Shoreline Vegetation on Herring Spawning Grounds in Barkley Sound in 1978 Compared with Similar Assessments for 1974 and 1975

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SHORELINE VEGETATION ON HERRING SPAWNING GROUNDS IN BARKLEY SOUND IN 1978 COMPARED WITH SIMILAR ASSESSMENTS FOR 1974 AND 1975

by

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ABSTRACT

Haegele, C. W., and M. J. Hamey. 1980. Shoreline vegetation on herring spawning grounds in Barkley Sound in 1978 compared with similar assessments for 1974 and 1975. Fish. Mar. Serv. MS Rep. 1549: 37 p.

The vegetation on major herring spawning grounds is being mapped in British Columbia from large format colour and colour-infrared photographs. Photographs were obtained for 48 km of coastline in Barkley Sound in 1978, repeating 14 km photographed in 1974. A diver survey of 4.8 km at two locations photographed was conducted in 1975. There were 734.2 ha of vegetation mapped from the 1978 photography of which red algae accounted for the major portion followed by sea grasses, brown algae and rockweed. There were no major shifts in vegetation noted between the 1974 and 1978 photographs or between the 1975 diver survey and 1978 photographs. However, vegetation both deeper than -5 m and of less than 25 percent cover cannot be identified on aerial photographs taken on a +1.5 m tide.

Key words: Marine vegetation, aerial photography, mapping.

RÉSUMÉ

Haegele, C. W., and M. J. Hamey. 1980. Shoreline vegetation on herring spawning grounds in Barkley Sound in 1978 compared with similar assessments for 1974 and 1975. Fish. Mar. Serv. MS Rep. 1549: 37 p.

On cartographie actuellement la végétation des principales frayères de hareng en Colombie-Britannique à l'aide de photos couleur ordinaires et prises à l'infra-rouge, de grand format. En 1978, on a ainsi cartographié 48 km de côte dans la baie Barkley, dont 14 km avaient déjà été photographiés en 1974. En 1975, des plongeurs ont procédé, à deux endroits, à la reconnaissance du fond marin sur 4,8 km. À partir des clichés pris en 1978, on a cartographié 734,2 ha de végétation composée principalement d'algues rouges, puis de zostères, d'algues brunes et de fucus. La comparaison des photos prises en 1974 et en 1978, ou des rapports des plongeurs avec les photos de 1978, n'a révélé aucune modification importante de la végétation. Il faut toutefois noter que la végétation située à une profondeur plus de 5 m ou qui couvre une superficie inférieure à 25 pour cent du fond marin ne peut être repérée sur les photographies aériennes prises quand la marée est supérieure a 1,5 m.

Mots clés: Végétation marine, photographie aérienne, cartographie.

INTRODUCTION

Aerial photographs are used to map vegetation on herring spawning grounds in British Columbia (eg. Haegele 1978). These maps are used to record and assess herring spawnings which take place mainly on rooted algae and sea grasses in the littoral and upper sublittoral zone. There has always been some concern that there may be short or long term changes in the spatial distribution or abundance of vegetation that would render these vegetation maps too temporal for continued use over a period of years. Rephotographing and remapping a previously mapped area after several years should provide some indication of whether this was a likely occurrence. Also, these maps are not routinely field checked because of constraints of time and cost. Fortuitously, diver surveys of herring spawnings have been conducted in most mapped areas and information obtained on these can be used for field-checking of maps. Also, when these diver surveys do not coincide with photography by year or season, they can provide some information on the stability of the vegetation zones.

METHODS

Vertical aerial photographs of 23 cm format at a photo-scale of 1:4800 were obtained for the NW portion of Barkley Sound (Fig. 1) on March 2, 1978 with a Zeiss RMK A30/23 camera with a 305 mm focal length lens at an altitude of 1463 m. There were 12 flight lines, some of which were parallel at 20% sidelap. Forward overlap was 60%. Forty-eight km of coastline were photographed before predicted low tide (1.4 m at 1220 PST) with Kodak Aerochrome Infrared No. 2443 film between 1110 and 1200 PST and with Kodak Aerochrome Infrared No. 2448 film after low tide between 1230 and 1325 PST. A medium yellow (B 111 70) filter was used with the infrared film and a clear (HF3) filter with the colour film.

A portion of NW Barkley Sound (map 1, 2, 4, and 5 in Fig. 1) was photographed and mapped four years previously (Haegele and Hamey 1977). This photography was flown on July 21, 1974 between 0750 and 0835 PST for the infrared film and 0700 and 0740 for the colour film. Predicted low tide was 0.0 m at 0745 PST. The scale of photography (1:3600) and altitude (1097 m) differed for this photography but all other specifications remained the same.

Vegetation maps were prepared at the scale of photography, using enlarged Canadian Hydrographic Service Navigation charts Nos. 3636 and 3637 as a base map, with standard photogrammetric techniques. Exposed vegetation was identified from the infrared diapositives (141 in 1978, 57 in 1974) employing colour keys previously developed (Haegele 1975). For vegetation submerged at the time of photography, identification was by colour and texture from the colour diapositives (140 in 1978, 57 in 1974). The vegetation was mapped by five major types identifiable on the photographs: sea grasses, rockweed, red algae, brown algae and green algae.

A diver survey of shoreline vegetation and herring spawnings was conducted in Mayne Bay (map 9 in Fig. 1) and on the east shore of Macoah Passage from Maggie River to a point 1.7 km south (map 6 in Fig. 2) between February 18 and April 15, 1975 (Humphreys and Haegele 1976). Transects roughly perpendicular to the shore were established at between 50 and 200 m intervals. A team of divers sampled along each transect at roughly 20 m intervals. A sample consisted of all the rooted vegetation and attached herring eggs, if spawn was present, within a 0.25 m^2 (0.5 m x 0.5 m) or 1m^2 (1m x 1m) quadrat. All samples were separated into fractions by vegetation species according to Widdowson (1973 and 1975) and Scagel (1967). Each fraction was weighed to the nearest gram and each sample was classified into one of the five vegetation types by the percent contribution by weight of the species within that type to the total weight of the sample.

The proportion of the bottom that was occupied by vegetation was also recorded for each sample quadrat according to an arbitrary scale of 5 "cover values" as follows:

Cover value	Percent cover
5	76 to 100
4	51 to 75
3	26 to 50
2	6 to 25
1	1 to 5

The depth of each sample was measured from the surface with a weighted tape and corrected to chart datum from Ocean and Aquatic Sciences tidal height printouts.

RESULTS AND DISCUSSION

The vegetation for Barkley Sound, as mapped from the 1978 photographs, is presented in ten maps (Fig. 2 to 11). The total area of vegetation mapped was 734.2 ha[1] (Table 1). Red algae accounted for the major portion of the vegetation; 21% (by area) of the vegetation being typed as pure red algae, 29% as a mixture of grasses and red algae and 28% as a mixture of brown and red algae. Eight percent of the vegetation was typed as rockweed with grasses and brown algae accounting for 7% each. Only 0.2 ha were typed as green algae.

A comparison of the distribution of vegetation as mapped from 1974 and 1978 photographs is made in Fig. 12 to 14 for the coastline from Toquart Bay to Macoah Passage. Differences in mapped vegetation between the two years appear mostly at the upper and lower boundary of the vegetation. The lower boundary generally has low percent cover vegetation while the upper boundary usually has patchy vegetation, making the location of these

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[1] 1 hectare (ha) = 10,000m^2

boundaries somewhat arbitrary. Some of the differences may also be accounted for by differences in plant vigour since photographs were taken near the end of the growing season in 1978 and near the beginning in 1974. Since the vegetation in the 1974 photographs was identified by the senior author and the vegetation in the 1978 photographs by the junior author, these differences can also, in part, be accounted for by individual differences in the photo interpretation. Nevertheless, there do not appear to be any major shifts in vegetation between the two years. That is, major beds of vegetation have not disappeared in the intervening four years between the photography nor have portions of the coastline that were devoid of vegetation in 1974 been colonized.

During the 1975 vegetation and spawn diver survey there were 461 samples of vegetation and vegetation with spawn collected at the Mayne Bay and Maggie River sites (Fig. 15 and 16). This does not include detritus samples or samples of less than one percent cover vegetation. For vegetation transects, 50% of sample sites corresponded with 1978 photo-mapped vegetation types (Table 2: Identified-correct). For a further 6% of samples, the presence of vegetation was determined but incorrectly typed (Table 2: Identified-incorrect). The sites for the remaining 44% of samples were incorrectly identified as bare on photographs, with 86% of these (38% of total samples) occurring beyond the outer edge of photo-identified vegetation. The average depth of correctly identified samples was -2.2 m, of incorrectly identified samples it was -2.3 m, and for incorrectly identified as bare and beyond the outer edge samples it was -9.4 m. Corresponding average cover values, with average biomass in g/m^2 in parenthesis, were: 2.8 (749), 2.5 (513) and 1.6 (168). The average cover value and the average biomass was high for the small number (6% of total samples) of incorrectly identified as bare and within outer edge samples because these were taken mostly on the upper edge of the vegetation (average depth was 1.1 m) where vegetation was patchy but of high percent cover. At the scale of aerial photography (1:4800), these small patches could not be mapped. For example, a patch 5 m × 5 m was 1 mm^2 on the photographs. The average cover values are a better indication of plant density than the average biomass since the latter is influenced by plant height, a dimension not used in the photo-interpretation. Also, the standard deviation of the mean is greater for biomass than for cover value for the five accuracy of identification categories because biomass is affected by the diversity of plant species while cover value is not.

For the spawn samples in Mayne Bay, results were better with 58% of samples Identified-correct, 11% of samples Identified-incorrect, and 31% of sample sites Incorrectly identified as bare. Corresponding average depths were -2.1 m, -0.3 m, and -9.8 m and corresponding average cover values were 3.4, 3.9, and 2.6. No biomass average values can be given for spawn samples because vegetation for these samples was weighed with herring spawn attached.

These diver survey results are not significantly different from a similar study in the Strait of Georgia (Haegele 1978) where photography preceded the diver survey by only one year. It would appear, then, that there have been no real vegetation zone changes between the March 1975 diver survey and the March 1978 photography. Rather, it appears that vegetation that is both deeper than -5 m and of less than 25 percent cover is not recorded on aerial photography clearly enough to be identified.

ACKNOWLEDGEMENTS

We would like to thank the personnel of Pacific Survey Corporation for obtaining the photographs. We are grateful to Debbie Bams, summer student at the Pacific Biological Station, for measuring the area of the vegetation. To Dr. A. S. Hourston, Herring Program Head at PBS, we remain appreciateive for his continued support and encouragement of the vegetation mapping project.

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1974. The marine algae of British Columbia and northern Washington: revised list and keys. Part II. Rhodophyceae (red algae). Syesis 7: 143-186 and Fig. 1-8.

Table 1. Area of photoidentified vegetation in hectares (1 ha = 10,000 m^2).

Map	Area in ha							
	Grasses	Grasses & reds	Rockweed	Brown algae	Browns & reds	Red algae	Green algae	All
1. Hillier Island		19.4	1.6			2.1		23.1
2. Toquart River	0.6	33.5	9.2			0.5		43.8
3. Snowden Island	1.4	11.1	4.1			5.2		21.8
4. Stopper Islands	4.9	8.4	8.1	6.1	44.8	10.4		82.7
5. Maggie River	8.9	7.0	8.4		37.5	9.5		71.3
6. David Island	1.3	15.0	5.9		17.5	21.0		60.7
7. Twin Rivers	23.7	27.9	5.8		42.2	48.2		147.8
8. Food Islets	3.4	81.0	5.4	19.3	2.8	55.0		166.9
9. Lyall Point	9.0	9.9	4.1	10.8	37.6		0.2	71.6
10. Dutch Harbour	1.1		5.6	12.6	22.2	3.0		44.5
All	54.3	213.2	58.2	48.8	204.6	154.9	0.2	734.2

Table 2. Comparison of 1975 transect results with 1978 photo-mapped vegetation.

Location, transect type and identification of samples on aerial photographs	n	% total	Depth (m) Av	Depth (m) S.D.	Cover value Av	Cover value S.D.	Biomass (g/m^2) Av	Biomass (g/m^2) S.D.
A. Macoah Pass-vegetation								
1. Identified-correct	70	64	-1.7	2.5	3.4	1.3	1,006	896
2. Identified-incorrect	4	4	-1.5	2.7	3.5	1.3	1,130	1,237
3. Incorrectly identified as bare								
a. Beyond outer edge	30	27	-8.7	2.9	1.9	0.6	127	208
b. Within outer edge	6	5	0.6	0.1	3.5	1.5	1,275	1,064
B. Mayne Bay-vegetation								
1. Identified-correct	95	43	-2.6	3.4	2.3	1.2	558	807
2. Identified-incorrect	15	7	-2.5	2.6	2.2	1.2	349	301
3. Incorrectly identified as bare								
a. Beyond outer edge	95	43	-9.6	3.9	1.5	0.8	181	265
b. Within outer edge	14	7	1.2	0.6	2.3	1.3	463	636
C. All vegetation								
1. Identified-correct	165	50	-2.2	3.1	2.8	1.4	749	873
2. Identified-incorrect	19	6	-2.3	2.5	2.5	1.3	513	658
3. Incorrectly identified as bare								
a. Beyond outer edge	125	38	-9.4	3.7	1.6	0.8	168	253
b. Within outer edge	20	6	1.1	0.6	2.6	1.4	707	849
D. Mayne Bay-spawn								
1. Identified-correct	76	58	-2.1	2.6	3.4	1.3	-	-
2. Identified-incorrect	15	11	-0.3	1.4	3.9	1.3	-	-
3. Incorrectly identified as bare								
a. Beyond outer edge	38	29	-9.8	3.4	2.6	1.2	-	-
b. Within outer edge	3	2	0.8	-	3.3	-	-	-

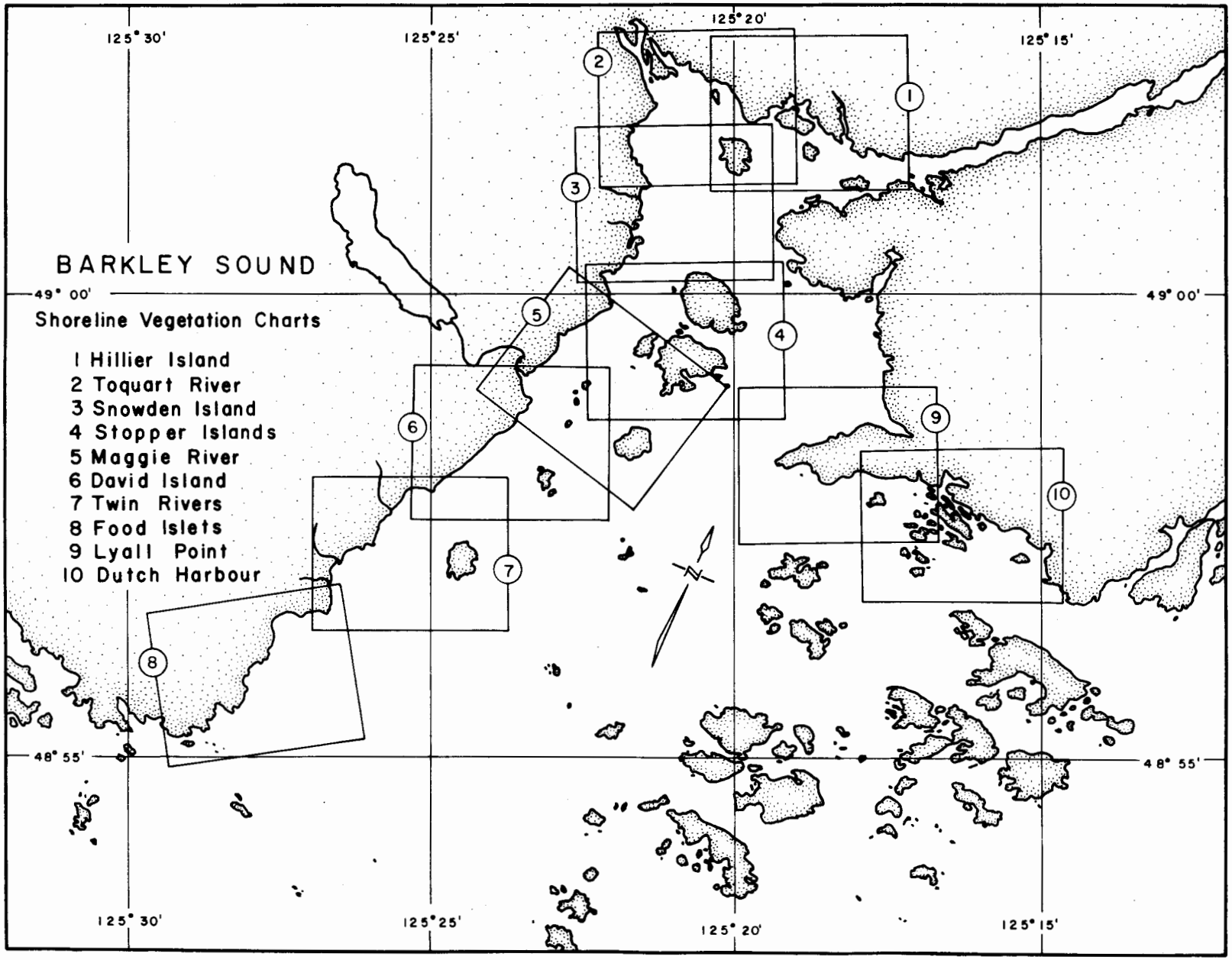

Fig. 1. Shoreline vegetation maps for Barkley Sound.

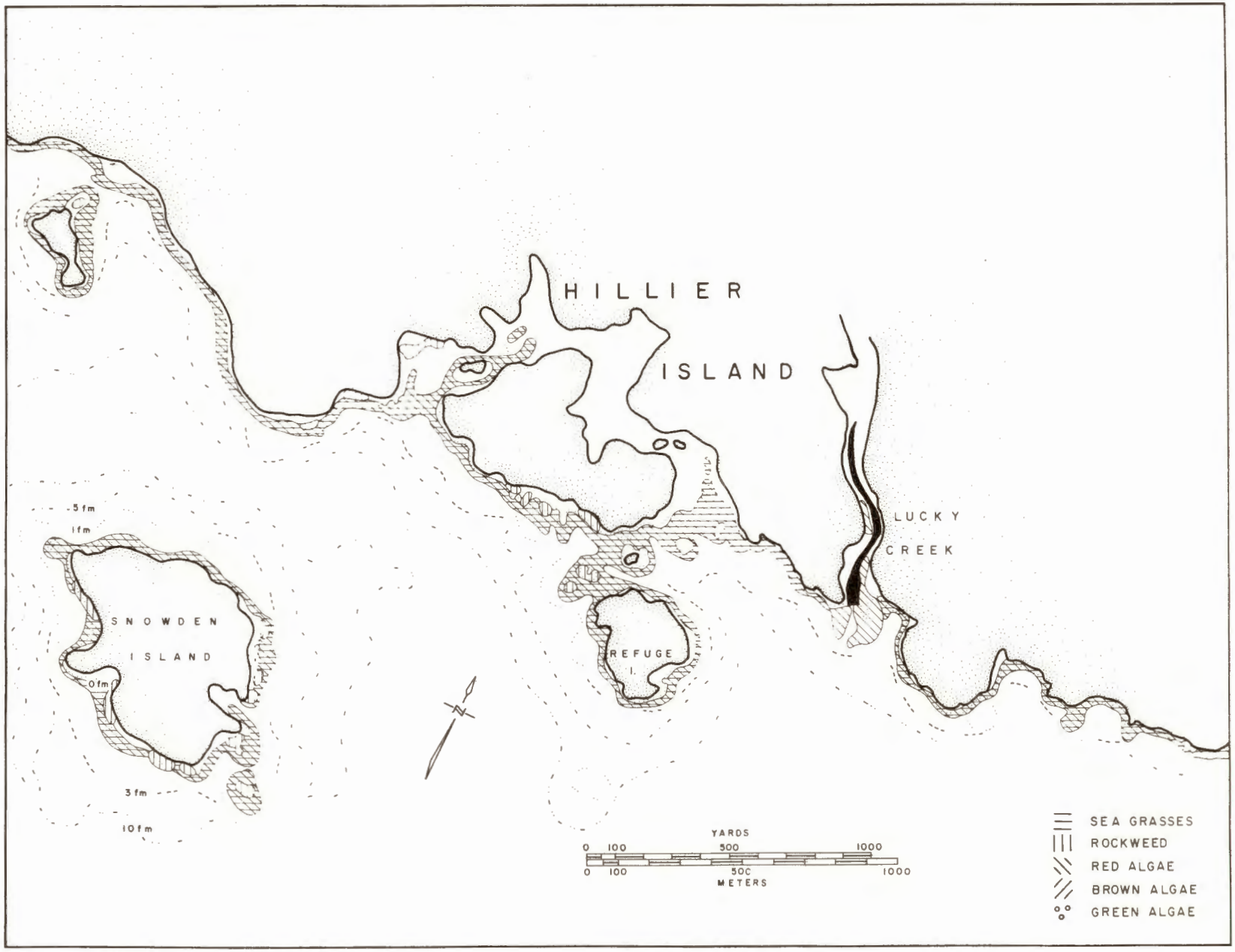

Fig. 2. Shoreline vegetation map from aerial photographs for Hillier Island (map 1 in Fig. 1).

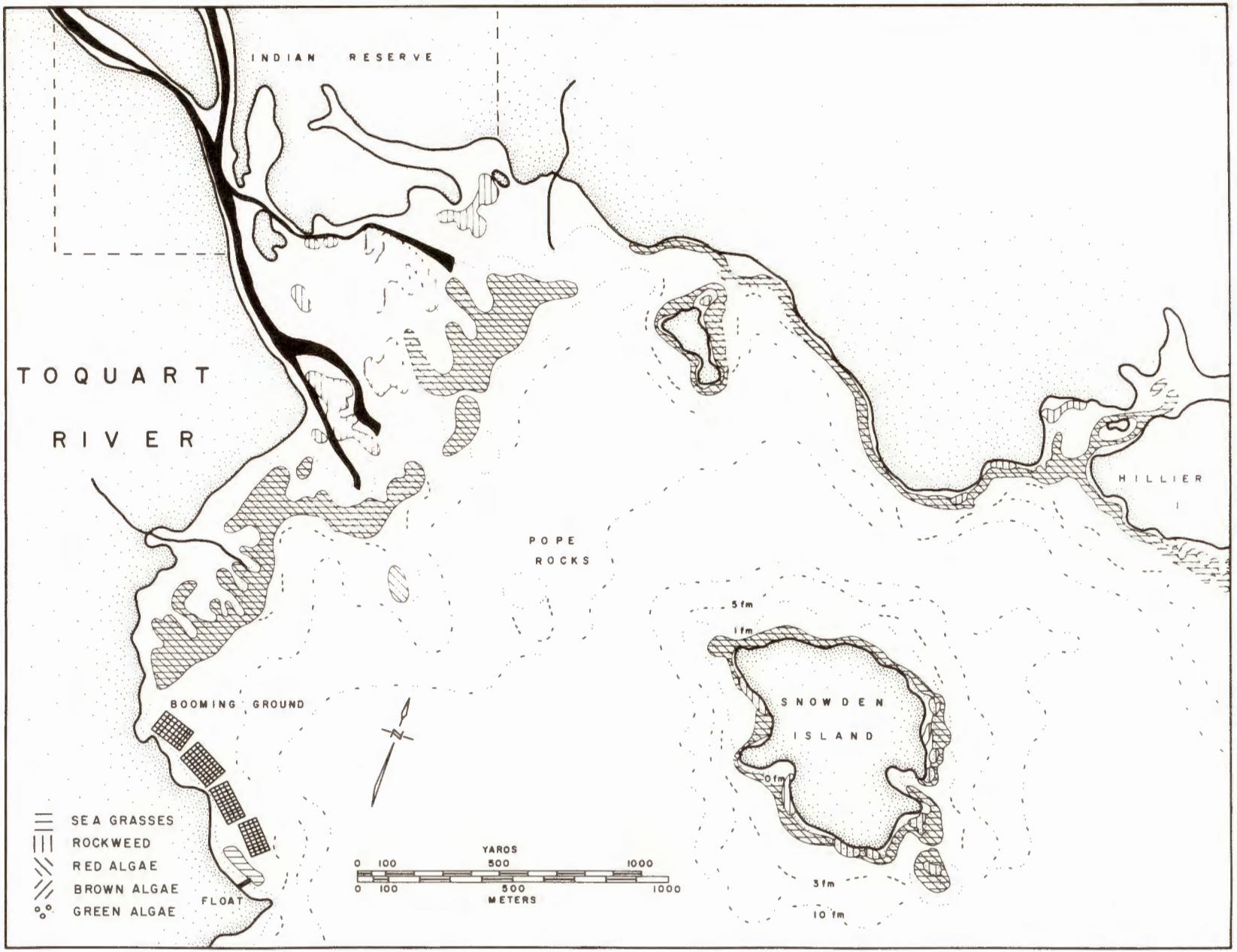

Fig. 3. Shoreline vegetation map from aerial photographs for Toquart River (map 2 in Fig. 1).

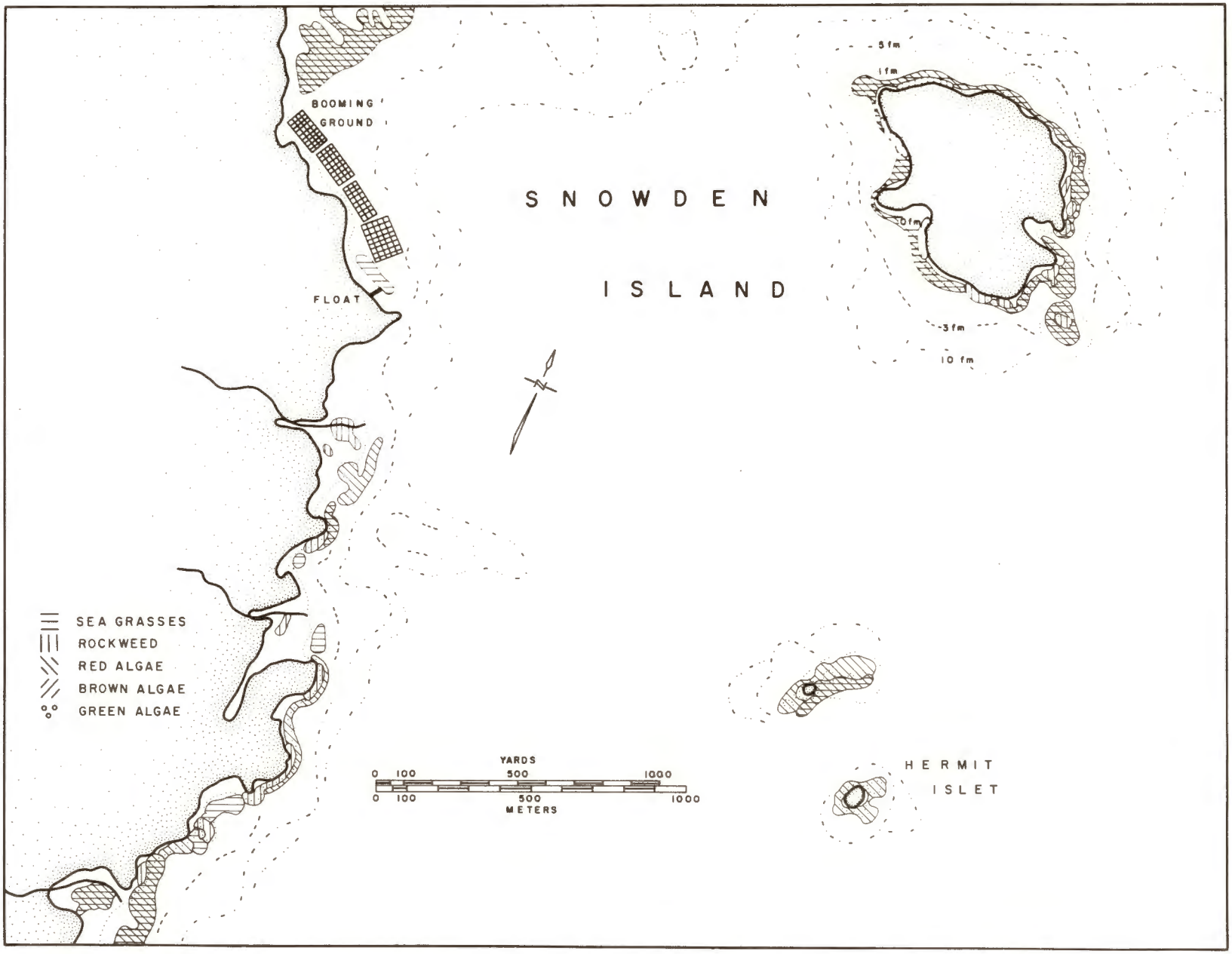

Fig. 4. Shoreline vegetation map from aerial photographs for Snowden Island (map 3 in Fig. 1).

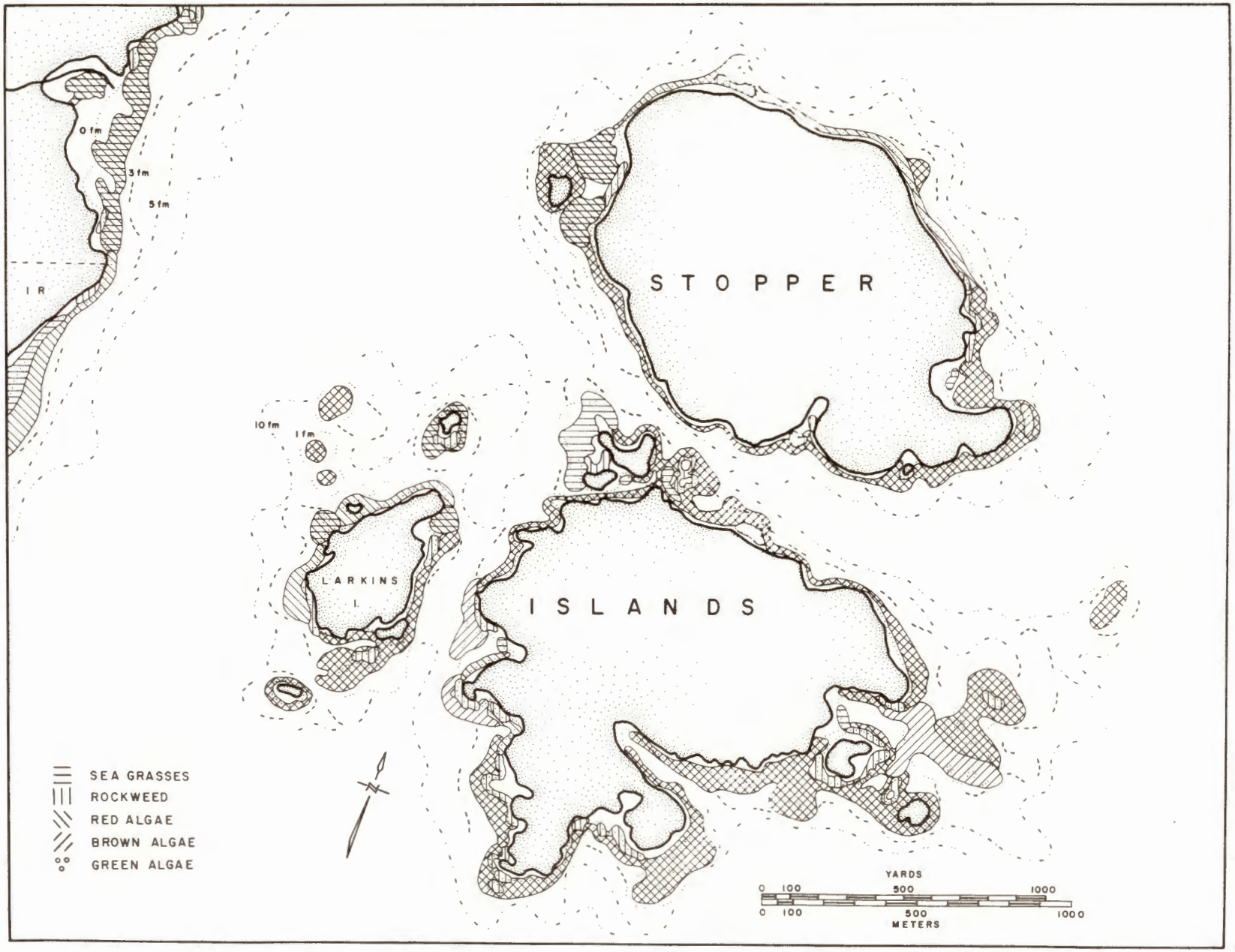

Fig. 5. Shoreline vegetation map from aerial photographs for Stopper Islands (map 4 in Fig. 1).

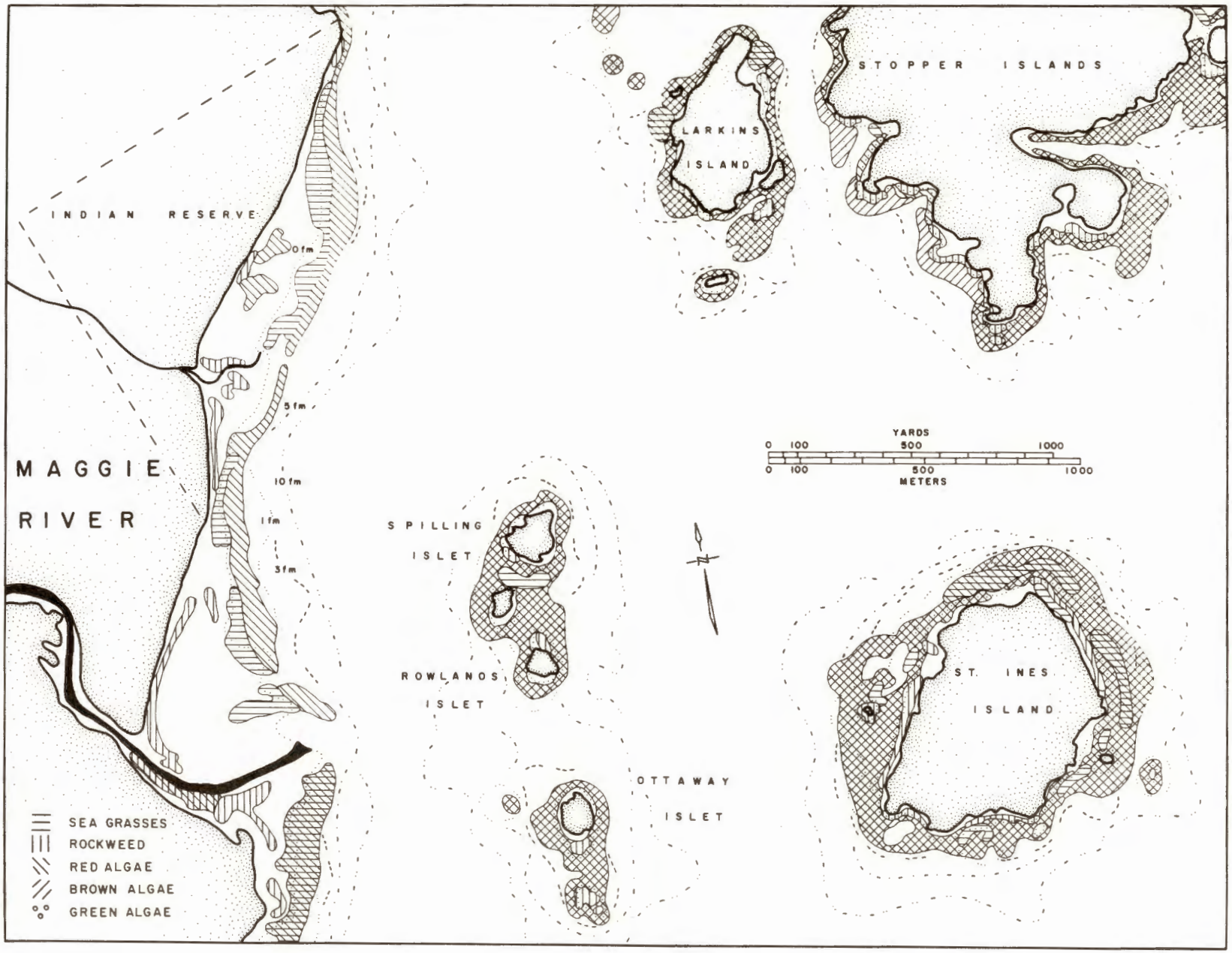

Fig. 6. Shoreline vegetation map from aerial photographs for Maggie River (map 5 in Fig. 1).

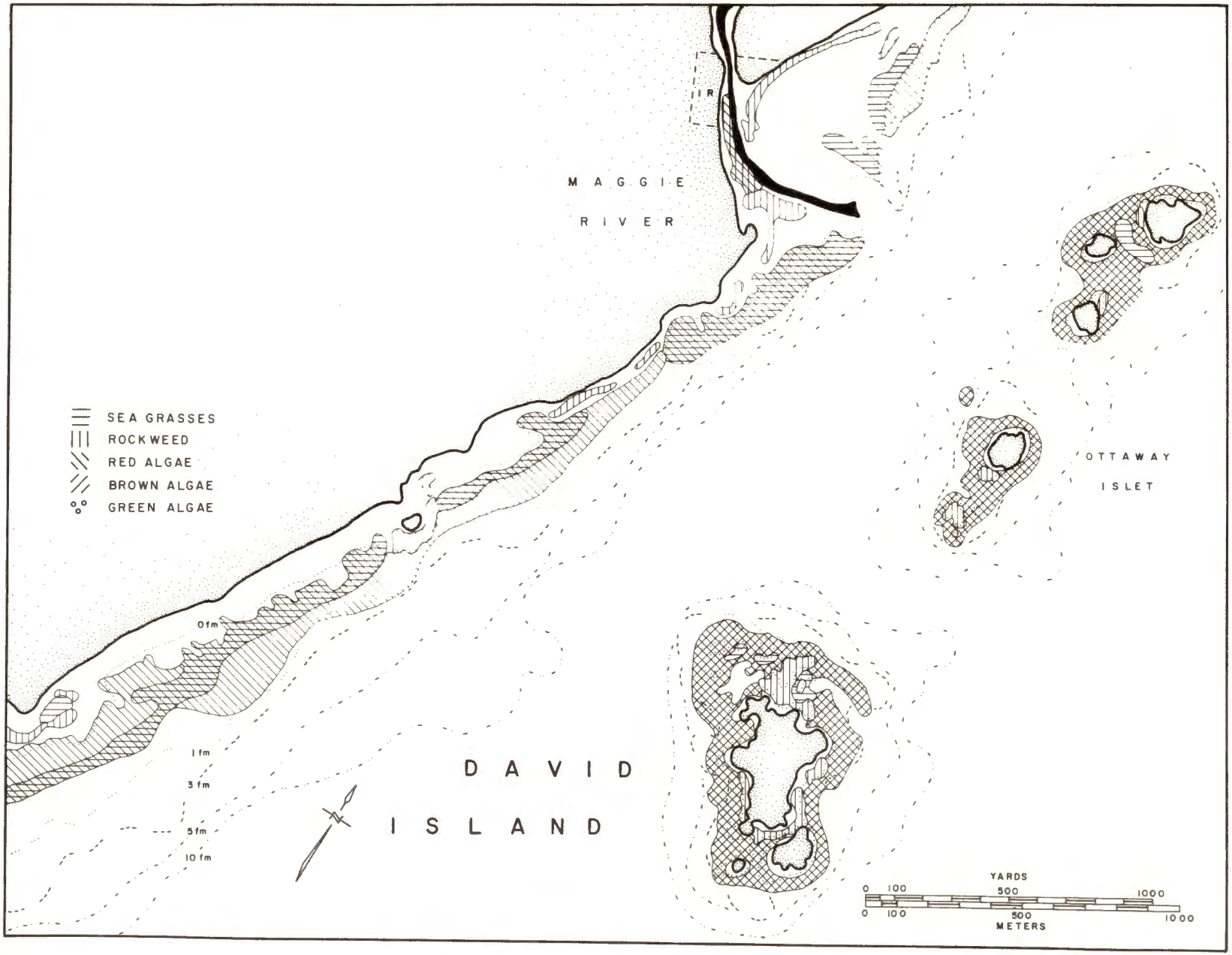

Fig. 7. Shoreline vegetation map from aerial photographs for David Island (map 6 in Fig. 1).

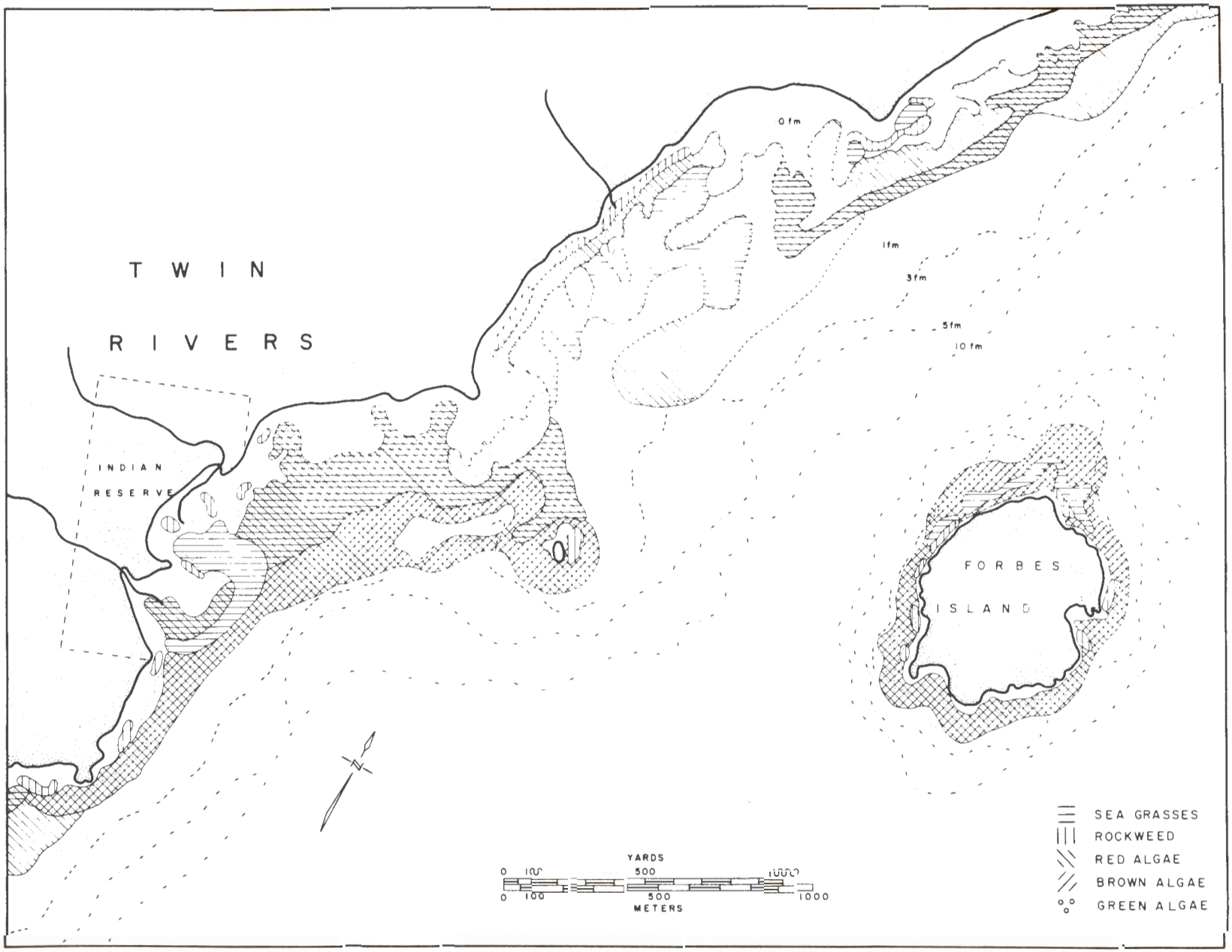

Fig. 8. Shoreline vegetation map from aerial photographs for Twin Rivers (map 7 in Fig. 1)

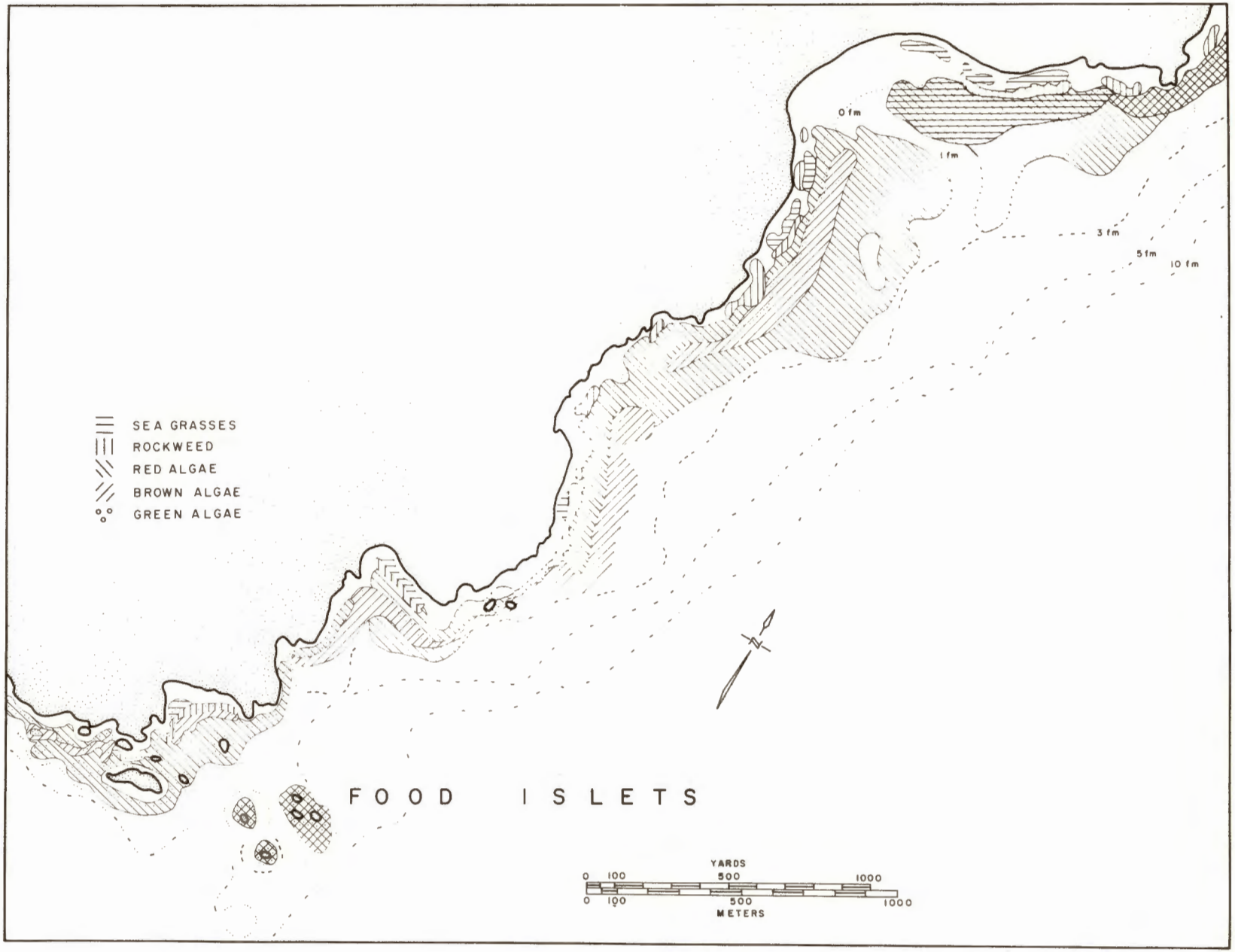

Fig. 9. Shoreline vegetation map from aerial photographs for Food Islets (map 8 in Fig. 1).

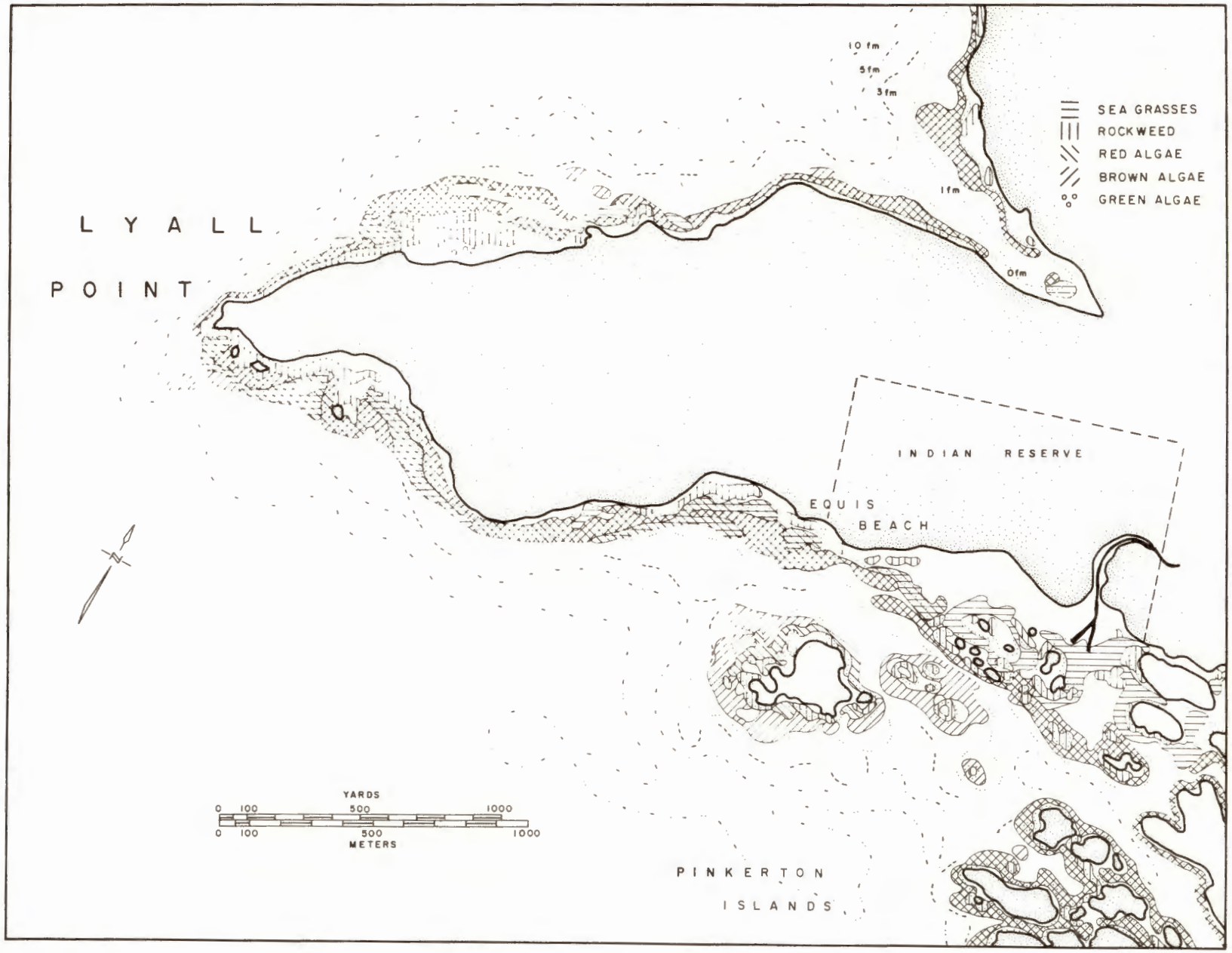

Fig. 10. Shoreline vegetation map from aerial photographs for Lyall Point (map 9 in Fig. 1).

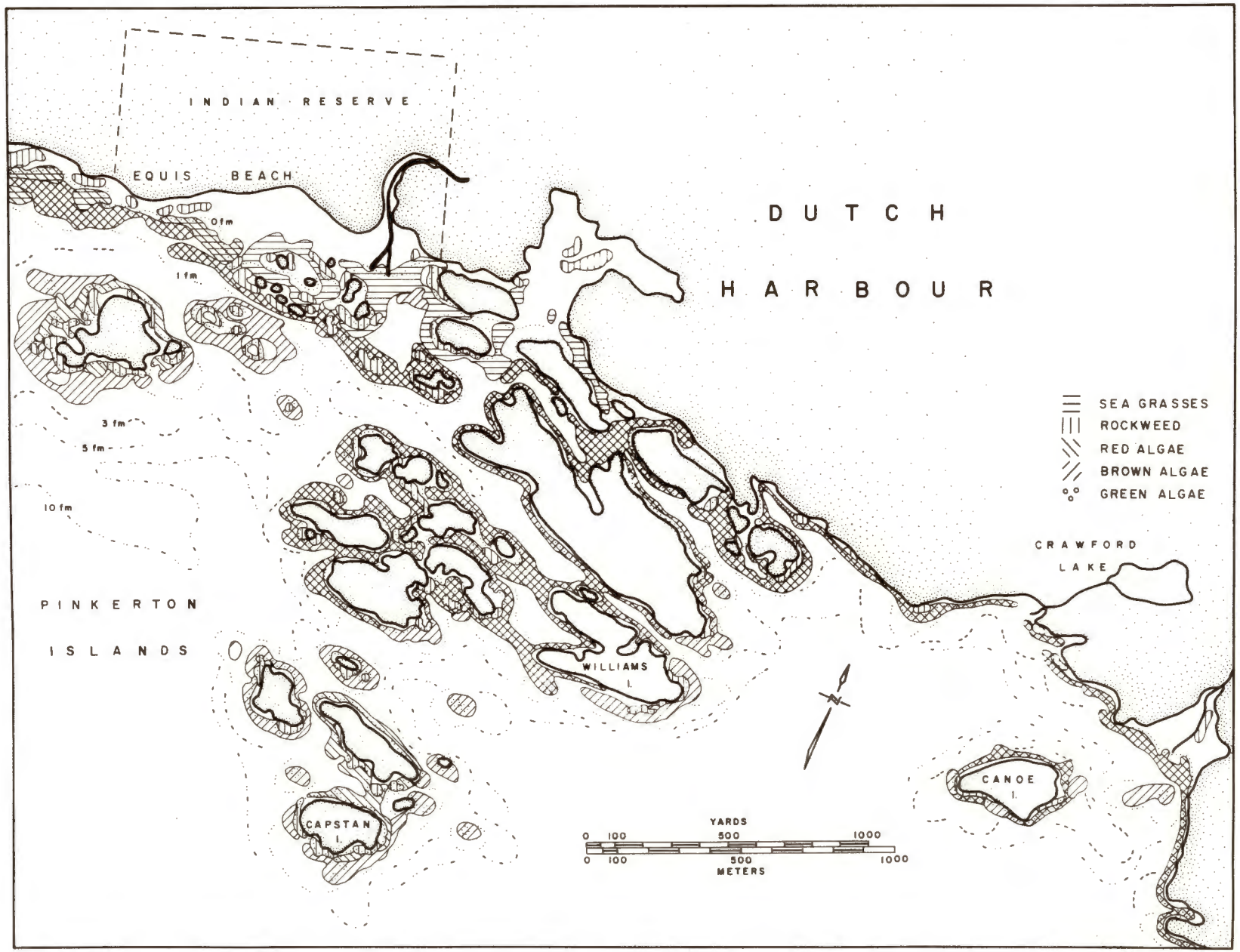

Fig. 11. Shoreline vegetation map from aerial photographs for Dutch Harbour (map 10 in Fig. 1).

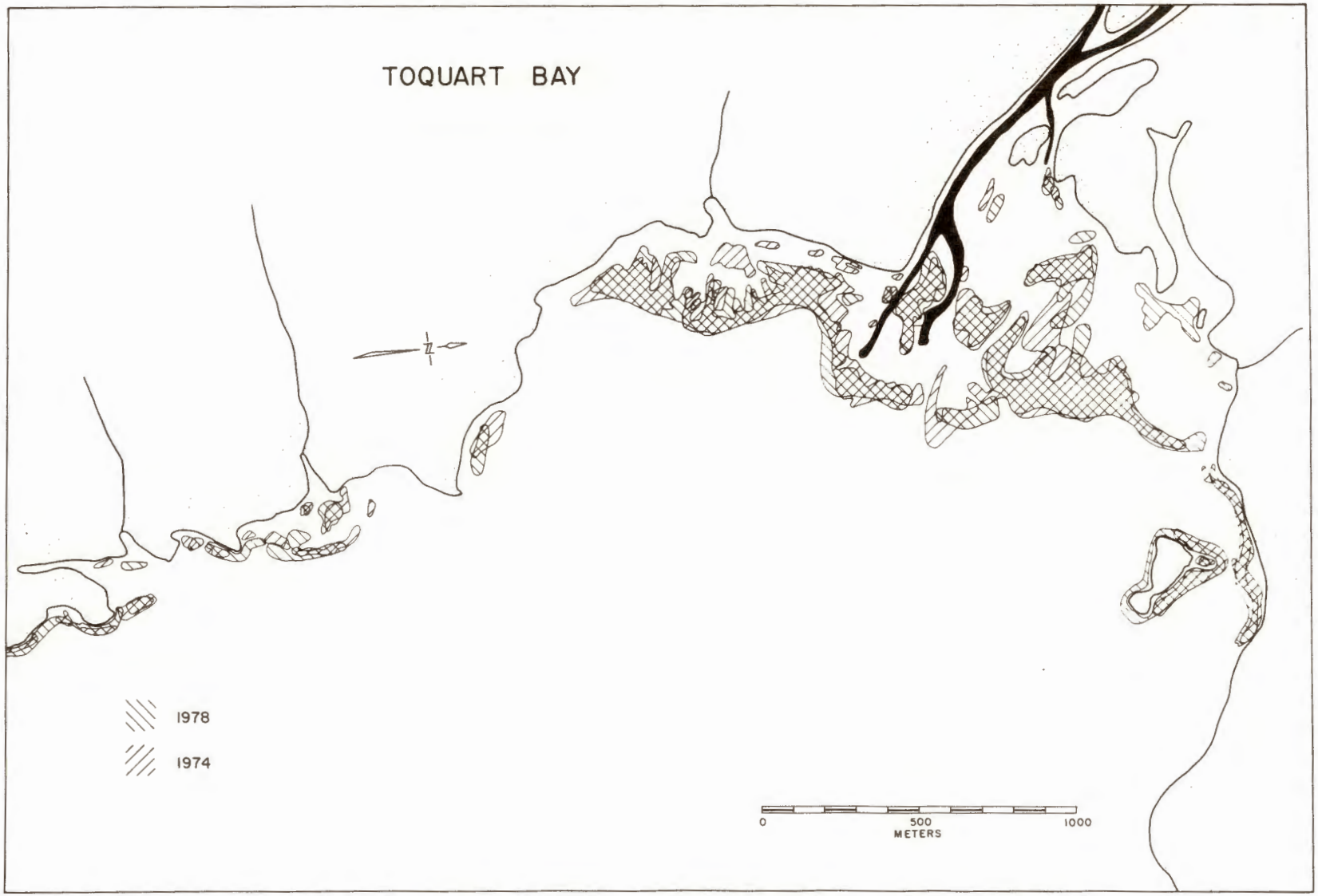

Fig. 12. A comparison of the distribution of vegetation in Toquart Bay as mapped from 1974 and 1978 aerial photographs.

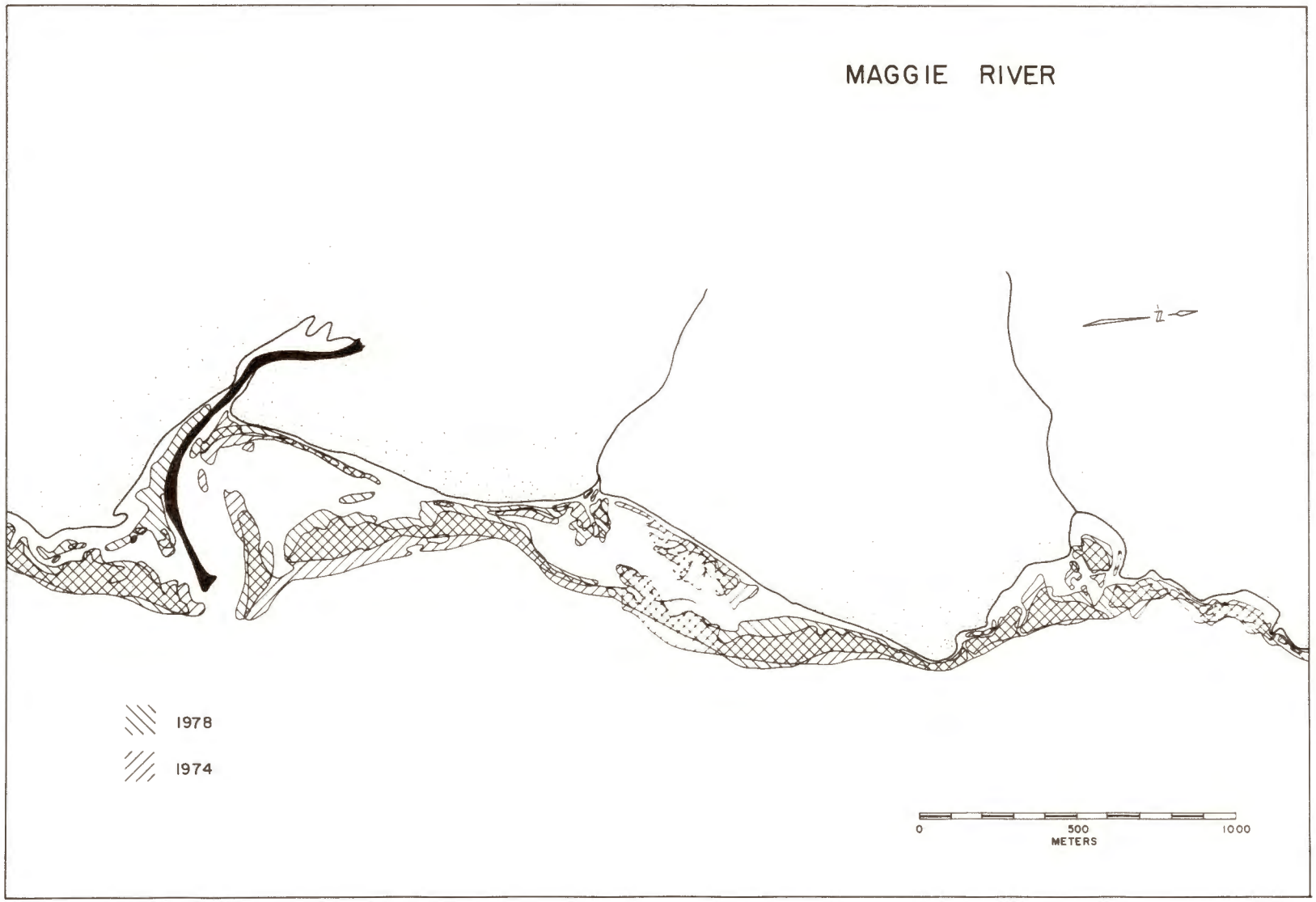

Fig. 13. A comparison of the distribution of vegetation near Maggie River as mapped from 1974 and 1978 aerial photographs.

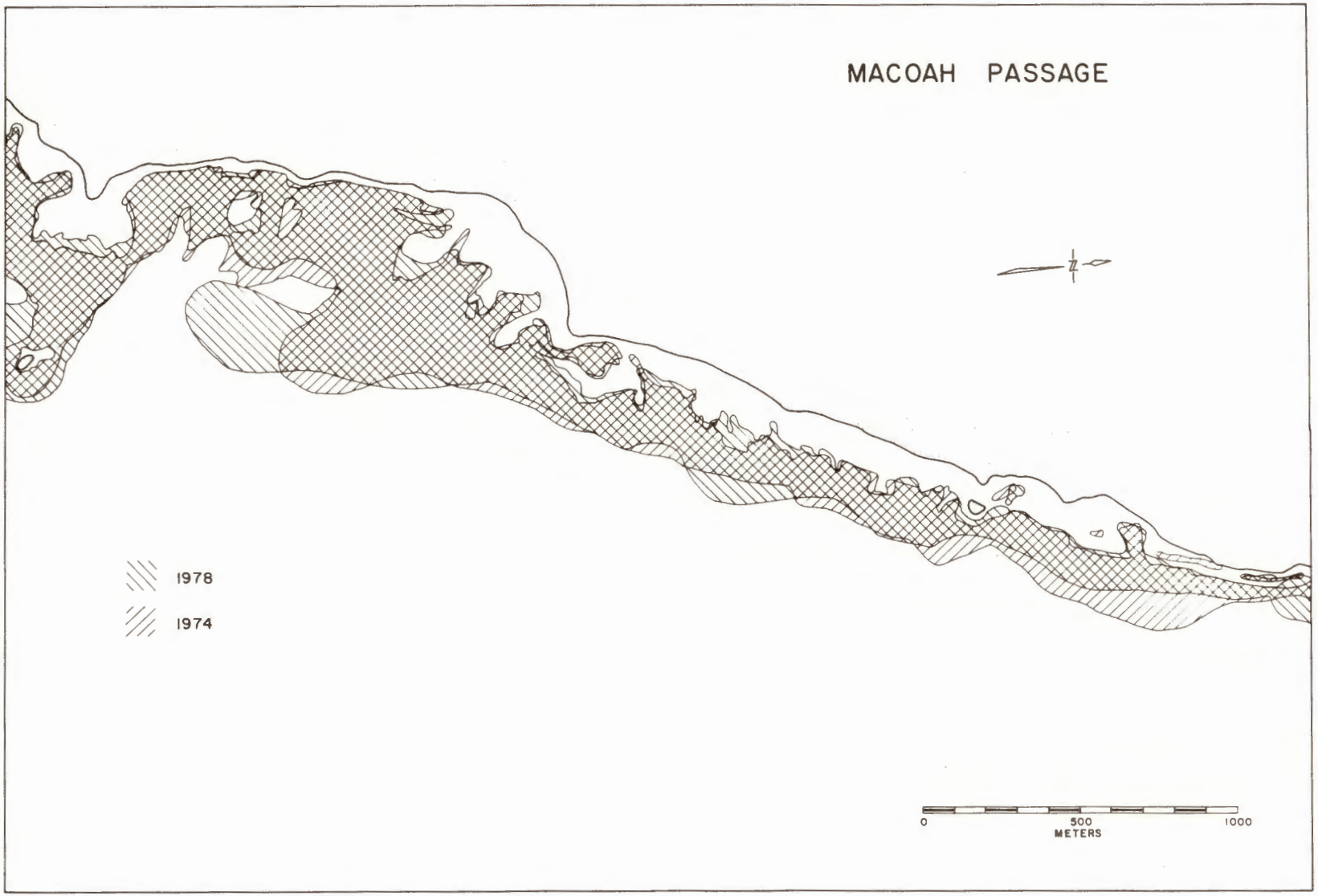

Fig. 14. A comparison of the distribution of vegetation in Macoah Passage as mapped from 1974 and 1978 aerial photographs.

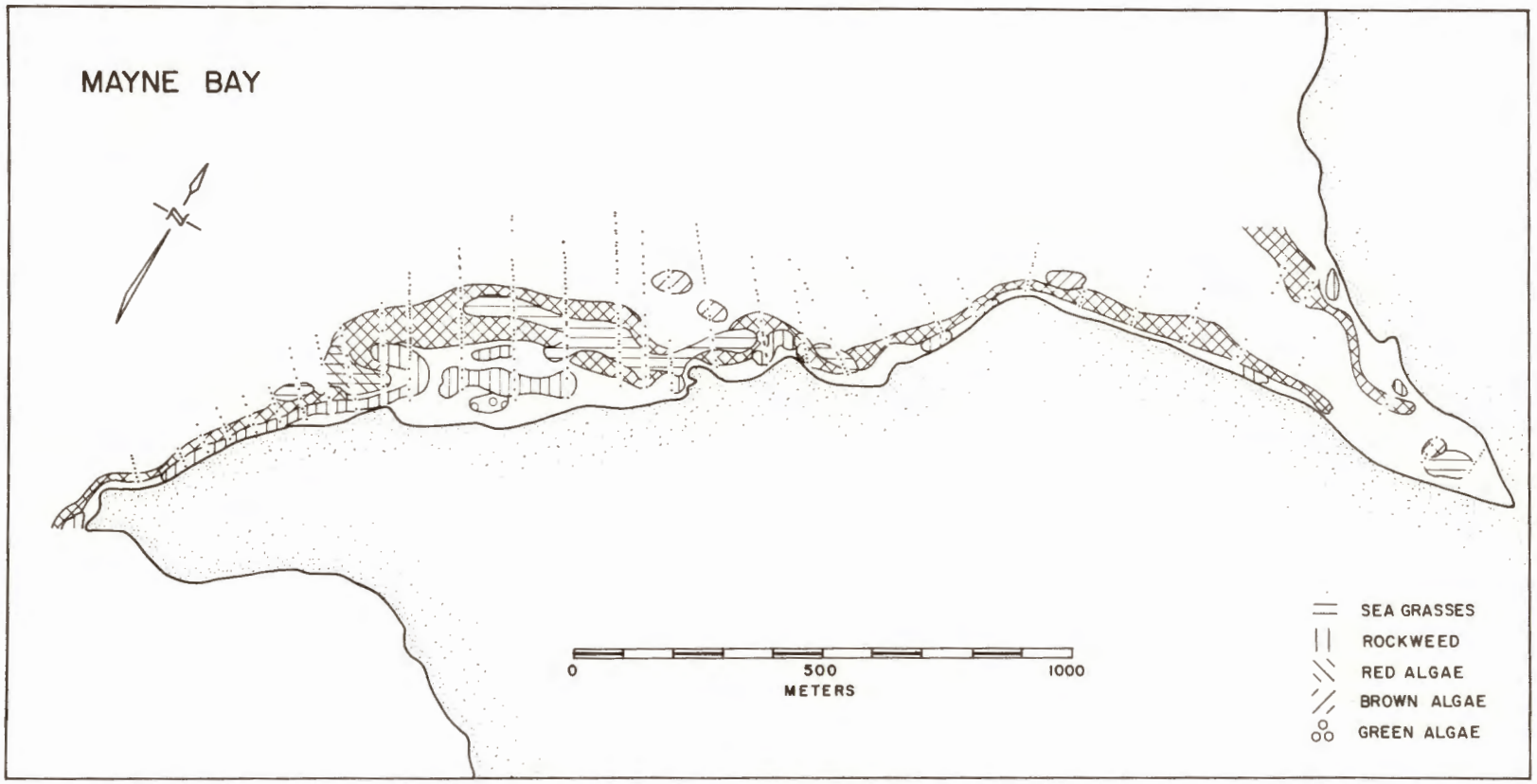

Fig. 15. Sampling stations in 1975 diving survey plotted on 1978 vegetation map from aerial photographs for Mayne Bay.

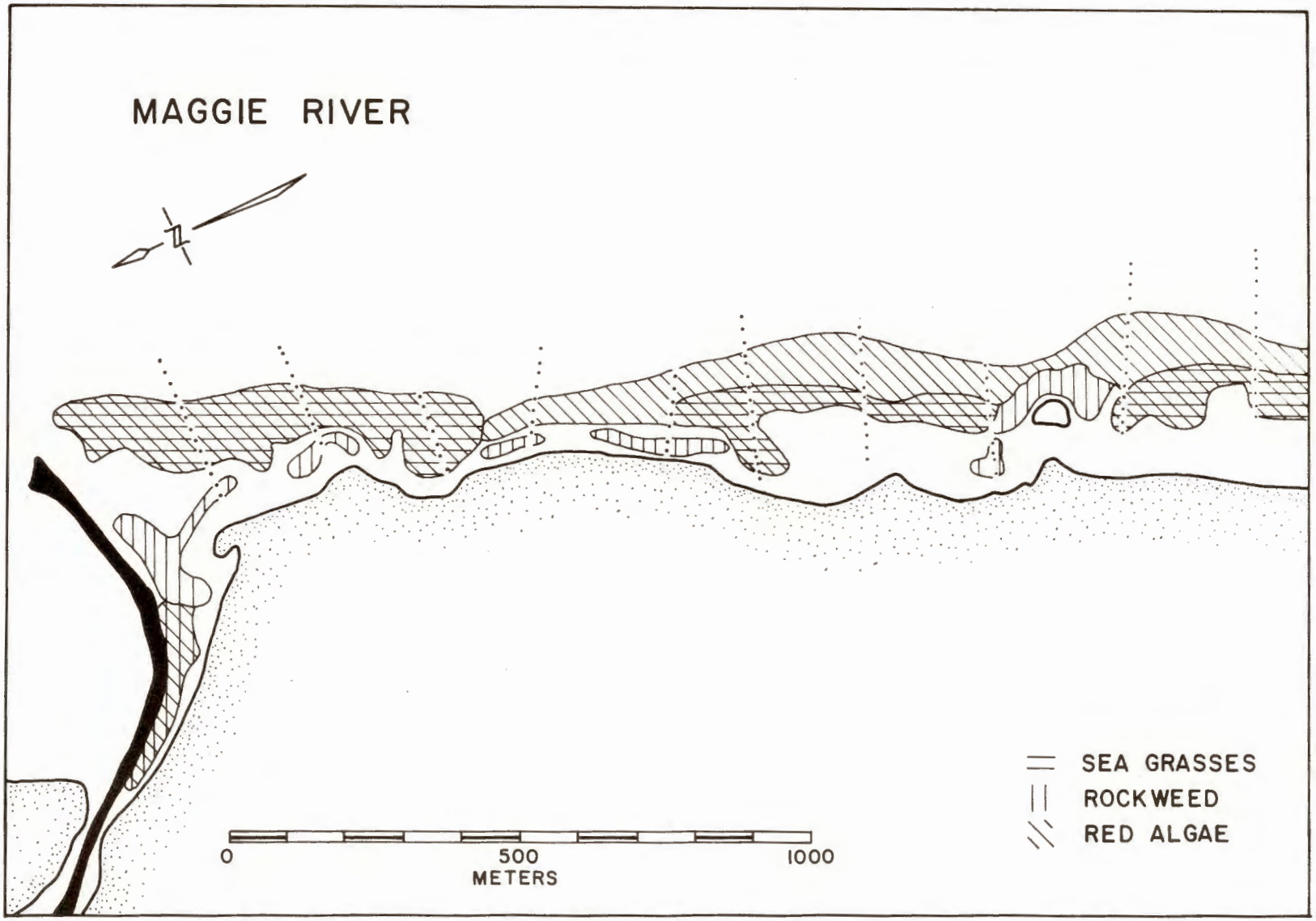

Fig. 16. Sampling stations in 1975 diving survey plotted on 1978 vegetation map from aerial photographs for Maggie River.