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Distribution of macroalgae groupings in shallow waters of Admiralty Bay (King George Island, South Shetland) Islands, Antarctic), plotted with the help of air photographs analysis *

ABSTRACT: A map was made of the distribution of macroalgae groupings in shallow waters of Admiralty Bay. The map was plotted on the basis of analysis of color reversal air photograph taken from a helicopter.

A significant agreament of the results of the pictures analysis with the field studies was found. Also a number of areas not covered by field studies was determined as the ones of probable occurrence of macroalgae. A detailed map of distribution of four distinguished forms of macroalgae groupings was plotted for a small area in the region of Shag Point. Each of these forms is characterised by different association of algal species.

KEY WORDS: Antarctic, Admiralty Bay, benthic algae, photointerpretation, remote sensing

1. Introduction

The observations of benthic algae of the littoral and sublittoral zones in the region of South Shetlands and Antarctic Peninsula were made till now by N e u s h u l (1965), M o e and D e L a c a (1976) and by D e L a c a and L i p p s (1976). A list of algal species and the zonal character of their occurrence dependent on the water depth were estabilished on the basis of these studies. The already presented maps of the distribution of benthic algae were plotted usually on the basis of exploratory

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studies made is various regions of Antarctic (Delepine 1966, Neushul 1968).

Only Delepine (1976) plotted on the basis of air photographs and feild studies a map of the distribution of groupings of benthic algae in Morbinhan Bay, in the region of Kergulene Islands.

The benthic algae of Admiralty Bay are not presented at any map.

The present paper aims at the presentation of an applictaion of color air photographs for plotting the distribution of macroalgae groupings in shallow waters of Admiralty Bay. The term shallow waters determine, in understanding of the authors, the areas where sea bottom is visible at air photographs. The depth of this zone depends on the transparency of sea waters, which reached about 25 m in the optimum conditions for the studied region.

2. Material and methods

The color air photographs were used to plot the map of macroalgae groupings of the studied region. The pictures were taken with the camera Pentacon six TL on a reversal color film ORWO CHROM UT 18 from helicopter Mi-2 during the period December 1978 — February 1979. The height of flight was 1—4.5 km, the camera axis was more or less vertical (Furmańczyk 1981).

The pictures were analysed with the help of a projector — reader Dokumator DL 2, resulting in drawing the sketches with marked ranges of the occurrence of benthic algae. These were transfered on the map of Admiralty Bay of Furmańczyk and Marsz (1980) with the help of an scetchmaster LUZ. The results of field studies were plotted on the same map.

The field study of the distribution of the groupings of benthic algae was done by dredging in the period December 1978 — December 1979 (Zieliński 1981). Observations of benthic flora through the immersible sight-glass and direct observations in the tidal zone during the low water were made, too.

3. Results

A subject map of the distribution of macroalgae groupings in the shallow waters of Admiralty Bay (Fig. 1) was made as a result of analysis of air photographs. It was found, that positively identified algal groupings occur in the following regions:

— from Point Thomas to Demay Point,
— along the South and East coasts of Keller Peninsula,
— in the area of Chabrier Rock,
— in the neighbourhood of West promontory of Dufayel Island.

Analysis of air photographs showed the probability of the occurrence of macroalgae in some areas, but without the possibility of precise and positive determination of the range of their occurrence. These areas are:

— region of the West coast of Keller Peninsula,
— bays Monsimet and Herve.

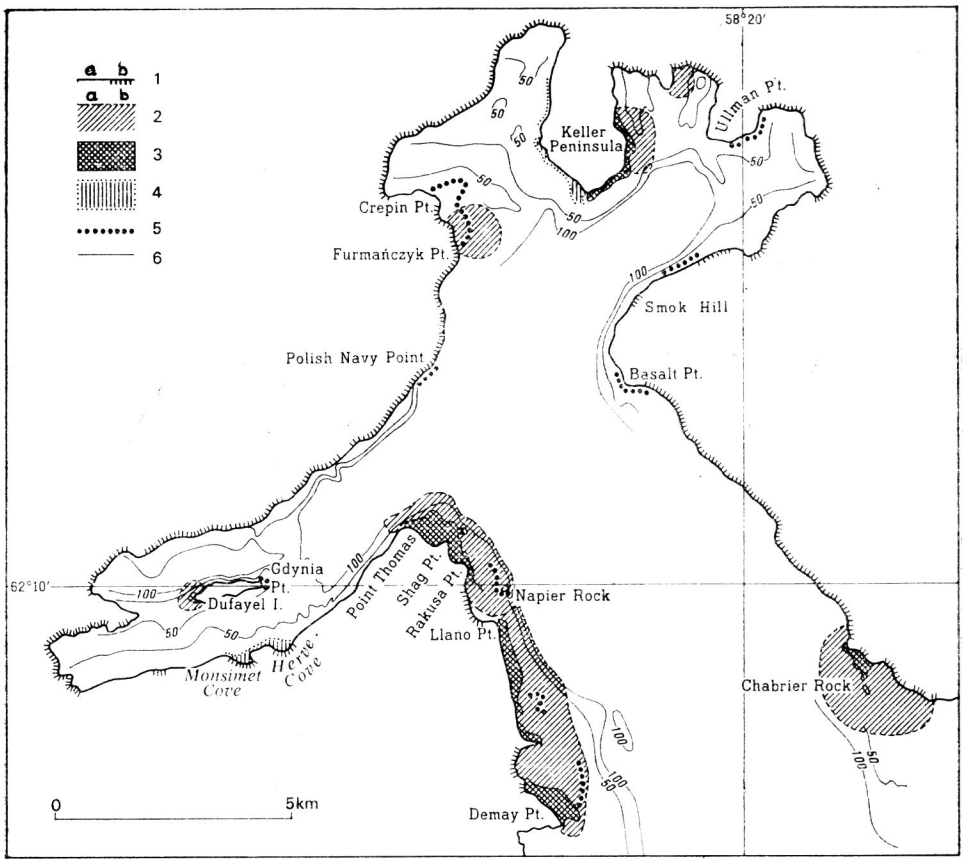

Fig. 1. Distribution of macroalgae groupings in Admiralty Bay

1a — rocky or sandy coast line, 1b — ice coast line, 2 — the range of the occurrence of macroalgae found on the basis of bottom samples, a — definite range, b — approximate range, 3 — range of the occurrence found on the basis of air photographs, 4 — places of the probable occurrence of macroalgae groupings found on the basis of air photographs, without the confirmation of field studies, 5 — area which image on air photographs shows the probability of the occurrence of macroalgae, but without possibility of accurate determination of their range, 6 — isobaths

Apart from that, numerous areas were distinguished, where photographs indicated the possibility of the macoalgae occurrence, but without the possibility of precise and positive determination of the range of their occurrence. The occurrene of macroalgae was confirmed by the field studies in the following places:

— in region from Rakusa Point to Demay Point,
— in region of Crepin Point.

In the following remaining regions determined on the basis of air photographs, the field studies were not made:

— region of Basalt Point,
— region of Ullman Point,
— region of Smok Hill,
— between Crepin Point and Furmańczyk Point,
— area surrounding Polish Navy Point,
— area surrounding Gdynia Point.

A detailed map of the distribution of four forms of macroalgae groupings, with an indication of algal species determined by the field studies, was made on the basis of air photographs for the area from Point Thomas to Rakusa Point (Fig. 2).

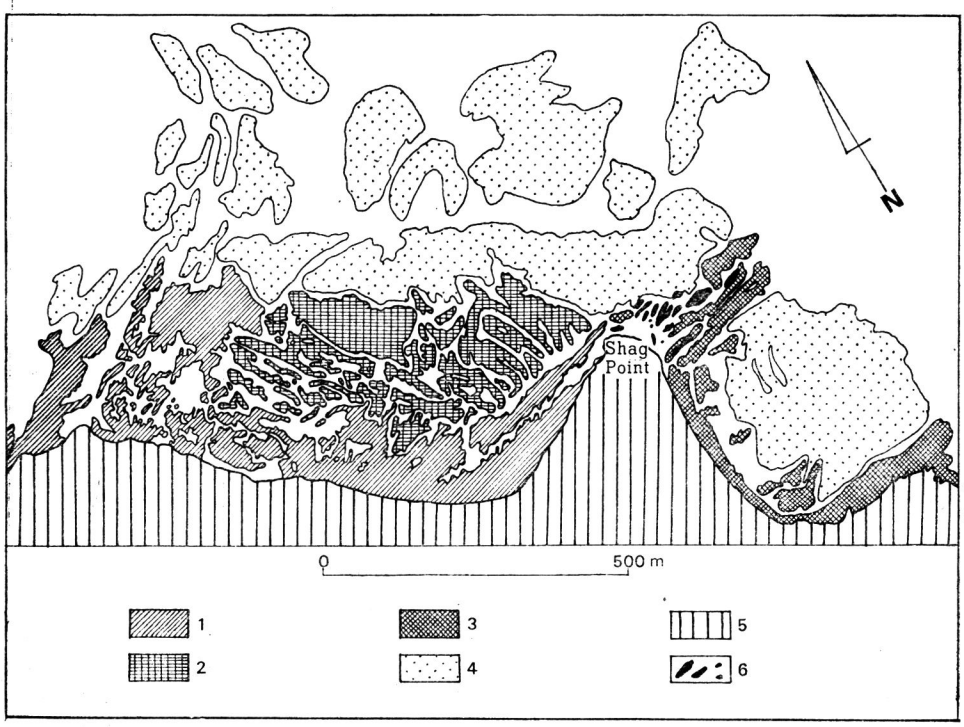

Fig. 2. Distribution of various forms of groupings of benthic algae in the shallow water zone of Shag Point region in Admiralty Bay in 1978—1979, plotted on the basis of analysis of color air photographs

1 — places of the occurrence of macroalgae: *Monostroma hariotii* Grain, *Adenocystis utricularis* (Bory) Skottsberg, *Iridaea obovata* Kützing, *Leptosomia simplex* (A. et E. S. Gepp) Kylin 2 — places of the occurrence of macroalgae: *Leptosomia simplex*, *Ascoseria mirabilis* Skottsberg, *Hildenbrandia lecannellieri* Hariot, *Phycodrys antarctica* (Skottsberg) Skottsberg, *Desmarestia* sp., *Desmarestia menziesii* J. Agardh, *Himantothallus grandifolius* (A. et E. S. Gepp) Skottsberg 3. places of the occurrence of macroalgae: *Monostroma hariotii, Adenocystis utricularis, Iridaea obovata, Leptosomia simplex, Ascoseira mirabilis, Desmarestia menziesii, Desmarestia* sp. 4 — places of the occurrence of macroalgae: *Himantothallus grandifolius, Desmarestia* sp., *Plocamium coccineum* (Hudson) Lynobye, 5 — land 6 — rocks emerging from water

4. Summary of the results

An application of the analysis of color air photographs proved its utilization for the determination of the range of occurrence of macroalgae groupings in the shallow water zone.

The determination of the boundaries of these groupings is difficult for some areas due to the masking of the image by suspended materials, brought in by waters from the land, and drifting on the bay surface.

The transparency of waters does not allow, too, to plot the occurrence ranges of algae below some 25 m depth.

Simultaneous field research and air photography creates the optimum conditions for plotting the occurrence of benthic algae. Air photographs help to decide on the sites of field sampling. In such situations the field study is limited to the verification of regions indicated by air photographs and to studies of the bottom areas overgrown by algae at larger depths.

Similar results on the efficiency of air photographs analysis were obtained by D e l e p i n e (1976). This author plotted a map of the distribution of the groupings of two dominant algal species (*Macrocystis pyrifera* (Linnaeus) C. Agardh and *Durvillea antarctica* (Chamisso) Hariot in Morbihan Bay.

The method of plotting the maps of distribution of benthic algae on the basis of air photography allows to plan efficiently the field studies, and to obtain detailed maps of algal occurrence. Such a map is the basis for further broad biological studies.

5. Summary

A map of the distribution of groupings of macroalgae in the shallow water zone of Admiralty Bay (Fig. 1) was plotted on the basis of analysis of color photographs taken from helicopter Mi-2 during the period December 1978 — February 1979 .The areas of algal groupings, positively determined on the pictures, were distinguished. They occur in the following regions: from Point Thomas to Demay Point, in the area of Chabrier Rock, along the East and South coasts of Keller Peninsula and in the neighbourhood of the West promontory of Dufayel Island. The above was confirmed by the field studies carried out from December 1978 to December 1979.

The areas of probable occurrence of macroalgae, but where the field studies were not made, stretch along the West coast of Keller Peninsula and in bays Monsimet and Herve.

The other distinguished areas have not any precise boundaries, but analysis of their image on air photographs shows the possibility of algal occurrence there. These are the following areas: from Rakusa Point to Demay Point, from Crepin Point to Furmańczyk Point, and near Basalt Point, Ullman Point, Smok Hill, Polish Navy Point and Gdynia Point.

Apart from the above, on the basis of air photographs the four forms of macroalgae groupings were distinguished in the form of a separate map (Fig. 2) for the area from Point Thomas to Rakusa Point, with an indication of characteristic associations of algal species determined on the basis of field studies.

6. Резюме

На основании интерпретации цветных аэрофотоснимков, сделанных в период с декабря 1978 до февраля 1979 г. с вертолёта Ми-2, была разработана карта размещения группировок крупных водорослей в мелководной зоне Залива Адмиралты (рис. 1). Были обозначены места концентрации водорослей четко выделяющиеся на снимках. — от Поинт Томас до Демай Поинт, вблизи Шабрер Рок, вдоль восточного и южного берега полуострова Каллер и в соседстве западнего края острова Дифаел. Это подтвердили полевые исследования, проведенные в период декабрь 1978 — декабрь 1979.

Следующие районы, где вероятно выступают водоросли, расположены вдоль западнего берега полуострова Келлер, а также в бухтах Монсиме и Херви. Однако там полевые исследования не проводились.

В других выделенных районах не были установлены точные границы присутствия крупных водорослей, все же интерпретация картин этих районов по аэрофотоснимкам указывает на такую возможность. Это районы: от Ракуса Поинт до Демай Поинт, от Крепе Поинт до фурманьчик Поинт, вблизи Базальт Поинт, Ульман Поинт, Смок Хилл, Полиш Нави Поинт, Гдыня Поинт.

Кроме того, в форме отдельной карты (рис. 2) можно было по аэрофотоснимкам выделить на территории от Томас Поинт до Ракуса Поинт четыре типа группировок крупных водорослей, для которых на основании полевых исследований были определены характеристические видовые ассоциации водорослей.

7. Streszczenie

Na podstawie interpretacji barwnych zdjęć lotniczych wykonanych w okresie grudnia 78 — lutego 79 ze śmigłowca Mi-2, sporządzono mapę rozmieszczenia skupień makroalg w płytkowodnej strefie Zatoki Admiralicji (rys. 1). Wyróżniono obszary skupień glonów jednoznacznie, czytelne na zdjęciach. Występują one w następujących rejonach: od Point Thomas do Demay Point, w okolicy Chabrier Rock, wzdłuż wschodniego i południowego brzegu płw. Keller i w sąsiedztwie zachodniego cypla wyspy Dufayel. Zostało to potwierdzone badaniami terenowymi w okresie od grudnia 78 do grudnia 79.

Następne obszary, gdzie prawdopodobnie występują makroglony, ale na których nie prowadzono badań terenowych ciągną się wzdłuż zachodniego brzegu półwyspu Keller oraz w zatoczkach: Monsimet i Herve.

Inne wyróżnione obszary nie posiadają dokładnych zasięgów, lecz interpretacja ich obrazów na zdjęciach lotniczych wskazuje na prawdopodobieństwo występowania tam makroalg. Są to obszary: od Rakusa Point do Demay Point, od Crepin Point do Furmańczyk Point, koło: Basalt Point, Ullman Point, Smok Hill, Polish Navy Point oraz Gdynia Point.

Ponadto w postaci odrębnej mapy (rys. 2) wyróżniono na podstawie zdjęć lotniczych cztery formy skupienia makroglonów dla obszaru od Point Thomas do Rakusa Point, którym przyporządkowano charakterystyczne zespoły gatunków glonów na podstawie badań terenowych.

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