2	3	1	1			
18	BULWER'S P	.019	1	2	2				7	2	4	
13	SHEAR/PET	.014	3	4	3	1	1					1
6	LEACH'S SP	.006	2						1	2		1
2	WILSON'S SP	.002							2			
27	STORM PET SP.	.029	14	1	1							7
1	WTSP	.001									1	
4	WTTB	.004		1	2		1					
23	RTTB	.024	12	3		3			1			3
2	T-B. SP.	.002	2									1
117	BFB	.116	5	1						11	17	23
29	BB	.030	1	2		2						29
52	RFB	.056	1			5				1	5	4
17	GR. FRIG	.018					36			1		
1	LESS. FRIG	.001					3			1	3	10
128	FRIG SP.	.139	77				1				1	47
9	RUDDY T.	.010	2							1		6
4832	SOOTY TERN	5.26	969	429	19				81	86	101	3104
171	GBT	.187							2		5	164
1495	CNT	1.61		1	9	38	1117	2				328
14	HAW NOD.	.015				1	1	1	2			9
7	BGN	.008	1							2	4	
207	FT	.225	9	8	23	37	97	17	9			17
41	TERN SP	.044	15				25			1		
2	LTI	.002		2								
1	BIRD SP	.001	1									
1	XMAS I.	.001										1
		1161		478	122	111	1288	41	141	135	146	3921
1	POM J.	.001										1
7599		8.27										

ASP-  
LA-  
BFA-

-NEW

-K

-JFP

PRP-

in small PTAP

sm PT-

Lg PT-

es -