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STUDIES ON THE TERRESTRIAL AND FRESHWATER ALGAE
OF ALDABRA ATOLL

by

Alan Donaldson (B.Sc. Dunelm)

A thesis submitted for the degree of Doctor of Philosophy
in the University of Durham, England

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Harold Alderson
30th November 1978

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ABSTRACT

A study was made of the terrestrial and freshwater algae of Aldabra Atoll, Indian Ocean. Field work was carried out between September 1972 and June 1973. Wide ranging excursions were made to various areas of the atoll in order to collect information on the species present together with physico-chemical and descriptive data from representative habitats. Data were collected in a standard manner and stored in a computable form using a modified version of a stream recording system devised in Durham. 1053 samples were collected during the field study, of which 521 were complete with detailed taxonomic and environmental data. The latter are stored on computer file at Durham. The 521 samples constituted an Aldabran data bank and a range of computer programmes facilitated the rapid retrieval of information and the performing of statistical analyses. An example of one such statistical analysis is included in the present study. A taxonomic checklist is given of the 292 species together with descriptions of these species, comparisons with the descriptions given by other authors, the areas of Aldabra from which they were recorded, notes on distribution on Aldabra, habitats, abundance and comparisons with records of other workers.

Blue-green algae are the most abundant species present, predominating in both terrestrial and freshwater habitats. In terrestrial habitats they are often present almost to the exclusion of other species, though in freshwater habitats this predominance is less well-marked. It is probable that some species are restricted to certain regions or habitats; the reasons for such restriction are discussed.

A study of one physiological process in blue-green algae is presented. The nitrogen-fixing potential of Tolypothrix hyssoides and several Nostoc species was investigated using the acetylene reduction assay technique. The study includes rates measured between 0930 and 1200 h, a 24 h time course study for Nostoc commune and laboratory studies on the onset of acetylene reduction after rewetting.

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I am especially indebted to Dr B. A. Whitton, my supervisor, for his original inoculation and further culture of my interest in blue-green algae.

This work would not have been possible without the splendid support of the Royal Society and all those concerned with the conservation of Aldabra. In particular I should like to thank Mr L. U. Mole and Mr D. J. H. Griffin who ensured efficient transport of myself and my equipment to and from Aldabra. While on Aldabra the staff of the Royal Society Research Station gave invaluable assistance with travel on the atoll and in discussion. Without George Larue, Mazarin, Harry Charles, Andrew Quatre and Bernard Legae travel and collection of data on Aldabra would have been so much more difficult. Harry Vidot and Octavien ensured that I was well fed.

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1 INTRODUCTION

1.1 Algal vegetation of atolls and related habitats

Although the literature on the ecology of terrestrial and freshwater algae is large, only a small proportion of it concerns island habitats. Much of what exists was written by early taxonomists (Treub, 1888; Fritsch, 1907; West, 1916; Fritsch, 1945), often forming only a part of larger vegetational surveys or simple floristic lists.

1.11 Coral islands and atolls

It has long been established that there exists a relationship between blue-green algae and carbonate deposits (Fritsch, 1945; Golubić, 1973). It is therefore not surprising that blue-green algae predominate on coral islands and atolls. Of the few accounts of atolls, Taylor (1950), though dealing mainly with marine species, included a number of terrestrial and freshwater algae in an annotated catalogue of the plants of Bikini and other Northern Marshall Islands. He described the blue-green algae as 'unexpectedly varied in character, considering the apparent lack of diversity in environmental conditions'. The most abundant species were: Hassallia byssoides (Tolypothrix byssoidea), Gloeocapsa alpicola, Scytonema ocellatum and Porphyrosiphon fuscus. Tolypothrix byssoidea constituted the most important element of the flora found on the surface of sandy soil inland, abundant crusts of the alga rolling up in the dry season, drifting into heaps which gave the appearance of a 'pile of cinders'. Other terrestrial and freshwater species recorded were: Plectonema golenkinianum in temporary rainwater pools,

Calothrix parietina from the surface of sandy soil, Schizothrix calcicola on sand in openings in woodland, S. longiarticulata forming a coarsely areolate crust on sand in openings of the scrub woodland, Symploca muscorum on sand in openings among trees and Microcoleus acutissimus consolidating fine sand among scattered bushes far above the high tide line. Newhouse (1954) stressed the role of blue-green algae in their possible contribution to the nitrogen budget on Raroia and Arno atolls. The latter point was also stressed by Whitton (1971). Newhouse (1954) recorded blue-green algae occupying a wide range of habitats: Anacystis montana on coral fragments and Cocos nucifera (coconut) husks Fischerella ambigua on inland coral fragments and vegetable fragments, Microcoleus acutissimus from damp inland habitats, M. chthonoplastes on a 'thoroughly algalated' foundation of a village house, Nostoc commune forming thin, olive, membranaceous sheets on the ground and on the trunks of trees in coconut groves, Porphyrosiphon fuscus from coral fragments and coconut stumps, Schizothrix giuseppei on heavily 'algalated' inland coral fragments, Scytonema guyanense from rotten debris, coral fragments and at the bases of coconut, Scytonema hofmanni from the bark and husks of coconut and Symploca muralis from coconut trunks and the cement foundations of houses. He agreed with Cloud (1954) that blue-green algae may aid the binding of sand and coral prior to cementation and that they may be actually 'boring' into the calcareous substrata. Preliminary algal floras were reported for the atolls of Astove and Farquhar and the island of St Pierre (Whitton and Donaldson, 1977) (Table 6.2). These are approximately 60,

750 and 650 km east of Aldabra respectively.

On Astove Tolypothrix byssoidea and Gloeocapsa sanguinea formed a general cover over rocks. Occasionally Tolypothrix byssoidea formed black patches on bare sand; Schizothrix arenaria was the principal associated alga on this occasion. Nostoc commune was sometimes present on limestone, while N. commune var. flagelliforme was frequent in the coconut plantations. Species found frequently on rocks at the edges of pools were, Calothrix parietina, Gongrosira sp. and Oedogonium spp. The plankton consisted of varying proportions of blue-green and green algae.

Farquhar had an inconspicuous algal vegetation. This was possibly due to large areas being covered by coconut and relatively little standing water. Exposed rock surfaces possessed a thin cover of Tolypothrix byssoidea and Gloeocapsa sanguinea. Only one area of freshwater was found in which blue-green algae and purple photosynthetic bacteria predominated. Genera of blue-green algae included: Aphanocapsa, Chroococcus, Lyngbya, Synechococcus.

St Pierre was sufficiently small to obtain an impression of the whole island during the short visit. The visit occurred a year after guano mining had ceased on the island. High levels of phosphate were still available, however, in many microhabitats. Exposed parts of the rock were dominated by Tolypothrix byssoidea and a thin film of Nostoc was common in rock concavities. No large Nostoc commune colonies were seen. At the time of the visit there was much standing water. Small freshwater pools were sometimes completely

filled with Rhizoclonium mixed with numerous small blue-green algal colonies. In the Casuarina equisetifolia forest Oscillatoria animalis was abundant.

In a study of 50 samples from various algal communities on the islands of Egmont, Eagle and Danger in the Chagos Archipelago, Indian Ocean, Whitton et al. (1977) (Table 6.2) found that blue-green algae predominated on all three islands. In three out of the six different types of community described from the three islands Tolypothrix byssoidea predominated. Colonies of Nostoc commune were abundant overlying sand, Lyngbya martensiana and Schizothrix arenaria were frequently noted binding the sand, occasionally forming flattened hemispherical lumps which reached a maximum height of 9 mm.

1.12 Other types of tropical island

The algal vegetation of Heron Island, a sand cay on the southern tip of the Great Barrier Reef was described by Cribb (1964). Although this paper deals mainly with marine algae, some records of terrestrial species were included. There was no natural freshwater on the island other than seepage from rainwater tanks and algae were restricted to terrestrial and subaerial habitats. He described a blue-green algal crust on the bark of Pisonia grandis, where the bark had become tessellated, thus retaining more water. Phormidium corium was the dominant alga, Anacystis montana was occasionally interspersed among the filaments. The crust was better developed on the lower sides of the branches where more water collected. Phormidium autumnale, P. molle

and P. jadinianum were among the additional species found in this better developed crust. Species of Chlorococcum, Phormidium and Oscillatoria were found in sand compacted by bird droppings.

In an extensive study of stromalitic mats on Eastern Andros Island, Monty (1967) observed terrestrial algal mats in which the dominant species were Scytonema myochrous and Schizothrix calcicola. Associated species were: Lyngbya aestuarii, Plectonema sp., Entophysalis deusta, Johannesbaptistia pellucida, Gloeocapsa, Aphanocapsa, green algae and diatoms. He suggested that the relative abundance of each species was controlled by local ecological conditions.

1.2 Environmental factors

Differences between tropical and temperate algal floras have been noted by a number of authors (Fritsch, 1907 ; West, 1916; Strøm, 1924; Prescott, 1956). Climatic factors noted as possible effecting these differences were temperature, light, rainfall, wind, humidity, day length and desiccation (Fritsch, 1907; West, 1916; Strøm, 1924; Whitford, 1960 ; Ganapati, 1960; Lund, 1965; Fogg et al., 1973; Whitton and Sinclair, 1975).

Tiffany (1951) suggested that many of the ecological factors affecting algal distribution were identical with those affecting larger land plants but 'the degree of intensity, the availability and distribution of such factors are different, attention must be directed more and more to the microenvironments of the algae'.

1.21 Subaerial and terrestrial communities

The luxurious development of subaerial algal communities in the tropics has frequently been noted (Fritsch, 1907; West, 1916; Strøm, 1924; Prescott, 1956; Cribb, 1964). High temperatures and rainfall leading to increased humidity contribute to a well developed subaerial flora on rocks, soil, bark, and leaves (Fritsch, 1907; West, 1916). Strøm (1924) suggested that blue-green algae often constituted a main part of the subaerial vegetation in tropical regions, but were probably of little importance in similar situations in temperate regions. West (1916) recognized a number of subaerial plant 'formations' able to develop due to increased humidity:

- i) Protococcus - formation consisting of a bright green encrustation of Protococcus viridis covering the windward side of tree-trunks and walls
- ii) leaf - bark epiphytes
- iii) miscellaneous - formations and associations on rocks and damp ground

The abundance of Trentepohlia as a leaf and bark epiphyte was noted by West (1916) and Strøm (1924). West (1916) suggested that its abundance 'depends entirely on rainfall' and 'this genus attains its greatest luxuriance in damp tropical forests'. Blue-green algae were also regarded by West (1916) as frequent epiphytes on leaves and bark, the genera including: Chroococcus, Gloeocapsa, Hapalosiphon, Phormidium,

Schizothrix, Scytonema and Stigonema. Blue-green algae were described as pioneer species in the colonization of rock (Mishustin and Shil'nikova, 1971). Treub (1888) noted the early development of blue-green algae on the igneous rocks of Krakatoa. Strøm (1924) regarded species of Gloeocapsa as common on wet rocks. He suggested that the differences between rocks which were only occasionally wetted and those which were more or less regularly inundated could not be sharply defined.

The high light intensities and arid conditions often encountered in tropical regions may favour the growth of blue-green algal communities (Fritsch, 1907; Prescott, 1956; Shields and Durrell, 1964; Friedmann et al., 1967; Stewart, 1970; Mishustin and Shil'nikova, 1971; Castenholz, 1973; Whitton and Sinclair, 1975).

Mishustin and Shil'nikova (1971) noted that algae may differ considerably in their tolerance of light and shade. Although blue-green algae were less exacting in their requirements than green algae, Cylindrospermum licheniforme existed in more shady conditions than other blue-green algae and Nostoc developed vigorously in soil shaded by forest vegetation. Fritsch (1907) suggested that the phycocyanin present in the cells of blue-green algae may prevent damage to the cell contents and was the reason for the deep blue colour of the heterocysts, especially in species of Rivularia. Shields and Durrell (1964) noted that the sheaths of blue-green algae were inclined to become pigmented when exposed to strong sunlight and frequent desiccation. Certain green algae may be

excluded at high light intensities and the success of certain green algae such as Trentepohlia which can grow under such conditions may be due to the presence of protective pigments such as haematochrome (Fritsch, 1907). Fritsch (1935) described Pleurococcus and Trentepohlia growing on soft dry rocks in 'full isolation'. Rocks in the shade supported growths of Gloeocapsa, Tolypothrix byssoidea and Stigonema.

When high temperature is combined with lack of moisture, arid conditions result. In the slightly arid, slightly alkaline soils of the south-west U.S.A., Microcoleus and Nostoc were found to be consistently present and often abundant (Shields and Durrell, 1964). Phormidium, Schizothrix, and Plectonema were other genera found in this habitat. Species reported from Death Valley soils by Shields and Durrell (1964) were Anabaena variabilis, Phormidium tenue and Microcoleus vaginatus. In the soils of the southern Nevada Desert they recorded Scytonema hofmanni and Nostoc commune in various stages of parasitism by fungi. In the same area they found that Anacystis montana developed rapidly after precipitation. Stewart (1973) stated that blue-green algae may form an important part of the microbial population in arid desert soils, often forming distinct crusts on soil surfaces, alone or in lichen associations. They also occurred beneath pebbles and stones where light penetrated but where the desiccating effect of the sun's rays was less severe (Stewart, 1970). The ability of blue-green algae to withstand desiccation and thus to favour their growth in arid regions, has been stressed (Fritsch, 1907;

Shields and Durrell, 1964; Fogg et al., 1973). Fritsch (1945) suggested that the sheath possessed by blue-green algae protected them from desiccation, but that the 'peculiar characteristics of their protoplasts' must also be important, since not all strongly resistant types were provided with well defined sheaths. The size and structure of blue-green algal sheaths may vary with environmental conditions (Shields and Durrell, 1964) and they may retain water during periods of drought (Fritsch, 1922). The sheath may absorb up to 13 times its own volume within six minutes on rewetting (Durrell and Shields, 1961). In general, vegetative cells of species of the Oscillatoriaceae which have no perennating cells survive desiccation better than do the vegetative cells of Calothrix, Nostoc and Scytonema (Fogg et al., 1973). The spores and hormocysts of the latter may show great resistance to desiccation, though growth does not take place at humidities of less than 80% (Fogg et al., 1973). Lund (1965) listed three groups of algae in relation to perennation:

- i) Those producing no known resting stage e.g. Microcystis, Gomphosphaeria, Oscillatoria and some desmids
- ii) those occasionally producing a perennating organ e.g. Aphanizonenon
- iii) those producing an organ of perennation annually e.g. Anabaena.

1.22 Freshwater communities

Fritsch (1907) noted a predominance of blue-green algae in tropical waters. He suggested that this may have been due

to higher temperature and the resulting decrease in dissolved gases, the smaller size of blue-green algae facilitating efficient diffusion of gases, thus favouring their growth. He claimed that this view was supported by the predominance of narrow forms of Oedogonium, though his argument is somewhat weakened by his comments on the importance of Spirogyra in the tropics, noting that wider forms predominated in stagnant, poorly aerated waters. He also stresses the scarcity of Cladophora and Rhizoclonium in the tropics, and he explained their 'replacement' by Pithophora as being due to the relatively thinner membrane possessed by Pithophora and its ability to produce a perennating organ. Strøm (1924) suggested that aeration and stagnation as well as having the direct effect of altering the proportions of dissolved gases would also have the indirect effect of altering ionic concentrations.

1.23 Algae and carbonate deposits

Although the literature on the relationships between algae and carbonate deposits is large, much of it deals with marine or ancient deposits. This account deals only with terrestrial and freshwater situations.

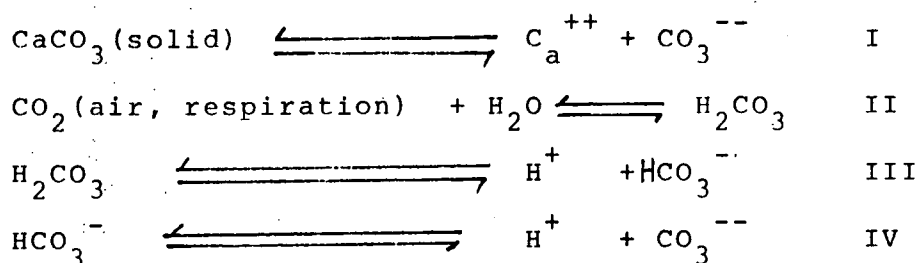
Many authors have noted that certain algae may show a preference for carbonate habitats (Strøm, 1924; Koster, 1939; Fritsch, 1945; Jaag, 1945; Golubić, 1969). The practice of species distinction in blue-green algae based on carbonate encrustation still persists throughout the taxonomic literature (Desikachary, 1959; Starmach, 1966; Bourrelly, 1970). The

relationships between blue-green algae and carbonate deposits have been reviewed by Fritsch (1945) and Golubić (1973); both authors included some mention of other groups of algae. The review of non-vascular plants associated with carbonate deposits by Pia (1934) remains one of the most comprehensive.

1.231 Chemistry of carbonate

A clear account of the role of carbonate in the CO_2 cycle can be found in Hutchinson (1957) and Ruttner (1963). Chemical equilibria for carbonate solution and deposition were quoted by Golterman (1975).

The equations for carbonate in contact with water are:



It can be seen therefore that the solution of carbonate depends on the solubility of CO_2 in water, the solubility product of CaCO_3 and upon the degree to which the solution becomes charged with H^+ . The sources of H^+ may be:

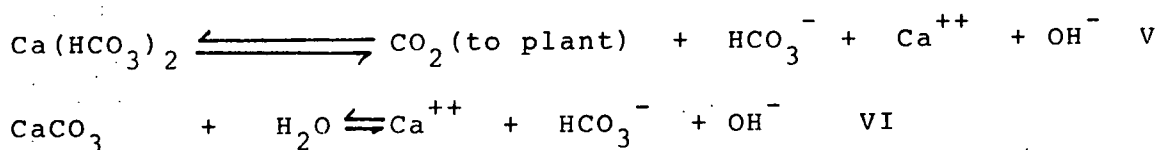
- i) from CO_2 in the atmosphere dissociating in rain water
(equations II, III)
- ii) from CO_2 in the soil dissociating in soil water
(equations II, III)
- iii) from acid metabolic products dissociating in soil water
- iv) from acid decay products dissociating in soil water

Using data on the solubility of calcite, Smith and Mead (1962) calculated that rain water in equilibrium with the CO_2 in the

atmosphere would have a solution potential for CaCO_3 of 75 mg l^{-1} . Rainwater runoff collected from a clean corrugated zinc roof on $\hat{\text{I}}\text{le Picard Aldabra}$ had a mean solution potential for CaCO_3 of 90 mg l^{-1} (Trudgill 1971). Soil water contains much more dissolved CO_2 than rainwater, consequently it has a much higher solution potential for CaCO_3 . A solution potential for CaCO_3 of 175 mg l^{-1} has been calculated by Hem (1970) for soil water at 25°C containing $1\% \text{ CO}_2$.

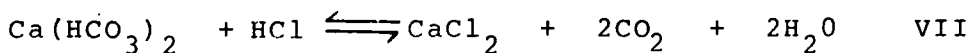
A decrease in dissolved CO_2 due to photosynthesis or a rise in temperature may cause precipitation of CaCO_3 (equations I, II, III, IV). Initial deposition is rapid, but as less CaCO_3 remains in solution the process becomes much slower and many streams and lakes may become supersaturated (Ruttner 1963). A supersaturated bicarbonate-monocarbonate solution may result due to a CO_2 deficit resulting from less CO_2 being returned at night than was removed during the day, removal of bicarbonate being more rapid than the precipitation of CaCO_3 .

The regulation of pH by CaCO_3 was stressed by Ruttner (1963) and Golterman (1975). The ability of some groups of plants to utilise bicarbonate may lead to an excess of OH^- , this in turn leading to an increase in pH (Ruttner 1963). The decrease in free CO_2 followed by a decrease in $\text{Ca}(\text{HCO}_3)_2$ is followed by more CaCO_3 coming into solution.

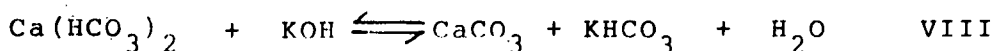


In exceptional cases where growth of vegetation is luxuriant the pH may rise to 11.0 (Ruttner 1963). Ruttner (1963) stated that the pH cannot rise above this value even where there is complete breakdown of CaCO_3 , as CaCO_3 is always precipitated before OH^- reaches a very high level.

The buffering role of carbonate-carbonic acid systems has also been discussed by Ruttner (1963). On addition of acid to a bicarbonate, part of the bicarbonate is split off combining with the H^+ . The CO_2 released is only weakly dissociated and the overall increase in H^+ is only slight (equation VII).



On the addition of alkali a similar reaction takes place (equation VIII).



The importance of these reactions to species with narrow pH tolerances was stressed by Ruttner (1963).

It is of interest to note that though Ruttner (1963) stated that the maximum pH attainable in carbonate systems is 11.0, Baas-Becking et al. (1960) stated that the pH limit for natural waters was 10.55, which is the equilibrium of Na_2CO_3 in contact with atmospheric CO_2 . They suggested however that there may be exceptions to this rule where there were small "ponds" filled with a mass of growing plants. They cited the work of Schutte and Elsworth (1954) who, studying a growth of Potamogeton in a pond recorded a pH of 12.6 in the late afternoon.

1.232 Deposition of carbonate

Two causes of carbonate deposition are recognised in the literature, inorganic and biogenic. Inorganic deposition occurs when water supersaturated with CO_2 , which has brought CaCO_3 into solution, returns to equilibrium with the atmospheric CO_2 . Such occurrences have been described in springs by Jaag (1945) and Irion and Mueller (1968). The deposition is termed travertine and is common around calcareous springs and water falls (Golubić, 1973). Subsequent bacterial decomposition of the entrapped algae leads to increased CO_2 , resulting in the solution of the travertine. The dissolved CaCO_3 is transported downwards and is reprecipitated as a compact deposit known as sinter. Biogenic deposition occurs where water is approaching equilibrium with the atmospheric CO_2 and the ability to encrust may become species specific (Golubić, 1973). In freshwater the deposit is generally calcite while in seawater it is aragonite (Monty, 1965). In reviewing deposition by blue-green algae Fritsch (1945) stated that the crystals were always deposited within the sheath of the alga. The form of the deposit depends on the environmental conditions and whether the deposit is allocthonous or autocthonous.

Calcareous nodules may be formed by autochthonous deposition by algae colonizing pebbles, shells or other debris rolling over a river bed (Roddy, 1915; Howe, 1932; Fritsch, 1945). Sections of the concretions described by Roddy (1915) showed that their formation was due to a community containing Congrosira incrustans, Phormidium incrustatum and Homoeothrix janthina (Golubić 1973). Other species associated with the formation of such concretions are Lithomyxa calcigena (Howe 1932) and Rivularia haematites (Geitler 1932).

In lacustrine environments a substantial part of the CaCO_3 precipitation occurs biogenically due to the phytoplankton (Golubić 1973). Its presence in crusts produced by benthic blue-green algae must therefore be suspected of being largely allochthonous. Soft and hard crusts from a littoral environment have been described by Kann (1941). She found that the soft crust was formed by Schizothrix lacustris and the hard crust formed by Rivularia haematites. She found also that in eutrophic waters the crust was restricted to parts of rocks projecting above the water level where Cladophora cannot grow.

1.233 Erosion of carbonate

Erosion of limestone may take place indirectly due to retention of water or passive release of acids and chelating agents by epilithic and chasmolithic algae (Golubić 1973). Direct erosion of the limestone takes place when endolithic

algae actively penetrate the rock (Golubić 1973). The species of penetrating algae have been reviewed by Frémy (1936). Of the 67 species, 53 were restricted to saline environments, nine to freshwater and five species neither to saline nor freshwater. Blue-green algae were represented by 38 species, green algae by 17 species, red algae by 11 species and brown algae one species.

Limestone erosion on Aldabra has been studied in detail by Trudgill (1972). Analysis of rainwater pools immediately after rainfall showed that by the time the water had run over the surfaces of rocks to pools its CaCO_3 solution potential had been used up. Notches around the edges of pools showed however that further solution must have occurred. Pools containing the blue-green alga Nostoc, decaying litter and faecal material had their solution potential restored.

1.3 Aldabra

The atoll of Aldabra (lat. $9^{\circ} 24'S$, long. $46^{\circ} 20'E$) has in recent years received much scientific attention (Stoddart 1967a; 1971a). Much of the background to Aldabra was discussed in detail in Westoll and Stoddart (1971); only points of major relevance to this thesis are reviewed here.

1.31 Geography

Aldabra is one of a group of slightly elevated coral islands 400 km north-west of Madagascar and 650 km east of the African mainland. It has a maximum length of 34 km and a maximum width of 14.5 km. The atoll occupies a total area of 365 km^2 , 155 km^2 of which are occupied by land. The land

rim consists of four main islands (Fig. 1.1) varying in width from 0.2 km to 5 km. The place names on Aldabra have been reviewed by Stoddart (1971b). Places often bear two names, one Creole and one English. Where possible the Creole names are used in the text. The main islands are Grande Terre (110 km²), Île Malabar (26.4 km²), Île Picard (9.3 km²) and Île Polymnie (1.8 km²).

1.32 Climate

The climate of Aldabra has been reviewed by Farrow (1971) and Stoddart and Mole (1977). The atoll experiences two main climatic seasons, each of approximately six months duration. Aldabra experiences a monsoon or rainy season which lasts from approximately December to April, and a dry season from approximately May to October. Meteorological data provided by the Royal Society synoptic observation station for the period 1967-74 are included in Appendix (Tables A1.1- A1.6).

1.33 Geomorphology

The geomorphology of Aldabra has been reviewed by Fryer (1911) and Stoddart et al. (1971). The depositional and erosional history has been reviewed by Braithwaite et al. (1973). Fryer (1911) first introduced the terms champignon and platin to describe certain types of land forms on Aldabra. Champignon describes deeply pitted, dissected, solution-fretted limestone (Fig. 1.2), often forming pinnacles several metres high. Platin describes smooth-surfaced, paving-stone like slabs of limestone (Fig. 1.3), which is at times slightly rounded but always with very little relief. Stoddart et al.

Fig. 1.1 Aldabra Atoll showing major localities and landmarks.

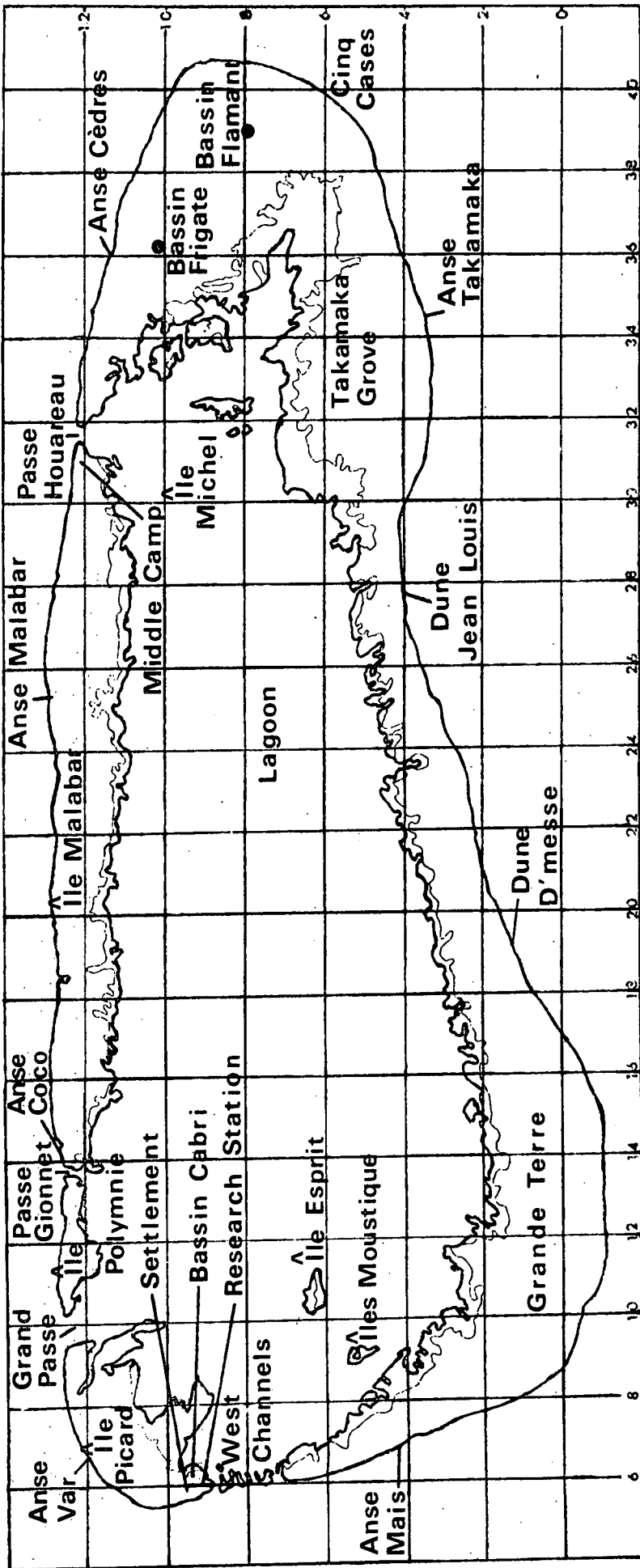


Fig. 1.2 Champignon, Cinq Cases region, Grande Terre

Fig. 1.3 Platin, Cinq Cases region, Grande Terre



Fig. 1.4 Pavé, Cinq Cases region, Grande Terre



(1971) introduced a third term, *pavé*, to describe an intermediate form. *Pavé* describes large areas of rough limestone with a relief of not more than 0.5 m, with points rubbed dull, or rounded (Fig. 1.4). These three rock surfaces accounts for much of the total land area of the atoll and these terms will be used throughout the text. Champignon occupies much of [^]Ile Picard, [^]Ile Malabar, most of Grande Terre from West Channels to a point just west of Dune Jean Louis and occupies the whole width of Grande Terre near Passe Houreau. Small areas of *platin* exists near Settlement on [^]Ile Picard but on Grande Terre it occupies the whole eastern end from Takamaka towards Passe Houareau, in all covering about a quarter of the total land area of the atoll. Much of the rest of the land area other than coastal areas are occupied by intermediates of *champignon* and *platin* here generally termed *pavé*.

Little work has been carried out on the soils of Aldabra. Braithwaite et al. (1972) stated that there were no true soils on Aldabra. Trudgill (1972) was the only person to attempt to describe the 'soils' in any detail. He described the parent materials as being limestone rock, leaf litter, phosphate deposits and calcareous sand, the soils arising from the interaction phosphatic guano, acid mor humus (from litter) and limestone (dissolved by rain water). He suggested that there were two main types of soil, organic and calcareous, further subdividing the calcareous soil into sandy calcareous, brown calcareous and phosphatic, commenting that they were not unlike those described by Fosberg (1954) from the Northern Marshall Islands. He also suggested that the algal "sludge"

in shallow solution basins was possibly the first stage in soil formation. Both he and Fryer (1911) commented that there was very little continuous soil cover on the atoll.

The coastal morphology has been described by Stoddart et al. (1971). Aldabra possesses rarely interrupted perched beach running along the south coast from Point Houdoul to Dune Blanc. The beach consists of coarse sand with some gravel occasionally extending some metres inland where it is only reached by the sea during storms and at the equinoxes, though it is normally drenched with spray at high tide during the trade wind season. In several places it develops into large isolated dunes up to 18 m above sea level as at Dune Jean Louis. Cliffs in various stages of erosion occupy much of the rest of the coastal land rim where cliff retreat has been uneven. There are small pocket beaches locally known as "anses". The lagoonal shores are formed by undercut limestones.

1.34 Flora and fauna

1.341 Flora

A vegetational survey of the atoll has not been published. Fosberg (1971) carried out a preliminary survey and his vegetational categories are used here. A brief resumé of the vegetation types is given here.

Cocos nucifera L. groves are found in a few sandy areas such as settlement, [^]Ile Michel and Anse Mais, with scattered shrubs, grasses and herbs as ground vegetation.

Mixed scrub and scrub forest was 1 - 7 m tall. The main vegetation consists of twelve species but up to 39 species

have been recorded in this category. It has several species of sedge as ground cover with other herbs. It is possible that this category may be further subdivided on completion of the vegetation survey.

Guettarda speciosa L. scrub forest is found on the coastal ridge champignon and sandy ridges and dunes, occasionally with Pandanus cf. tectorius Park.

Mangrove swamp occupies tidally inundated areas of various types of substrata, frequently on mud and marl on lagoonal shores.

Ephemeral herb meadows occurs in areas that are unavailable for other vegetation being submerged or too dry for part of the year. Immediately after heavy rain or dew seed germination takes place of such annuals as Mollugo spargula L., Bacopa monnieri (L.) Wettst., Panicum sp. and Sporobolus sp. on mud or marl along the lagoonal shores.

Pemphis acidula Forst. scrub is generally found on rough low lying champignon; the rougher the champignon, the denser the Pemphis scrub becomes. It formed a belt between the lagoonal mangrove fringe and the mixed scrub scrub-forest.

Casuarina equisetifolia L. forest often occurs with an admixture of Cocos nucifera. It has a sparse shrub layer with few other species.

Mixed herb vegetation is described as open stands of low herbs including Boerhavia elegans Choisy, Asystasia bojeriana Nees, Portulaca oleracea and Solanum nigrum L.

Sedge meadows occurs on open plain where there has been an appreciable accumulation of soil; species include Cyperus

ligularis L., Fimbristylis ferruginea Vahl and F. cymosa R. Br.

Sporobolus virginicus L. meadows are a common feature of the south-coastal sandy ridges and dunes. This species forms a dense sod of matted underground rhizomes and above ground stolons. It occurs usually as pure stands.

Sclerodactylon macrostachyum (Benth.) Camus (bunch grass) occupies large areas of sandy ridges and dunes. Though they occupy identical sites Sporobolus and Sclerodactylon rarely mix.

Mixed orthophyll "tortoise pastures" occurs on silty very flat soil which fill depressions in the plain and in poorly developed champignon and pavé areas, mainly at the eastern end of the atoll. It forms a closely cropped sod of grasses and sedges including Panicum sp. Dactyloctenium pilosum Stapf and Sida parvifolia DC.

Submerged meadows in fresh water or brackish pools are formed by growths of Naias graminea Del. and Chara zeylanica Kl. ex Willd. var. diaphana (Meyen) R.D.W.

1.342 Fauna

The fauna of Aldabra was reviewed by Stoddart (1967b) and detailed accounts of particular groups can be found in Westoll and Stoddart (1971).

Mammals are represented only by bats of which there are four species (Hill 1971).

There are about 21 species of land bird resident on Aldabra and 20 migratory species have been recorded; these have been reviewed by Benson and Penny (1971). Ten species

of resident sea bird have been recorded for Aldabra (Diamond, 1971) and in 1967/68 Penny (1971) recorded 17 species of migrant waders.

Land reptiles are represented by the giant tortoise Geochelone gigantea, two geckos Hemidactylus mercatorius and Phelsuma abbotti abbotti and a skink Ablepharus boutonii personii.

The land invertebrates are represented by insects, (of which there may be over a thousand species) (Cogan et al., 1971), molluscs, spiders, scorpions and eleven species of land crabs. The latter have been reviewed by Grubb (1971). Cardisoma carniflex and Birgus latro are the only species which range far from shore. Grubb (1971) noted that Cardisoma carniflex occurred in large numbers around freshwater pools. The freshwater invertebrates on Aldabra have been investigated; the only published data at present are those of McKenzie (1971) on the Entomostraca and of Wright (1971) on the genus Bulinus.

There are a number of introduced animal species on Aldabra (1.35).

1.35 Influence of man on Aldabra

The influence of man on Aldabra has been reviewed by Stoddart (1967; 1971c) and McKenzie (1971). Major structures include corrugated iron buildings, wood and concrete houses, as well as a number of concrete reservoirs and solar stills on [^]Île Picard. McKenzie (1971) noted enclosures built of wood and boulders on Grande Terre, tracks cleared through scrub, covered rock holes to conserve potable water and

with reference to covered rock holes suggested human contamination of local niches with regards to the local Entomostrocan fauna. Stoddart (1971c) noted the introduction of cats, dogs, goats, mice and rats.

1.4 Taxonomy of blue-green algae

Many authors have commented on the special difficulties involved in the identification of blue-green algae (Papenfuss, 1955; Desikachary, 1970; Bourrelly, 1969; Stanier et al., 1971; Komárek, 1973). The problem may be discussed briefly here. Many difficulties arise due to the lack of easily identifiable characters (Papenfuss, 1955; Desikachary, 1970).

This is more evident in groups where infrageneric taxa are based merely on dimensions such as is the case in the coccoid forms of blue-green algae (Desikachary, 1967). Populations taken from the field may often show great variation (Jaag, 1940; Desikachary, 1967) leading to what various workers have described as 'polymorphisms' (Pringsheim, 1966) and 'morphological plasticity' (Prud'homme van Reine and van den Hoek, 1966) within genera and individual species.

The casual worker has no means of knowing how much this is a response to the environment or how much it reflects genetic differences. It has been shown from laboratory studies that sometimes a single strain can show the features of 3 or 4 different genera depending on the mineral composition of the medium. The taxonomy of the blue-green algae is still based on a number of classical works (Desikachary, 1973) but various authors have suggested the adoption of modern techniques (Whitton, 1970; Stanier et al., 1971).

For many purposes this approach is undoubtedly more sound, it is however much too time consuming for routine monitoring and often involves a great deal of specialized equipment. Whitton (1969) and Desikachary (1973) suggested that for the present, workers in the field would have to rely on the present manuals.

Bourrelly (1969) recognised three types of classical approach. The 'tendance à la pulverisation' of the school of Elenkin who divided the group into 12 orders and 49 families; the 'tendance au rassemblements' of Drouet and Daily who advocated a great reduction in the numbers of orders and families; and, the moderate, conservative approach of Geitler.

Of the earlier accounts of the blue-green algae (Kützing, 1849; Thuret, 1875; Bornet and Flahault, 1886-1888; Gomont, 1892-93; Lemmermann, 1907; Forti, 1907; Tilden, 1910) the International Code for Botanical Nomenclature has recommended that the starting points for the filamentous forms should be Bornet and Flahault (1886-1888) and Gomont (1892), although none have been designated for the coccoid forms. Desikachary (1973) proposed that Lemmermann (1907) be declared as the starting point for the nomenclature of the coccoid forms. Stanier et al. (1971) proposed Nägeli (1849). Koster (1960) suggested that the increased material over the years had given workers a chance to reconsider their conception of species and that later works would reflect this in the varying treatment of the groups within them. Whitton (1969) suggested that Starmach (1966) included the results of much modern research but that its use might be limited due to it

being written in Polish. This would probably be true of Elenkin (1936-49) and Hollerbach et al. (1953), both written in Russian. The works of Drouet and Daily (1956) and Drouet (1963) have gained criticism from Bourrelly (1957; 1969) and Stanier et al. (1971). Their revision of the order Chroococcales and the families Oscillatoriaceae and Nostocaceae greatly reduced the number of genera, uniting species which they regarded as 'ecophenes' (morphological variations produced by varying environmental factors). In the Hyellaceae Drouet and Daily (1956) reduced the five genera into one species Entophysalis deusta. Experimental support for this was produced by Prud'homme van Reine and van den Hoek (1966). Nielsen (1973) demonstrated marked differences in culture of two species Gloeocapsa crepidinium and Hyella balani listed as synonyms of Entophysalis deusta by Drouet and Daily (1956). Stanier et al. (1971) reject their methods on the grounds that they did not embody any extension of the knowledge of the properties of the group. The view that they relied too much on dried material was voiced by Padmaja and Desikachary (1967).

In addition to works on the whole group some authors have published accounts on sections within the group: Calothrix (Fan, 1956-57); Chroococcaceae (Zehnder, 1960); Gloeocapsa (Golubić, 1965); Chroococcales (Starmach, 1967); Homoeothrix (Komárek and Kann, 1973).

Komárek (1973) discussed the prospects for taxonomic developments within the blue-green algae. He suggested that studies which are to support taxonomic evaluation should be as comprehensive as possible, but that the bases should be

investigation of living material both from nature and from cultures. The importance of studying the development of populations in given localities over a period of time in order to ascertain changes in morphology of whole populations e.g. formation of 'stati' reproductive processes and hibernating stages, is stressed by Komárek (1973). He suggested that such ecological studies make it possible to state the range of ecological factors which a species may tolerate and that in this sense 'ecology becomes not only the complement of taxonomic characterization, but directly its constituent.'

The chief disadvantage of a taxonomy based on field material is that it is not possible to measure the extent of variation within a whole taxon and of relating such variation precisely to particular environmental conditions (Komárek, 1973).

Observations of field material must be supported by cultural studies in order to assess what variation may take place under a variety of environmental conditions (Komárek, 1973). The variability of blue-green algae due to the influence of external factors has been studied by a number of authors (Padmaja and Desikachary, 1967; Komárek, 1970; Zehnder, 1970). Such methods however are extremely time-consuming and require the application of precise methods (Komárek, 1970).

Desikachary (1973) stated 'Blue-green algal taxonomy knows no other taxonomy than the classical one.' In the absence of a modern approach which would allow field workers to make relatively rapid decisions relating to species present, it seems that present workers follow the suggestions of Whitton (1969) and Desikachary (1973) and rely on the present manuals.

1.5 Nitrogen fixation

Biological nitrogen fixation is a characteristic of certain prokaryotes including many blue-green algae; these are the only group of algae in which nitrogen-fixing species are known to occur. Stewart (1973) divided this phylum into three groups with regard to nitrogen fixation: heterocystous filamentous, non-heterocystous filamentous, unicellular. He concluded that heterocystous N_2 -fixing species are more abundant in tropical and subtropical areas than in temperate regions. Watanabe and Yamamoto (1971) reported that nitrogen-fixing blue-green algae were more abundant south of the 30° north latitude. Such algae have been reported from a wide range of habitats (Stewart, 1969; Stewart, 1973). In tropical and subtropical regions most attention has been paid to nitrogen fixation in rice paddy soils (Watanabe and Yamamoto, 1971). Among six heterocystous genera, Tolypothrix tenuis showed the highest fixation rates. The earlier literature on nitrogen fixation by blue-green algae in paddy-fields was reviewed at length by Singh (1961).

Renaut et al. (1975) carried out detailed investigations into nitrogen fixation by blue-green algae in Morocco. They recorded nitrogen fixing potential in 22 species isolated from habitats which were neutral or slightly alkaline. There was no evidence of nitrogen fixation in arid and semi-arid soils except in a few habitats after the rainy season. In coastal dune areas there were good growths of Nostoc species which did not reduce acetylene during the dry season except during the morning when the algae were wet with dew, the temperature was below $38^\circ C$ and the light intensity below

40,000 lx. In untreated samples activity decreased from that found in the morning to a negligible level in the early evening. If samples were wetted with distilled water rates of acetylene reduction were higher, suggesting that desiccation was an important regulatory factor. The samples treated with distilled water however showed a decrease around midday and the authors suggested that high temperatures and/or light intensity may also have inhibitory effects on nitrogen fixation.

In aquatic ecosystems blue-green algae are abundant in many neutral and alkaline freshwaters, and may comprise an important component of the freshwater phytoplankton. Few accounts exist from tropical lakes, though Horne and Viner (1971) suggested that the nitrogen fixation by blue-green algae in Lake George, Uganda may account for 30% of the total particulate nitrogen present. The dominant blue-green algae present were Microcystis aeruginosa, M. flos-aquae and Anabaenopsis spp., together constituting 80% of the phytoplankton (Burgis et al., 1973). In their study of Moroccan lakes, Renaut et al. (1975) found that rates of acetylene reduction by planktonic blue-green algae varied with time of day.

1.6 Aims of project

Aldabra, an isolated atoll in the Western Indian Ocean (1.3) has long attracted the interest of scientists, being one of the least disturbed elevated limestone ecosystems and due to it possessing a particularly varied island flora and fauna.

In the mid 1960's attention was drawn to the atoll when it became known that Aldabra was being considered as a possible site for a strategic airbase. Stoddart (1968) outlined the possible effects that this might have on Aldabra, suggesting that the human influence had already disrupted the ecosystems of other Indian Ocean islands. In 1967 The Royal Society decided to launch an immediate scientific expedition to make what records it could before development began. The plans for the airbase were eventually shelved and in 1969 The Royal Society established a research station on ^{Île} Picard in order to facilitate continued research on the atoll. This present study forms part of this research programme.

Aldabra appeared particularly suitable for the study of terrestrial and freshwater algae. The land rim is composed entirely of limestone, much of which is exposed due to the paucity of soil (1.33) and there are a large number of freshwater pools formed by rainwater collecting in hollows in the limestone. Many authors have commented on the luxuriant growths of blue-green algae on limestone (1.23) and the rich algal floras often possessed by tropical pools (1.22).

Aldabra is sufficiently small (1.31) to present the possibility of obtaining a complete floristic list of the terrestrial and freshwater algae, data on physics and chemistry

of habitats and a possible insight into the role played by terrestrial and freshwater algae in the primary productivity of a relatively undisturbed, closed ecosystem.

Many species of blue-green algae have been shown to fix atmospheric nitrogen (1.5). A number of authors have commented on the possible contribution such species may make to nitrogen budget of atolls (1.5). The acetylene reduction assay method of assessing nitrogen fixing potential requires little in the way of sophisticated equipment in the field, although final estimation of ethylene could be done only on return to Durham. It was therefore decided to assess the nitrogen fixing potential of certain blue-green algal species on Aldabra.

Such possibilities had to be modified in the light of difficulties presented by the atoll itself. The extreme isolation of Aldabra (it can be reached only by chartered ship) and the general inaccessibility of certain areas of the atoll placed limitations on the initial aims. The laboratory on [^]Ile Picard (Fig.1.1) possessed basic laboratory facilities but it was not possible to use complex and sensitive equipment on the atoll.

It had been intended that field studies would last up to 12 months during which time large amounts of partially unassimilated date would accumulate. As there would be no opportunity to return to Aldabra to check data it was decided to store the data in computable form to facilitate retrieval and analysis of data on return to Durham.

The following aims were selected:

- a) Preparation of a computer data storage and retrieval system,
- b) Collection and examination of material from various areas of the atoll for the compilation of a species list.
- c) Measurement of physical and chemical parameters in selected algal habitats.
- d) Use of acetylene reduction technique to assess the nitrogen fixing potential of selected algal species.

2 MATERIALS AND METHODS2.1 List of abbreviations and symbols

A	= absorbance
A _{max}	= maximum absorbance
chl <u>a</u>	= chlorophyll <u>a</u>
cm	= centimetre
°C	= degrees Celsius
g	= gram
h	= hour
kts	= knots
KN	= Kilonewton
l	= litre
lx	= lux
m	= metre
M	= mole
mb	= millibar
mg	= milligram
ml	= millilitre
mm	= millimetre
max	= maximum
min	= minimum
nm	= nannometre
nM	= nannomole
s	= second
µg	= microgram
µm	= micrometre
<u>v.</u>	= versus
%	= percent
‰	= per thousand

2.2 Collection, preservation and examination of specimens

2.21 Collection

In order to produce a complete floristic list of terrestrial and freshwater algae it was necessary to visit as many areas of the atoll as possible. The areas visited are shown in Fig. 2.1. The choice of areas visited was governed to a considerable extent by ease of accessibility, availability of natural landing stages, tides and, to a lesser extent, weather. In addition visits were made to obtain representative samples from a variety of environments:

- a) various geological types e.g. various rock and soil types
- b) various types of vegetation e.g. Casuarina forest, mixed scrub
- c) where there were obvious influences from the flora and fauna e.g. dense shade created by trees, presence of large numbers of tortoises, pools visited by large numbers of birds
- d) areas where there were marked effects of climate e.g. strong S E winds in the Cinq Cases area of Grande Terre
- e) areas influenced by man e.g. settlement and research station, [^]Ile Picard
- f) any other areas where there may have been some local influence on algal communities e.g. possible effect of sea spray in Cinq Cases and Dune Jean Louis areas of Grande Terre.

To ease the recording of data the atoll was divided into various sampling areas each of which was designated with an

Fig. 2.1 Areas of Aldabra visited during the present survey



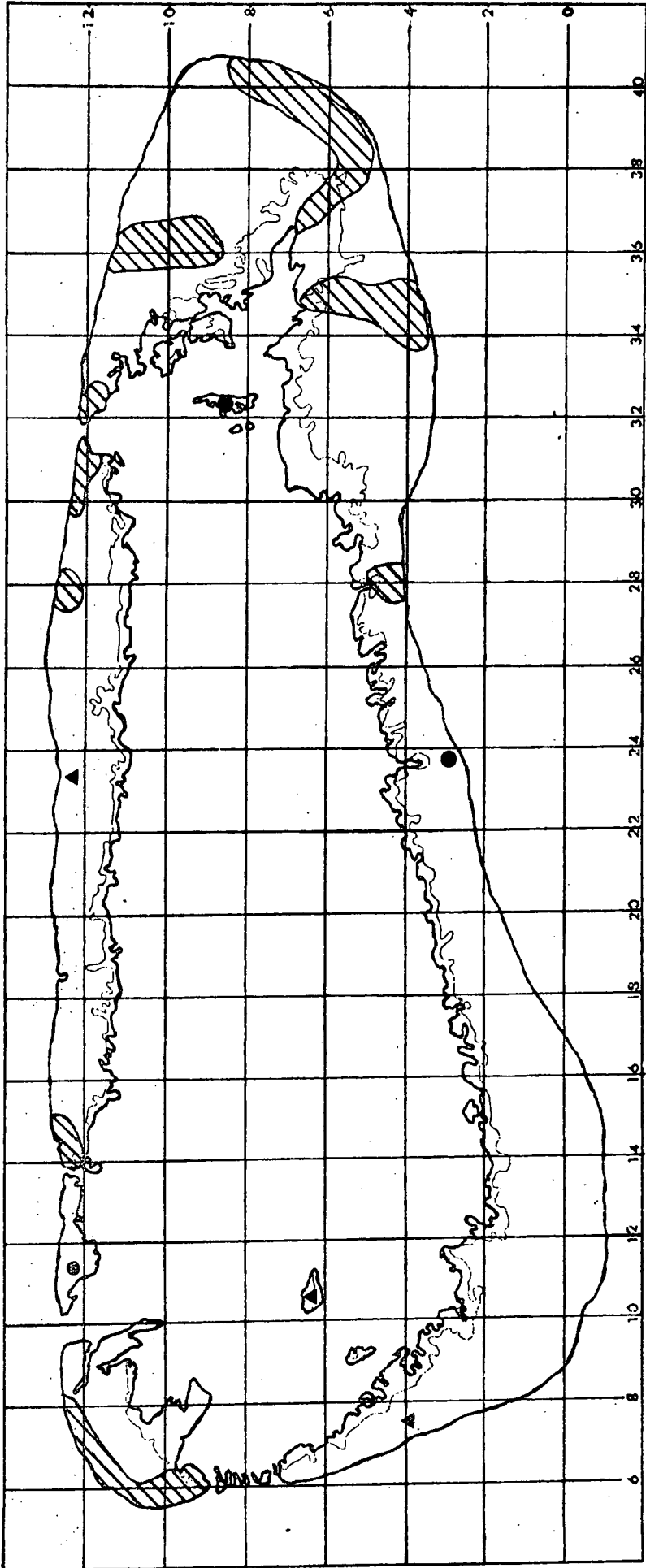
areas sampled extensively



areas visited for localized collecting



samples obtained but area not visited
personally



'island code' Fig. 2.2 Each sample number was prefixed by the island code of the area from which it was collected. Major pools were allocated numbers 1 - 100 and less important pools 101 - 200 and were prefixed with the island code of their location, thus pool W9 is major pool number 9 on Ile Picard. Typical pools are illustrated in Figs. 2.3 - 2.12.

All pools and terrestrial sampling points were allocated grid references devised by the following method:

Either the pool itself, or the nearest obvious landmark, was located on the reduced lay-down of the June 1960 aerial photographs (D.O.S. (P.M. SEY) Aldabra West, Aldabra East, 1969)). The position on these photographs was then related to the two nearest points (such as sites with bench-marks) which could be found both on the aerial photographs and the outline map of Aldabra which includes both grid lines and bench-marks (D.O.S. 304 - series Y852, 1964). Using these marker points, the position of the pool was determined on the outline map, thus giving the grid reference. Pools studied in this survey are described in Table 2.1.

At each site sampling was broken down into two major processes. Terrestrial samples were collected first, followed by aquatic samples if present. Macroscopic growths were collected first and examined with the aid of a Cooke McArthur portable field microscope (Vickers Instruments Ltd.). The result of this preliminary examination determined what further detailed sampling would be required. Representative substrata were then collected for detailed examination of microscopic algal growths on return to the research station.

Fig. 2.2 Aldabra showing areas, divisions and associated
'island codes'

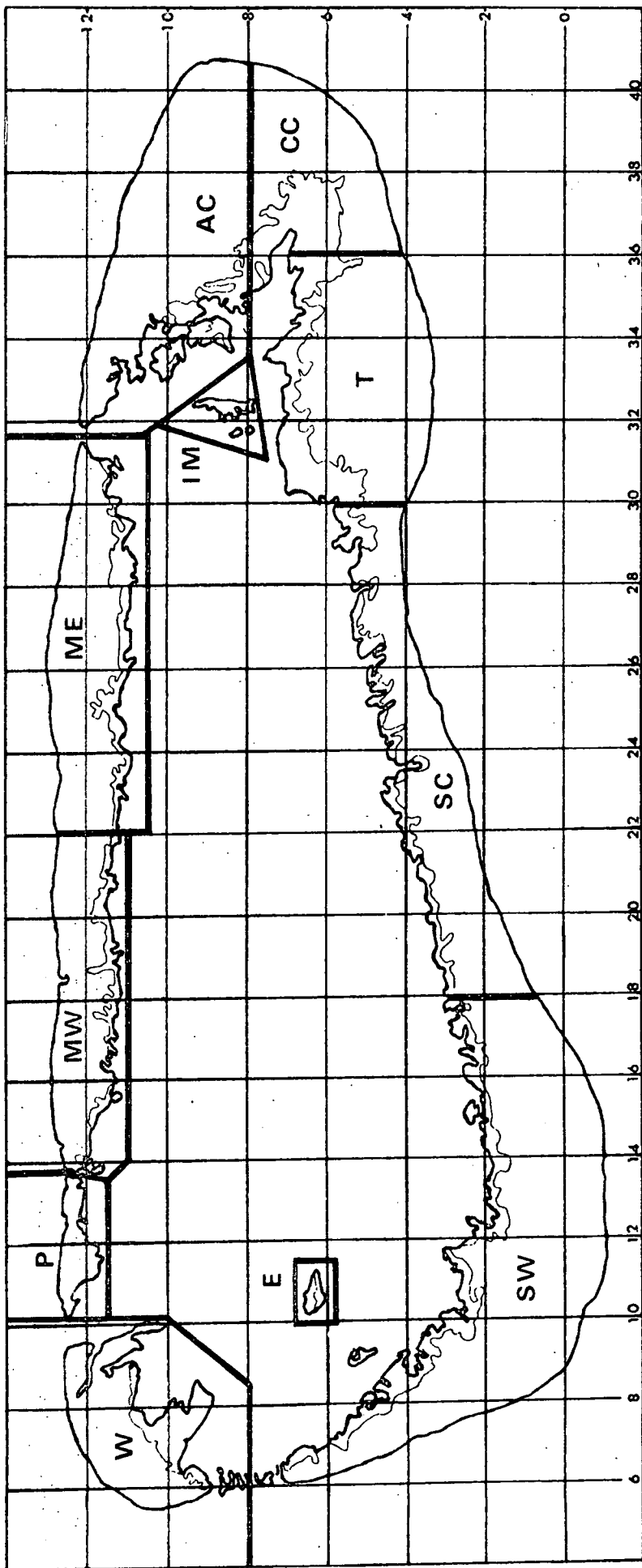


Fig. 2.3 Pool W1 at beginning of wet season. Note massive flocs of floating Oedogonium. Marker in this (and subsequent figures) is 1 m long.



Fig. 2.4 Pool W1 near end of wet season, showing its steep sides exposed as pool dried out.

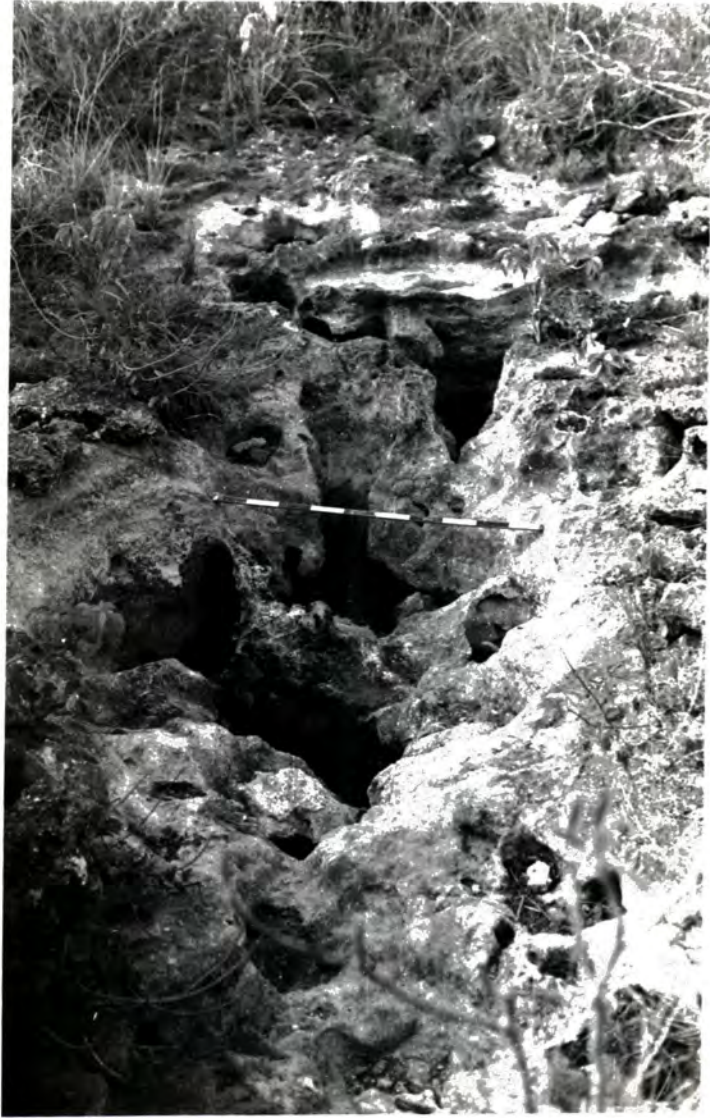


Fig. 2.5 Pool W7 after heavy rain.

Fig. 2.6 Pool W7, when relatively low. Note flocs of Closterium floating on the surface, and the black mud already deposited as the pool dries out.



Fig. 2.7 Pool W2, when almost full. The surrounding white, terrestrial areas are ones which lack the normal Tolypothrix byssoidea algal cover.

Fig. 2.8 Pool W4 when full. The floating flocs are Closterium acerosum and Oedogonium spp.



Fig. 2.9 Pool W4 towards the end of the dry season.

Note sharp boundary between the terrestrial rock which is never submerged, and which appears dark due to growths of Tolypothrix byssoidea, and the now exposed upper part of the pool which has a cover of Calothrix parietina.

Fig. 2.10 Pool W3. A shallow pool lying on platin.

This pool could dry out within 48 h.



Fig. 2.11 Pool CC 107. A pool heavily grazed by tortoises.

Fig. 2.12 An Aldabran giant tortoise (Geochelone gigantea) grazing on Spirogyra mirabilis in pool CC 107. This tortoise was seen to remain in the pool for at least 6 h. During this period it was seen to mictruate and defaecate into the pool.



Table 2.1 Aldabran pools included in the present survey

66

no.	grid ref.	location/description	approx. max size m
<u>Ile Picard</u>			
W1	0677,+1197	perched cliff champignon 10 m south Anse Var: linear pool	3.5 x 1.5
W2	0630,+0997	in open platin near Bassin Cabri; linear pool	2.0 x 0.5
W3	0620,+0990	in open platin near Bassin Cabri: shallow transient pool	2.0 x 2.0
W4	0593,+0961	in open area of scrub along track to Bassin Cabri deep relatively permanent	2.9 x 1.2
W5	0565,+1015	in <u>Casuarina</u> forest east of settlement: deep steep sided pool	2.4 x 1.3
W6	0565,+1016	in <u>Casuarina</u> forest east of settlement: shallower bowl shaped pool	1.5 x 1.0
W7	0580,+0957	in scrub just off the track running behind research station large elongate pool	6.0 x 4.3
W8	0579,+0958	in scrub just off the track running behind research station smallest pool in the group	1.0 x 0.6
W9	0579,+0956	in scrub just off the track running behind research station second largest of the three pools	
W10	0590,+0917	in scrub just off the track behind research station	3.0 x 1.5
W101	0625,+0995	in platin near Bassin Cabri: small pool deeply undercut	0.3 x 0.3
W102	0574,+1022	on track east of settlement: formed by fallen <u>Casuarina</u>	1.0 x 0.5
W103	0576,+1032	on edge of <u>Casuarina</u> forest east of settlement: formed by fallen <u>Casuarina</u>	0.75 x 0.5
W104	0594,+0962	in open area of scrub on track to Bassin Cabri: linear undercut pool close to W4	0.8 x 0.4
W105	0560,+0990	in <u>Casuarina</u> forest east of settlement: smallest pool in the W5 group: shallow bowl shaped	0.5 x 0.5
W106	0676,+1198	in north west of W1: small shallow transient pool	0.5 x 0.5
W107	0593,+0962	in open area of scrub on track to Bassin Cabri: shallow bowl shaped pool just north W4	0.2 x 0.2
W108	0590,+0961	in open area of scrub on track to Bassin Cabri: 3 m west of W4: very shallow transient pool	0.5 x 0.2

W109	0588,+0961	in open area of scrub on track to Bassin Cabri 5 m west of W4 deep narrow cylindrical hole	0.2 x 0.2
W110	0594,+0956	in open area of scrub on track to Bassin Cabri 5 m south of W4: large linear pool	1.5 x 0.3
W111	0575,+1035	circular pool on edge of track due east of settlement: formed by fallen <u>Casuarina</u>	1.5 x 1.5
W112	0630,+0972	20 m north west of lagoonal landing stage at Bassin Cabri: circular bowl shaped pool	0.5 x 0.5
W113	0590,+0960	at very beginning of track to Bassin Cabri just off track running behind settlement: circular shallow pool	0.4 x 0.4
W114	0595,+0962	20 m along track to Bassin Cabri east of W4: shallow bowl-shaped pool	0.5 x 0.4
W115	0596,+0960	30 m along track to Bassin Cabri east of W4 on top of large brown residual	0.3 x 0.4
W116	0596,+0961	on track to Bassin Cabri 3 m north of W115: shallow basin in champignon	0.3 x 0.4
W117	0605,+0962	150 m along track to Bassin Cabri	0.3 x 0.3
W118	0606,+0963	10 m east of W117: circular pool steep sided	0.3 x 0.3
W119	0607,+0965	at edge of dense scrub along track to Bassin Cabri. Shallow bowl-shaped pool	0.4 x 0.3
W120	0640,+0980	in platin at beginning of lagoonal champignon near Bassin Cabri: deep with very black bottom mud	1.0 x 1.0
W121	0590,+0957	in scrub just off track behind research station: north of W7	2.0 x 1.0
W122	0640,+0972	in lagoonal champignon near path to Bassin Cabri lagoonal landing stage	0.5 x 0.4
W123	0575,+1015	almost due east of settlement on track: formed by fallen <u>Casuarina</u> .	0.5 x 0.3
W124	0562,+1055	on top of tall residual at north edge of <u>Casuarina</u> forest north of settlement on track to Anse Var.	0.2 x 0.2
W125	0602,+1120	on south edge of <u>Casuarina</u> forest on track to Anse Var: large shallow pool	1.5 x 1.0

W126	0610,+1132	near first <u>Pandanus</u> grove along track to Anse Var north of settlement: shallow transient pool	0.7 x 0.5
W127	0570,+1023	Small shallow round pool in platin	0.4 x 0.4

^A
Ile Malabar

MW1	1396,+1235	large pool in complex on top of hill behind hut at Anse Coco	1.0 x 0.5
MW101	1392,+1247	pool in raised pavé between landing stage Passe Gionnet and in <u>Casuarina</u> forest	2.0 x 1.0
MW102	1392,+1250	pool in <u>Casuarina</u> forest between landing stage in Passe Gionnet and that at Anse Coco	0.5 x 0.5
MW103	1397,+1235	2nd largest pool in complex at top of hill behind hut; at Anse Coco	1.0 x 0.5
MW104	1394,+1233	well at top of hill behind Anse Coco further inland from MW103	0.5 x 0.5
MW105	1398,+1235	smaller pool in complex at top of hill behind hut at Anse Coco	0.5 x 0.5
MW106	1499,+1235	smallest pool in complex at top of hill behind hut at Anse Coco	0.75 x 0.25
MW107	1395,+1250	small pool in pools complex at bottom of hill behind hut at Anse Coco	0.7 x 0.4
MW108	1398,+1233	shallow bowl shaped pool inland from MW103	0.5 x 0.5

ME101	2525,+1275	well at Anse Malabar	
ME102	2523,+1275	round pool in raised pavé near well	0.25 x 0.25
ME103	2524,1280	pool in raised pavé near ME102	0.6 x 0.2
ME104	2525,1280	shallow pool under deep shade	
ME105	2529,1284	open pool in raised pavé inland from Anse	
ME106	2526,+1282	cylindrical hole in residual with sandy bottom mud	0.3 x 0.3
ME107	2524,+1280	pool in raised pavé near well	0.4 x 0.3
ME108	2522,1281	pool in raised pavé, shallow basin-like pool	1.0 x 0.5
ME109	3142,+1185	oil drum at Middle Camp	0.8 x 0.8
ME110	3137,+1215	<u>Casuarina</u> forest north of Middle Camp; formed by fallen <u>Casuarina</u> tree	0.8 x 0.5
ME111	3150,+1212	pool in coastal champignon on path between <u>Casuarina</u> forest and Middle Camp	0.5 x 0.25

Anse Cèdres

AC1	3585,+0901	Frigate Pool	15.0 x 15.0
AC2	3672,+0980	pool in open white platin on track between Anse Cèdres and Frigate Pool: bordered by <u>Pandanus</u>	10.0 x 5.0
AC3	3670,+0975	pool in open white platin south of AC2	15.0 x 10.0
AC4	3652,+0952	very large open expanse surrounded by <u>Pandanus</u>	100.0 x 50.0
AC101	3640,+1075	pool 10 m south of <u>Macphersonia</u> zone on track between Anse Cèdres and Frigate Pool	1.0 x 0.5
AC102	3641,+1074	pool adjacent to AC101 in open platin	1.0 x 0.5
AC103	3651,+1052	pool further south along track to Frigate Pool in open platin	0.5 x 0.3
AC104	3587,+0904	pool 30 m north of Frigate Pool in low residual in pavé	0.8 x 0.4
AC105	3670,+1087	pool in pave south of <u>Macphersonia</u> zone	1.0 x 0.2
AC106	3671,+1086	cylindrical hole near AC105	0.3 x 0.3

AC107	3587,+0906	pool in pavé north of Frigate Pool	1.0 x 0.5
AC108	3589,+0911	basin-shaped pool in raised pavé north of AC107	1.5 x 0.8
AC109	3598,+1115	pool in scrub inland from Anse Cèdres behind <u>Casuarina</u> forest	1.5 x 1.0
AC110	3598,+1122	shallow pool in scrub behind <u>Casuarina</u> forest Anse Cèdres	0.5 x 0.5
AC111	3592,+1130	pool formed by fallen <u>Casuarina</u> in <u>Casuarina</u> forest Anse Cèdres	0.8 x 0.5
AC112	3597,+1122	well behind <u>Casuarina</u> forest Anse Cèdres	0.8 x 1.0

Cinq Cases

CC1	3800,+0635	in scrub near lagoonal camp on track to coast	2.0 x 2.0
CC2	3800,+0625	further inland from CC1 on track to coast in open plain	5.0 x 2.0
CC3	3817,+0620	further inland from CC2 along track to coast in raised pavé	5.0 x 4.0
CC4	3825,+0617	in open plain along track between lagoon and coast	0.75 x 0.5
CC5	3850,+0612	almost halfway along track between Cinq Cases lagoonal camp and the coast	6.0 x 5.0
CC6	3914,+0615	in open plain Cinq Cases old camp	2.5 x 1.0
CC7	3912,+0615	well at Cinq Cases old camp	1.0 x 1.0
CC8	3960,+0595	at edge of coastal champignon rockhole used as well	1.0 x 0.8
CC9	3902,+0792	Bassin Flamant	80.0 x 90.0
CC10	3965,+0620	in coastal champignon north of Cinq Cases coastal camp	20.0 x 10.0
CC11	3930,+0787	on track between Cinq Cases old camp and Bassin Flamant	10.0 x 10.0
CC12	3912,+0601	in plain near Cinq Cases old camp: well defined pool	5.0 x 4.0
CC13	3922,+0667	along track between Cinq Cases old camp and Bassin Flamant large pool in pavé surrounded by <u>Ficus</u>	20.0 x 10.0
CC14	3895,+0772	sunken into pavé west of Bassin Flamant steep sided pool bordered by <u>Ficus</u>	15.0 x 7.0

CC15	3805,+0620	in scrub west of CC2 shallow pool over platin	8.0 x 5.0
CC16	3810,+0625	north-east of CC2: narrow pool bordered by <u>Pandanus</u>	10.0 x 3.0
CC17	3947,+0677	in platin on track between Cinq Cases old camp and Bassin Flamant	10.0 x 8.0
CC18	3875,+0607	near CC5: large shallow expanse on platin	25.0 x 15
CC101	3960,+0580	in coastal champignon south of Cinq Cases coastal camp	1.0 x 0.8
CC102	3842,+0622	near CC5: ill defined large shallow basin	20.0 x 10.0
CC103	3935,+0590	on track between Cinq Cases old camp and Bassin Flamant: small pool in platin	0.7 x 0.5
CC104	3895,+0790	north-west of Bassin Flamant ill-defined: shallow pool bordered by <u>Ficus</u>	15.0 x 5.0
CC105	3955,+0593	on northern edge of coastal champignon track from Cinq Cases old camp to coastal camp	0.4 x 0.4
CC106	3897,+0772	near CC14 pool in champignon residual	0.7 x 0.5
CC107	3975,+0625	north-east of CC10 pool in platin: bordered by <u>Pandanus</u>	8.0 x 7.0
CC108	3742,+0660	in champignon at Cinq Cases lagoonal camp	0.7 x 0.5
CC109	3962,+0581	in coastal champignon south of Cinq Cases coastal camp	0.8 x 0.5
CC110	3760,+0623	in platin near and south of CC2: shallow undercut pool	1.0 x 0.5
CC111	3931,+0789	along track between Cinq Cases old camp and Bassin Flamant near CC11	3.0 x 4.0
CC112	3942,+0637	on track between Cinq Cases old camp and Bassin Flamant	4.0 x 5.0

T1	3342,+0590	Bassin Ibis south of camp Takamaka	20.0 x 35
T2	3345,+0550	Bassin Takamaka	20.0 x 15.0
T3	3372,+0525	south-east of Bassin Takamaka: large brackish pool	40.0 x 30.0
T101	3413,+0390	in scrub northern edge of coastal champignon near Anse Takamaka	0.8 x 0.5
T102	3374,+0524	very near T3: probably joined at high water levels	1.0 x 1.0
T103	3376,+0526	in pavé east of T3: well- defined steep-sided pool	2.0 x 1.0
T104	3377,+0527	in pavé east of T3	3.0 x 1.0
T105	3370,+0507	in scrub south of T3 on track to Anse Takamaka shaded by <u>Macphersonia</u>	1.0 x 0.5
T106	3362,+4990	in open area of <u>Macphersonia</u> south of T3 along track to Anse Takamaka	1.5 x 1.0
T107	3380,+0480	in large open area of platin south of <u>Macphersonia</u> zone	1.5 x 0.8
T108	3415,+0372	at edge of scrub almost at beginning of coastal champignon on track to Anse Takamaka	1.0 x 0.8
T109	3440,+0347	in coastal champignon north of Anse Takamaka	2.0 x 0.8
T110	3447,+0355	in coastal champignon at Anse Takamaka	0.8 x 0.5
T111	3303,+0580	south of Bassin Takamaka in pavé	1.0 x 0.8
T112	3414,+0391	adjacent to T101: may be joined at high water levels	0.5 x 0.5
T113	3347,+0549	south of T2: large open pool in pavé	5.0 x 3.0
T114	3347,+0550	near T2: shallow bowl-shaped pool in pavé	1.0 x 0.8
T115	3344,+0550	on pavé shelf west of T2: may joined at high water levels	2.0 x 0.8
T116	3344,+0592	in pavé north of Bassin Ibis	0.8 x 0.5
T117	3344,+0594	in pavé north of Bassin Ibis	1.5 x 0.7
T118	3367,+0632	in scrub south of Takamaka camp: small circular pool	0.5 x 0.5
T119	3375,+0526	near T103: may be joined at high water levels	0.7 x 0.5
T120	3367,+0655	north of Takamaka camp: small pool in champignon residual	0.8 x 0.5

T121	3368,+0652	in scrub near camp Takamaka	1.0 x 0.5
T122	3369,+0650	in scrub south of camp Takamaka in pavé: well-defined steep- sided pool.	2.0 x 1.0
T123	3367,+0649	near T122 may be joined at high water levels	0.5 x 0.5
T124	3367,+0650	in <u>Maytenus</u> scrub south of camp Takamaka	1.5 x 1.0

Grande Terre Central

SC101	2652,+0377	in champignon halfway along track between lagoonal stage and camp at Dune Jean Louis: U-shaped pool	1.5 x 0.4
SC102	2653,+0378	near SC101: smaller oval pool	0.8 x 0.6

After collection of terrestrial samples, representative pools in the area were chosen for sampling in a standard manner:

- a) obvious macroscopic algal growths
- b) rock sample from side of pool such that it included a submerged portion and a dry portion from above the water level (up to 0.05 m). The submerged portion provided the epilithic, endolithic and associated species present at the time of sampling and the dry portion provided naturally dried material (2.2) which would in turn provide viable species for culture purposes on return to Durham
- c) surface layer of bottom mud from the deepest point in the pool
- d) aquatic macrophytes for associated epiphytes and 'aufwuchs' species
- e) plankton sample from a depth of 0.1 m; if the pool was less than 0.1 m in depth the sample was collected from a depth halfway between the surface and the deepest point within the pool

At the time of collection each sample was coded with temporal and environmental data summarized below:

- a) time (4 - digit)
- b) date (6 - digit)
- c) grid reference (10 - digit)
- d) island code (Fig. 2.2) (2 - digit)
- e) pool number (including terrestrial identifier) (4 - digit)

As well as general sampling, a set of samples was collected with accompanying detailed environmental data (Table 2.2). These were termed '1 cm² samples' and each consisted of all the plant material removed from an area of the substrate approximately 1 cm². Though the actual area was never measured accurately, care was made to ensure that it was sufficiently homogeneous that all the material present was subject to the same environmental categories (Table 2.2). As well as the sampling criteria listed above the following were used in the selection of 1 cm² samples:

- a) representative of the main physiognomic forms listed in Table 2.2
- b) representative of any species, locally dominant, covering any considerable area, but not included with (a)
- c) pairs of samples whose environment differs with respect only in one parameter
- d) inclusion of species of special interest, but not represented in any of the other categories

2.22 Preservation

Methods of preservation were chosen after microscopic examination of the state of preservation of samples brought back by B. A. Whitton from his visit to Aldabra in January 1969. Samples of blue-green algae were preserved best in buffered glutaraldehyde, green algae and flagellates in formaldehyde. As most aquatic and damp mud samples contained representatives of both of these groups samples were divided into three and preserved as follows:

Table. 2.2 Physiognomic and environmental categories recorded for each sample. (The numbers of categories are not sequential due to their being adapted from the Durham river analysis system (2.383)). Computer codes for each category are given in brackets.

a) Physiognomic (PHY)

0. Not known
1. Film
2. Filaments or filamentous floc, ± horizontal
3. Filaments, predominantly vertical away from substratum
4. Totally encrusting
5. Partially encrusting
6. "Felt": interwoven filaments or other small thalli
(± prostrate, without soft mucilage, often lifting as sheet)
7. Attached subspherical or hemispherical colonies, without obvious surface film
8. Attached subspherical or hemispherical colonies, with obvious surface film or other closely associated surface growth
9. (Not applicable)
10. Larger gelatinous colonies
12. Various larger plant growths, ± vertical
13. "Loose" colonies, greater than 4 mm diameter
14. Algae dispersed among loose non-living particles
15. Planktonic, whole "standing crop"
41. Not "standing crop", only subsample of data recorded elsewhere: see notebooks held in Durham.

42. Not "standing crop", floating at or near surface, data not recorded elsewhere
43. Not "standing crop", plankton sampled c. 20 mm below surface, data not recorded elsewhere
60. "Aufwuchs" on larger plant: general microenvironment (squeezings etc.)
61. "Aufwuchs" on larger plant: film
62. "Aufwuchs" on larger plant: filaments or filamentous floc
63. "Aufwuchs" on larger plant: filaments, predominantly vertical
64. "Aufwuchs" on larger plant: partially encrusting
65. "Aufwuchs" on larger plant:
66. "Aufwuchs" on larger plant: attached subspherical or hemispherical colonies, without obvious surface film
67. "Aufwuchs" on larger plant: attached subspherical or hemispherical colonies, with obvious surface film
- b) Proportion of substratum (living + non-living) contributed by same physiognomic forms as the sample unit (PRO)
0. Not known
1. 0 - 0.1%
2. 0.1 - 1%
3. 1 - 10%
4. 10 - 100%
9. Not applicable
- c) Thickness scale (THI)
0. Not known
1. Very thin
2. Thin

3. Moderate
4. Thick (5 - 10 mm)
5. Very thick (10 mm+)
9. Not applicable

d) Substrate (SUB)

0. Not known
3. Other limestone
9. Not applicable, including 'obviously mixed'
15. Plastic
16. Dead plant, species not recognizable, not peat
17. Humic soil (humus content > 50%)
18. Limestone soil (> 50% degraded limestone)
19. Sand
20. Live bark
21. Other plant
22. Bone

e) Substrate size (S.SI)

0. Not known
1. Sheet (or totally immovable)
2. Large boulder
3. Medium boulder
4. Large pebble or small boulder
5. Small pebble
6. Sand-size particles
7. Coarse or medium silt
8. Very fine silt
9. Not applicable

f) Substrate microtopography (TOP)

0. Not known
1. Markedly emergent above average level
2. Plane
3. Hollows (\pm round)
4. Crack

g) Surface inclination (INC)

0. Not known
1. None
2. Just detectable, visually 10°
3. $10 - 45^{\circ}$
4. $45 - 85^{\circ}$
5. Approximately vertical
6. More than vertical

h) Surface aspect (ASP)

0. Not known
5. North facing
6. South facing
7. East facing
8. West facing

i) Water depth at position of sample (DEP)

0. Not known
1. Dry
2. Moist, or very thin film (2 mm)
3. 2 - 20 mm
4. 20 - 100 mm
5. Over 100 mm
9. Not applicable

j) Exposure to light at actual sample point (LI)

0. Not known
1. More or less open through year
2. Moderate cover through year
3. Heavy shade through year
4. Moderate shade in summer
5. Heavy shade in summer
6. Intermittent daily shade
9. Not applicable

- a) 2 to 3% glutaraldehyde in distilled water
- b) 4% formaldehyde saturated with CaCO_3
- c) drying in the shade

Preserved liquid samples were stored in 10, 30 or 250 ml polyethylene bottles and sealed by dipping the tops in molten paraffin wax. Small air dried samples were sealed by staples in grease-proof bags, larger samples were sealed by staples in heavy gauge polyethylene bags. B. A. Whitton (pers. comm.) had added silica gel to his dried samples. On return to Durham he found that many of these samples would not grow when placed in culture media. It was thought that the presence of silica gel might have killed these samples and it was therefore not included with dried samples collected during my visit.

2.23 Examination

Preliminary examinations were carried out in the field using the portable field microscope (2.21). Every attempt was made to examine samples in detail as soon as possible after collection. On extended excursions however samples had to be stored for up to two days before detailed examination could take place (2.21). Such samples were compared with portions of the sample which had been preserved at the time of collection (2.21; 2.22). Very few samples seemed affected by storage. On return to the laboratory however the samples most likely to deteriorate were examined first. The order of examination was:

- a) aquatic macrophytes for epiphytic and aufwuchs species
- b) plankton samples
- c) mud samples
- d) substrates other than soil and rock
- e) soil samples
- f) rocks

Samples were examined using a dissecting microscope and a transmitted light microscope (Wild M11), fitted with screw micrometer measuring eyepiece. This latter attachment permitted very accurate measurement of even very small forms. For each sample two slides were prepared with 22 x 44 mm coverslips and each was systematically scanned over its whole area. Dry material was soaked in rain water for 2 h prior to examination. Rock samples were examined for associated epilithic and endolithic species by the following treatment:

- a) rewetted for two hours in rain water if dry
- b) observation with dissecting microscope
- c) observation of surface scrape
- d) a small chip of rock was immersed in 10% HCl for 10 - 20 s; this normally caused the release (usually as a sheet) of encrusting and associated species
- e) after the release of encrusting species the chip of rock was transferred to fresh 10% HCl and immersed for a longer period in order to release endolithic species

Where possible binomials were allocated to species using the taxonomic conventions discussed in (1.4).

2.3 Physical and chemical techniques

2.31 Meteorological

The Royal Society research station on Île Picard was also a synoptic observation station, where the following daily readings were taken: cloud cover, wind direction, wind speed, barometric pressure, dry bulb temperature, wet bulb temperature, relative humidity, rain fall, maximum temperature, minimum temperature, earth surface grass temperature and one foot earth temperature. Data collected at the synoptic observation station has been included in the present study for comparative purposes (3.1). Some individual temperature and relative humidity measurements were taken from a range of algal habitats on Île Picard.

Temperature measurements were taken using a thermistor thermometer produced specially for use in this research project by the electronics workshops, Durham University. This thermometer had a probe with a diameter of 1 cm which permitted access to extremely confined spaces. A shroud around the probe prevented air movements affecting readings. Response of the thermometer was rapid (about 10 s); cooling of the area under the probe due to shading was therefore negligible. Two measurements were made during the day, the first between 0515 h and 0715 h to obtain an indication of minimum temperatures. The second measurement was made between 1530 h and 1600 h to obtain an indication of maximum temperatures.

Relative humidity data were collected in the field using an Atkins 90023 portable psychrometer (Atkins Technical Inc., Florida, U.S.A.), which gave wet and dry air temperatures.

The psychrometer had a 'gun' type probe with an aperture of 1 cm which permitted access to confined spaces. Actual values of relative humidity were calculated from psychrometric tables (Marvin, 1973). Readings were taken with the probe at ground level and at a height of 1 m. Fourteen sites which represent a range of algal habitats on the atoll were chosen for comparison. All the sites were measured twice during the day. The first measurement was taken between 0615 h and 0715 h to obtain an indication of maximum values, the second reading between 1330 h and 1430 h to obtain an indication of minimum values. The synoptic observation station was chosen as the reference point, the first and last readings being taken there to obtain an indication of any changes which took place during the hour it took to take the readings.

2.32 Analysis of water

The location of the pools studied is shown in Fig. 2.13, examples are illustrated in Figs 2.3 - 2.12 and the environmental details summarized in Table 2.1 and Appendix II. All the pools studied were free from tidal influence. The pools were sampled for their water chemistry but for practical reasons (2.21) it was not possible to adopt a rigorous programme of visits to pools, time of day sampling, or measurements of all parameters for all samples. A summary of individual analyses carried out is given in Table 2.3. Two main programmes of sampling and analysis were adopted.

Programme A was used to establish the main features of pools and possible correlations between individual ions.

Fig. 2.13 Aldabra showing the location of the 20 pools studied for water chemistry. (Pools situated within 5 m of each other are represented by only one square.) The atoll is shown in inset to demonstrate the relevant positions of the two sampling areas.

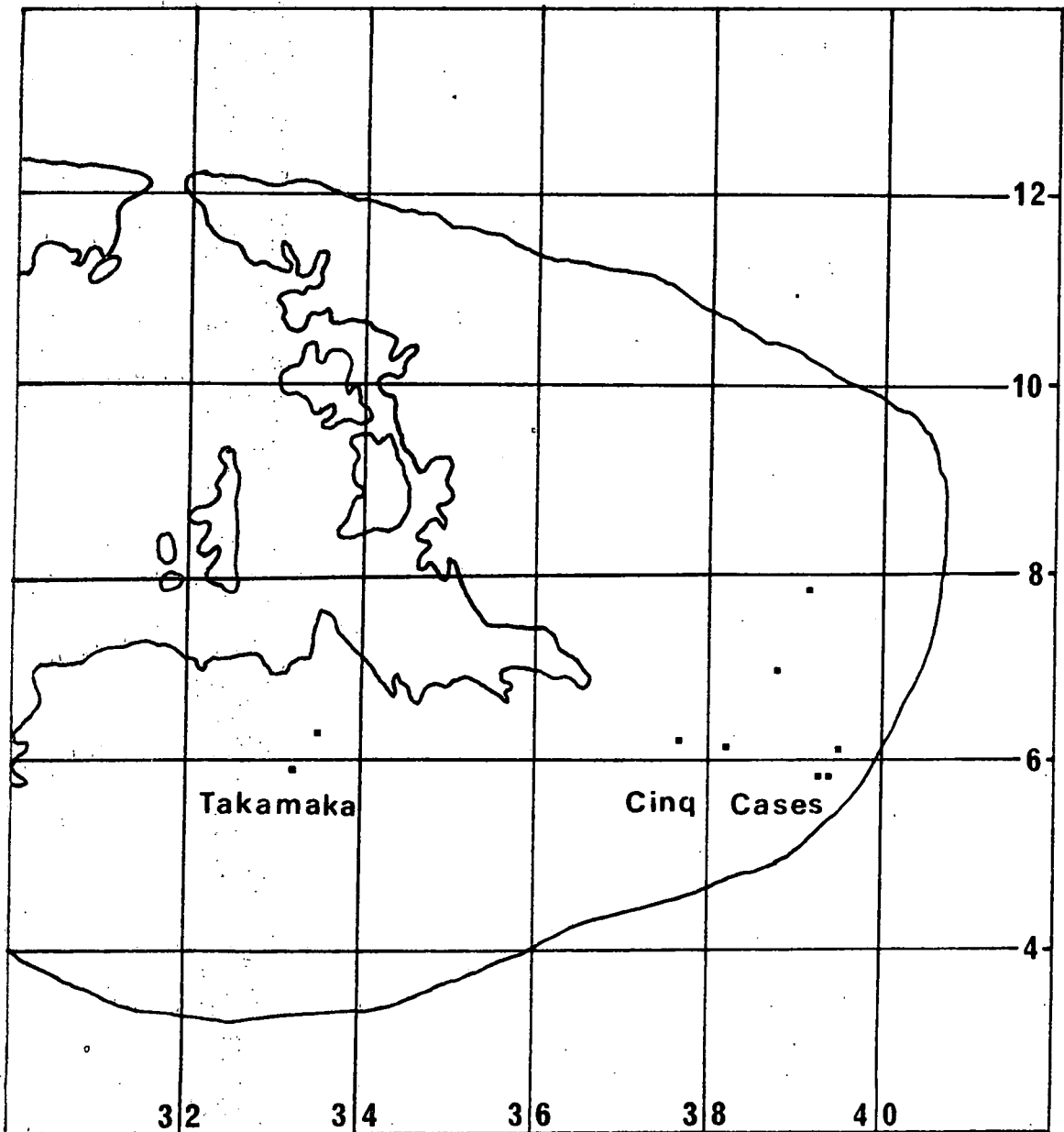
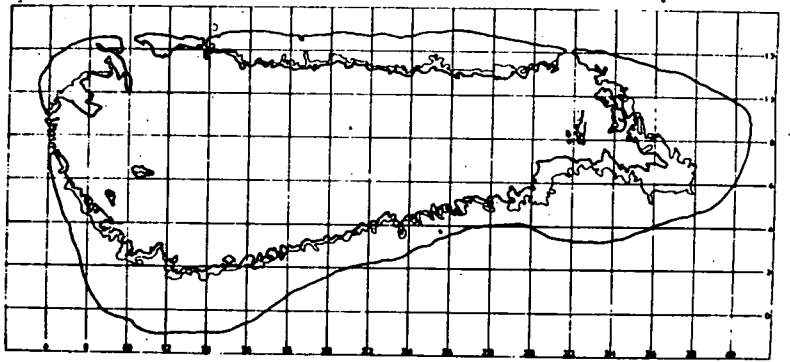
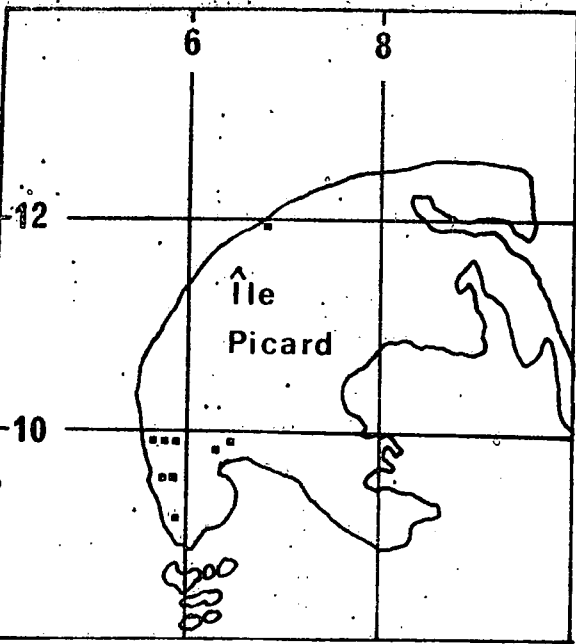


Table 2.3 Sampling programme for water chemistry

A samples, excluding repeats for 24 h surveys (see text) = 54
 B total samples = 136

<u>Individual parameters</u>	<u>no. of pools sampled</u>	<u>no analyses in programme A</u>	<u>no analyses in programme B</u>
maximum possible	20	55	137
OD 420nm	16	24	92
temperature	17	52	134
O ₂	17	50	130
pH	20	54	135
Na	16	27	92
K	16	27	92
Mg	16	27	92
Ca	16	27	92
Cl	19	27	92
ortho PO ₄ -P	20	55	94
poly PO ₄ -P	11	25	25
organic PO ₄ -P	11	24	24
ammonia-N	20	55	100
NO ₂ -N	20	55	100
NO ₃ -N	20	55	100

This consisted of 54 samples from 19 different pools. Samples taken from a single pool on more than one occasion, were in all cases separated by at least two weeks. In most cases there were about 17 weeks between the first and last sample. Most samples in programme A were collected between 0800 h and 1100 h.

Programme B was used to establish the changes in individual parameters over a period of 24 h. It involved a further 82 samples in addition to those in programme A. Pools W1, W2, W4, W5 and W10 were all studied over full 24 h cycles, while T1 and T2 were studied from early morning to late evening.

In addition to these sampling programmes, individual measurements for temperature, pH and dissolved oxygen were made on other occasions, in these same pools and also in other pools. Where results from these are included this is mentioned specifically.

Where a pool was deep enough, water was collected with a glass beaker at 20 cm depth; if the pool was shallow the sample was taken from a point half-way between the surface and the bottom of the pool. The sample was immediately filtered through a No. 2 Sinta funnel (Gallenkamp, Stockton, England). The pore size quoted by the manufacturer for this filter is 40 - 50 μm . This funnel removed the bulk of any algal standing crop prior to storage or analysis. The bulk of the samples (usually 250 ml) were stored in 250 ml screw-top polythene bottles. Prior to storage the rubber liners of the bottles were removed, as it has been shown that they leak

zinc (B. A. Whitton, pers. comm.). The tops were then dipped in molten wax and the bottles stored in a deep freeze at -10°C (except for the time spent in transit between Aldabra and Durham). The remainder of the samples were used for in situ analysis (2.326, 2.327).

2.321 Conductivity

Conductivity measurements from representative pools were made where possible, using a type M.C.5 National Institute of Oceanography conductivity meter. The limits of the standard model used were 0 - 38‰ (i.e. 0 - 38 g⁻¹) and 0 - 31^oC. Little use could be made of the instrument as it was heavy, cumbersome and was supplied with an extremely long, heavy, cable. As the probe was cylindrical with a volume of 72 cm³ it was far too large to be used in the smaller pools.

2.322 Optical density

Optical density was read on a Hilger and Watts Uvispec at 240, 254 and 420 nm using high precision 4 x 1 cm optical cells (Thermal Syndicate Ltd.).

2.323 Temperature

Temperature of representative pools and some terrestrial habitats were measured by one or more of the following methods:

- a) mercury in glass thermometers
- b) the thermistor probe associated with the oxygen meter
(2.325)

- c) the probe associated with the psychrometer (2.31)
- d) the thermistor probe produced by the Electronics Department, Durham University (2.31)

Where mercury in glass thermometers were used the temperature taken was the average of the readings given by three thermometers. Temperature readings in pools were always taken simultaneously with conductivity, pH and dissolved oxygen.

2.324 pH

Measurements of pH were made using a Pye Unicam model 293 portable meter combined with a glass electrode (sinta plug, 450 E 7) and a 1 M KCl reference electrode. The probes were calibrated using pH buffers made up at pH 4.0, 7.0 and 9.2 using 'Soloid' buffer tablets (Burroughs-Wellcome & Co.) in distilled water at 20°C. In the field pH values were obtained by placing the electrode into the water vertically as carefully as possible to avoid disturbance. Values were normally obtained from a depth of 0.1 m. Where the pool or stretch of water was shallower than this the value was obtained from a point halfway between the surface and the bottom of the pool. Readings were obtained from more than one point in order to check for variations within the pool.

2.325 Dissolved oxygen

Dissolved oxygen measurements were made using a Lakelands Instrument Company portable meter, with accessory cable and a Mackereth type electrode. When not in use the electrode

was stored in saturated sodium sulphite solution to prevent unnecessary oxidation of the electrolyte. Dissolved oxygen was read on a scale of 0 - 100% saturation. When values exceeded 100% saturation and refrigeration was available (i.e. on Île Picard) an airtight container was completely filled with a sample of the water under test and cooled to 4°C. At this temperature the oxygen saturation could be read on the scale of the meter. From this value the saturation of oxygen present at the time of sampling could be calculated. Readings were taken at 10 cm intervals between the surface and the deepest point in the pool. If the bottom mud was deep enough readings were also taken into the mud.

2.326 Cations

Na, K, Mg, Ca were all measured after return to the U.K. Hydrochloric acid ('Analar' Grade, B.D.H. Ltd.) was added to the samples and measurements were made by atomic absorption spectroscopy (Perkin-Elmer 403).

2.327 Anions

Chloride was measured on return to U.K. using an argentometric technique (Strickland & Parsons, 1968; Standard Methods, 1971). Orthophosphate, polyphosphate, organic phosphate, $((\text{NH}_3 + \text{NH}_4) - \text{N}, \text{NO}_2 - \text{N}, \text{NO}_3 - \text{N})$ were all measured at the time of sampling using HACH portable kits (Hach Chemical Co., Iowa, U.S.A.). Each kit consisted of dry, powdered reagents packed in individual, pre-measured amounts in sealed polyethylene 'powder-pillows'. Each 'pillow' contained the exact amount of reagent required for one test,

this being added to a standard volume of water sample in a glass tube. On mixing the chemical with the water sample a colour reaction occurred, the intensity of which was compared with a comparator disc using an unreacted sample of water as a blank. The concentrations could then be calculated in mg l^{-1} from the reading on the comparator disc.

2.33 Analysis of photopigments

2.331 Introduction

The chlorophyll a content of algae was used to estimate standing crop per unit area of algal population and to quantify acetylene reduction experiments (5). The results of acetylene reduction experiments were given as $\mu\text{g C}_2\text{H}_4$ $\mu\text{g chl a}^{-1} \text{ min}^{-1}$. It was not possible to estimate chlorophyll a on the atoll and therefore a detailed discussion is included here to justify the methods adopted.

The determination of photosynthetic pigments for estimation of algal standing crop is a widely used method in the study of algal communities (Moss, 1967a). Strickland (1960) has outlined the many problems which may be associated with this method. The more important problems which were associated with determining photosynthetic pigments in Aldabran material are outlined below:

- a) Algal material for pigment estimation had to be stored for long periods. It was hypothesised that as the algal material on Aldabra was subjected to frequent drying and rewetting there would be no significant loss of chlorophyll on drying down and subsequent

- rewetting. Evidence supporting this hypothesis was obtained by experiment (2.334)
- b) Due to the often small size of samples and their tough nature the most widely used technique of breaking down colonies by grinding with sand proved ineffective and open to the introduction of errors
 - c) Only a certain percentage of the total pigments may be obtained using certain solvents. The widely used solvent acetone proved ineffective in the extraction of the pigments of the blue-green algae investigated in the present study
 - d) Absorption coefficients are only partly known for some pigments (Lorenzen, 1967). These vary from solvent to solvent (Marker, 1972), and some have only been calculated for particular solvents. When small experimental errors occur in conjunction with errors in the absorption coefficients, large inaccuracies in estimated chlorophyll a result (Marker, 1972).
 - e) Light scattering and loss of definition of absorption bands, enhanced absorption values and long wavelength shift in the band of chlorophyll a, are all errors associated with spectrophotometric light cells (Thomas & Nagaraja, 1973). These are overcome if ground-glass face cells are used.
 - f) Algal communities may sometimes contain chlorophyll degradation products, which in some instances can constitute a significant fraction of the total green pigmented materials present (Yentsch & Menzel, 1963; Lorenzen, 1967). These breakdown products can give

large errors in estimated chlorophyll a when spectrophotometry is used, as they absorb in the red part of the spectrum (Lorenzen, 1967). They may also be associated with local sediments combined with the communities.

On acidification, a chlorophyll a molecule loses a magnesium atom and is converted to phaeophytin (Moss, 1967a). Lorenzen (1967) advocated this as a method of determining chlorophyll a in samples containing phaeopigments, discriminating between chlorophyllous magnesium containing compounds and those which are magnesium free by the addition of 1 N HCl and the resulting change in absorbance. The calculation assumes that all this pigment is phaeophytin, when in fact a small proportion will be other products (Patterson & Parsons, 1963). The calculation of the chlorophyll a: phaeophytin a ratio was discussed by Moss (1967a) and he later used this to derive equations for estimating absolute concentrations of pigments (Moss, 1967b). Lorenzen (1967) based his method on the absorption at 665 nm; he assumed that the spectrum of phaeophytin a was not affected by pH. Vernon (1960) had not been able to demonstrate any effect of pH using oxalic acid and Moss (1967a) had only been able to demonstrate very small effects he could attribute to pH.

Marker (1972) applied the principles of Lorenzen (1967) and Moss (1967a, 1967b) to the use of methanol for the extraction of algal pigments; he showed that methanol was

more efficient than acetone in the extraction of chlorophyll a from a range of algae which included some blue-green algal species. He attempted to compensate for spectral changes on acidification by the addition of magnesium carbonate solution, but found that poor replication was obtained due to precipitation of pigments upon neutralization.

Preliminary extractions of chlorophyll a from Aldabran material suggested that hot methanol was more efficient than acetone though attempts to neutralize using magnesium carbonate proved tedious and time-consuming due to the large number of samples requiring extraction. Talling & Driver (1969) had suggested that chlorophyll a extracted in methanol degrades rapidly and it was decided to determine the rate of degradation experiments by experiment (Table 2.4). The results suggested that the errors introduced by the time-consuming process of neutralization would be far greater than estimating the pigment concentrations as soon as possible after extraction and omitting the neutralization process.

All material requiring pigment estimation had been dried in a standard manner (2.37), the assumption being that algae subjected to frequent drying and rewetting would show little change in pigment composition on rewetting. This was demonstrated by experiment (2.334). It was not possible however to extract pigments directly from dried material and rewetting was required (2.331). It was hypothesised that too short a period of rewetting might result in incomplete

Table 2.4 The degradation of chlorophyll a extracts in methanol when stored under different conditions

a) Stored on a laboratory bench for 12 h at 20°C in artificial light (500 lx)

sample species	chlorophyll <u>a</u> (μg)		
	before storage	after storage	% decrease
1. <u>Nostoc commune</u>	188.6	157.2	16.67
2. <u>Nostoc commune</u>	106.1	82.5	22.2
3. <u>Nostoc commune</u>	110.0	82.5	25.0
4. <u>Nostoc commune</u>	168.9	125.8	25.6
5. <u>Nostoc commune</u>	129.6	98.2	24.2
6. <u>Nostoc commune</u>	157.2	125.8	20.0
7. <u>Nostoc commune</u>	137.6	110.0	20.0
8. <u>Nostoc commune</u>	121.8	94.3	22.6
9. <u>Nostoc sp.</u>	451.9	373.4	17.4
10. <u>Tolypothrix</u> <u>byssoides</u>	235.8	196.5	16.7
			$\bar{x} = 21.0 \pm 3.4$

b) Stored 48 h in the dark in refrigerator -4°C

sample species	μg chlorophyll		
	before storage	after storage	% decrease
1. <u>Nostoc commune</u>	216.2	216.2	0
2. <u>Nostoc commune</u>	149.3	145.4	2.6
3. <u>Nostoc commune</u>	137.6	137.6	0
4. <u>Nostoc commune</u>	58.9	58.9	0
5. <u>Nostoc commune</u>	110.0	110.0	0
6. <u>Nostoc commune</u>	66.81	58.9	11.7
7. <u>Nostoc sp.</u>	314.4	314.4	0
8. <u>Nostoc sp.</u>	373.4	373.4	0
9. <u>Tolypothrix</u> <u>byssoides</u>	294.8	294.8	0
10. <u>Tolypothrix</u> <u>byssoides</u>	235.8	235.8	0
			$\bar{x} = 1.4 \pm 3.5$

It should be noted that the number of zero decrease values in section b) are simply a product of the limits of accuracy of measuring the heights of peaks produced on the spectrophotometer, rather than an actual value of zero decrease in chlorophyll a.

Table 2.5 Effect of drying and rewetting on the amount of chlorophyll a extracted from colonies of Nostoc commune. The twenty colonies chosen all appeared similar visually.

Samples 1 - 10 were rewetted only

Samples 11 - 20 were rewetted, dried and rewetted again

Samples rewetted only

No.	Wet weight (g)	chl <u>a</u> (μg)	chl <u>a</u> /wet weight
1.	0.34	65.6	1.92×10^{-4}
2.	0.41	56.3	1.37×10^{-4}
3.	0.37	65.6	1.80×10^{-4}
4.	0.46	65.6	1.40×10^{-4}
5.	0.51	28.1	0.56×10^{-4}
6.	0.36	65.6	1.82×10^{-4}
7.	0.39	84.4	2.16×10^{-4}
8.	0.49	150.0	3.06×10^{-4}
9.	0.53	93.8	1.77×10^{-4}
10.	0.38	65.6	1.73×10^{-4}

$$\bar{x} = 1.76 \times 10^{-4} \pm 0.63 \times 10^{-4}$$

Samples rewetted, dried, rewetted

No.	Wet weight (g)	chl <u>a</u> (μg)	chl <u>a</u> /wet weight
1.	0.51	46.9	1.51×10^{-4}
2.	0.46	103.13	2.24×10^{-4}
3.	0.39	93.8	2.41×10^{-4}
4.	0.37	46.9	1.27×10^{-4}
5.	0.47	75.0	1.60×10^{-4}
6.	0.27	84.4	3.13×10^{-4}
7.	0.50	93.8	1.88×10^{-4}
8.	0.31	65.6	2.12×10^{-4}
9.	0.41	65.6	1.60×10^{-4}
10.	0.32	84.4	2.64×10^{-4}

$$\bar{x} = 2.04 \times 10^{-4} \pm 0.58 \times 10^{-4}$$

chlorophyll release, and that too long a period might result in abnormal pigment ratios due to the conditions of rewetting. The length of time chosen for rewetting was determined by considering two factors:

- a) the time taken to reach maximum water content
- b) the time taken for the onset of metabolic processes, in this case the fixation of atmospheric nitrogen determined by acetylene reduction assay. (Fig. 5.3)

Experiments on water uptake (2.34, Fig.5.2) and the onset of acetylene reduction on three rewetted Nostoc species suggested that a rewetting time of 8 h would be suitable, by which time all the species had achieved over 80% moisture content and had shown detectable acetylene reduction. The above considerations led to the adoption of the following standard method for the extraction of chlorophyll a from Aldabran samples.

2.332 Extraction of chlorophyll a

Samples were rewetted in distilled water for 8 h at 32°C and 3000 lx. They were then introduced into 30 ml McCartney bottles containing 10 ml of 95% methanol. The caps with rubber liners were screwed down tightly and the bottles stood in a water bath maintained at 70°C. The bath was covered with a hood so that the extraction took place in darkness. Extraction was complete within 5 to 10 mins. However, up to two extractions were required for some of the Tolypothrix byssoidea samples. Extracts were filtered immediately through 24 mm G/FC filter discs (Whatman), under reduced pressure.

The extracts were then made up to known volume (usually 50 ml) using 95% methanol. Aliquots were transferred to ground glass sided, high precision 1 cm optical cells (Thermal Syndicate Ltd.). Absorption spectra were read at 665 nm using a Perkin Elmer Model 403 Ultraviolet spectrophotometer. Extracts were then acidified by adding one drop of 1 N 'Analar' HCl (B.D.H. Ltd.), and the absorbance at 665 nm read one minute later. This method enabled up to 40 extractions an hour to be made, samples were stored in a refrigerator in the dark prior to estimation, and all were estimated within 2 h of extraction.

2.333 Estimation of chlorophyll a

The formulae used to calculate chlorophyll a and phaeophytin a are essentially those used by Marker (1972) with the exception that a different 'acid factor' constant has been used. The 'acid-factor' denotes the ratio of the absorbance before acidification to that after acidification.

$$\text{acid factor} = \frac{A_{665}(\text{before acidification})}{A_{665}(\text{after acidification})}$$

The 'acid-factor' of 1.5 used by Marker (1972) was calculated from the chlorophyll a extracts of four eukaryotic algae, all of which contained accessory pigments (chlorophyll b and c). He did not study any extracts from blue-green algae which lack these accessory pigments (Myers & Kratz, 1955). He also assumed that breakdown products of pigments were absent. It seemed desirable therefore to calculate a new 'acid factor' using Aldabran blue-green algal material. The mean 'acid factor'

calculated from 300 samples of blue-green algae was 1.85, though a slight degree of variation was noticed between species. C. Sinclair (pers. comm.) found a similar 'acid-factor' for laboratory grown cultures of species of the blue-green alga Calothrix ($\bar{x} = 1.9$). Using the 'acid-factor' of 1.85 a constant of 2.17 was derived for use in the equations of Marker. This figure is the calculated ratio of the absorbance of the chlorophyll a solution before acidification, to the reduction in the absorbance due to the formation of phaeophytin a on acidification.

$$\text{acid factor} = \frac{\text{absorbance before acidification}}{\text{absorbance after acidification}} = 1.85$$

$$\text{Constant} = \frac{R}{R - 1} \quad \text{Where } R = 1.85 \text{ (ratio shown above)}$$

$$\text{Constant} = \frac{1.85}{1.85 - 1} = 2.17$$

Thus the final equation would become:

$$\text{chl } \underline{a} = 2.17(A_b - A_a) \times (v/l) \times 13.1$$

A_b = absorbance at 665 nm before acidification

A_a = absorbance at 665 nm after acidification

v = volume of solvent used in making up extract

l = light path = width of optical cell = 1 cm

0.973 = correction factor to compensate for loss of Mg on acidification

13.1 = constant, assuming a specific absorption coefficient of chl a in 95% methanol of $76.07 \text{ l g}^{-1} \text{ cm}^{-1}$

2.17 = constant, derived from an 'acid-factor' of 1.85

2.334 Uptake of moisture in three types of Nostoc colony

The rates of moisture uptake in three types of Nostoc colony used in acetylene reduction assays (5) are illustrated in Fig. 5.2. Dry colonies were brushed to remove any inorganic debris and weighed. They were then placed in pneumatic troughs and immersed in AAD - N medium. Colonies were removed at various time intervals, excess moisture removed by blotting on filter paper and weighed. At the completion of the time course the dry weights of the colonies were obtained (2.35). The percentage moisture content was obtained using the formula of Showman and Rudolph (1971):

$$\% \text{ moisture content} = \frac{W_t - W_d}{W_s - W_d} \times 100$$

where: W_t = weight (g) at time t

W_d = dry weight of the colony

W_s = final weight of the colony

2.335 Effect of drying and rewetting on the chlorophyll a content of Nostoc commune

Dried Nostoc commune colonies were spread in thin layers in pneumatic troughs and covered with AAD - N medium (2.365). The troughs were placed in a culture room maintained at 32°C and 3000 lx. Care was taken to ensure that the colonies were always completely covered with medium. The colonies were rewetted for 8 h (2.331) after which time 10 healthy colonies were removed and washed in distilled water to remove any debris present. Excess moisture was removed by blotting on filter paper. The wet weight and chlorophyll a content (2.332) of each colony were then determined. A further ten colonies



were then removed for drying and subsequent rewetting. The colonies were removed from the troughs and allowed to dry under the same conditions of light and temperature. These colonies were left overnight to ensure complete dryness. When completely dry the colonies were rewetted and their chlorophyll a and wet weights determined as above. Chlorophyll a to wet weight ratios are compared in Table 2.5.

2.34 Estimation of total nitrogen

A standard solution containing 1000 mg l^{-1} N was prepared by drying 'Analar' NH_4SO_4 (B.D.H. Ltd.) for 2 h at 105°C and dissolving 4.7162 g in 1 litre of double distilled water. Dilutions of this were used to produce a calibration curve. 10 ml of acid reagent (130 ml H_2PO_4 : 2500 ml N-free H_2SO_4) and 3 g of anhydrous K_2SO_4 were added to each standard prior to the final addition of distilled water.

All glassware was soaked overnight in 10% HCl and thoroughly rinsed in double distilled water. Crucibles were treated with aqua regia to remove any organic contaminant and thoroughly rinsed in double distilled water. Having determined the dry weights of the samples (2.35) they were initially digested in the crucibles by adding 5 ml of acid reagent. The partially digested sample was then completely transferred into Kjeldahl flasks and 3 ml of 100 volumes 'Analar' H_2O_2 (B.D.H. Ltd.) added in a fume cupboard. A 'Kjeltab' (Thompson and Capper Ltd.) catalyst tablet was added (1.5 g K_2SO_4 , 0.0075 g selenium) and the samples boiled till clear. The sample was then cooled and diluted to a suitable concentration for analysis on a Carlo Erba

automatic nitrogen analyser. Hypochlorite solution was prepared by mixing two parts of filtered 'Chlorosan' (Boots Ltd) to one part double distilled water. Alkaline phenate was prepared by dissolving 136 g NaOH and 240 g of phenol separately in a minimum of double distilled water. The two solutions were then mixed with continuous cooling. When fully mixed and cool the mixtures were made up to 1000 ml with double distilled water. The solution is unstable and was kept for a maximum of 24 h in a darkened polythene bottle.

2.35 Dry weight determinations

Where already dry, algal material was rewetted overnight in culture medium (2.365). The material was then washed in distilled water thoroughly and then transferred to 'Vitreosil' crucibles which had been previously dried at 105°C for 24 h and weighed. The algal material was then dried in the crucibles at 105°C for 24 h, cooled in a dessicator and weighed. The process was repeated to constant weight.

2.36 Isolation and culture

2.361 Apparatus for the growth of cultures

Cultures were maintained in 100 ml or 250 ml conical flasks or 100 mm petri dishes.

On Aldabra, cultures were maintained on a window ledge. In Durham, cultures were grown initially in growth rooms maintained at temperatures of 32°C or 25°C. The rooms were illuminated from above by a bank of fluorescent warm white tubes (Thorn Lighting Ltd). The manufacturers quote these tubes as having a low output in the ultraviolet, (c. 350 nm)

region of the spectrum and a high output in the yellow-orange region of the spectrum, (c. 550-650 nm). Light intensity could be varied by changing the position of flasks on the shelves or by covering them with fine mesh black muslin. When more rapid growth of cultures was required, cultures were incubated in water-filled tanks maintained at 32°C or 25°C, illuminated from below by a bank of warm white fluorescent tubes. Light intensity could be regulated by varying the number of tubes switched on, or by covering the flasks with fine mesh black muslin. The flasks were shaken 64 times per minute through a horizontal distance of 30 mm.

2.362 Measurement of physical features

Light intensity was measured using an EEL light master photometer (Evans Electroselenium Ltd). Temperature was measured using mercury in glass thermometers inside separate culture flasks placed among the cultures.

2.363 Cleaning of glassware

On Aldabra, flasks and petri dishes were cleaned in dilute 'Teepol' solution and scrubbed with test tube brushes. They were rinsed three times in tap water and given a final rinse in distilled water. In Durham, flasks and petri dishes were cleaned by soaking overnight in a hot 2% solution (w/v) of 'Quadralene' laboratory detergent. After soaking they were scrubbed and rinsed thoroughly in hot water. They were given final rinses in distilled water. Pipettes used for algal inoculation were cleaned by soaking overnight in a

mixture of one volume of saturated NaNO_3 to six volumes of concentrated H_2SO_4 . They were rinsed thoroughly in tap water and given a final rinse in glass-distilled water. Both on Aldabra and in Durham, pipettes used for mineral media were soaked overnight in 10% HCl, rinsed thoroughly in tap water and rinsed finally in glass-distilled water.

2.364 Sterilisation

Media, pipettes, flasks and Millipore filter apparatus were sterilised by autoclaving at 121°C and 10.35 KNm^{-2} (15 lb in^{-2}) for 15 min. The phosphate was autoclaved separately from the rest of the medium and added aseptically after cooling to prevent precipitation. The ammonium salt was sterilized by filtering through a sterile Millipore filter, pore diameter $0.45 \mu\text{m}$. Inoculation was carried out in a room partially sterilised by ultraviolet irradiation. Benches were cleaned down with absolute ethanol and the room sprayed with absolute ethanol to remove suspended material from the atmosphere.

2.365 Media

Table 2.6 shows the composition of the media used, in mg l^{-1} of each element; the salts are shown in Table 2.7. All culture work was carried out using two types of media; AAD - N and AAD + N. Both were modified from that of Allen and Arnon (1955). AAD - N was used for routine isolation of all heterocystous strains of blue-green algae, and as a control medium for experiments with these strains. AAD + N was used for the isolation and as a control medium for all other strains.

Table 2.6

Composition of media
(mg l⁻¹ of elements)

<u>Element</u>	<u>AAD - N</u>	<u>AAD + N</u>	<u>Medium of Allen & Arnon (1955)</u>
N	-	0.144	-
P	44.5	44.5	61.9
S	26.0	26.0	32.0
Cl	171.8	171.8	177.3
Na	90.5	90.5	92.0
K	112.2	112.2	156.0
Ca	18.1	18.1	20.0
Mg	19.7	19.7	24.3
Si	-	-	-
Fe	4.0	4.0	4.0
Mn	0.12	0.12	0.5
Mo	0.08	0.08	0.1
Zn	0.01	0.01	0.05
Cu	0.005	0.005	0.02
Co	0.0005	0.0005	0.01
B	0.09	0.09	0.5
V	-	-	0.01
W	0.005	0.005	0.01
Ni	0.002	0.002	0.01
Cr	0.001	0.001	0.01
Ti			0.01

Table 2.7

<u>Composition of media</u>			
<u>(mg l⁻¹ salt)</u>			
<u>Salt</u>	<u>AAD - N</u>	<u>AAD + N</u>	<u>Medium of Allen & Arnon (1955)</u>
K ₂ HPO ₄	250.0	250.0	348.4
MgSO ₄	200.0	200.0	246.5
NaCl	230.0	230.0	233.8
CaCl ₂ .2H ₂ O	66.2	66.2	73.5
FeCl ₃ .6H ₂ O	0.97	0.97	?
Na ₂ EDTA.2H ₂ O	12.7	12.7	?
ratio EDTA:Fe (g)	13.1	13.1	
MnSO ₄ .4H ₂ O	2.03	2.03	2.03
Na ₂ MoO ₄ .2H ₂ O	0.25	0.25	-
MoO ₃	-	-	0.15
ZnSO ₄ .7H ₂ O	0.22	0.22	0.22
CuSO ₄ .5H ₂ O	0.079	0.079	0.08
CoCl ₂ .6H ₂ O	0.04	0.04	0.04
H ₃ Bo ₃	2.86	2.86	2.86
NH ₄ Cl	-	500.0	-
NH ₄ VO ₃	-	-	0.02
Na ₂ WO ₄ .2H ₂ O	0.018	0.018	0.018
NiSO ₄ .6H ₂ O	-	-	0.045
NiSO ₄ .7H ₂ O	0.04785	0.04785	-
Cr(SO ₄) ₃ .K ₂ SO ₄ .24H ₂ O			0.96

Media were made up as required from stock solutions stored in a refrigerator. Iron and EDTA (ethylenediaminetetraacetic acid) were made up as one solution. Glass-distilled water was used for both media. Aliquots of 50 ml or 100 ml of medium were used in 100 ml or 250 ml conical flasks. For solid media, 1.0% (w/v) agar (Davis Standard Agar: Davis Gelatin Ltd., Leamington Spa) was used in 100 mm petri dishes. Media were used without buffers, relying on the natural buffering properties of the phosphate to maintain a fairly constant pH.

2.37 Nitrogen fixation

For in situ and laboratory studies the general method of acetylene reduction assay proposed by Hardy and Knight (1967) and Stewart et al., (1967, 1971) was followed. Field assays and most laboratory assays were carried out in 7 ml serum bottles fitted with rubber stopper liners. 4 replicates were used for most assays, but where no standard deviation is shown in Table 5.1 only 1-2 bottles were used. In each case approximately 1 ml of alga was used in the incubation. Although every attempt was made to introduce this amount as accurately as possible it was found by experiment that the volume of alga had little effect upon the composition of the final gas phase. Only whole algal colonies were used to eliminate any inaccuracies which might occur due to injuries caused by the disruption of colonies. All the standard field assays were carried out on sunny days usually commencing at 10.00 h with cloud cover never exceeding 50% except for very short periods. Laboratory assays were carried out in 250 ml

conical flasks with 25 ml of medium, $p_{C_2H_2} = 0.17$ atm, and usually 3 colonies; the flasks were sealed with Suba-seal closures and incubated under continuous illumination (warm white fluorescent source, 3000 lx) and a constant temperature of $32^{\circ}C$.

Each sample was allowed to preincubate for 15 min in 1 ml of acetylene gas (East African Oxygen Ltd). The acetylene was injected through the rubber stopper liner using Gillette Scimitar disposable syringes. 1 ml of acetylene gas gave a $p_{C_2H_2} = 0.17$ atm. Using this concentration of acetylene eliminated the need to flush any N_2 from the bottles prior to incubation. Stewart et al. (1971) have shown that there was no appreciable difference in the rate of C_2H_2 reduction in four genera of blue-green algae under a $p_{C_2H_2}$ near 0.2 atm, whether or not air was removed from the system.

After the addition of acetylene the tubes were shaken to aid the dissolving of the gases and the algal colonies repositioned by gently tapping the tubes such that they received maximum light. Assays were incubated for 1-2 h and time course experiments were sampled at 0.5 h intervals. Zero time and dark controls were included in all assays. For dark incubation bottles were tightly wrapped with aluminium foil. In the field, assays were incubated in the required environment in the vertical position. It was decided that although maximum light could be obtained by incubating the bottles in the horizontal position it was possible that the alga might be scorched due to the lens effect produced by the cylindrical

shape of the bottle. Throughout the incubation periods atmospheric temperature and the temperature within serum bottles were recorded. Temperature within serum bottles was measured by using four serum bottles fitted with mercury in glass thermometers and bulbs of which were immersed in 2 ml of rain water. At the end of the incubation period gas samples were removed with multiple-sample vacutainer needles (Becton and Dickinson Ltd.) and stored in 'Vacutainers' (Becton and Dickinson, 3206U, formula 134). These were then further sealed by dipping the rubber stoppers in molten paraffin wax, though Schnell and Alexander (1971) and M. Potts (pers. comm.) found no leakage from such tubes over a period of weeks. Chemical methods of terminating experiments were avoided as Thake and Rawle (1972) have demonstrated that non-biologically produced ethylene may be released into the gas phase. After the removal of the gas phase the algal colonies were removed from the bottles and dried in the shade with the aid of an electric fan.

On return to Durham, 1 ml aliquots of the gas sample from the vacutainers (at 20°C) were analysed for acetylene and ethylene using gas chromatography. Analyses were carried out on a Varian Aerograph series 1200 gas chromatograph, fitted with a stainless steel column (1800 mm x 3.2 mm) packed with Poropak R and maintained at 100°C and a hydrogen ion flame detector maintained at 150°C. Nitrogen was used as a carrier gas, at a flow rate of 24 ml min⁻¹. The machine was calibrated using dilutions of high purity ethylene (Air Products Ltd.) prepared using a Hamilton Gas Syringe in a

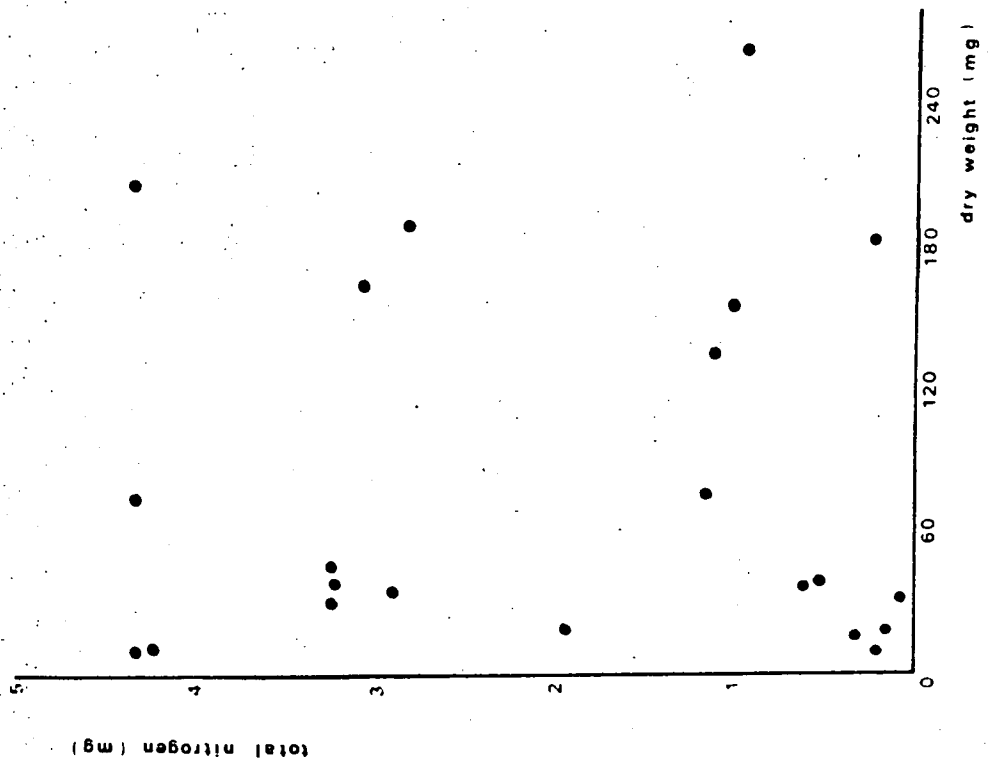
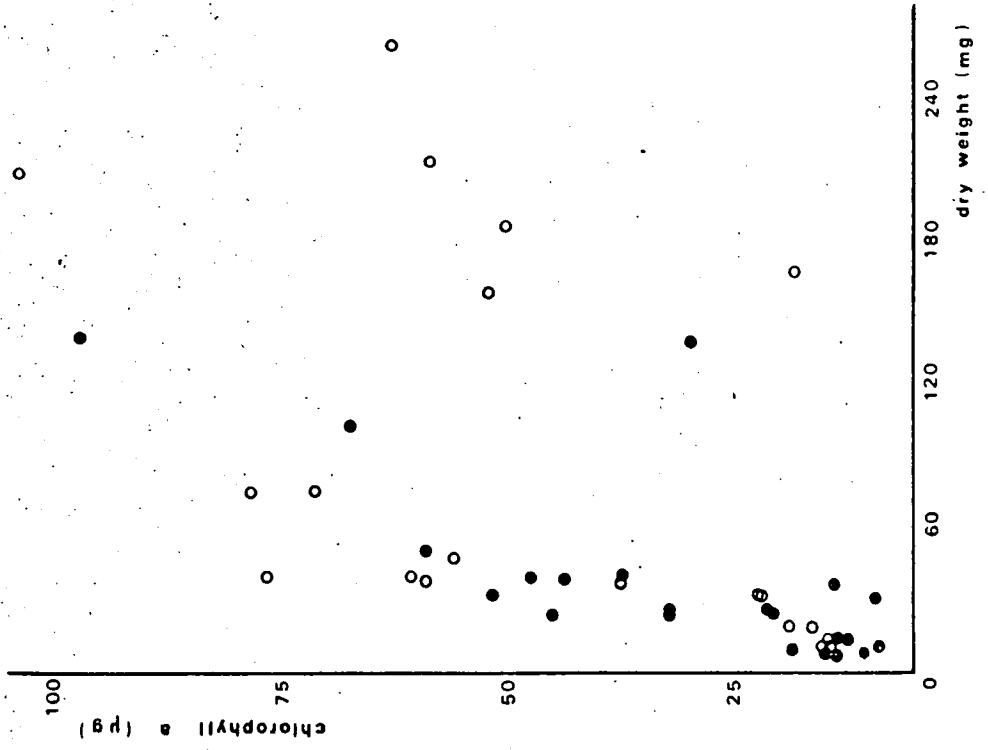
constant temperature environment (20°). In all experiments syringes, rubber stopper liners and football bladders (used for carrying gases in the field) were all aired for at least a week prior to use, as Kavanagh and Postgate (1970) have shown that such materials may absorb and release ethylene. It had originally been intended to quantify acetylene reduction assays using total nitrogen ($\text{nM C}_2\text{H}_4 \text{ mg N}^{-1} \text{ min}^{-1}$). However preliminary observations of the colonies used in assays showed that they often possessed a great deal of foreign organic material or dead algal material. Comparisons of chlorophyll a content to dry weights of colonies and total nitrogen to dry weights of colonies (Fig. 2.14) showed a closer correlation of chlorophyll a to dry weight than total nitrogen to dry weight. It was thought also that the chlorophyll a content of colonies would give a more accurate representation of the living material present. Acetylene reduction assays were therefore quantified using the chlorophyll a content of colonies ($\text{nM C}_2\text{H}_4 \mu\text{g chl a}^{-1} \text{ min}^{-1}$).

2.38 Statistics and computing

2.381 Parametric tests

The mean (\bar{x}) and standard deviation (s) were calculated using parametric tests for comparisons between samples where n was equal to or greater than 4 (Elliot, 1971). For testing the significance of difference between sets of replicate data a modified version of Student's 't' test was used (Bailey, 1959). The means of two small samples ($n \leq 30$) from normal populations

Fig 2.14. Comparisons of total nitrogen to dry weight (Fig.2.14a) and chlorophyll a to dry weight (Fig.2.14b) for Aldabran algal colonies (Nostoc spp. and Tolypothrix byssoidea). Solid circles (•) are colonies which had both chlorophyll a and total nitrogen estimated.



and unknown variances (S_1 and S_2) were compared. A 5% level of significance was taken for the rejection of h_0 .

the formula used was as follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where: t = modified Student's t

\bar{x}_1 = mean of the first sample

\bar{x}_2 = mean of the second sample

n_1 = number of observations in the first sample

n_2 = number of observations in the second sample

s = estimate of the standard deviation based on both samples

2.382 Non-parametric tests

The Mann-Whitney U test was used to test for significance of difference between sets of replicate data in acetylene reduction assays. This test is particularly useful for analysis of data with small sample numbers (replicates) and has the advantage of not depending on the parent distribution being normal or that the parameters of the distribution (e.g. mean μ and the variances) are the same for each sample. The formula quoted by Elliot (1971) was used and the probabilities were taken from the table of Mann and Whitney reproduced in Siegel (1956). A 5% level of significance was taken for the rejection of h_0 .

the formula used was as follows:

$$U_1 = n_1 n_2 + \frac{n_2 (n_1 + 1) - R_2}{2}$$

$$U_2 = n_1 n_2 + \frac{n_1 (n_2 + 1) - R_1}{2}$$

where: n_1 = number of counts in the first sample

n_2 = number of counts in the second sample

R_1 = sum of the ranks of sample 1

R_2 = sum of the ranks of sample 2

U_1 and U_2 = test statistics

2.383 Recording, storage and analysis of data

A total of 1053 samples were collected of which 521 were used for detailed study. The 521 samples represented 5962 individual algal records, all corresponded to 1 cm² samples (2.21). The fate of the remainder was as follows:

- a) 31 lost due to degradation during delays before examination at base camp or subsequent damage during transit.
- b) 100 not brought back to Durham due to limited transport space.
- c) 400 returned with full environmental and biological data, but not analysed due to lack of time.

Data concerning the 521 samples examined in detail were stored on computer following a system devised in Durham (Whitton et al., 1976). This system is briefly described below.

The Durham recording system required that every type of photosynthetic organism present in a 1 cm² sample be coded in some manner. Immature stages and small fragments of colonies had to be given a taxonomic code, although it was impossible at times to recognize them to the specific or even the generic levels. This permitted the use of various 'dumping grounds' for material only partially identified. As a result, a single species could sometimes be coded in two or even more ways. This meant that before certain types of question could be asked about the data collected, such as phytosociological analysis, it was essential to convert the raw data to a form applicable to the question. Data from 1 cm² samples were recorded as follows:

- a) species (Table 4.1)
- b) relative abundance of the species, both as live and dead cells
- c) whether live morphological forms of the species were present in addition to that typical for it
- d) the presence of firmly attached epiphytes on living material of a particular species
- e) notes, collector

Relative abundance

(i) This was recorded as 0, 1, 2, 3, 4 or 5. These correspond to the widely used absent, present, occasional, frequent, abundant, very abundant, and were thus highly subjective. As these values are simply the relative amounts of the whole standing crop in the 1 cm^2 sample, they give no indication of the absolute amounts unless combined with (C) and even then they are only a very rough guide. If abundance could be quantified, it would be related to biomass of species (and not number of cells).

(ii) Abundance scores were given for both live and dead material. Allocation of a score for dead material of a species was based on the amount of dead material in relation to the live material present of that species. Dead material of a species was scored even if no live material was present. When considering the relative amount of live material only the total living biomass was considered, but when similarly considering the dead material, the total living and non-living material was considered.

iii) The practical technique for scoring was as follows:

(1) Record data for any organisms macroscopically visible.

(2) Take a sample of remaining material for inspection on slide (using large cover-glass). If moss sample, this may be a squeezing. Make a rough score; allowance was made for the biomass of any large organisms in the original samples.

(3) Repeat (2) amending score where necessary. If (2) and (3) differ markedly, repeat with a still further microscopic sample.

(4) Inspect any larger organisms omitted from (2) and (3) for epiphytes.

(5) Check list obtained for possible omission of near ubiquitous or very small organisms e.g. Chlorella.

If only the typical growth-form was present, then no specific note of morph was made. If any other form than the typical one was present then this was coded together with the typical one if this was also present. The present recording system makes no allowance for the relative abundance of the various morphs present for a particular species, but this data was recorded and stored in note form. The relative abundance of a species in the records refers to the total amount of that species, irrespective of morphs.

Morphological forms (morphs) 0-9

0 Not known

1 Normal growth form

2 Zoospore, if not normal form

- 3 Palmelloid, if not normal form
- 4 "Juvenile" stage, if not normal form
- 5 Asexually produced spore, gemma or similar structure, non-motile
- 6 Sexually produced spore, non-motile, detached from reproductive structure
- 7 Obvious fruiting structure present
- 8 Sex organs (or flower) present
- 9 Other structure: see notes

Epiphytes

- (a) All 1 cm² samples were checked for epiphytes.
- (b) Each plant with epiphytes was checked separately. It was thus possible for 1 cm² sample to have information about the epiphytes on many species.
- (c) Only those organisms which were firmly attached to a surface were considered as epiphytes.
- (d) Parasites were treated as epiphytes, even though the host plant was quite dead. When it was not possible to show the relationship between the species of parasite and the host species this was included in the notes.
- (e) The following semi-quantitative data were collected for epiphytes on a species:

thickness scale, on 1-3 scale

relative abundance, on 1-5 scale

A very rough guide to the application of the thickness scale is:

- 1 1% very thin
- 2 1-10% thin
- 3 10% moderate and +

used for any species within the genus, whereas the latter was used only if it was certain that the organism was not one of the listed binomials.

Binomials were included in Table 4.1 wherever it was thought that a competent taxonomist could name the organism on the majority of occasions he encountered it without having to use time-consuming techniques such as culture to produce spores. In most cases it should be possible to name the organism directly, or at least after some simple treatment such as dissolving away the limestone around endoliths. Binomials were allocated after study of specimens by light microscope and consultation of the taxonomic literature (1.4). Where it was impossible to allocate a suitable binomial a species was placed in the most suitable 'species' number category of the Durham recording system. In most cases this was a width category. It was possible that several binomials fell within one 'species' number category. This was true for genera within the order of blue-green algae, Chroococcales. In this case the most suitable name was attributed to the size range category. Provided the description fitted, the binomial attributed was usually the earliest, whether or not this was a marine or freshwater species. Binomials included under a particular 'species' number are included in the floristic list (Table 4.2).

Width category numbers

These were used where binomials were difficult or impossible to allocate. In most cases they represent an

General principles used in allocation of species numbers

The basic unit of biological information in the Durham recording system is termed the 'species number', and consists of 6 digits. In many, but not all, cases the species number corresponds to a binomial.

The left-hand two digits of the 6 digit species number are called the 'phylum pair' and specify a phylum or other broad taxon into which the organism may be put.

The middle pair of digits, the 'genus pair', identifies the genus. For instance, the genus pair 02 following the phylum pair 01 (i.e. the four digits 0102 refer to the Myxophyta genus Anabaena). Genera are placed, as far as possible, in alphabetical order within the phylum or broad taxon.

The last pair of digits, the 'species pair', identifies the species and/or subspecies or special taxonomic category. For instance, the whole species number 010215 refers to the Myxophyta, Anabaena variabilis. The species are placed, as far as possible, in alphabetical order within the genus.

Certain pairs of digits have a similar meaning wherever they occur. There is only one such genus pair, the genus pair 99, which indicates either that no identification beyond the phylum or broad taxon could be made, or that the species belongs to a genus not coded for in the phylum or broad taxon. Hence the genus pair 99 following the phylum pair 01 (i.e. the four digits 0199) refers to the Myxophyta as a group.

Various species pairs or blocks of species pairs are used in the same way wherever they occur. The distinction between 50 'sp' and 49 'sp , not above' is important. The former was

aggregate of a number of possible binomials. In almost all cases a width or length category is added to the genus, but in some cases further information such as the nature of a sheath is also included.

There are two halves to this group of special numbers, one being an expanded version of the species pair 49 and the other of the species pair 50. The numbers 31-48 inclusive were used for the former, and the numbers 51-68 inclusive for the latter. The width categories used for 51-68 correspond exactly to those used for 31-48. For instance, 014234 refers to an alga which is definitely not Lyngbya allorgei or any of the other Lyngbya species in Table 4.1, but one which fits into the width category Lyngbya sp. not above $> 4 \leq 6 \mu\text{m}$ and 014254 refers to any clearly recognizable Lyngbya which fits into the width category Lyngbya sp. $> 4 \leq 6 \mu\text{m}$.

Although a particular species pair does not correspond to the same width category in every genus for which it is used, nevertheless similar width categories are as far as possible used throughout the recording system. These are based on the geometric series 1, 2, 4, 8, 16, 32, 64 μm . In some cases the higher width categories are subdivided arithmetically, but these width categories can if necessary be amalgamated together to permit easy comparison with other genera where the subdivision is not used. In a few genera size criteria other than width were used. For instance, length categories were used for some flagellates and length/breadth ratios for some genera in the Chlorococcales where a single cell differed greatly in size according to age e.g. Characium.

In some cases the use simply of a width range would permit too many conventional binomials to fall within a single category, yet nevertheless the variation in width found within a single population could ^{be} so great that it was unsatisfactory to split the broad width category into smaller ones. In these cases width criteria were combined with one or more morphological criteria widely used within the particular genus e.g. chloroplast number and method of cell division in Spirogyra.

Private numbers

Species which are only likely to be used by one person operating the Durham system are allocated private numbers. In this case the phylum pair and genus pair are the same as used in the common system but the species pair allocated are 69 onwards. If a particular species cannot be given a binomial it is generally identified by the generic name followed by a letter. In either case the initials of the user are also included. Private numbers were allocated to 10 Aldabran algae and two angiosperms (4).

The expansion of the 1 cm² sample to include further data

Though the data described have been concerned mainly with plant species composition the 1 cm² sample was also used as a framework for collecting quite different data.

Data from Aldabran samples included:

- a) Records of animals e.g. protozoa, rotifers, nematodes.

Data on grazing were also collected here

- b) Records of changes taking place over a period of time

Summary of digit allocation

The phylum (or major taxon) pair may be any pair 01 to 98 inclusive. 99 is reserved for 'phylum unidentified'.

The genus pair may be any pair 01-98 inclusive. 99 is reserved for 'genus unidentified'.

The species pairs are:

01 - 30 for normal binomials

31 - 48 for normal binomials

49 species 'not above'

50 sp. i.e. any organism definitely in that genus

51 - 68 for width categories 'sp'

69 - 84 for private numbers

85 - 98 overflow block for normal binomials

99 for special use

Within the genus pair 99 the species pairs:

01 - 30 not used

31 - 48 for width categories genus 'not above'

49 genus 'not above'

50 sp. i.e. any organism definitely in the phylum

51 - 68 for width categories 'sp'

69 - 84 for private genus and species numbers

85 - 98 not used

99 for special use

All field and laboratory data were punched onto computer cards and processed by the Northumbrian Universities Multiple Access Computers (NUMAC), based on IBM 360 and 370 main frames and running under the Michigan Terminal System (MTS). From

this processing a data bank was produced for further analysis.

Using a number of different computer programmes it was possible to perform a range of different types of statistical analyses on this data bank. The basis of these computer programmes was a retrieval system which allowed the preparation of subsets of data for further analysis. A retrieval consisted of a clause which could contain one or a number of the 23 variables listed in Table 2.8. Examples of a range of query clauses are listed below:

- a) RETRIEVE ALL, SPECIES = 014202 (this is an indexed search for all the information from all samples containing the species 014202 (Lyngbya allorgei))
- b) RETRIEVE SPECIES LIVES = 4 & LIVES = 5 (this is a sequential search for all samples where there is at least one species at lives level 4 and a least one species at lives level 5)
- c) RETRIEVE ALL PHY \leq 3 & THI OR LI = 4 (this query demonstrates the free format nature of the query system. It consists of a sequential search for all the data of samples which had the physiognomic form 3 (filaments, predominantly vertically away from the substratum), 2 (filaments or filamentous floc \pm horizontal), 1 (film) and thickness = 4 (thickness 5 - 10 mm) or samples which received moderate shade in summer

Table 2.8 Simple variables for the Aldabra data set

computer code

SPECIES	... six digit number with size range or binomial
LIVES	... level 0-5 at which the species was recorded live
DEADS	... level 0-5 at which the species was recorded dead
DAY	... 1-31 day on which sample was collected
MONTH	... 1-12 month during which sample was collected
YEAR	... 2-3 year during which sample was recorded
HOUR	... 00 01-12 00 time of day when sample was collected
GRID REF	... grid reference from where sample was collected
SERAL	... serial number allocated to the sample on the Aldabra
IC	... island code of area of atoll from where sample was collected (Fig. 2.2)
PNOS	... pool number from pool where sample was collected (terrestrial samples = \emptyset)
PHY	... physiognomic form of sample when collected (Table 2.2)
PRO	... proportion of substratum (living + non-living) contributed by the same physiognomic form as the sample (Table 2.2)
THI	... thickness of sample (Table 2.2)
SUB	... substrate (Table 2.2)
S.SI	... substrate size (Table 2.2)
TOP	... substrate microtopography (Table 2.2)
INC	... surface inclination of sample (Table 2.2)
ASP	... aspect of sample (Table 2.2)
DEP	... depth of water at position of sample (Table 2.2)
LI	... exposure to light at actual sample point (Table 2.2)

3 ENVIRONMENTAL DATA

3.1 Meteorological

Meteorological data were collected by Royal Society Research Station staff at the synoptic observation station on Île Picard. Although none of these data were collected personally it is felt that for comparative purposes they should be included here.

The meteorological data obtained at the synoptic observation station Île Picard during the period of this study (Oct 1972 - July 1973) are listed in Table 3.1. For comparative purposes data obtained between 1967 and 1974 are listed in Appendix I. The total rainfall for 1973 (1220.9 mm) was the third highest on record 53% of this fell between January and July. The total rainfall for the period of the survey was 1250.6 mm. The totals for similar periods in other years are compared in Table 3.2.

Some individual measurements of temperature and relative humidity were made on a range of algal habitats on Île Picard (2.31).

All temperatures were measured within one hour of each other on 9.4.73. The maximum and minimum temperatures recorded at the synoptic observation station on Île Picard on that day were 31.0°C and 26.1°C respectively. The results of the measurements from the 14 sites are listed in Table 3.3. The maximum temperature recorded was 39.6°C (site 10) and the minimum temperature recorded 24.7°C (site 3). The greatest temperature range recorded was 13.6°C , ($24.7 - 38.3^{\circ}\text{C}$, site 3), the minimum range 5.0°C ($25.9 - 30.9^{\circ}\text{C}$, site 9).

Table 3.1 Meteorological data collected at the synoptic observation [^]Ile Picard during the period of this survey (Oct 1972 - June 1973 inclusive). (The data were collected by staff at the Royal Society Synoptic Observation station and are included here for comparative purposes.)

	1972	1973	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Mean monthly atmospheric pressure (mb)	1014.8	1013.2	1013.2	1012.3	1011.4	1012.2	1012.4	1013.8	1016.1		
Mean monthly wind speeds (kts)	15.1	8.9	5.2	10.1	6.7	7.2	6.4	8.2	8.5		
Maximum wind speeds recorded each month (kts)	25	20	12	24	24	19	10	12	20		
Highest maximum temperatures each month (°C)	31.2	32.4	32.6	35.9	32.2	33.2	32.5	33.6	30.0		
Mean maximum monthly temperature (°C)	29.75	30.64	30.97	31.06	30.57	31.40	31.33	30.08	28.49		
Mean minimum monthly temperature (°C)	24.52	25.50	24.28	25.87	25.99	26.36	25.86	25.03	23.62		
Lowest minimum temperatures each month (°C)	23.5	23.6	22.8	21.4	23.8	24.0	23.9	23.5	22.2		
Monthly total rainfall (mm)	12.7	25.6	240.2	261.0	286.8	262.8	56.7	57.1	47.7		

Table 3.2 Rainfall totals for periods October - June inclusive 1967 - 1974

year	rainfall (mm)
Oct. July	
1967 - 1968	459.6
1968 - 1969	1207.5
1969 - 1970	667.5
1970 - 1971	970.5
1971 - 1972	939.8
1972 - 1973	1250.6
1973 - 1974	1332.6

Table 3.3 Temperature of selected terrestrial sites on Île Picard

site	temperature (°C)	
	a.m. (06.15-07.15 h)	p.m. (15.30-16.30 h)
1 sandy patch amongst <u>Sporobolus virginicus</u> at synoptic observation station	25.6	33.2
2 perched cliff champignon near synoptic observation station	26.5	37.5
3 sandy patch amongst <u>Sclerodactylon macrostachyum</u> inland from small beach just south of synoptic observation station	24.7	38.3
4 open sand dune surface Passe Femme	25.1	35.6
5 sandy patch amongst <u>Sporobolus virginicus</u> in coconut grove north of research station	26.5	36.3
6 mixed herb vegetation on path behind research station sheltered by <u>Pemphis acidula</u> scrub	26.5	34.9
7 tall champignon pinnacle on path behind settlement	25.8	37.7
8 under dense <u>Pemphis acidula</u> scrub among leaf litter	26.3	32.7
9 small rock under dense <u>Pemphis acidula</u> scrub	25.9	30.9
10 open flat plain with an overlying layer of <u>Tolypothrix byssoidea</u>	27.6	39.6
11 open flat white plain without <u>Tolypothrix byssoidea</u>	27.5	39.2
12 pavé among <u>Plumbago aphylla</u> in <u>Casuarina</u> forest behind settlement	26.6	34.7
13 surface of <u>Casuarina</u> "needle" soil in forest behind settlement	25.9	35.3
14 rock pinnacle projecting above soil in <u>Casuarina</u> forest behind settlement	25.9	35.7
15 sandy patch as measured in 1	26.6	33.7

Relative humidity readings were taken at ground level and 1 m vertically above the ground measurement. All readings were taken within 1.25 h of each other (Table 3.4). At ground level the maximum value recorded was 100% (site RH 16) and the minimum 36.6% (site RH 7). The maximum range was 58.4% (36.6 - 95.0%, site RH 7) and the minimum range 0.9% (98.5 - 99.4%, site RH 8). At a height of 1 m the maximum value recorded was 96% (site RH 16), the minimum value 56.6% (site RH 6), the maximum range 28.2% (56.6 - 84.8%, site RH 6) and the minimum range 16.8% (67.2 - 84.0%, site RH 9).

3.2 Analysis of water

For reasons discussed in Section 2.32 data are somewhat fragmentary and some discussion is occasionally included here in order to clarify certain aspects of the analyses.

Data concerning individual pools (Programme A, 2.32) are summarized in Table 3.6 and Table 3.7. Examples of 24 h studies (Programme B, 2.32) from pools on Île Picard are illustrated in Fig. 3.1. Upper and lower limits for parameters showing obvious diurnal cycles are shown in Table 3.8, and changes over a three month period in pool W2 are shown in Table 3.9. Relationships between various parts of ions are illustrated in Fig. 3.2. A summary of the physical and chemical data is given in Table 3.10.

3.21 Conductivity

The data on conductivity are very much fragmentary (2.321). Values obtained ranged from 16.5 - 0.5%. No

Table 3.4 Relative humidity values from various points along a transect across Île Picard (a.m. = 06.15-07.30, p.m. = 13.30-14.35), (g = ground level, 1 m = one metre vertically above ground measurement).

site	wet bulb		dry bulb		relative humidity %		
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	
RH1 open patch of sand amongst <u>Sporobolus virginicus</u> at synoptic observation station	g.	25.5	30.7	26.3	40.5	93.6	48.0
	1m	25.5	27.1	27.0	32.7	88.0	63.4
RH2 coastal perched cliff champignon near synoptic observation station	g.	25.6	28.0	26.8	36.0	90.0	53.0
	1m	25.6	27.2	27.3	32.6	87.5	63.4
RH3 south facing open area of sand dune, Passe Femme	g.	25.8	27.6	26.5	33.0	94.0	63.4
	1m	25.8	28.4	27.0	33.6	90.0	66.4
RH4 south facing sheltered area of sand dune Passe Femme	g.	25.8	28.1	26.8	33.4	92.0	65.6
	1m	25.9	27.8	27.1	33.0	90.0	66.1
RH5 open sand amongst <u>Sclerodactylon macrostachyum</u> tufts inland from small beach near Passe Femme	g.	25.6	28.7	26.7	36.2	91.0	55.2
	1m	25.4	28.2	27.0	34.5	87.0	60.1
RH6 open sand amongst <u>Sporobolus virginicus</u> in coconut grove north of research station	g.	25.8	30.4	26.6	40.5	93.5	46.6
	1m	25.3	28.4	27.3	35.6	84.8	56.6
RH7 at base of <u>Sporobolus virginicus</u> clump in coconut grove north of research station	g.	25.5	31.3	26.1	44.8	95.0	36.6
	1m	(not measured)					
RH8 mixed herb vegetation sheltered by mixed scrub, along track behind settlement	g.	26.1	40.9	26.3	41.0	98.5	99.4
	1m	25.3	29.2	26.6	34.6	90.0	66.2

Table 3.4

site	wet bulb		dry bulb		relative humidity %	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
RH9 depression in platin near W2 containing <u>Lyngbya/Nostoc</u> community	25.2	28.3	26.7	38.2	88.0	45.6
	1m		27.2	31.6	84.0	67.2
RH10 depression in platin similar to that in RH9 but lacking <u>Lyngbya/Nostoc</u> community	25.2	27.7	27.3	36.0	84.5	51.2
	1m		27.3	32.6	84.0	63.4
RH11 large boulder with thin surface layer of <u>Tolypothrix byssoidea</u>	25.2	28.0	27.2	36.3	84.4	52.5
	1m		27.3	33.8	84.0	58.8
RH12 mixed herb vegetation along track to Bassin Cabri	25.8	36.0	26.2	39.2	96.5	80.8
	1m		26.9	32.4	87.0	68.2
RH13 amongst dense <u>Pemphis acidula</u> scrub along track to Bassin Cabri	25.4	27.8	26.5	32.6	91.0	68.2
	1m		27.0	31.9	87.0	68.0
RH14 in <u>Casuarina</u> forest over projecting rock surface near W5	25.4	28.5	26.8	36.3	90.0	49.5
	1m		26.9	34.0	87.0	60.8
RH15 over algal "felt" attached to rock near W5	25.7	29.2	27.0	33.7	90.0	70.7
	1m	(not measured)				
RH16 amongst tall grass near the entrance to <u>Casuarina</u> forest	26.8	31.2	26.8	38.8	100.0	57.2
	1m		26.3	33.0	96.0	62.8
RH17 open patch of sand amongst <u>Sporobolus virginicus</u> at synoptic observation station	25.6	29.7	27.2	40.1	90.0	45.4
	1m		27.2	32.5	88.0	64.0

Table 3.5 Conductivity measured in three pools at Takamaka over a period of 7 h 5.3.73 (all values were measured within 1 h of each other at 20 cm depth)

Time	Conductivity (%)		
	T1	T2	T3
1055 - 1150 h	2.0	2.0	16.5
1500 - 1530 h	2.0	2.0	16.5
1800 - 1830 h	2.0	2.0	16.3

Table 3.6 Total physical and chemical data collected
for 20 pools on Aldabra

Table 3.6

Pool	date	time	depth of pool (m)	depth of sample (m)	O.D. 420nm	temp. °C	O ₂ (% satn.)	O ₂ (mg l ⁻¹)	pH	Na	K	Ca	Cl	ortho PO ₄ -P	poly PO ₄ -P	total inorg.P	organic P	NH ₄ -N	NO ₂ -N	NO ₃ -N
W1	29.12.72	1000	0.70	0.20		27.9	112	8.8	9.1					0.86	0.06	0.92		0.7	<.003	<.01
W1	24.1.73	1100	0.72	0.20		30.6	125	9.3	10.4					3.4	0.50	0.90		0.2	<.003	<.01
W1	7.2.73	1000	0.50	0.20		30.9	108	8.2	9.8					0.19	0.21	0.40		0.5	<.003	<.01
W1	22.2.73	1030	0.65	0.20		28.4	111	8.6	9.2					0.37	<.01			0.5	<.003	<.01
W1	8.3.73	1530	0.69	0.20		37.8	150	>10.4	10.5	34.1	2.4	26.3	62	0.33				0.35	<.003	<.01
W1	21.5.73	1600	0.21	0.20		23.3	152	11.8	9.5	89.0	6.4	20.3	161	0.10				0.8	<.003	<.01
W1	6.7.73	1600	0.20	0.10	0.026	23.8	102	9.6	7.9	98.5	6.4	22.0	186	0.43				1.0	<.003	0.10
W2	23.1.73	1700	0.31	0.20		33.0	130	9.4	9.4					3.3	1.7	5.0	2.33	0.6	0.003	0.127
W2	6.2.73	0930	0.10	0.10		28.4	34	2.6	8.6					10.0	1.33	11.3	2.67	13.5	<.003	<.01
W2	20.2.73	1030	0.32	0.20		27.7	61	4.6	7.5					4.33	2.33	6.66	2.0	3.2	<.003	<.01
W2	6.3.73	1045	0.22	0.20		29.7	69	5.2	8.0	104	24.0	65.3	182	5.30				24.0	<.003	<.01
W2	20.5.73	1420	0.23	0.20		31.5	138	10.2	8.1	332	55.0	98.0	700	5.83				45.0	0.273	0.257
W3	5.6.73	1000	0.24	0.20	0.038	24.9	48	4.0	7.8	385	60.5	59.7	108	7.67				31.0	0.099	0.071
W3	23.1.73	1700	0.03	0.20		37.0	141	9.8	7.9					0.6	0.17	0.77	0.3	1.3	<.003	<.01
W3	21.2.73	0930	0.075	0.05		27.9	102	8.1	8.0					0.45	0.15	0.60	0.06	1.3	<.003	<.01
W4	22.1.73	1400	0.07	0.20	0.058	34.8	255	18.2	10.7	196	11.7	14.8	99.0	0.13	<.01	0.13	0.31	0.6	<.003	<.01
W4	5.2.73	1430	0.43	0.20		33.8	>150	>10.8	10.2					0.02				0.6	<.003	<.01
W4	19.2.73	0930	0.56	0.20		28.1	69	5.3	8.0					0.07	0.33	0.40	0.23	0.5	<.003	<.01
W4	3.3.73	1015	0.43	0.20		30.7	120	8.9	8.5	7.2	0.82	2.6	26.4	0.13	0.17	0.30	0.30	0.5	<.003	<.01
W4	3.5.73	1000	0.47	0.20	0.021	27.6	140	11.0	9.4	14.4	3.2	2.6	26.1	0.05				0.5	<.003	<.01
W4	20.5.73	1520	0.32	0.20	0.026	32.9	198	14.4	10.8	22.0	3.9	4.7	32.9	0.30				0.5	<.003	<.01
W5	23.1.73	1530	0.38	0.20		31.5	134	9.4	7.8					0.4	0.18	0.58	0.30	1.0	<.003	<.01
W5	6.2.73	1430	0.25	0.20		32.9	104	7.8	7.7					1.23	3.80	5.03	0.33	1.8	<.003	<.01
W5	20.2.73	0930	0.23	0.20		28.8	117	9.0	8.0					0.23	0.23	0.46	0.17	0.8	<.003	<.01
W5	6.3.73	0920	0.37	0.20	0.076	29.4	46	3.5	8.0	37.5	3.2	10.2	50.2	1.4				0.8	<.003	<.01
W5	30.5.73	1000	0.60	0.20	0.190	27.7	119	4.6	8.9	102	8.0	18.7	54.7	0.8				1.2	<.003	<.01
W5	20.5.73	1630	0.41	0.20		31.5	190	13.3	8.9	101	11.2	17.1	66.0	0.4				0.7	<.003	<.01
W6	23.1.73	1530	0.19	0.13		35.4	123	8.8	6.6					0.8	0.18	0.76	0.15	0.7	<.003	<.01
W6	6.2.73	1430	0.13	0.13		34.8	116	8.4	7.7					1.10	0.10	1.20	1.07	1.5	<.003	<.01
W6	20.2.73	0930	0.23	0.20		28.8	117	9.0	8.0					0.23	0.23	0.46	0.17	0.8	<.003	<.01
W6	6.3.73	0920	0.14	0.10	0.132	29.7	73	5.6	8.0	109	7.0	20.4	59.5	0.70	0.20	0.33	0.17	0.6	<.003	<.01
W6	20.5.73	1640	0.10	0.10	0.098	32.7	195	14.1	10.4	222	13.3	28.0	79.0	0.067				0.9	<.003	<.01
W7	22.1.73	1530	0.61	0.20		30.5	120	9.7	9.0					0.12	0.15	0.27	0.33	1.2	<.003	<.01
W7	5.2.73	0930	0.15	0.10		30.4	94	7.0	8.2					0.23	0.07	0.50	0.20	0.8	<.003	<.01
W7	19.2.73	1430	0.36	0.20	0.174	28.5	84	6.4	7.5	66.0	2.7	10.2	43.0	0.23	0.20	0.33	0.23	0.6	<.003	<.01
W7	5.3.73	0910	0.16	0.16		28.2	15	1.2	7.8	93.5	9.8	22.0	90.1	0.23	0.15	0.27	0.33	1.0	<.003	<.01
W7	30.5.73	1700	0.07	0.07	0.108	31.4	65	5.0	8.6	118	21.5	24.3	83.2	0.10				2.0	<.003	<.01
W9	5.2.73	0930	0.04	0.04		21.9			7.2					0.50	0.33	0.83	0.23	0.07	<.003	<.01
W9	20.2.73	1430	0.73	0.20		28.2	88	6.6	7.5	49.7	2.6	10.1	55.0	0.10	0.30	0.40	0.20	6.0	<.003	<.01
W9	5.3.73	0910	0.73	0.05	0.130	27.9	28	2.2	7.5					0.37				0.6	<.003	<.01
W10	29.2.73	1000	0.09	0.05		28.3	145	11.0	9.5					0.20				2.0	<.003	<.01
W102	16.4.73	1145	0.10	0.05					8.9	121	7.7	18.7	59.6	0.43				0.5	<.003	<.01
W103	10.4.73	1245	0.07	0.05	0.135				8.6	103	9.3	21.0	62.7	0.30				0.9	<.003	<.01
T1	5.3.73	1055	0.40	0.20	0.071	29.0	155	11.9	8.3	99.5	24.0	23.5	74.8	0.17				10.5	<.003	<.01
T2	8.1.73	0830	0.50	0.20		26.2	122	9.7	8.5					0.90				0.7	<.003	<.01
T2	5.3.73	0735	0.44	0.20	0.075	25.3	10	0.7	7.7	685	59.5	85.1	146	6.00				15.0	<.003	<.01
CC5	8.1.73	1030	0.20	0.10		31.9	134	10.1	8.9					0.20	0.13	0.33	0.13	0.4	<.003	<.01
CC5	8.1.73	1100	0.20	0.10		29.2	131	9.7	8.9					0.30	0.34	2.24	10.00	0.8	<.003	<.01
CC5	14.4.73	0820	0.10	0.05		30.8	150	>9.0	9.0	176	17.8	23.3	48.1	1.30				0.8	<.003	<.01
CC8	8.1.73	1130	0.40	0.20		32.0	125	8.8	8.2					0.97	0.40	1.37	10.30	0.8	<.003	<.01
CC9	15.4.73	1220	1.80	0.20	0.032	32.6	>150	>10.8	8.8	637	34.0	67.5	49.4	0.10				0.5	<.003	<.01
CC10	13.4.73	1500	0.25	0.10	0.062	33.3	>150	>10.8	8.5	244	49.0	32.5	45.5	0.23				0.5	<.003	<.01
CC11	15.4.73	0930	0.10	0.05	0.027	27.1	104	8.5	38.4	7.0	9.5	41.4	80	0.33				1.4	0.030	<.01
CC12	15.4.73	0840	0.10	0.05	0.087			8.2	8.5	386	24.0	41.2	62.2	0.76				2.3	<.003	<.01

Table 3.7 Summary of some chemical data for individual pools. Mean values are based on Programme A (2.32), minimum and maximum values on Programme B (2.32). Numbers of samples for each programme in each pool are indicated. (The total for all pools is sometimes one more than in Table 2.2, because pools W5 and W6 were joined together on one date and the single results are used twice in Table 3.7). Concentrations are in mg l^{-1} .

Table 3.7

	W1	W2	W3	W4	W5	W6	W7	W9	W10	W102	W103	T1	T2	CC2	CC5	CC8	CC9	CC10	CC11	CC12
Na	no. B 17	19	1	3	10	2	10	1												
	min. 34.1	104		7.2	37.5	109	66													
	max. 98.5	414		22	102	222	118													
	no. A 3	3	1	3	3	2	3	1												
	mean 73.9	277	196	15.2	80.0	166	92.5	49.7	121	103	103	99.5	685		176	637	244	1	38.4	386
K	no. B 17	19	1	3	10	2	10	1												
	min. 2.4	18.1		0.82	3.2	7.0	2.7													
	max. 11.9	64.0		3.9	8.0	13.3	21.5													
	no. A 3	3	1	3	3	2	3	1												
	mean 5.1	44.5	11.7	2.7	7.5	10.2	11.3	2.6	7.7	9.3	24.0	59.5		17.8	34.0	49.0	7.0	1	24.0	
Mg	no. B 17	19	1	3	10	2	10	1												
	min. 6.7	24.0		2.6	10.2	20.4	10.2													
	max. 23.9	62.8		4.7	18.7	28.0	24.3													
	no. A 3	3	1	3	3	2	3	1												
	mean 16.3	44.9	14.8	3.3	15.3	24.2	18.8	10.1	18.7	21.0	23.5	85.1		23.3	67.5	32.5	9.5	1	41.2	
Ca	no. B 17	19	1	3	10	2	10	1												
	min. 26.3	65.3		26.4	50.2	59.5	43.0													
	max. 59.2	112		32.9	55.6	79.0	83.2													
	no. A 3	3	1	3	3	2	3	1												
	mean 43.6	90.3	99.0	29.8	57.0	69.8	72.1	55.0	59.6	62.7	74.8	146		48.1	49.4	45.5	41.4	1	62.2	
Cl	no. B 17	19	1	3	10	2	10	1												
	min. 62	182		20	58	176	82													
	max. 201	880		70	225	461	266													
	no. A 3	3	1	3	3	2	3	1												
	mean 136	556	490	43	158	319	174	78	49	144	182	1250		334	1260	454	80	1	766	
ortho PO ₄ -P	no. B 11	11	3	3	11	5	10	3	6	0.05	0.17	0.9		2	0.30					
	min. 0.17	3.3	0.13	0.05	0.23	0.07	0.03	0.10	0.05	0.17	0.9		5	0.30						
	max. 0.40	10.0	0.6	0.30	1.0	0.70	0.23	0.50	0.20	0.23	12.3		2	1.90						
	no. A 7	6	3	6	5	5	6	3	1	1	2		2	2						
	mean 0.38	6.1	0.40	0.11	0.74	0.47	0.14	0.32	0.20	0.43	0.30	0.17	3.5	0.20	1.1	0.97	0.10	0.33	0.27	0.43
"poly"PO ₄ -P	no. B 4	3	3	2	3	3	3	2												
	min. <0.01	1.3	<0.01	0.17	0.18	0.10	0.07	0.30												
	max. 0.50	2.3	0.17	0.33	3.80	0.23	0.20	0.33												
	no. A 4	3	3	2	3	3	3	2												
	mean 0.19	1.79	0.11	0.25	1.40	0.17	0.14	0.32												
organic PO ₄ -P	no. B 3	3	3	2	3	3	3	2												
	min. 0.10	2.3	0.06	0.23	0.17	0.17	0.17	0.20												
	max. 0.23	2.7	0.3	0.30	0.30	1.07	0.33	0.23												
	no. A 3	3	3	2	3	3	3	2												
	mean 0.17	2.34	0.22	0.26	1.20	0.46	0.23	0.22	6											
ammonia-N	no. B 17	17	3	6	11	5	10	3	0.45			4	5							
	min. 0.2	0.6	0.6	0.4	0.7	0.8	0.07	0.50	0.65			6.0	0.7							
	max. 1.2	45.0	1.3	0.6	1.5	1.5	2.0	2.0	15.0			10.5	15.0							
	no. A 7	6	3	6	5	5	6	3	1	1	1	2	2							
	mean 0.52	19.2	1.1	0.50	1.1	1.1	1.9	2.9	0.5	0.90	0.90	10.5	7.8	0.40	0.70	0.80	0.50	1.4	2.3	1.2

Fig. 3.1 Diurnal cycles of various parameters in
six pools on Île Picard.

Fig. 3.1

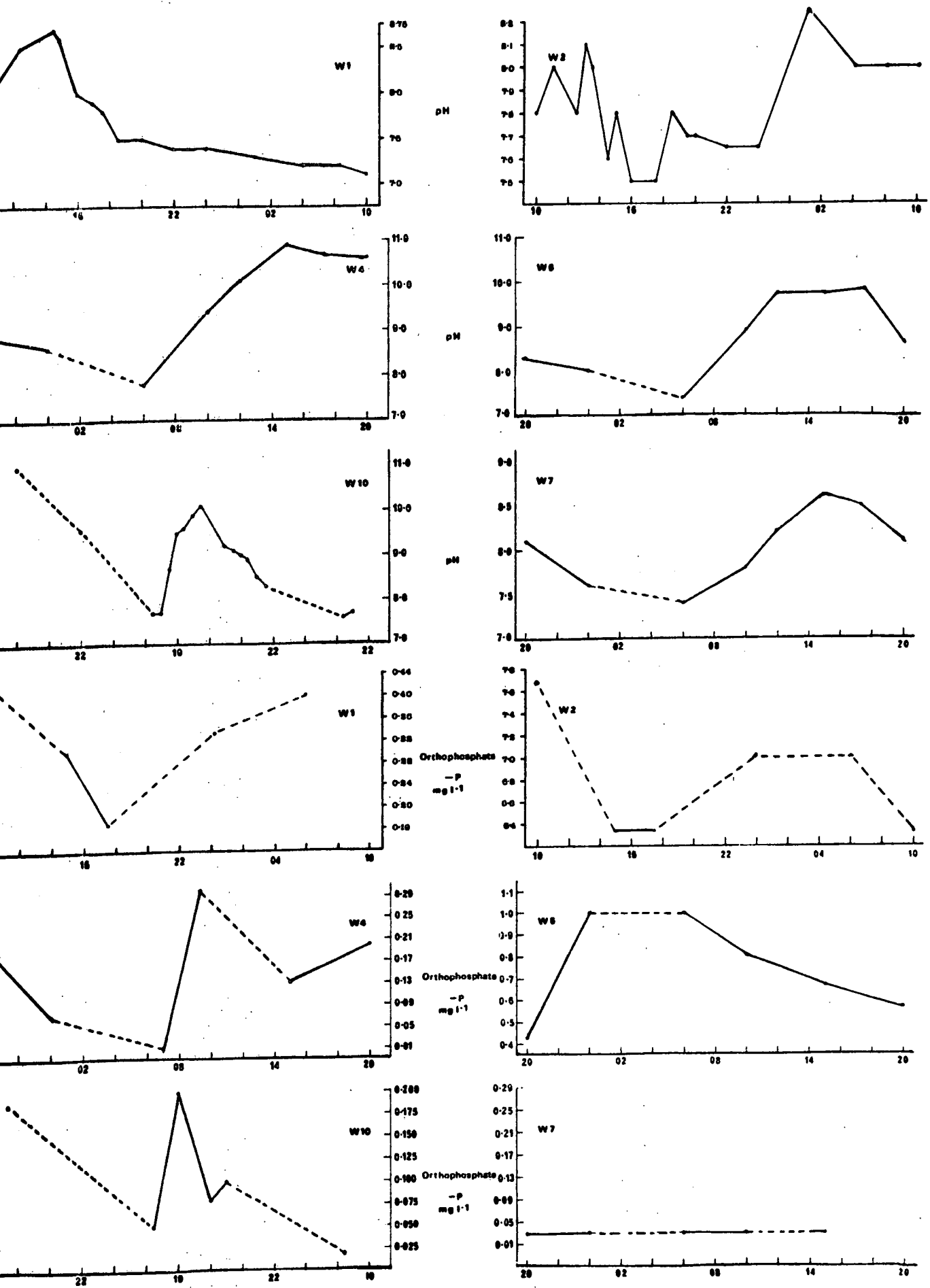


Fig. 3.1

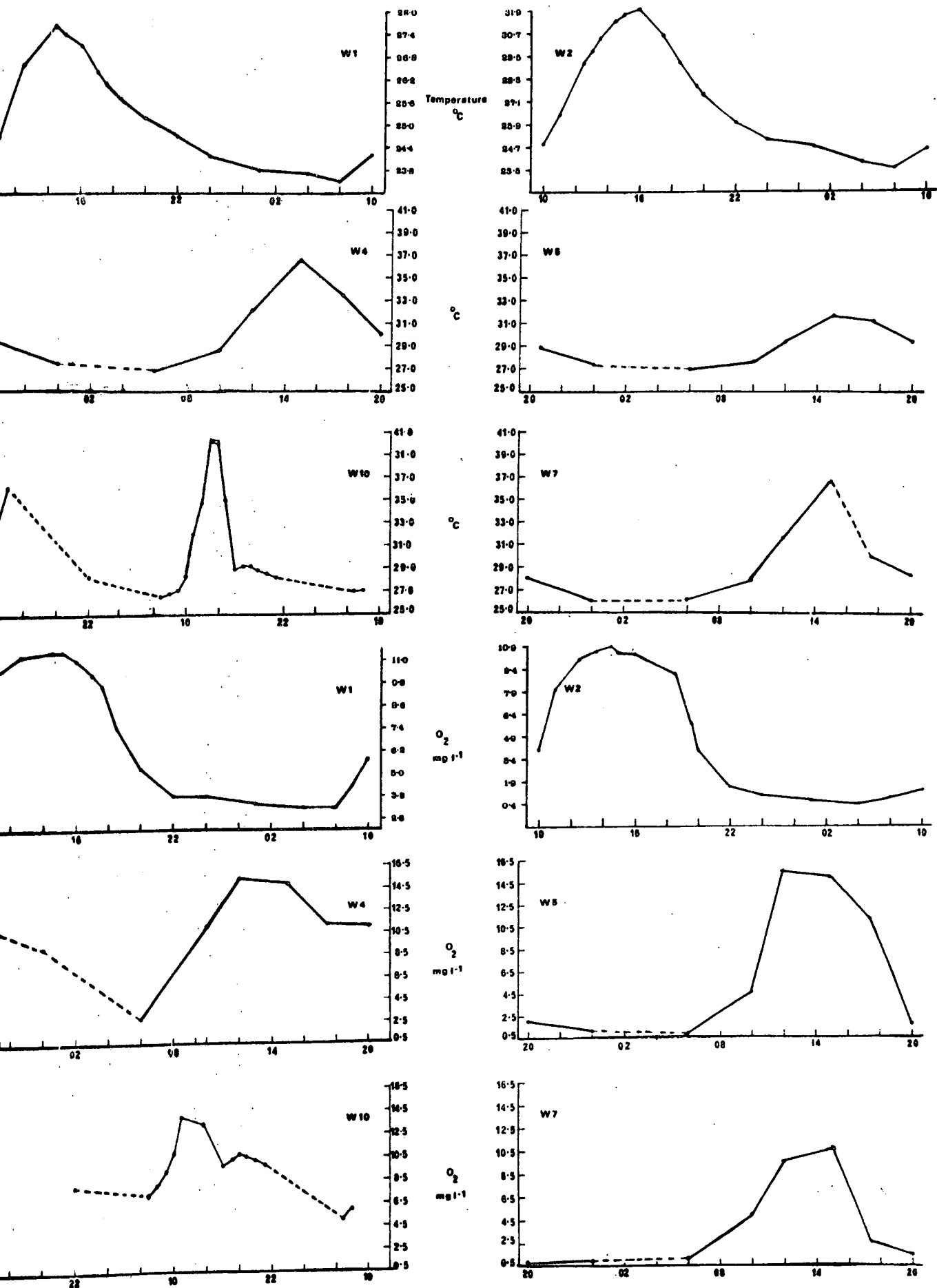


Fig. 3.1

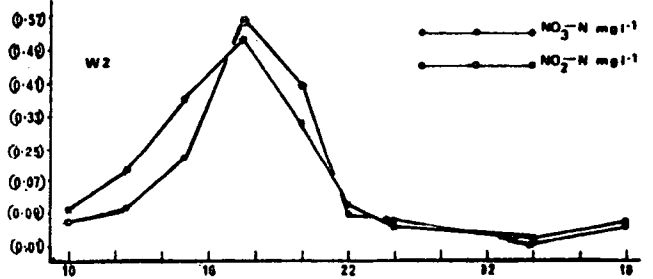
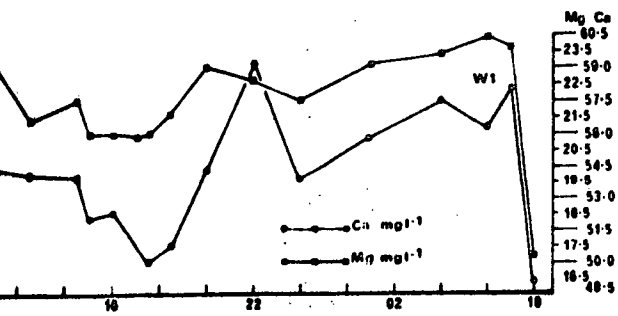
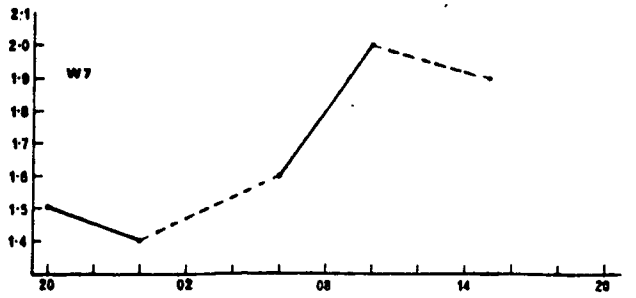
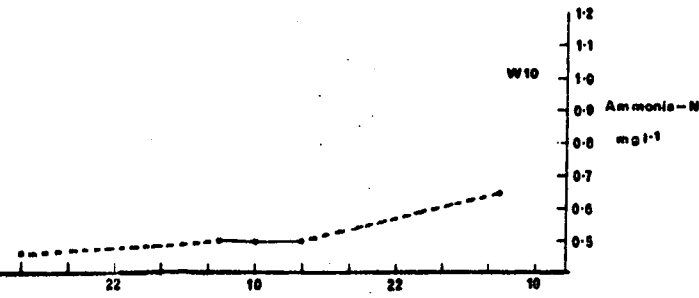
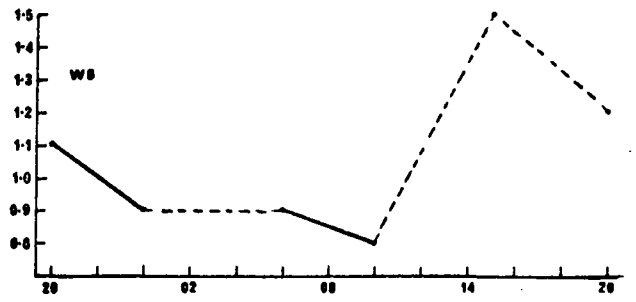
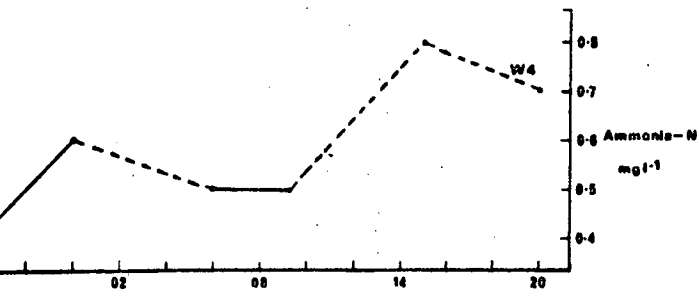
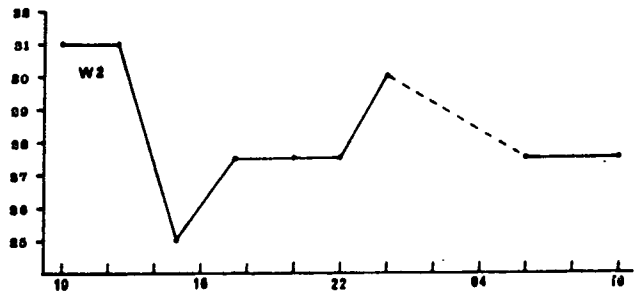
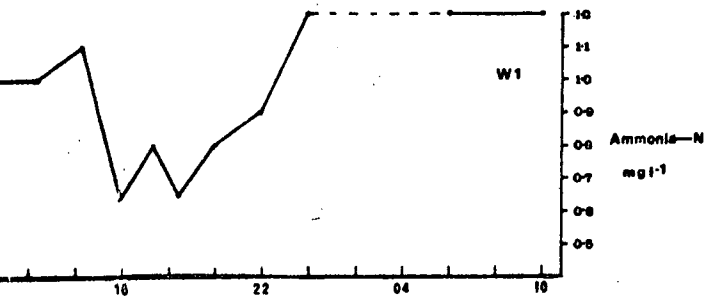


Table 3.8: Lower and upper limits for parameters found during 24 h surveys of pools; only those parameters showing an obvious diurnal cycle are included. All concentrations are in mg l^{-1} .

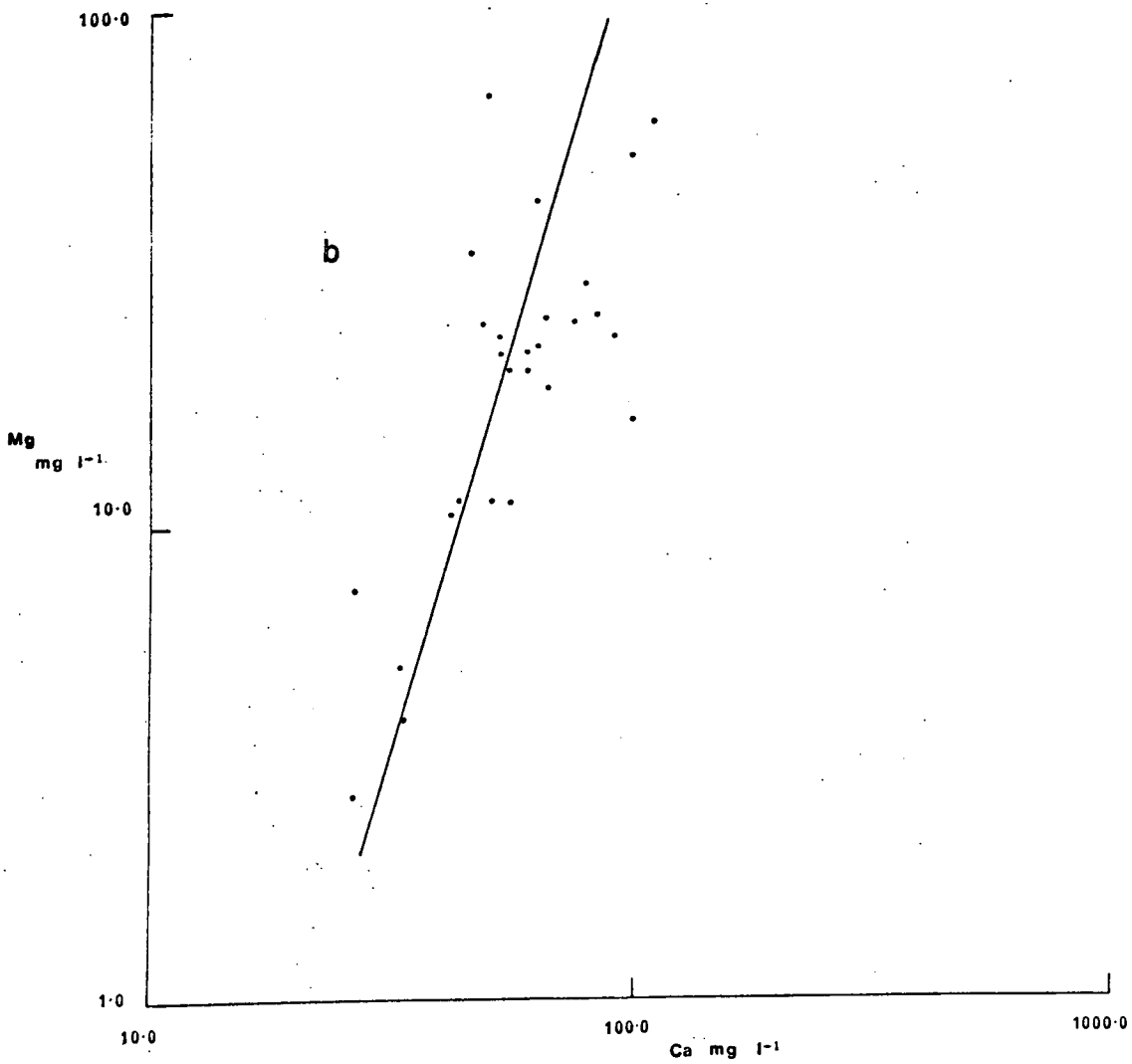
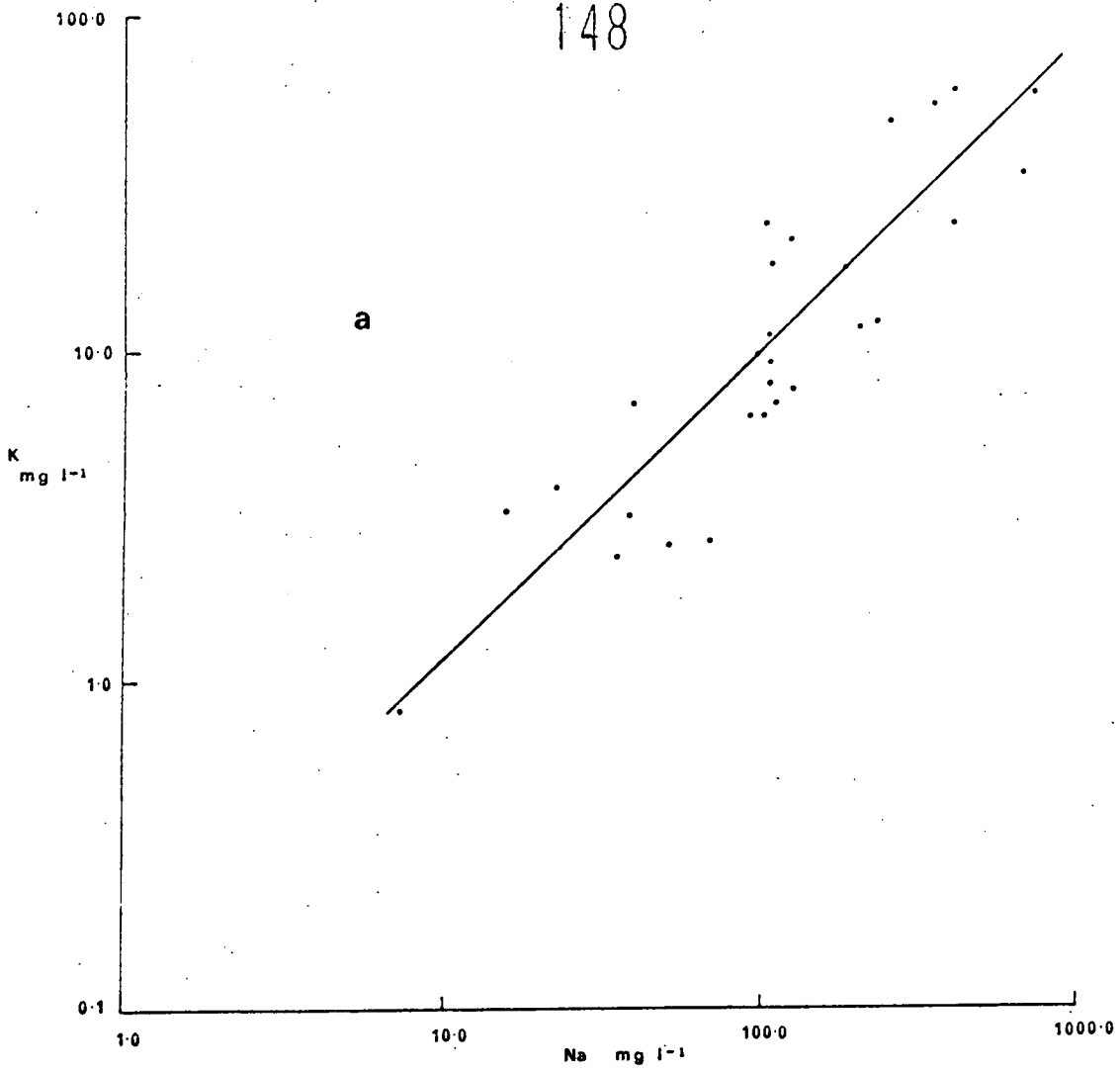
	W1 5/6 June		W2 5/6 June		W5 2/3 May		W7 2/3 May		W10 29/30 March	
	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper
temp	23.8	27.6	24.9	32.0	27.0	31.7	28.1	36.7	26.5	40.2
pH	7.1	8.7	7.5	8.0	7.4	9.7	7.4	8.6	7.7	10.1
O ₂	2.8	11.4	0.4	10.6	0.9	15.4	0.8	9.8	5.1	14.0
Mg	20.9	23.9	c. 60, no cycle		c. 15, no cycle		18.9	22.5		no data
Ca	50.0	58.0	c. 108, no cycle		c. 55, no cycle		73.4	90.1		no data
ortho P	0.17	0.43	6.3	7.0	0.43	1.0	c. 0.03, no cycle		0.05	0.19
NH ₄ -N	0.6	1.2	25	30	0.8	1.5	1.1	2.0	0.5	0.65

Table 3.9 Changes in pool W2 of various parameters over a 3-month period.
Concentrations are in mg l⁻¹.

	max. depth	Na	K	Mg	Ca	Cl	ortho-P	NH ₄ -N
on 6.3.73	0.22	104	18.1	24.0	65.3	182	5.3	24
on 20.5.73	0.23	332	55.0	51.0	98.0	700	5.8	45
on 5.6.73	0.24	385	60.5	59.7	108	785	7.7	31
change between first and last	+0.02	+281	+42.4	+35.7	+33	+503	+2.4	+7
ratio of increase to conc. in seawater		.026	.11	.025	.09	.026		

Fig. 3.2 Relationship between various pairs of ions studied in programme A:

- a) $\log K$ v. $\log Na$, regression coefficient = 0.9, correlation coefficient = 0.9, $n = 28$
- b) $\log Ca$ v. $\log Mg$, regression coefficient = 3.4, correlation coefficient = 0.5, $n = 27$
- c) $\log NH_4-N$ v. \log total inorganic PO_4-P regression coefficient = 0.5, correlation coefficient = 0.7, $n = 24$
- d) $\log N$ v. \log ortho PO_4-P , regression coefficient = 1.8, correlation coefficient = 0.8, $n = 50$



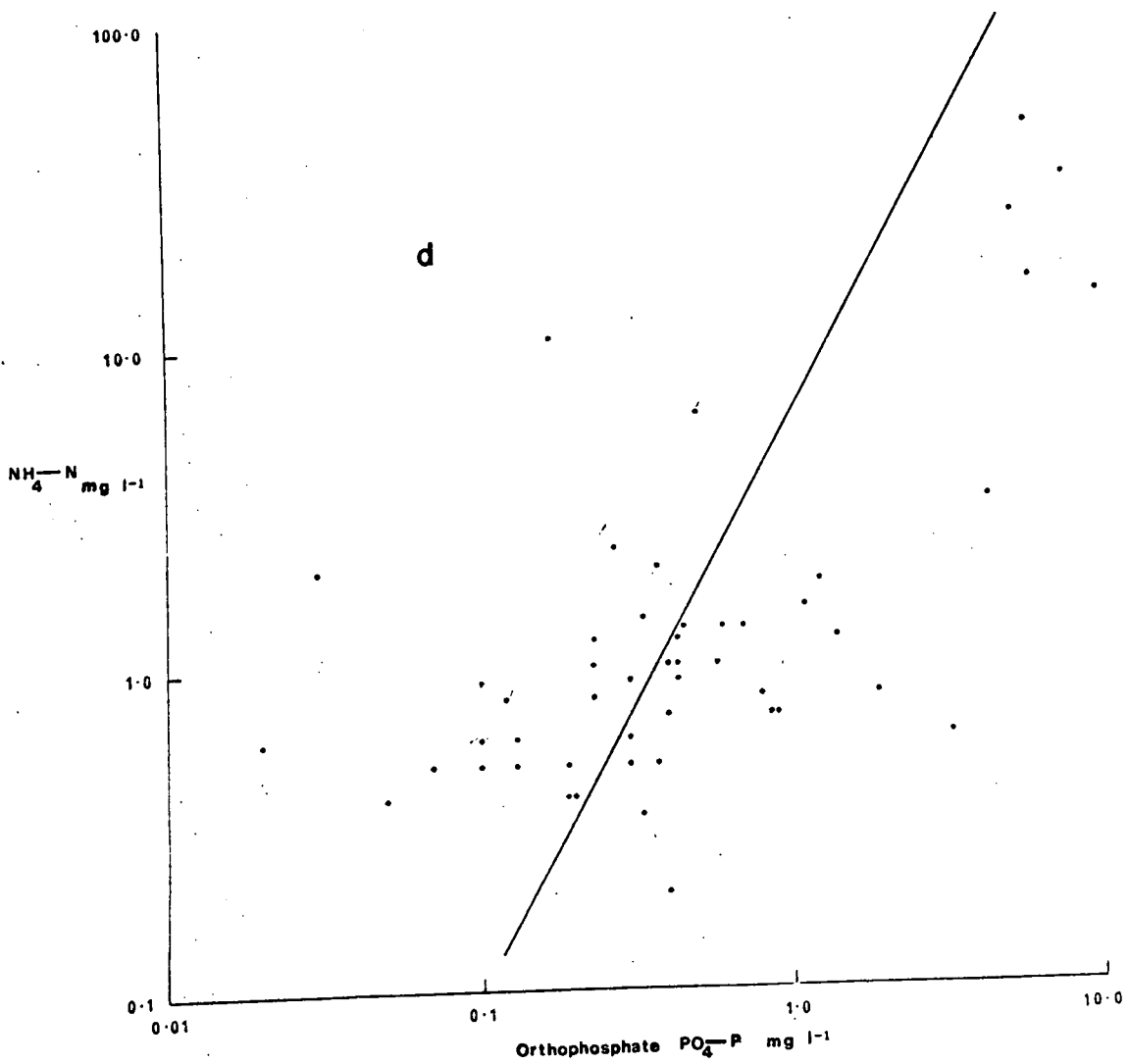
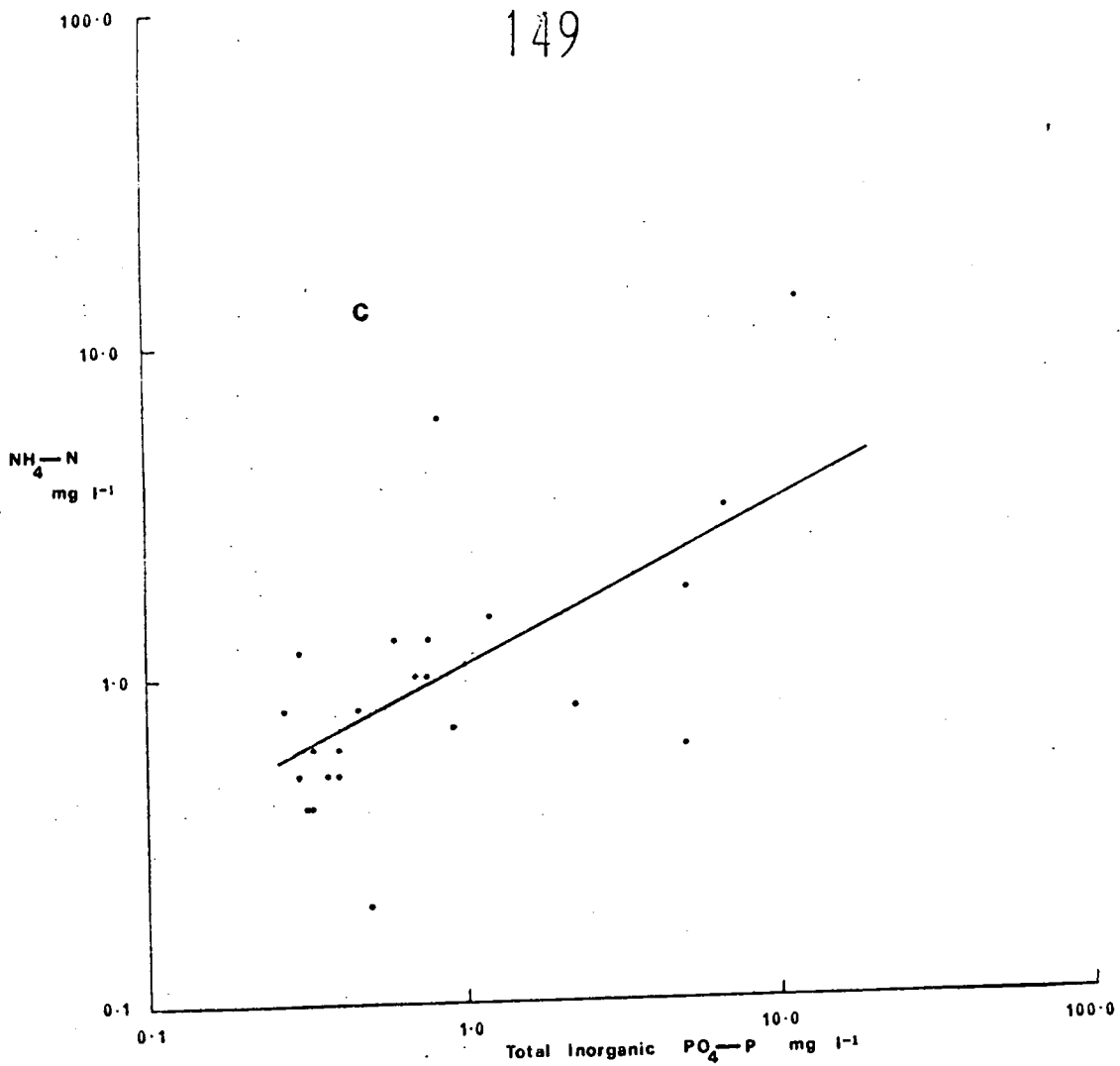


Table 3.10 Summary of data on physical and chemical parameters for water in pools. Mean values are based on programme A (2.32), minimum and maximum ones on programme B. Values added in brackets are extremes found during spot readings taken anywhere in freshwaters on Aldabra. Concentrations are in mg l^{-1} . (In calculation of means, non-detectable values are treated as zero.)

	minimum	maximum	mean (including W2)	mean (excluding W2)
O.D. 420	0.021	0.273	0.084	0.088
temperature	24.9° (23.0°)	37.2° (41.2°)		
pH	6.6 (6.2)	10.8 (11.8)		
O ₂ (%)	6 (5)	255		
O ₂ (conc.)	0.5 (0.4)	18.2		
Na	7.2	696	186	128
K	0.82	59.0	16.6	12.0
Mg	2.6	86.6	22.5	19.7
Ca	26.4	156	59.7	55.8
Cl	20	1590	286	255
orthophosphate-P	0.01	12.3	1.13	0.53
"polyphosphate"-P	0.01	3.8	0.58	0.40
organic phosphate-P	0.06	10.3	1.34	1.05
ammonia-N	0.2	45	3.46	1.47

significant variation was found with increasing depth. Of the three pools studied at Takamaka no significant change was found when measured over a period of 7 h (Table 3.5).

3.22 Optical density

Water in pools containing decaying leaves sometimes appeared brown in colour, this being especially evident if Casuarina "needles" were present. This is well illustrated in two pools, W4 and W7. Both pools had water samples collected within a few minutes of each other on 3 May 73 at 2000 h. Pool W4 is a pool well away from Casuarina forest, in an open plain area, with Pemphis acidula scrub nearby, pool W7 is in Casuarina forest. The optical density recorded for W4 was 0.020, the minimum recorded during the survey. The optical density recorded for W7 was 0.273, the maximum recorded during the survey. The range of values even after storage from pools in or near Casuarina forest was clearly different from pools away from Casuarina forest, (0.146 ± 0.055 , $n = 9$ v. 0.048 ± 0.025 , $n = 15$).

3.23 Temperature

Temperature curves for pools measured over a period of 24 h (Fig. 3.1) show similar rises between 1000 h and 1600 h with a decrease between 1600 h and 0800 h, the minimum being reached by 0800 h. Depth profiles were carried out in the deeper pools on Île Picard on various dates and at various times of day. The maximum recorded difference between the surface and bottom temperatures was 6.0°C (pool W1 at 1520 h on 8.3.73 with a maximum depth of 0.69 m). A very slight increase in temperature was sometimes found to occur

immediately above the bottom mud. At night pools were more or less isothermal with minor temperature differences not exceeding 1.0°C .

3.24 pH

For readings taken at 0.2 m depth the maximum recorded pH was 10.8 and the minimum 6.6 (Table 3.10), although a maximum of 11.8 and a minimum of 6.2 were obtained from random spot readings. Diurnal cycles for 6 pools on Île Picard are illustrated in Fig. 3.1. The maximum range observed was 3.3 pH units (7.5 - 10.8, W10) and the minimum range 0.7 pH units (7.5 - 8.2, W2).

3.25 Dissolved oxygen

Oxygen measurements taken in pools over a period of 24 h (Fig. 3.1) show similar curves to those of temperature and pH. A relatively rapid rise occurs between 1000 h and 1600 h. The oxygen decrease appears to be much more rapid than that of temperature, the lower values being reached by 2200 h. Pools W4 appeared to be an exception to this rule on the day these measurements were taken as the oxygen concentration was still at a relatively high level at 2200 h, whereas the oxygen in pools W6 and W7 (measured at the same times on the same date) had shown a rapid decrease by this time.

3.26 Cations

Where pools were sampled on several different occasions, Na and K levels increased throughout the season, the increase being roughly parallel to increases in Cl. The increase in K, as a fraction of seawater, was four times as great as that

for Na and Cl. Data for three occasions when the depths of water in W2 were almost the same are summarized in Table 3.9. Apart from CC9 there was no obvious relationship between K/Na and Mg/Ca. As seawater has a lower K/Na and a higher Mg/Ca ratio than found in any of these freshwater pools, it would be expected that the more a terrestrial pool is subject to the influence of added seawater, then the nearer its ratios for these ions would approach those of seawater. The pools deviating most markedly from lines of best fit for K v. Na and Mg v. Ca (Fig. 3.2) were:

high K/Na T1 W4 CC10 CC11...W6 W9 W7 CC9 high Na/K

high Mg/Ca CC9 W1 CC10 CC12 CC11...W2 W7 T2 W3 high Ca/Mg

Among the four pools whose Ca levels were surveyed in detail over a period of 24 h (Table 3.8, Fig. 3.1) one (W7) showed a clear diurnal cycle, two (W1 and W5) showed an erratic distribution of values, whilst one (W2) showed no indication of cyclical change.

3.27 Anions

3.271 Chloride

Throughout the period of the survey increasing levels of Cl were found in pools. The greatest increase found was 182 mg l^{-1} - 785 mg l^{-1} in W2 between 5 March 73 and 5 June 73.

3.272 Phosphate

Fractions attributed to orthophosphate, polyphosphate and organic phosphate were all well represented in the pools. All three were represented at levels likely to be of significance to organisms able to use these particular forms

of phosphate. Examples occurred of each of the three fractions being most abundant, but in general orthophosphate and organic phosphate were more abundant than polyphosphate. Although levels showed considerable variation, W4 and W7 were clearly characterised as low (ortho-) phosphate pools, whilst W2 showed very high levels. In contrast to the four cations measured, there was no obvious tendency for concentrations of any of the phosphate fractions to increase throughout the season. There was an apparent diurnal cycle of orthophosphate in pools W1, W2, W4, W5 and W10; pool W7 showed a constant level of orthophosphate over a period of 24 h (Table 3.8, Fig. 3.1).

3.273 Inorganic combined nitrogen

The Aldabra pools always carried moderate to very high levels of ammonia (Table 3.10). It seems likely that nitrite and nitrate levels were low in comparison but due to the possibility of interference by reducing substances, this is still uncertain and values here are treated with caution. The results for nitrite and nitrate have therefore been omitted from Tables 3.7 and 3.10 and are enclosed with brackets in Fig. 3.1 but are summarized here as they do provide some clues to the situation in the pools. Only 5 out of 54 analyses in programme A (2.32) gave detectable values for these ions. The values recorded were, for $\text{NO}_2\text{-N}$: minimum, 0.003; maximum, 0.53, mean including W2, 0.008, mean excluding W2, 0.003; for $\text{NO}_3\text{-N}$: minimum, 0.01, maximum, 0.56, mean including W2, 0.12, mean excluding W2, 0.01 mg l^{-1} . In one case however (W2, Fig. 3.1), there was an apparent

diurnal cycle of these ions, with the oxidised forms reaching a peak in the afternoon. Even then the indicated nitrogen present in these oxidised forms represented only 3.5% of the total inorganic combined nitrogen. As with orthophosphate, there was no tendency for ammonia levels in particular pools to increase throughout the season.

3.3 Algal cultures

Algae were isolated on return to Durham with a view to carrying out future experiments for comparison with observations made in the field.

Present cultures are maintained in Durham in 250 ml conical flasks containing 100 ml of AAD-N or AAD+N medium in a room maintained at 32°C and a light intensity of 3000 lx.

Information on cultures is presented as follows:

Durham culture collection number, computer number, species (where available), medium, description of species and other relevant information.

201 015218 Nostoc piscinale Kützing, AAD-N, soil sample Île Malabar. Cells: 4.5 - 6.1 µm wide; 4.0 - 7.1 µm long; barrel-shaped. Heterocysts: 4.0 - 6.0 µm wide; oval or spherical. Spores: 6.0 - 6.5 µm wide; 6.5 - 7.0 µm long; spherical to ovate; epispore, smooth.

203 Nostoc sp., AAD-N, soil sample Cinq Cases. Cells: 3.2 - 4.0 µm wide; 4.0 - 5.5 µm long; barrel-shaped. Heterocysts: 3.9 - 10.0 µm long; ovate to cylindrical. Sheath: almost colourless, indistinct. Spores: not noted.

208 Nostoc sp., AAD-N and AAD+N, soil sample Cinq Cases. Cells: 6.0 - 7.0 µm in diameter, spherical. Heterocysts: 5.0 - 6.0 µm in diameter, spherical. Sheath: thin, almost colourless. Spores: not noted.

214 017801 Westiellopsis prolifica Janet, AAD-N, soil sample Île Picard. Cells: main filaments; 8.0 - 10.0 µm wide, 8.0 - 10.0 µm long, elongate to cylindrical. Heterocysts: 5.0 -

7.0 μm wide, 7.0 - 19.0 μm long, globose to elongate cylindrical. Pseudohormocysts: 7.5 - 9.0 μm in diameter.

Some of the size ranges differ slightly from the type material. Desikachary (1959) gave the size ranges as - cells: main filaments; 8.0 - 12.0 μm wide, as long as broad or slightly longer, branches; 4.0 - 6.0 μm wide, elongate - cylindrical. Heterocysts: 5.5 - 6.0 μm wide, 10.5 - 22.0 μm long. Pseudohormocysts: 8.5 - 9.0 μm in diameter.

215 Nostoc sp., AAD-N, soil sample Île Picard. Cells: 3.0 - 3.5 μm wide, 4.0 - 4.8 μm long, barrel-shaped. Heterocysts: 3.5 - 4.0 μm wide, 3.5 - 4.0 μm long, spherical to ovate. Sheath: thin, almost colourless. Spores: 5.0 - 6.4 μm wide, 6.0 - 7.0 μm long, ovate; epispore, smooth.

217 010269 Anabaena sp., (A.D.), AAD-N, bottom mud sample W1. Cells 8.0 - 10.0 μm wide, 6.0 - 9.5 μm long; spherical to barrel-shaped, often heavily gas-vacuolate. Heterocysts: 10.0 - 14.0 μm wide; 9.5 - 14.0 μm long, with thick wall and prominent pores. Spores: 10.5 - 14.0 μm wide; 11.5 - 17.0 μm long, spherical to ovate, formed in chains next to heterocysts; epispore, smooth.

218 015201 Nostoc carneum Agardh, AAD-N, bottom mud sample ME102. Cells: 3.2 - 4.5 μm wide, 3.5 - 7.5 μm long; barrel-shaped to cylindrical, deep red to rose coloured. Heterocysts: 6.5 - 8.0 μm wide; 8.5 - 10.0 μm long. Sheath: thin almost colourless, diffluent, indistinct. Spores: 5.5 - 7.0 μm wide; 8.0 - 10.5 μm long, ellipsoidal; epispore, smooth, formed in chains.

302 011811 Cylindrospermum muscicola Kutzing, AAD-N, soil sample Cinq Cases. Cells: 3.0 - 3.5 μm wide; 3.4 - 4.0 μm long; oblong to cylindrical, slightly constricted at the cross-walls. Heterocysts: 2.5 - 3.5 μm wide; 3.5 - 4.5 μm long; elongate, oval to rounded triangular. Spores: 8.0 - 10.5 μm wide; 12.5 - 14.0 μm long; epispore smooth, golden-brown in colour.

4 SYSTEMATIC ACCOUNT

Much of the data collection on Aldabra was directed towards the production of a systematic account which would contain, as far as possible, a list of species present and a detailed description of the species and their occurrence. The storage of data on computer enabled statistical analyses to be performed with the aid of specially designed computer programmes (2.383).

Data relating to species are treated as follows:

a) species list (4.1)

This is a list of all algal species recorded during this survey including 'dumping grounds' (2.383).

b) description of species (4.2)

This is a descriptive list of all species except those placed in 'dumping grounds' (2.383); the latter are listed in Table 4.3.

c) statistical analyses

These analyses use the Aldabran computer data bank. For the purposes of this thesis one example of computer based statistical analysis is included, combining habitat data with species data (2.383).

4.1 Species list

It was not possible to allocate binomials to all algae recorded on Aldabra. Records were placed into one of three categories.

- a) those for which sufficient data were available to allocate a binomial.

- b) those for which insufficient data were available to attribute a binomial or where the species would require specialist techniques in order to identify it, but where the species was definitely not one of the binomials already listed. These records were generally allocated to a size category with the 'species pair' 31-48 (2.383).
- c) those for which insufficient data were available even to say that the species was not one of those listed e.g. only a few cells seen, only small fragments seen, material unhealthy or dead. These records were generally allocated to a 'dumping ground' size category with the 'species pair' 51-68 (2.383).

Table 4.1 gives an alphabetical list of terrestrial and freshwater algae recorded during this survey. Information on each species is given in the following order: species number (2.383), generic name, specific name (where applicable), authority (where applicable), size range (where applicable). Species recorded by Potts (1977) are followed by (+); where the number or specific name differed these are given in full.

4.2 Description of species

A standard scheme was followed for the presentation of data for each species. The scheme resembles that used by Potts (1977) in his parallel studies of the lagoonal blue-green algae and bacteria of Aldabra. The scheme is outlined below.

Table 4.1 Species list of terrestrial and freshwater algae recorded from Aldabra Atoll

<u>Species</u>	as recorded by Potts (1977)	as recorded by Whitton & Donaldson (1977)
010215 <u>Anabaena variabilis</u>		
010250 <u>Anabaena</u> sp.		
010269 <u>Anabaena</u> sp., (A.D.) A		010216 <u>A. ambigua</u>
010301 <u>Anabaenopsis arnoldii</u>		
010550 <u>Aphanocapsa</u> sp.		
010551 <u>A. concharum</u> > 1 ≤ 2 μm	010531	010531
010552 <u>A. montana</u> > 2 ≤ 4 μm	010532	010532
010553 <u>A. grevillei</u> > 4 ≤ 6 μm	010533	010533
010554 <u>A. roeseana</u> > 6 ≤ 8 μm	010534	010534
010555 <u>A. testacea</u> > 8 μm		010535
010602 <u>Aphanothece pallida</u>		
010631 <u>A. saxicola</u> ≤ 2 μm	+	
010632 <u>A. microspora</u> > 2 ≤ 4 μm	+	
010633 <u>A. microscopica</u> > 4 ≤ 6 μm	+	
010650 <u>Aphanothece</u> sp.		
010902 <u>Calothrix braunii</u>		
010910 <u>C. marchica</u>		
010911 <u>C. parietina</u>		
010950 <u>Calothrix</u> sp.		

<u>Species</u>	as recorded by Potts (1977)	as recorded by Whitton & Donaldson (1977)
011551 <u>Chroococcus varius</u> ≤ 4 μm , sheaths striated		
011553 <u>C. schizodermaticus</u> $> 6 \leq 8$ μm , sheaths striated	011533	
011554 <u>C. turgidus</u> $> 8 \leq 16$ μm , sheaths striated	011534	011534
011555 <u>C. westii</u> $> 16 \leq 32$ μm , sheaths striated	011535	
011556 <u>C. macrococcus</u> > 32 μm , sheaths striated	011536	
011557 <u>C. minor</u> ≤ 4 μm , sheaths not striated	011537	
011558 <u>C. minutus</u> $> 4 \leq 6$ μm , sheaths not striated	011538	011538
011559 <u>C. membraninus</u> $> 6 \leq 8$ μm , sheaths not striated	011539	011539
011560 <u>C. turicensis</u> $> 8 \leq 16$ μm , sheaths not striated	011540	011540
011561 <u>C. spelaeus</u> $> 16 \leq 32$ μm , sheaths not striated	011541	011541
011562 <u>Chroococcus</u> sp., > 32 μm , sheaths not striated	011542	
011811 <u>Cylindrospermum muscicola</u>		
011903 <u>Dactylococcopsis raphidioides</u>		
011904 <u>D. rupestris</u>		
012201 <u>Entophysalis granulosa</u> (including <u>samoensis</u>)		
012249 <u>Entophysalis</u> not above		
012651 <u>Gloeocapsa montana</u> $> 2 \leq 4$ μm , sheath colourless, layered		012631
012652 <u>G. arenaria</u> $> 4 \leq 6$ μm , sheath colourless, layered		
012653 <u>G. caldarium</u> $> 6 \leq 8$ μm , sheath colourless, layered		
012660 <u>G. dermochroa</u> $> 2 \leq 4$ μm , sheath yellow/brown	012640	012640

Species

as recorded by
Potts (1977)

as recorded by
Whittton & Donaldson
(1977)

012661	<u>Gloeocapsa kutzingiana</u> > 4 ≤ 6 μm, sheath yellow/brown	012641
012662	<u>G. muralis</u> > 6 ≤ 8 μm, sheath yellow/brown	012642
012663	<u>G. gigas</u> > 8 μm, sheath yellow/brown	
012665	<u>G. quarternaria</u> > 2 ≤ 4 μm, sheath orange/ red/violet	
012666	<u>G. alpina</u> > 4 ≤ 6 μm, sheath orange/red/ violet	012646
012667	<u>G. sanguinea</u> > 6 ≤ 8 μm, sheath orange/ red/violet	012647
012668	<u>G. magma</u> > 8 μm, sheath orange/red/violet	
012703	<u>Gloeotheca rupestris</u>	012733
012732	<u>Gloeotheca palea</u> > 2 ≤ 4 μm	
012802	<u>Gloeotrichia ghosei</u>	
012901	<u>Gomphosphaeria aponina</u>	
012969	<u>G. aponina</u> var. <u>multiplex</u> (A.D.)	
013107	<u>Hapalosiphon welwitschii</u>	
013313	<u>Homoeothrix varians</u>	
013601	<u>Hyella caespitosa</u>	
013602	<u>H. fontana</u>	
013604	<u>H. balani</u>	
013650	<u>Hyella</u> sp.	

+

Speciesas recorded by
Potts (1977)as recorded by
Whitton & Donaldson
(1977)

013801	<u>Johannesbaptistia pellucida</u>	+
014202	<u>Lyngbya allorgei</u>	+
014203	<u>L. aerugineo-coerulea</u>	
014204	<u>L. confervoides</u>	+
014205	<u>L. digueti</u>	+
014206	<u>L. epiphytica</u>	+
014208	<u>L. kutzingii</u>	+
014209	<u>L. limnetica (including subtilis)</u>	+
014210	<u>L. majuscula</u> > 16 \leq 32 μ m	+
014211	<u>L. martensiana</u> \leq 8 μ m	+
014212	<u>L. norgardhii (including polysiphoniae)</u> \leq 8 μ m	+
014214	<u>L. pusilla</u>	+
014215	<u>L. rigidula</u>	
014220	<u>L. ocreata</u>	
014223	<u>L. rivularianum</u>	
014224	<u>L. palmarum</u>	
014231	<u>Lyngbya</u> not above \leq 1 μ m	
014232	<u>Lyngbya</u> not above > 1 \leq 2 μ m	
014233	<u>Lyngbya</u> not above > 2 \leq 4 μ m	
014234	<u>Lyngbya</u> not above > 4 \leq 6 μ m	

Species

as recorded by Potts (1977) as recorded by
Whitton & Donaldson
(1977)

014631	<u>Merismopedia warmingiana</u>	$\leq 1 \mu\text{m}$		<u>M. minima</u>
014632	<u>M. tenuissima</u>	$> 1 \leq 2 \mu\text{m}$	+	<u>M. minima</u>
014633	<u>M. punctata</u>	$> 2 \leq 4 \mu\text{m}$	+	
014634	<u>M. glauca</u>	$> 4 \leq 6 \mu\text{m}$	+	
014707	<u>Microchaete tenera</u>			
014801	<u>Microcoleus chthonoplastes</u>			
014902	<u>Microcystis flos-aquae</u>		+	
015051	<u>Myxosarcina</u> sp.,	$\leq 4 \mu\text{m}$		
015052	<u>Myxosarcina</u> sp.,	$> 4 \leq 6 \mu\text{m}$		
015053	<u>Myxosarcina</u> sp.,	$> 6 \leq 8 \mu\text{m}$		
015054	<u>Myxosarcina</u> sp.,	$> 8 \mu\text{m}$		
015201	<u>Nostoc carneum</u>			
015202	<u>N. commune</u>			
015203	<u>N. commune</u> var. <u>flagelliforme</u>			
015207	<u>N. microscopicum</u>			
015211	<u>N. punctiforme</u>			
015213	<u>N. sphaericum</u>			
015218	<u>N. piscinale</u>			
015250	<u>Nostoc</u> sp.			
015504	<u>Oscillatoria amphibia</u>			
015505	<u>O. angusta</u>			

Species

as recorded by Potts (1977) as recorded by
Whitton & Donaldson
(1977)

015506	<u>Oscillatoria animalis</u>	
015508	<u>O. brevis</u>	
015509	<u>O. chalybea</u>	
015510	<u>O. chlorina</u>	
015511	<u>O. claricentrosa</u>	
015514	<u>O. geminata</u>	
015517	<u>O. limosa</u>	
015520	<u>O. princeps</u>	
015521	<u>O. proboscidea</u>	
015523	<u>O. pseudogeminata</u>	
015530	<u>O. subtilissima</u>	
015531	<u>Oscillatoria</u> not above	> 1 ≤ 2 μm
015532	<u>Oscillatoria</u> not above	> 2 ≤ 4 μm
015535	<u>Oscillatoria</u> not above	> 8 ≤ 12 μm
015538	<u>Oscillatoria</u> not above	> 32 μm
015550	<u>Oscillatoria</u> sp.	
015551	<u>Oscillatoria</u> sp.,	> 1 ≤ 2 μm
015552	<u>Oscillatoria</u> sp.,	> 2 ≤ 4 μm
015553	<u>Oscillatoria</u> sp.,	> 4 ≤ 6 μm
015555	<u>Oscillatoria</u> sp.,	> 8 ≤ 12 μm
015558	<u>Oscillatoria</u> sp.,	> 32 μm

Species

as recorded by Potts (1977) as recorded by
Whitton & Donaldson
(1977)

015585	<u>Oscillatoria tenuis</u>	
015586	<u>O. acuta</u>	
015587	<u>O. acuminata</u>	
015588	<u>O. acutissima</u>	
015589	<u>O. amphigranulata</u>	
015590	<u>O. guttulata</u>	
015591	<u>O. jasorvensis</u>	
015592	<u>O. koetlitzii</u>	
015593	<u>O. lacustris</u>	
015596	<u>O. obscura</u>	
015597	<u>O. okeni</u>	
015598	<u>O. tambi</u>	
015704	<u>Phormidium foveolarum</u>	
015705	<u>P. hendersonii</u>	
015707	<u>P. jenkelianum</u>	
015708	<u>P. mucicola</u>	
015713	<u>P. rubroterricola</u>	
015731	<u>Phormidium</u> not above	> 1 ≤ 2 μm
015732	<u>Phormidium</u> not above	> 2 ≤ 4 μm
015736	<u>Phormidium</u> not above	≤ 1 μm
015750	<u>Phormidium</u> sp.	

as recorded by
Potts (1977)

as recorded by
Whitton & Donaldson
(1977)

Species

015751	<u>Phormidium</u> sp., > 1 ≤ 2 μm	
015769	<u>P. bohneri</u> (A.D.)	
015770	<u>P. corium</u> (A.D.)	
015771	<u>P. molle</u> (A.D.)	
015772	<u>P. asterii</u> (A.D.)	
015773	<u>P. fragile</u> (A.D.)	
015802	<u>Plectonema boryanum</u>	
015806	<u>P. gloeophilum</u>	
015807	<u>P. gracillimum</u>	
015811	<u>P. notatum</u>	
015815	<u>P. tomasinianum</u>	
015849	<u>Plectonema</u> not above	
015850	<u>Plectonema</u> sp.	
015931	<u>Pleurocapsa</u> not above ≤ 4 μm	
015932	<u>Pleurocapsa</u> not above > 4 ≤ 8 μm	
015933	<u>Pleurocapsa</u> not above > 8 ≤ 16 μm	
015934	<u>Pleurocapsa</u> not above > 16 μm	
015950	<u>Pleurocapsa</u> sp.	
016003	<u>Porphyrosiphon notarisi</u>	
016101	<u>Pseudanabaena catenata</u>	

P. fuliginosa

P. crepidinum

+

Speciesas recorded by
Potts (1977)as recorded by
Whitton & Donaldson
(1977)

016103	<u>Pseudanabaena schmidlei</u>		
016104	<u>P. schmidlei</u> var. <u>gracilis</u>		
016301	<u>Radaisia cornuana</u>	+	
016602	<u>Schizothrix arenaria</u>	+	
016604	<u>S. calcicola</u>	+	
016752	<u>Scytonema</u> sp., >8 ≤ 12 μm, sheaths having parallel layers		
016753	<u>Scytonema</u> sp., >12 ≤ 16 μm, sheaths having parallel layers		
016754	<u>Scytonema</u> sp., >16 μm, sheaths having parallel layers		
016901	<u>Spirulina subsalsa</u>	+	
016931	<u>Spirulina</u> not above ≤ 1 μm		
016933	<u>S. gigantea</u> >2 ≤ 4 μm		
016952	<u>Spirulina</u> sp., >1 ≤ 2 μm		
017452	<u>Synechococcus cedrorum</u> >2 ≤ 4 μm		017432
017453	<u>Synechococcus</u> sp., >4 ≤ 6 μm		
017454	<u>S. brunneolus</u> >6 ≤ 8 μm		017434
017455	<u>S. aeruginosus</u> >8 ≤ 16 μm		017435
017456	<u>S. euryphyes</u> >16 ≤ 32 μm		017436 <u>S. maior</u>
017457	<u>Synechococcus maior</u> >32 μm		017437 <u>S. maior</u> var. <u>maximum</u>
017469	<u>Synechococcus</u> sp., (A.D.), A		

Species
 as recorded by Potts (1977) as recorded by
 Whitton & Donaldson
 (1977)

017602	<u>Tolythrix byssoidea</u>	+	
017603	<u>T. byssoidea</u> var. <u>polycladus</u>		
017606	<u>T. distorta</u>		
017650	<u>Tolythrix</u> sp.		
017801	<u>Westiellopsis prolifica</u>		
017850	<u>Westiellopsis</u> sp.		
018053	<u>Xenococcus kernerii</u> > 4 <= 6 μ m		
018101	<u>Chroococopsis gigantea</u>	018033	018033
018201	<u>Dalmatella buaënsis</u>	+	
021103	<u>Chroothece richteriana</u>		
030201	<u>Euglena acus</u>		
030202	<u>E. gracilis</u>		
030205	<u>E. spirogyra</u>		
030206	<u>E. minuta</u>		
030207	<u>E. oxyuris</u>		
030250	<u>Euglena</u> sp.		
030251	<u>Euglena</u> sp., > 32 μ m long		
030401	<u>Lepocinclis sphagnophilia</u>		
030502	<u>Phacus orbicularis</u>		030401 <u>L. ovum</u>
030601	<u>Trachelomonas hispida</u> var. <u>coronata</u>		<u>T. hispida</u>
030602	<u>T. volvocina</u>		

<u>Species</u>	as recorded by Potts (1977)	as recorded by Whitton & Donaldson (1977)
049951 <u>Cryptophyta</u> sp., ≤ 8 μ m long, blue-green		049931
049952 <u>Cryptophyta</u> sp., $> 8 \leq 16$ μ m long, blue-green		049932
049954 <u>Cryptophyta</u> sp., ≤ 8 μ m long, brown		
049955 <u>Cryptophyta</u> sp., $> 8 \leq 16$ μ m long, brown		
049956 <u>Cryptophyta</u> sp., > 16 μ m long, brown		
049957 <u>Cryptophyta</u> sp., ≤ 8 μ m long, green		
049958 <u>Cryptophyta</u> sp., $> 8 \leq 16$ μ m, green		
049959 <u>Cryptophyta</u> sp., > 16 μ m long, green		
059950 <u>Pyrrrophyta</u> , genus not known sp.		
059969 <u>Pyrrrophyta</u> sp., (A.D.), A		
059970 <u>Pyrrrophyta</u> sp., (A.D.), B		
061150 <u>Goniochloris</u> sp.		
062050 <u>Akanthochloris</u> sp.		
090750 <u>Chaetoceros</u> sp.		
099950 <u>Centrales</u> genus not known, sp.		
099951 <u>Centrales</u> sp., ≤ 8 μ m diameter		
011250 <u>Amphora</u> sp.		
101849 <u>Navicula</u> not above		
101901 <u>Nitzschia acicularis</u>		
101904 <u>N. palea</u> + <u>paleacea</u>		

Species

as recorded by
Potts (1977)

as recorded by
Whitton & Donaldson
(1977)

109950 Pennales, genus not known, sp.

120201 Closterium acerosum

120204 C. diana

120250 Closterium sp.

120306 Cosmarium ornatum

120369 C. subcostatum (A.D.)

120370 C. regnellii (A.D.)

120372 C. tinctum (A.D.)

120373 C. pseudoholmii (A.D.)

121451 Mougeotia sp., $\leq 8 \mu$

122169 Spirogyra mirabilis

122401 Staurastrum alternans

122469 S. cyrtocerum (A.D.)

130201 Carteria globosa

130432 Chlamydomonas not above $\leq 8 \mu$ long not
palmelloid

130450 Chlamydomonas sp.

130469 C. globosa (A.D.)

130901 Kudorina elegans

131601 Phacotus lenticularis

132601 Pleodorina californica

140201 Ankistrodesmus acicularis

120269 Closterium sp. A

120271 C. Cynthia

120272 Closterium sp. C

120306 C. subcostatum

C. polygonum

120373 C. trachydermum

122154 Spirogyra sp., $> 32 \leq 48 \mu$

122469 S. polymorphum

Species

as recorded by
Potts (1977)

as recorded by
Whittor & Donaldson
(1977)

140205	<u>Ankistrodesmus braunii</u>	
140206	<u>A. falcatus</u>	
140207	<u>A. longissimus</u>	
140208	<u>A. minutissimus</u>	
140209	<u>A. mucosus</u>	
140210	<u>A. pseudomirabilis</u>	
140454	<u>Characium</u> sp., cells obviously curved, l x b > 3 μ m	140402 <u>C. ornithocephalum</u>
140470	<u>Characium strictum</u> (A.D.)	
140501	<u>Chlorella ellipsoidea</u>	
140504	<u>C. vulgaris</u>	
140505	<u>C. mucosa</u>	
140550	<u>Chlorella</u> sp.	
141003	<u>Coelastrum cambricum</u>	
141009	<u>C. microporum</u>	
141501	<u>Dimorphococcus lunatus</u>	
142102	<u>Golenkinia radiata</u>	
142701	<u>Nautococcus caudatus</u>	142750 <u>Nautococcus</u> sp.
142902	<u>Oocystis crassa</u>	
142907	<u>O. parva</u>	
142910	<u>O. pusilla</u>	

Species

as recorded by
Potts (1977)

as recorded by
Whitton & Donaldson
(1977)

143103	<u>Pediastrum boryanum</u>	
143109	<u>P. tetras</u>	
143501	<u>Scenedesmus acuminatus</u>	
143502	<u>S. bijugatus</u>	
143508	<u>S. obliquus</u>	
143510	<u>S. quadricauda</u>	
144102	<u>Tetraedron incus</u>	
144103	<u>T. minimum</u> (including <u>minutissimum</u>)	
144104	<u>T. triangulare</u>	
144403	<u>Treubaria triappendiculata</u>	
144703	<u>Sorastrum spinulosum</u>	
149950	Chlorococcales, genus not known, sp.	
149953	Chlorococcales sp., $> 8 \leq 16 \mu\text{m}$, narrowest diameter	
150101	<u>Apatococcus lobatus</u>	150150 <u>Apatococcus</u> sp.
152801	<u>Gongrosira debaryana</u>	
152850	<u>Gongrosira</u> sp.	
152901	<u>Hormidium fluitans</u>	
152949	<u>Hormidium</u> not above	
152950	<u>Hormidium</u> sp.	

<u>Species</u>	as recorded by Potts (1977)	as recorded by Whitton & Donaldson (1977)
154455 <u>Stichococcus bacillaris</u> cells + <u>cylindrical</u> \leq 2 μ m		154435
154603 <u>Trentepohlia lolithus</u>		
159950 <u>Ulotrichales</u> + <u>Chaetophorales</u> , genus not known, sp.		
159953 <u>Ulotrichales</u> + <u>Chaetophorales</u> sp., <u>Chaetophorales</u> , no upright filaments, \leq 8 μ m		
159954 <u>Ulotrichales</u> + <u>Chaetophorales</u> sp., <u>Chaetophorales</u> , no upright filaments, \leq 8 μ m		
160751 <u>Oedogonium</u> sp., \leq 8 μ m		160731
160752 <u>Oedogonium</u> sp., $>$ 8 \leq 12 μ m		160732
160753 <u>Oedogonium</u> sp., $>$ 12 \leq 16 μ m		160733
160754 <u>Oedogonium</u> sp., $>$ 16 \leq 20 μ m		160734
160755 <u>Oedogonium</u> sp., $>$ 20 \leq 24 μ m		160735
160801 <u>Pithophora oedogonia</u>		
170106 <u>Chara zeylanica</u> var. <u>diaphana</u>		

Presentation of data for species:

computer 'species' number, (2.383), binomial, authority, data, size range

- A) Description of the Aldabran population: description of colony size, shape, organization of cells; filaments, average width or width range; sheath, width, colour; cells, average width or width range, shape, colour, cross-wall characters, end-cell characters; characters of specialized cells, size, shape, colour (heterocysts, spores, nanocytes, hormocysts).

Where a large number of populations had been studied, the cell size range, from the smallest to the largest was given. Where only a few populations had been studied, only the average cell size was given. In describing the genera Calothrix and Gloeotrichia, the recording system of Kirkby (1975) was followed.

Descriptions of the Aldabran population are followed by lists of other binomials included under the 'species' number and problems associated with allocation of binomials.

- B) Relevant information on the 'type' species.
- C) Number of populations studied and geographical locations from which the species was recorded. On no account do these records imply that it was restricted to the particular area described. The number of populations listed do not always correspond to the number of locations (pool numbers and grid references) listed as occasionally more than one population occurred within the area covered by one grid reference.

Table 4.2 Description of species

Whitton (1969), where it appears in section E of this table does not refer to a reference but records from unpublished field notes.

010215 Anabaena variabilis Kützing ex Bornet et Flahault

- A) **Thallus:** up to 1 cm in size, although younger colonies were often only visible with a microscope; larger colonies dark-green and convoluted. **Cells:** 4.0 - 6.8 μm wide; 3.5 - 8.0 μm long; barrel-shaped often with gas vacuoles, slightly constricted at the cross walls. **Heterocysts:** spherical to oval, 5.6 - 6.7 μm wide; 5.0 - 7.6 μm long. **Spores:** elliptical, formed in chains away from the heterocysts.
- B) Geitler (1932) gave the size ranges as - cells: 4.0 - 6.0 μm wide; 2.5 - 6.0 μm long. **Heterocysts:** 6.0 μm wide; up to 8.0 μm long. **Spores:** 7.0 - 11.0 μm wide; 8.0 - 14.0 μm long; the epispore smooth or with fine needles. Rao (1936) reported a form with the size ranges - cells : 2.5 - 6.0 μm wide; 2.5 - 6.0 μm long. **Heterocysts:** 4.5 - 7.0 μm wide; 6.3 - 9.6 μm long. **Spores:** 6.0 - 8.5 μm wide; 6.5 - 11.5 μm long. Fritsch (1949) considered this as not very different from the type.
- C) Ten populations studied:
 Île Picard: W1, W117
 Anse Cèdres: AC1, AC101, AC103
 Cinq Cases: CC2, CC5, CC8
 Takamaka: T1, T2
- D) Widespread but uncommon, never very abundant. From films, among the filaments of other algae and as free floating macroscopic colonies. Occasionally seen to form many hormogonia within a colony.

E) Possibly noted by Whitton (1969) but not positively identified.

F) Desikachary (1959) listed many records, from brackish mud, damp soil, stagnant pools, streams and rivers in Burma, India and Pakistan.

010269 Anabaena sp. (A. D.) A.

- A) Trichomes single. Cells: 7.9 - 10.5 μm wide; 6.3 - 9.8 μm long; spherical to barrel-shaped, often heavily gas-vacuolate. Heterocysts: average width 12.4 μm ; average length 11.1 μm , with prominent pores and thick wall. Spores: 10.8 - 13.8 μm wide; 11.0 - 18.9 μm long, spherical to slightly elliptical, formed in chains next to heterocysts, epispore, smooth.
- B) There is no comparable species in the literature.
- C) 16 populations studied:
- Île Picard: W1, W3, W4
 - Anse Cèdres: AC1
 - Cinq Cases: CC1, CC2, CC5, CC9, CC12, CC13, CC14, CC15, CC16, CC18, CC107
 - Takamaka: T1
- D) Widespread and often very abundant. Often forming a major constituent of the pool plankton.
- E) Possibly noted by Whitton (1969) but not positively identified.

010301 Anabaenopsis arnoldii Aptekarj

- A) Trichomes: 6.8 - 8.0 μm wide; single. Cells:
6.5 - 7.5 μm long; compressed to spherical, often heavily gas-vacuolate. Heterocysts: 6.0 - 7.0 μm in diameter; spherical, intercalary and terminal. Spores: 10.5 - 11.0 μm wide; 12.0 - 14.0 μm long; ovate to ellipsoidal; epispore: smooth and almost colourless.
- B) Desikachary (1959) gave the size ranges as - cells:
6.5 - 8.5 μm wide or 7.0 - 9.0 μm wide; 6.5 - 8.0 μm long. Heterocysts: 5.8 - 7.0 μm in diameter when spherical; 7.0 - 9.2 μm wide; 8.0 - 10.5 μm long when ellipsoidal. Spores: 10.4 - 11.5 μm wide; 11.5 - 14.5 μm long; ellipsoidal.
- C) One population studied:
Cinq Cases: CC5
- D) This species was not recorded during the period of field work but in a culture of bottom mud from pool CC5 on return to Durham.

010551 Aphanocapsa concharum Hansgirg > 1 ≤ 2 μm

- A) Colony: spherical or irregularly-shaped. Cells: average diameter 1.5 μm; light blue-green, evenly distributed within almost colourless mucilage. Cell contents occasionally granular.
- The size range of this 'species' number also includes the relevant size ranges of the following species:
- A. elachista W. et G. S. West and A. fusco-lutea Hansgirg
- B) Geitler (1932) gave the size range as - cells: 1.0 - 1.5 μm in diameter; spherical or elliptical in shape.
- C) 25 populations studied:
- Île Picard: W1, W2, W4, W6, W7, W9, W107, W111,
0609 + 0900, 0600 + 0900, 0500 + 0900
- Île Malabar: MW102, MW103, 1394 + 1233
- Anse Cèdres: AC1, AC104
- Cinq Cases: CC9, 3962 + 0581
- Takamaka: T122, 3345 + 0551
- Grande Terre Central: SC101
- Île Esprit: 1050 + 0620, 1000 + 0600
- D) Widespread, locally common and often abundant, from terrestrial and aquatic situations. From films over rock and mud, among the filaments of other algae, algal felts, plankton and in the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969). Recorded by Potts (1977) from Île Picard, Île Malabar and Grande Terre; occasional among Scytonema mats.

010552 Aphanocapsa montana Cramer > 2 ≤ 4 μm

A) Colony: irregularly-shaped, gelatinous, almost colourless, yellowish or blue-green. Cells: 2.2 - 4.0 μm in diameter; light blue-green, sometimes yellowish, contents occasionally granular, evenly distributed with almost colourless homogeneous mucilage.

The size range of this 'species' number also includes the relevant size ranges of the following species:

A. fonticola Hansgirg, A. grevillei (Hass.) Rabenhorst,
A. koodersi Strom, A. muscicola (Menegh.) Wille,
A. pulchra (Kütz.) Rabenhorst, A. sideroderma Naumann,
A. siderosphaera Naumann and A. thermalis (Kütz.) Brugg.

B) Geitler (1932) gave the size range as - cells:
 2.5 - 4.0 μm in diameter; spherical, light blue-green to almost yellow in colour.

C) 28 populations studied:

Île Picard: W1, W2, W3, W4, W6, W7, W9, W104, W107,
 W113, W117, W127, 0609 + 0900, 0600 + 0900

Île Malabar: MW1, MW103, ME111

Anse Cèdres: AC1, AC111

Cinq Cases: CC2, CC3, CC14, CC18, CC102

Takamaka: T2, T3

Grande Terre: SC101

D) Widespread and locally common, especially on Île Picard, occurring in both aquatic and terrestrial situations, occasionally abundant. From films over mud rock and soil, among the filaments of other algae, among algal felts, plankton and in the aufwuchs of larger plant growths.

- E) Recorded by Whitton (1969). Recorded by Potts (1977) from Île Picard, Île Malabar, and Grande Terre; occasional among other algal communities. On one occasion he recorded it as very abundant over the surface of silt at the intertidal pool, Bassin Lebine, Île Picard.
- F) Desikachary (1959) listed records from damp stones, on Pithophora and tree trunks in India.

010553 Aphanocapsa grevillei (Hass.) Rabenhorst > 4 ≤ 6 μm

A) Colony: spherical or irregularly-shaped, mucilaginous, almost colourless to dark blue-green. Cells: 4.1 - 6.0 μm in diameter; spherical, single or in pairs, contents often granular, densely packed within homogeneous mucilage. As the lower size range for this species is given as 3.2 μm, this 'species' number and size range exclude that part of the cell range 3.2 - 4.0 μm. Cells in this size range would be coded under 010552 A. montana Cramer > 2 ≤ μm.

The size range of this 'species' number also includes the relevant size ranges of the following species:

A. banaresensis Bharadhwaja, A. biformis A. Braun, A. brunnea Nageli, A. litoralis Hansgirg, A. pulchra (Kütz.) Rabenhorst, A. roeseana de Bary and A. thermalis Brugg.

B) Geitler (1932) gave the size range as - cells:
3.2 - 5.6 μm, spherical or hemispherical, densely packed within homogeneous mucilage.

C) 36 populations studied:

Île Picard: W1, W2, W3, W4, W5, W6, W7, W104, W113,
0609 + 0900

Île Malabar: MW101, ME107

Anse Cédres: AC1

Cinq Cases: CC2, CC3, CC8, CC9, CC12, CC13, CC14, CC15,
CC16, CC18, CC102, CC105, CC107

Takamaka: T2, T3, T102, T124

Grande Terre Central: SC101, SC102

- D) Widespread and locally common especially on Île Picard and occasionally abundant in the Cinq Cases region of Grande Terre. From films over mud and rock, among the filaments of other algae, among algal felts, planktonic and in the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969). Recorded by Potts (1977) from: Île Picard, Île Malabar, and Grande Terre; frequent among other algal communities and very abundant at Cinq Cases where it formed bright green-films over the surface of sediment.
- F) Desikachary (1959) listed records from lakes, tanks, stagnant areas of paddyfields, rivers and on moist ground in India. From lagoon shores in Curaçao (van den Hoek et al., 1971).

010554 Aphanocapsa roeseana de Bary $> 6 \leq 8 \mu\text{m}$

- A) Colony: irregularly-shaped, gelatinous, almost colourless.
 Cells: 6.1 - 8.0 μm in diameter; spherical, single,
 contents occasionally granular, dark blue-green, evenly
 distributed within almost colourless homogeneous mucilage.
 As the lower size range for this species is given as
 5.0 μm , this 'species' number and size range exclude that
 part of the cell range 5.0 - 6.0 μm . Cells in this range
 would thus be coded under 010553 A. grevillei (Hass.)
 Rabenhorst $> 4 \leq 6 \mu\text{m}$. The size range of this 'species'
 number also includes the relevant size ranges of the
 following species: A. biformis A.Br., A. grevillei de Bary,
A. litoralis Hansgirg var. macrococca Hansgirg, A. nivalis
 Lagerheim, A. salinarum Hansgirg, A. testacea Nägeli.
- B) Geitler (1932) gave the size range as - cells: 5.0 - 8.0 μm
 in diameter; broadly ovate, light blue-green within
 homogeneous mucilage.
- C) Five populations studied:
 Île Picard: W1, W4, W6, W9, W113
- D) Recorded only from Île Picard, never very abundant.
 From films over mud and rock among algal felts, the
 plankton and in the aufwuchs of larger plant growths.
- E) Recorded by Potts (1977) only from Bassin Lebine and
 La Gigi Île Picard; among other algal communities.

010555 Aphanocapsa testacea (A.Br.) Nägeli > 8 μ m

- A) Colony: spherical, gelatinous, almost colourless.
Cells: average diameter 8.8 μ m; blue-green, evenly distributed within almost colourless homogeneous mucilage.
As the lower size range for this species is given as 7.5 μ m, this 'species' number and size range exclude that part of the cell range 7.5 - 8.0 μ m. Cells in this range would thus be coded under 010554 A. roeseana de Bary > 6 < 8 μ m.
- B) Geitler (1932) gave the size range as - cells:
7.5 - 9.5 μ m in diameter; single or in pairs, spherical to ellipsoid, densely arranged within the colony.
- C) Two populations studied:
Cinq Cases: CC9 CC18
- D) Recorded from only two pools in the Cinq Cases region of Grande Terre; never abundant. From among the filaments of other algae.

010602 Aphanothece pallida (Kütz.) Rabenhorst

- A) Colony: up to 1 cm wide; up to 3 cm long; cylindrical or formless, gelatinous, almost colourless to dark blue-green or brownish-green. Cells: 4.5 - 7.3 μm wide; 6.9 - 9.5 μm long; elliptical to cylindrical, light to dark blue-green. Geitler (1932) described this species as possessing individual, lamellate sheaths. This has been treated as a character possessed only by Gloeotheca.
- B) Geitler (1932) gave the size range of cells as - cells: 5.0 - 8.0 μm wide; 1.5 - 3 times longer than broad; elongate-ellipsoid to cylindrical, blue-green to olive-green.
- C) 13 populations studied:
 Île Picard: W1, W3, W6, W7, W9, W102, W115, W117
 Cinq Cases: CC2, CC5, CC13, CC15
 Grande Terre Central: SC101
- D) Widespread, locally common on Île Picard, very abundant at times in W7 and W9. From films over mud (often attached to the surface of mud, colonies later becoming free-floating), among the filaments of other algae, among algal felts, the plankton and in the aufwuchs of larger plant growths.
- F) Desikachary (1959) listed many records from ponds, pools and paddy fields in India and Pakistan.

010631 Aphanothece saxicola Nägeli $\leq 2 \mu\text{m}$

A) Colony: formless, almost colourless. Cells:

1.4 - 2.0 μm wide; 2 - 3 times longer than broad,
elliptical to cylindrical, occasionally slightly bent.

The size range of this 'species' number also includes
the relevant size ranges of the following species:

A. caldariorum P. Richt, A. longior Naumann, A. nidulans
P. Richt, A. pulverulata Bachmann.

B) Geitler (1932) gave the size range as - cells:

1.0 - 2.0 μm wide; 2 - 3 times longer than broad.

C) Five populations studied:

Île Malabar: ME103

Cinq Cases: CC5, CC8

Takamaka: T102

Grande Terre Central: 2652 + 0378

D) Recorded only for the eastern region of the atoll,
widespread in this area but never abundant. From films
over mud and rock, among the filaments of other algae
and among algal felts.

E) Recorded by Potts (1977), from Île Picard and Îles
Moustique; present among other algal communities.

010632 Aphanothece microspora (Menegh.) Rabenhorst > 2 ≤ 4 μm

- A) Colony: formless, gelatinous and almost colourless, occasionally yellow to brown. Cells: 2.0 - 4.0 μm wide; 4.6 - 10.6 μm long; light blue-green. Geitler (1932) described the cells as occasionally possessing individual lamellate sheaths. This has been treated as a character only possessed by Gloeothece. The size range of this 'species' number also includes the relevant size ranges of the following species:
A. bullosa (Menegh.) Rabenhorst, A. caldariorum P. Richter, A. castegnei (Bréb.) Rabenhorst, A. naegeli Wartm.
- B) Geitler (1932) gave the size range as - cells:
 2.0 - 3.0 μm wide; 2 - 3 times longer than broad.
- C) Seven populations studied:
 ^
 Île Picard: W1, W4, O600 + 0900
 ^
 Île Malabar: 1394 + 1233
 Takamaka: T1, T2, T102
- D) Widespread, rare, never very abundant. From films over rock and mud, among the filaments of other algae and among algal felts.
- E) Recorded by Potts (1977) from ^
 Île Picard, ^
 Îles Moustique, ^
 Île Malabar and Grande Terre; widespread and frequent among other algal communities.

010633 Aphanothece microscopica Nägeli $> 4 \leq 6 \mu\text{m}$

A) Colony: formless, almost colourless, mucilaginous.

Cells: average width $5.6 \mu\text{m}$; average length $8.5 \mu\text{m}$; elliptical to cylindrical, light blue-green, evenly distributed within homogeneous mucilage.

The size range of this 'species' number also includes the relevant size ranges of the following species:

A. bullosa (Menegh.) Rabenhorst, A. naegelii Wartm.

B) Geitler (1932) gave the size range of cells as, $4.5 \mu\text{m}$ wide; 1.5 - 2 times longer than broad.

C) One population recorded:

Cinq Cases: CC13

D) Recorded only on one occasion in the Cinq Cases region of Grande Terre. From among the filaments of other algae.

E) Recorded by Potts (1977) from Île Picard and Île Malabar; abundant in areas of La Gigi beach where it formed green films over sand.

F) Desikachary (1959) listed many records from ponds and submerged soil in India.

010902 Calothrix braunii Bornet et Flahault

A) Colony: caespitose, gelatinous, blue-green to brown.

Filaments: 8.0 - 10.0 μm wide, swollen to almost twice this size at the base. Sheath: thin, tight-fitting and colourless. Cells: 6.0 - 7.0 μm wide; constricted at the cross-walls, generally shorter than broad. Heterocysts: basal and hemispherical.

Though this species was occasionally found in the same pools as Calothrix parietina (a similar species), it was felt that these species differed sufficiently in their general morphology such as to treat them as separate species for the present.

Desikachary (1959) stated that this species may possess a colourless hair. Such hairs were not noted in the Aldabran material.

B) Geitler (1932) gave the range as - filaments: 9.0 - 10.0 μm wide. Cells: 6.0 - 7.0 μm wide.

C) 11 populations studied:

Île Picard: W1, W3, W7, W104, W111

Cinq Cases: CC2, CC5, CC8, CC12, CC13

Takamaka: T1

D) Widespread, never very abundant. From films over rock, among the filaments of other algae, algal felts, the plankton and in the aufwuchs of larger plant growths.

010910 Calothrix marchica Lemmermann

- A) Filaments: single or a few together, never forming a distinct colony, 4.0 - 6.0 μm wide at their bases. Trichomes: 4.0 - 6.0 μm broad at their bases; constricted at the cross-walls, gradually tapering towards the apex, not ending in a hair. Cells: shorter to almost as long as broad; end cell conical. Heterocysts: average diameter 6.0 μm ; single, basal, generally hemispherical. Geitler (1932) stated that this species did not end in a hair, Desikachary (1959) however stated that it did end in a hair.

Though the Aldabran material fitted well the description in the literature, it is suspected that the material may be developing hormogonia of the larger forms of Calothrix present on the atoll.

- B) Geitler (1932) gave the size ranges as - filaments: 5.0 - 6.0 μm wide at their bases. Trichomes: 4.0 - 5.5 μm wide at their bases. Cells: almost as long as broad; constricted at the cross-walls, end cell conical. Heterocysts: 4.0 - 5.5 μm wide; basal, almost spherical or hemispherical.
- C) Nine populations studied:
- Île Picard: W4, W5, W6, W7, W113, W115
 - Anse Cèdres: AC1
 - Cinq Cases: CC2
 - Grande Terre Central: SC101

- D) Widespread and locally common. From films over rock and cement, free floating among the filaments of other algae, among algal felts, the plankton, and in the aufwuchs of larger plant growths.

010911 Calothrix parietina Thuret ex Bornet et Flahault

- A) Colony: forming a horizontal or vertical crust-like thallus, dark red-brown to almost black, often covering a large area of substrate; occasionally encrusted with calcium carbonate. Filaments: 8.0 - 17.5 μm wide at their bases; occasionally branched. Sheath: thin, colourless and non-lamellate in young filaments. In older filaments thick, lamellate, yellow to dark brown and becoming 'ragged' towards the apex, with the trichome protruding beyond the sheath. Trichomes: 5.6 - 14.8 μm wide at their bases; shorter than broad at the base, almost as long as broad at the apices; blue-green. Heterocysts: generally narrower than the trichomes but occasionally wider, basal or intercalary. Comparisons with the description given by Geitler (1932) are not easy as it is not always clear to which area of the filament the dimensions given apply. Geitler (1932) also stated that the basal heterocysts were wider than the trichome, yet material drawn by Frémy (1929) clearly showed basal heterocysts much narrower than the trichome.
- B) Geitler (1932) gave the size ranges as - filaments: 10.0 - 12.0, rarely up to 18.0 μm wide; up to 1 mm long. Cells: 5.0 - 10.0 μm wide; mostly 1.5 - 3 times longer than broad. Heterocysts: broader than the trichome, basal or intercalary.
- C) 51 populations studied:
- ^
 Ile Picard: W1, W2, W3, W4, W5, W6, W7, W104, W107, W110, W113, W115, W117, W119, W122, W127, 0600 + 0900, 0609 + 0900

Île Malabar: MW 101, ME 103, ME 107, 1394 + 1233

Anse Cèdres: AC1, AC109, AC111

Cinq Cases: CC2, CC3, CC5, CC8, CC9, CC12, CC13, CC15,
 CC16, CC17, CC102, CC104, CC112, 3900 + 0500,
 3841 + 0622, 3912 + 0615

Takamaka: T102, T103, T122, T124, T125, 3345 + 0551

Grande Terre Central: SC101, SC102

Île Esprit: 1000 + 0600

- D) Widespread, common and often very abundant. Forming films and felts which at times cover very large areas of submerged rocks. Occasionally recorded free-floating in the plankton and in the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969)
- F) Frémy (1929) described its habitats as, soil, rocks, damp wood, submerged wood, probably cosmopolitan. Desikachary (1959) listed many records from, submerged plants, other algae, and on wet rocks in Burma, India and Pakistan.

011551 Chroococcus varius A. Braun $\leq 4 \mu\text{m}$ sheath striated

A) Colony: spherical and gelatinous. Cells: 2.0 - 4.0 μm wide, blue-green, 2 - 4, seldom many together within the colony, with distinct lamellate individual sheaths. The size range of this 'species' number also includes the relevant size ranges of the following species:

Chroococcus montanus Hansgirg.

B) Geitler (1932) gave the size range as - cells: 2.0 - 4.0 μm ; single or 2 - 4, rarely very many together within a colony.

C) One population studied:

Île Picard. W1

D) Recorded only once from the base of a Fimbristylis plant just below the high water mark of pool W1.

011553 Chroococcus schizodermaticus West $> 6 \leq 8$ μm sheaths striated

A) Colony: spherical almost colourless. Cells: average width 7.0 μm ; blue-green, in almost colourless diffluent mucilage. Sheaths: distinct, lamellate.

As the lower size range for this species is given as 5.8 μm , this 'species' number and size range exclude that part of the size range 5.8 - 6.0 μm .

Cells in this size range would be coded under 011552

Chroococcus montanus Hansgirg $> 4 \leq 6$ μm sheaths striated.

As the upper size range is given as 11.0 μm , this

'species' number and size range exclude that part of

the cell size range 8.1 - 11.0 μm . Cells in this size

range would be coded under 011554 Chroococcus turgidus

(Kütz.) Nägeli $> 8 \leq 16$ μm sheaths striated.

B) Geitler (1932) gave the size range as - cells: 5.8 - 11.0 μm ; in groups of 2 - 4, blue-green. Sheath: yellow to brown distinctly lamellate.

C) One population studied:

Île Picard: W5

D) Recorded only once from among a layer of Calothrix parietina filaments overlying submerged rock.

E) Recorded by Potts (1977) from the La Gigi area of Île Picard and Îles Moustique; abundant among Scytonema mats.

011554 Chroococcus turgidus (Kütz.) Nägeli $>8 \leq 16 \mu\text{m}$ sheaths striated

A) Colony: gelatinous, light-green to brown in colour.

Cells: 11.0 - 16.0 μm wide; light-green to dark blue-green with distinct almost colourless to brown lamellate sheaths.

As the upper size range of this species is given as 32.0 μm , this 'species' number and size range exclude that part of the cell size range 16.1 - 32.0 μm . Cells in this size range would be coded under 011555 C. westii (W. West) Boye-Peterson $>16.0 \leq 32.0 \mu\text{m}$ sheaths striated.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Chroococcus montanus Hansgirg, Chroococcus schizodermaticus W. West, Chroococcus westii (W. West) Boye-Peterson.

B) Geitler (1932) gave the size range as - cells: 8.0 - 32.0 μm , in groups of 2 - 4, sheaths colourless.

C) 16 populations studied:

^
Ile Picard: W1, W2, W4, W110, W112, 0600 + 0900

Cinq Cases: CC2, CC5, CC9, CC12, CC13, 3841 + 0622

Takamaka: T3, 3345 + 0551, 3367 + 0631

D) Widespread and locally common, occasionally very abundant from terrestrial and pool situations. From films over mud and rock, among the filaments of other algae, algal felts and larger gelatinous colonies, the plankton and in the aufwuchs of larger plant growths.

- E) Recorded by Whitton (1969). Potts (1977) recorded this species from [^]Ile Picard and Grande Terre; present among other algal communities, never becoming abundant.
- F) Desikachary (1959) listed many records from the plankton, submerged plants and the subaerial parts of tree trunks in Burma, Ceylon, India and Pakistan.

011555 Chroococcus westii (W. West) Boye-Peterson $> 16 \leq 32 \mu\text{m}$
sheath striated

A) Colony: spherical, gelatinous, almost colourless.

Cells: 16.0 - 32.0 μm wide; light blue-green to olive-green with distinct individual lamellate sheaths.

As the lower size range for this species is given as 13.0 μm , this 'species' number and size range exclude that part of the cell size range 13.0 - 16.0 μm .

Cells in this size range would be coded under 011554

Chroococcus turgidus (Kütz.) Nägeli $> 8 \leq 16 \mu\text{m}$ sheaths striated. The size range of this 'species' number also includes the relevant size ranges of the following species: Chroococcus macrococcus (Kütz.) Rabenhorst, Chroococcus tenax (Kirchn.) Hieronymus.

B) Geitler (1932) gave the size range as - cells: 13.0 - 27.0 μm wide; violet with almost colourless individual lamellate sheaths.

C) One population studied:

Île Picard: 0600 + 0900

D) Recorded only on one occasion, on rock among the filaments of other algae.

E) Recorded by Potts (1977) from Île Picard and Grande Terre; frequent among other algal communities, never becoming abundant.

011556 Chroococcus macrococcus (Kütz.) Rabenhorst > 32 µm
sheaths striated

- A) Colony: spherical, almost colourless. Cells: 32.5 - 47.3 µm wide; bright blue-green with clearly lamellate individual sheaths.
- As the lower size range for this species is given as 25.0 µm, this 'species' number and size range exclude that part of the size range 25.0 - 32.0 µm. Cells in this size range would be coded under 011555 Chroococcus westii (W. West) Boye-Peterson >16 ≤ 32 µm sheaths striated. The size range of this 'species' number also includes the relevant size ranges of the following species: Chroococcus giganteus W. West.
- B) Geitler (1932) gave the size range as - cells: 25.0 - 50.0 µm wide; spherical. Sheath: thick and almost colourless.
- C) Two populations studied:
 Île Picard: 0600 + 0900
 Grande Terre: SC102
- D) Recorded from both terrestrial and pool situations. From films over damp sand, damp rock and among the filaments of other algae.
- E) Recorded by Potts (1977) from Île Picard. He described it as present among other algal communities at the bases of limestone residuals Bassin Lebine.

011557 Chroococcus minor (Kütz.) Nägeli ≤ 4 μm sheaths not striated

- A) Cells: average width 3.0 μm , hemispherical, light blue-green to grey-green, evenly distributed within almost colourless homogeneous mucilage. The size range of this 'species' number also includes the relevant size ranges of the following species: Chroococcus dispersus (Keissl.) Lemmermann, C. minimus (Keissl.) Lemmermann. Potts (1977) allocated the binomial Chroococcus minimus (Keissl.) Lemmermann to this size range category; the earlier binomial is in fact C. minor (Kütz.) Nägeli.
- B) Geitler (1932) gave the size as - cells: 3.0 - 4.0 μm wide.
- C) Three populations studied:
 Île Picard: W2, W4, 0600 + 0900
- D) Recorded only from Île Picard. From films over mud and rock and among algal felts.
- E) Recorded by Potts (1977), present among other algal communities, Île Picard and Takamaka.

011558 Chroococcus minutus (Kütz.) Nägeli $> 4 \leq 6 \mu\text{m}$ sheath not striated

A) Colony: spherical to formless in larger colonies, mucilaginous, almost colourless. Cells: 4.0 - 6.0 μm wide; light-green to blue-green evenly distributed within almost colourless homogeneous mucilage.

As the upper size range for this species is given as 10.0 μm , this 'species' number and size range exclude that part of the size range 6.1 - 10.0 μm . Cells in this size range would be coded under 011559 Chroococcus membraninus (Meneghini) Nägeli $> 6 \leq 8 \mu\text{m}$ sheath not striated and 011560 Chroococcus turicensis (Nägeli) Hansgirg $> 8 \leq 16 \mu\text{m}$ sheath not striated.

The size range of this species number also includes the relevant size ranges of the following species:

Chroococcus bituminosus (Bory) Hansgirg, Chroococcus caldariorum Hansgirg, Chroococcus cohaerens (Brébisson) Nägeli, Chroococcus helveticus Nägeli, Chroococcus lithophilus Ercegović, Chroococcus membraninus (Meneghini) Nägeli, and Chroococcus pallidus Nägeli.

B) Geitler (1932) gave the size range as - cells: 4.0 - 10.0 μm wide; 2 - 4 within a colony, spherical, light blue-green.

C) 19 populations studied:

Île Picard: W1, W2, W4, W5, W6, W9, W104, W107, W112, W113, W127, 0600 + 0900, 0609 + 0900

Cinq Cases: CC5, CC9, CC12, CC13, CC15, CC102

- D) Recorded from terrestrial and pool situations only from [^]Ile Picard and the Cinq Cases region of Grande Terre, locally very common on [^]Ile Picard. From films over mud and rock, among the filaments of other algae, among algal felts, the plankton, and the aufwuchs of larger plant growths.
- E) Recorded by Potts (1977) from [^]Ile Picard, Grande Terre, and [^]Iles Moustique; occasional among mats of Scytonema and Schizothrix.
- F) Desikachary (1959) listed many records from plankton, among other algae, soils, on the barks of trees, in the mucilage of other blue-green algae, and epiphytic on aquatic plants, in Burma, Ceylon and Pakistan.

011559 Chroococcus membraninus (Menegh.) Nägeli > 6 ≤ 8 μm
sheath not striated

- A) Colony: spherical, in older colonies formless. Cells: 6.0 - 8.0 μm wide; light to dark blue-green evenly distributed within almost colourless homogenous mucilage. As the lower size range for this species is given as 3.0 μm, this 'species' number and size range exclude that part of the size range 3.0 - 6.0 μm. Cells in this size range would be coded under 011557 Chroococcus minor (Kütz.) Nägeli < 4 μm sheath not striated and 011558 Chroococcus minutus (Kütz.) Nägeli > 4 ≤ 6 μm sheath not striated. The size range of this species number also includes the relevant size ranges of the following species: Chroococcus cumulatus Bachmann, Chroococcus gomontii Nygaard, Chroococcus helveticus Nägeli, Chroococcus limneticus Lemmermann, Chroococcus lithophilus Ercegović.
- B) Geitler (1932) gave the size range as - cells: 3.0 - 8.0 μm wide; 2 to 4 within a mucilaginous colony.
- C) Three populations studied:
Île Picard: W4, W104
Cinq Cases: CC2
- D) Widespread, rare, never abundant. From films over rock and floating at the surface of pools.
- E) Recorded by Potts (1977) from Île Picard and Île Malabar; present among other algal communities.

011560 Chroococcus turicensis (Näg.) Hansgirg $> 8 \leq 16 \mu\text{m}$
 sheath not striated

A) Colony: spherical, in older colonies formless, mucilaginous.

Cells: 8.6 - 14.6 μm wide, light blue-green, evenly distributed within almost colourless to light orange homogeneous mucilage.

The size range of this species number also includes the relevant size ranges of the following species:

Chroococcus hansgirgi Schmidle, Chroococcus limeticus Lemmermann, Chroococcus lithophilus, Chroococcus minutus (Kütz.) Nägeli, Chroococcus spelaeus Ercegović.

B) Desikachary (1959) gave the size range as - cells:

13.0 - 15.0 μm ; colony gelatinous, often light orange coloured.

C) Ten populations studied:

Île Picard; W1, W3, W4, W107, W110, W113, W115, 0600 + 0900

Cinq Cases: CC2

Takamaka: T3

D) Widespread and locally common on Île Picard, never very abundant. From films over rock and mud, among the filaments of other algae, larger gelatinous colonies, algal felts and the plankton.

E) Recorded by Potts (1977) from Île Picard and Île Malabar; frequent among other algal communities.

01156.1 Chroococcus spelaeus Ercegović > 16 ≤ 32 μm

sheath not striated

- A) Colony: spherical, in older colonies formless, mucilaginous to gelatinous. Cells: 16.1 - 19.5 μm wide; light to dark blue-green, rarely more than 8 cells evenly distributed within almost colourless homogeneous mucilage. As the lower size range for this species is given as 15.0 μm, this 'species' number and size range exclude that part of the size range 15.0 - 16.0 μm. Cells in this size range would be coded under 011560 Chroococcus turicensis (Näg.) Hansgirg > 8 ≤ 16 μm sheaths not striated.
- B) Geitler (1932) gave the size range as - cells: 15.0 - 30.0 μm wide; blue-green, olive green or violet, 2 - 4 within a colony.
- C) Three populations studied:
 Île Picard: W1, W6, 0600 + 0900
- D) Recorded only from Île Picard in both terrestrial and pool situations. From films over rock, amongst other loose colonies and the plankton.
- E) Recorded by Potts (1977) from Île Picard, Île Malabar, Grande Terre and Île Sylvestre; widespread and in the lagoon frequent among other algal communities.

011562 Chroococcus sp. > 32 μ m sheath not striated

A) Colony: spherical, gelatinous. Cells: average width 33.0 μ m; blue-green, evenly distributed within almost colourless homogeneous mucilage. There is apparently no suitable binomial which can be applied to this 'species' number size range.

C) Two populations studied:

Île Picard: W115

Grande Terre Central: SC101

D) Recorded only from two pools. From among other algal filaments on submerged rock.

E) Recorded by Potts (1977) from Île Picard, Île Malabar and Grande Terre; present among mats of Calothrix scopulorum and Schizothrix calcicola.

011811 Cylindrospermum muscicola Kützing

- A) Colony: forming an expanded mucilaginous sheet, dark olive-green to almost black. Cells: 2.8 - 3.5 μm wide; 3.4 - 3.9 μm long; oblong to cylindrical, slightly constricted at the cross-walls. Heterocysts: 2.6 - 3.5 μm wide; 3.5 - 4.0 μm long; elongate, oval to rounded-triangular. Spores: 8.0 - 10.0 μm wide; 12.0 - 15.0 μm long; epispore smooth, golden brown in colour.

This species was only noted on two occasions on the atoll. In culture in Durham many trichomes were seen to break away from their heterocysts and glide away after the fashion of some Nostoc species (Lazaroff, 1973). The lone trichomes resembled those seen frequently in samples on Aldabra. Such trichomes seen on the atoll were coded as Pseudanabaena sp.; it may be that Cylindrospermum muscicola is more common on the atoll than the survey might suggest. Potts (pers. comm.) found that combined nitrogen in the culture medium greatly suppressed heterocyst formation.

- B) Desikachary (1959) gave the size range as - cells: 3.0 - 4.7 μm wide; 4.0 - 5.0 μm long. Heterocysts: 4.0 - 5.0 μm wide; 5.0 - 7.0 μm long; elongate. Spores: 9.0 - 12.0 μm wide; 10.0 - 20.0 μm long; epispore smooth, golden brown in colour.
- C) One population studied:
Cinq Cases: CC5
- D) Floating at the surface of pools and on the surface of bottom mud.

F) From damp soil and more rarely in stagnant water, Africa (Frémy, 1929). Desikachary (1959) listed many records from damp soil, stagnant water, wheat fields and cultures of paddy field soil in Burma and India.

011903 Dactylococcopsis raphidioides Hansgirg

- A) Cells: 1.0 - 3.0 μm wide; 5 - 8 times longer than broad; spindle-shaped, sigmoid or lunate, light blue-green, generally solitary, occasionally 2 - 3 together in a thin diffluent mucilage.
- B) Geitler (1932) gave the size range as - cells: 1.0 - 3.0 μm wide; up to 25.0 μm long; spindle-shaped, 'S' shaped, or semicircular.
- C) One population studied:
Île Picard: W2
- D) Recorded from the plankton
- F) Fremy (1929) recorded this species from damp soil, walls and stagnant waters, he described its distribution as Europe and North America, probably cosmopolitan.

011904 Dactylococcopsis rupestris Hansgirg

- A) Cells: 1.5 - 2.5 μm wide at their widest point;
9.0 - 15.0 μm long; short spindle-shaped, very pointed
tapering towards the ends, blue green.
- B) Geitler (1932) gave the size range as - cells: 1.5 -
2.5 μm wide; 9.0 - 15.0 μm long, olive to light blue-green.
- C) One population studied:
Île Picard: W1
- D) Recorded only once; from a Tolypothrix byssoidea felt
just above the high water mark.

012201 Entophysalis granulosa Kützing

- A) Colonies: up to 1 mm thick, gelatinous with a thick outer 'skin' rounded to convoluted in older colonies, red brown to almost black in colour. Cells: 3.5 - 6.0 μm ; spherical to oval, dividing to form short rows, possessing a broad. Sheath: up to 2.0 μm thick; colourless in young cells, yellow to brown in older cells.
- B) Geitler (1932) gave the size range as - cells: 2.0 - 5.0 μm , sheath colourless yellow to brown. Colony: crustaceous, yellow-brown, cartilaginous.
- C) 24 populations studied:
- Île Picard: W1, W2, W3, W4, W103, W110, W113, 0600 + 0900
 - Île Malabar: ME101, ME107
 - Anse Cédres: AC1, AC2, AC3
 - Cinq Cases: CC2, CC10, CC14, CC109, 3980 + 0590, 3962 + 0581
 - Takamaka: T3, T102, T110, 3400 + 0600
 - Île Esprit: 1000 + 0600
- D) Recorded from terrestrial and pool situations. Usually found as macroscopic colonies on damp rock at the edges of pools and in other areas where humidity was high; also in films, among the filaments of other algae and algal felts. Occasionally very abundant.
- E) Recorded by Whitton (1969). Recorded by Potts (1977) from Île Picard, Île Malabar, Grande Terre, and Îles Moustique; very abundant in the upper intertidal zone of his 'mini' lagoon and over champignon and cerethid shells

in the upper intertidal zone of the lagoon and seaward coasts. On Îles Moustiques he recorded it forming small spherical gelatinous colonies over the surface of the cemented fine silt.

012651 Gloeocapsa montana Kützing > 2 ≤ 4 μm sheath colourless

A) Colony: 13.0 - 42.0 μm; spherical, formless in older colonies. Cells: 2.5 - 4.0 μm in diameter; blue-green, cell contents occasionally granular. Sheath: distinctly lamellate, evenly distributed within almost colourless homogeneous mucilage.

As the upper size range for this species is given as 5.0 μm, this 'species' number and size range exclude that part of the size range 4.1 - 5.0 μm. Cells in this size range would be coded under 012652 Gloeocapsa arenaria (Hassall) Rabenhorst > 4 ≤ 6 μm sheath colourless and layered.

The size range of this 'species' number also includes the relevant size ranges of the following species: Gloeocapsa aeriginosa (Carm.) Kützing, Gloeocapsa arenaria (Hassall) Rabenhorst, Gloeocapsa caldariorum Rabenhorst, Gloeocapsa gelatinosa Kützing, Gloeocapsa polydermatica Kützing and Gloeocapsa punctata Nägeli.

B) Geitler (1932) gave the size range as - cells: 2.0 - 5.0 μm in diameter ; 2 - 4 within a group; light blue-green. Sheath: colourless with clear lamellations, but often more or less diffluent, occasionally non-lamellate.

C) Three populations studied:

^
Ile Picard: 0600 + 09000, 0500 + 0900

Grande Terre Central: SC101

D) Recorded from terrestrial and pool situations. From films over rock, and the plankton.

012652 Gloeocapsa arenaria (Hassall) Rabenhorst $> 4 \leq 6 \mu\text{m}$
 sheath colourless

A) Colony: spherical or formless, mucilaginous, almost colourless, occasionally yellow to brown. Cells: 4.1 - 5.9 μm in diameter; blue-green to olive-green, densely packed within almost colourless mucilage. Sheath: distinctly lamellate.

As the lower size range for this species is given as 3.7 μm , this 'species' number and size range exclude that part of the size range 3.7 - 4.0 μm . Cells in this size range would be coded under Gloeocapsa montana Kützing $> 2 \leq 4 \mu\text{m}$ sheath colourless.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Gloeocapsa caldariorum Rabenhorst, Gloeocapsa decorticans (A. Br.) P. Richter and Gloeocapsa polydermatica Kützing.

B) Geitler (1932) gave the size range as - cells: 3.7 - 6.0 μm . Sheath: colourless, thick, lamellations indistinct.

C) Four populations studied:

Île Picard: W1, W4, 0600 + 0900

Cinq Cases: CC13

D) Recorded from pool and terrestrial situations. From films over rock and among algal felts.

012653 Gloeocapsa caldariorum Rabenhorst $> 6 \leq 8 \mu\text{m}$

sheath colourless

A) Colony: spherical, in older colonies formless. Cells: 6.0 - 8.0 μm in diameter; evenly distributed within homogeneous mucilage which is generally almost colourless but occasionally yellow to brown: Sheaths: distinctly lamellate.

As the lower size range for this species is given as 3.0 μm , this 'species' number and size range exclude that part of the size range 3.0 - 6.0 μm . Cells in this size range would be coded under 012651 Gloeocapsa montana Kützing $> 2 \leq 4 \mu\text{m}$ sheath colourless, and 012652 Gloeocapsa arenaria (Hassall) Rabenhorst $> 4 \leq 6 \mu\text{m}$ sheath colourless.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Gloeocapsa decorticans (A. Br.) P. Richter.

Gloeocapsa decorticans is the earlier described species and should therefore be the binomial attributed to this 'species' number, however it is felt that the description of Gloeocapsa decorticans best fits a species of Gloeotheca.

B) Geitler (1932) gave the size range as - cells: 3.0 - 8.0 μm ; blue-green. Sheath: almost colourless, distinctly lamellate.

C) Two populations studied:

Île Picard: W4, 0600 + 0900

D) Recorded only twice, on Île Picard in terrestrial and pool situations. From films over rock and the plankton.

012660 Gloeocapsa dermochroa Nägeli $> 2 \leq 4 \mu\text{m}$ sheath yellow-brown

A) Colony: spherical, formless in older colonies, yellow to brown in colour. Cells: 2.0 - 4.0 μm in diameter, blue-green. Sheath: lamellate, yellow-brown.

As the lower size range for this species is given as 1.5 μm , this 'species' number and size range exclude that part of the size range 1.5 - 2.0 μm . Cells in this size range would be coded under 012659 Gloeocapsa fusco-lutea (Näg.) Kützling $\leq 2 \mu\text{m}$ sheath yellow-brown.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Gloeocapsa kützlingiana Nägeli.

B) Geitler (1932) gave the size range as - cells: 1.5 - 3.0 μm in diameter, blue-green. Sheath: yellow-brown, non-striate.

C) 21 populations studied:

Île Picard: W1, W2, W3, W5, W6, W9, W104, W107, W115,
0600 + 0900, 0618 + 0991, 0565 + 1014,
0590 + 0920

Île Malabar: 1394 + 1233

Cinq Cases: 3900 + 0500, 3841 + 0623, 3980 + 0590

Takamaka: T102, 3300 + 0300, 3400 + 0600

D) Recorded from terrestrial and pool situations, widespread and locally common. From films over rock, among the filaments of other algae on rock, and among algal felts.

E) Recorded by Potts (1977) only on one occasion; among a Scytonema mat from the La Gigi area of Île Picard.

F) Recorded by Frémy (1929) from damp rocks, submerged stones, the edge of springs, and old damp wood.

012661 Gloeocapsa kützingiana Nägeli > 4 ≤ 6 μm sheath yellow-brown

A) Colony: spherical, formless in older colonies, brown in colour. Cells: 4.2 - 5.3 μm in diameter; blue-green. Sheath: tight-fitting, brown, non-lamellate.

As the lower size range for this species is given as 3.0 μm, this 'species' number and size range exclude that part of the size range 3.0 - 4.0 μm. Cells in this size range would be coded under 012660 Gloeocapsa dermochroa Nägeli.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Gloeocapsa muralis Kützing. Gloeocapsa crepidinium Thuret and Gloeocapsa deusta (Menegh.) Kützing though falling in the relevant size range of this 'species' number have not been included here due to their being well described marine species very different from the terrestrial and freshwater material seen on the atoll.

B) Geitler (1932) gave the size range as - cells: 3.0 - 5.0 μm in diameter, though Desikachary (1959) described a form from Madras with a size range 2.6 - 5.0 μm in diameter.

C) 27 populations studied:

Île Picard: W1, W2, W5, W7, W9, W104, W107, W115, W127

Île Malabar: 1394 + 1233, 3142 + 1185

Anse Cèdres: AC3

Cinq Cases: CC2, 3900 + 0500, 3841 + 0623

Takamaka: T102, 3300 + 0300, 3400 + 0600

Île Esprit: 1000 + 0600

D) Widespread in both terrestrial and pool situations. From films over rock, among the filaments of other algae, among algal felts, among larger gelatinous colonies and the plankton

012662 Gloeocapsa muralis Kützing > 6 ≤ 8 μm sheath yellow-brown

A) Colony: formless, mucilaginous, yellow to brown.

Cells: 6.9 - 8.0 μm. Sheath: yellow to brown, distinctly lamellate.

As the lower size range for this species is given as 5.0 μm, this 'species' number and size range exclude that part of the size range 5.0 - 6.0 μm. Cells in this size range would be coded under 012461 Gloeocapsa kützingiana Nägeli > 4 ≤ 6 μm sheath yellow-brown.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Gloeocapsa rupestris Kützing.

B) Geitler (1932) gave the size range as - cells:

5.0 - 8.0 μm in diameter. Sheath: colourless, bright yellow, sometimes brown, distinctly lamellate.

C) 26 populations studied:

^ Ile Picard: W1, W2, W3, W4, W5, W6, W9, W104, W107,

W115, W117, 0600 + 0900, 0565 + 1014,

1000 + 0500, 0618 + 0991

^ Ile Malabar: 1394 + 1233

Anse Cèdres: AC3

Cinq Cases: CC2, 3900 + 0500, 3841 + 0623

Takamaka: T102, 3300 + 0300, 3400 + 0600

^ Ile Esprit: 1000 + 0600

D) Widespread in both terrestrial and pool situations.

From films over rock, among filaments of other algae, algal felts and the plankton.

012663 Gloeocapsa gigas W. et G. G. West > 8 μ m sheath
yellow-brown

A) Colony: formless, gelatinous, yellow-brown in colour.

Cells: 8.3 - 22.7 μ m in diameter; blue-green, evenly distributed within yellow to brown homogeneous mucilage.

Sheath: distinctly lamellate, tight-fitting.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Gloeocapsa pleurocapsoides Novaček, Gloeocapsa rupestris
Kützing.

B) Geitler (1932) gave the size range as - cells:

9.0 - 15.0 μ m in diameter; 4 - 36 cells within a colony.

Sheath: wide yellow to brown, often rough, non-lamellate.

C) Two populations studied:

^
Île Picard: W115

^
Île Malabar: 1394 + 1233

D) Recorded only on two occasions, in terrestrial and pool situations. From among mud and leaves at the bottom of a pool and among algal filaments on a rock surface.

012665 Gloeocapsa quarternaria (Brébisson) Kützing > 2 ≤ 4 μm
 sheath orange/red/violet

A) Colony: spherical, gelatinous. Cells: 2.6 - 4.0 μm in diameter; dark blue-green with blackish-red, tight-fitting, often lamellate sheaths, evenly distributed within almost colourless to blackish-red homogeneous mucilage.

The size range of the 'species' number also includes the relevant size ranges of the following species:

Gloeocapsa rupicola Kützing, Gloeocapsa sabulosa (Menegh.) Richter, Gloeocapsa sanguinea Agardh emend. Fr. Novaček, Gloeocapsa stegophila (Itzigs.) Rabenhorst, Gloeocapsa thermalis Lemmermann, Gloeocapsa compacta Kützing and Gloeocapsa magma (Brébisson) Kützing.

Desikachary (1959) gave this species the binomial Gloeocapsa quarternata.

B) Geitler (1932) gave the size range as - cells:

3.0 - 4.5 μm in diameter; blue-green. Sheath: almost colourless to red, often lamellate.

C) Two populations studied:

Île Picard: W4, 0600 + 0900

D) Recorded only for Île Picard in terrestrial and pool situations. From among filaments of other algae on rock.

012666 Gloeocapsa alpina (Näg.) emend. Brand $> 4 \leq 6$ μm sheath
orange/red/violet

- A) Colony: only visible with microscope, spherical to irregularly shaped. Cells: 4.1 - 6.0 μm in diameter; dark blue-green. Sheath: red-brown, violet to almost black, lamellate. Nannocytes: frequently present.

As the upper size range for this species is given as 8.0 μm , this 'species' number and size range exclude that part of the size range 6.1 - 8.0 μm . Cells in this size range would be coded under 012667 Gloeocapsa sanguinea Ag. emend. Fr. Novaček $> 6 \leq 8$ μm sheath orange/red/violet. The size range of this 'species' number also includes the relevant size ranges of the following species: G. itsigsohnii Bornet, G. ralfsiana (Harv.) Kützing, G. sanguinea Ag. emend. Fr. Novaček.

- B) Geitler (1932) gave the size ranges as - cells: 4.0 - 6.0 μm wide, occasionally up to 8.0 μm wide.

- C) 11 populations studied:

^
Île Picard: W1, W2, W4, W101, W104, W107, W115, 0600 +
0900

- D) Recorded only from ^Île Picard. Forming films and sheets over rock. Often very abundant.

- E) Recorded by Potts (1977) only from ^Île Picard, among Scytonema mats, La Gigi.

012667 Gloeocapsa sanguinea Ag. emend. Fr. Novaček $> 6 \leq 8 \mu\text{m}$
sheath orange/red/violet

A) Colony: mucilaginous, gelatinous, spherical to irregular in shape. Cells: 6.0 - 8.0 μm wide, evenly distributed within almost colourless to pink mucilage. Sheath: blood-red, blue-violet, to almost black, striated or non-striated. Spores: 7.5 - 12.0 μm wide with rough, red-brown outer sheath.

As the lower size range of this species is given as 3.5 μm , this 'species' number and size range exclude that part of the cell size range 3.5 - 6.0 μm . Cells in this size range would be coded under 012665 G.

quarternaria (Brébisson) Kützing $> 2 \leq 4 \mu\text{m}$ sheath orange/red/violet or 012666 G. alpina (Näg.) emend. Brand $> 4 \leq 6 \mu\text{m}$ sheath orange/red/violet. As the upper size range of this species is given as 9.0 μm this 'species' number and size range exclude that part of the cell size range 8.1 - 9.0 μm . Cells in this size range would be coded under 012668 G. magma var. simmeri (Schmidle) Novaček $> 8 \mu\text{m}$ sheath orange/red/violet.

The size range of this 'species' number also includes the relevant size ranges of the following species: G. alpina (Näg.) emend. Brand, G. magma (Breb) emend. Hollerbach, G. ralfsiana (Harv.) Kützing, G. shuttleworthiana Kützing.

B) Geitler (1932) gave the size range as - cells: 3.5 - 9.0 μm . Spores: 8.0 - 12.5 μm wide.

C) 50 populations studied:

^
 Ile Picard: W1, W2, W3, W4, W6, W7, W104, W107, W110,
 W114, W116, W117, W118, 0600 + 0900, 0500 +
 0900, 0618 + 0991, 0564 + 1017, 0575 + 0976,
 0562 + 0976, 0565 + 1014, 0500 + 1000, 0591 +
 0920, 0590 + 0921

^
 Ile Malabar: MW1, ME108, 1394 + 1233, 3142 + 1185,
 3143 + 1186

Anse Cèdres: AC3

Cinq Cases: CC13, CC15, 3962 + 0581, 3912 + 0615

Takamaka: T2, 3345 + 0551, T102, T124, 3343 + 0590,
 3420 + 0640, 3400 + 0600

Grande Terre Central: SC101, 2652 + 0378

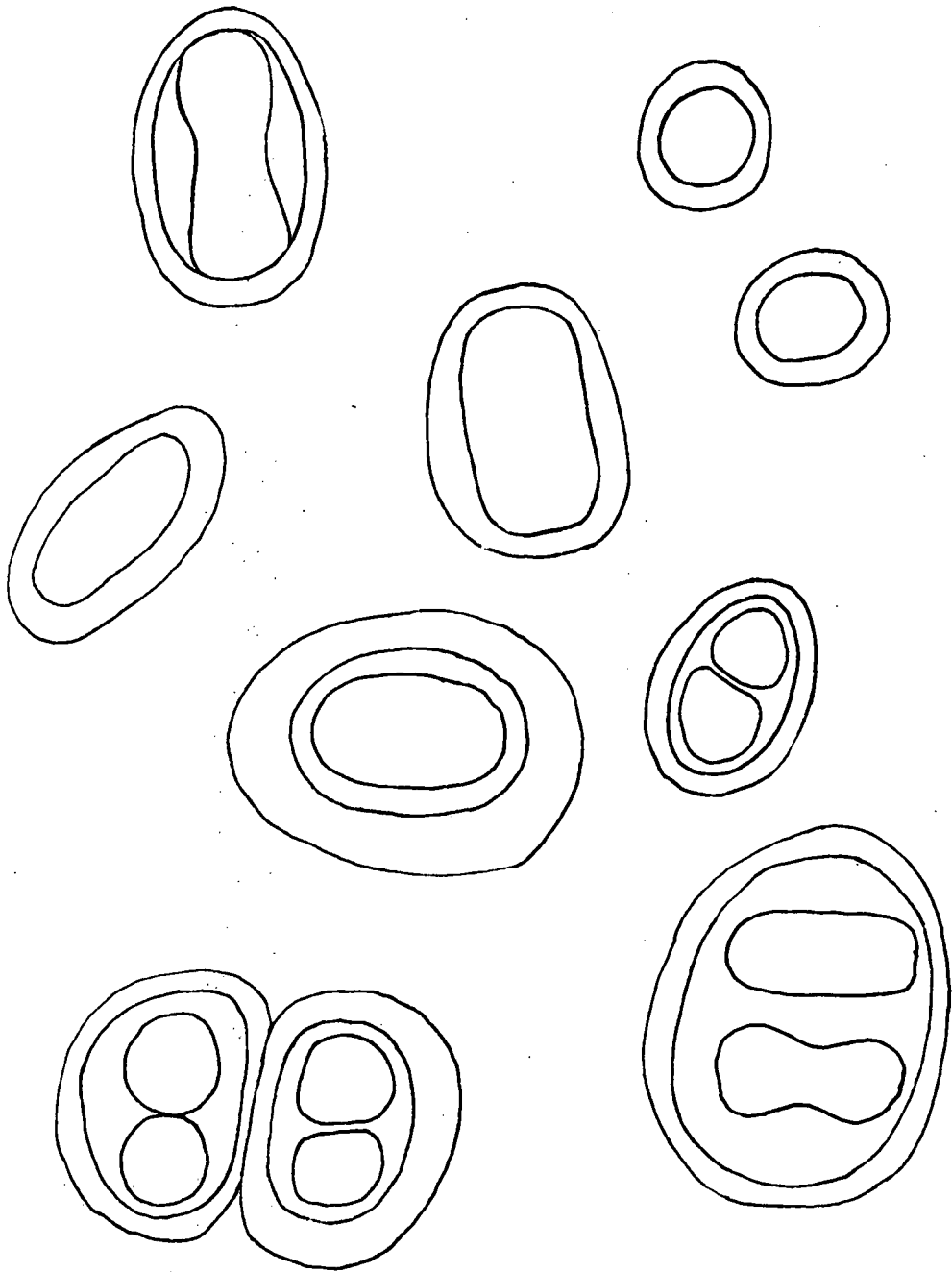
^
 Ile Esprit: 1050 + 0620, 1000 + 0600

- D) Common, widespread and often very abundant. From films, felts, and filamentous sheets on rock and dead wood, occasionally epiphytic on Nostoc and Tolypothrix, from the aufwuchs of larger plant growths and the plankton. Occasionally encrusting.
- E) Recorded by Potts (1977) only from ^ Ile Picard. Present among the surface film of Lyngbya confervoides, over silt in a tidal depression, close to the research station.

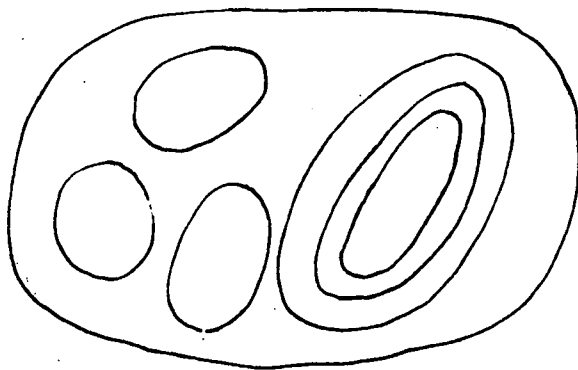
012668 Gloeocapsa magma (Bréb) Kützing var. simmeri (Schmidle)

Novaček > 8 µm sheath orange/red/violet

- A) Colony: crust-forming, spherical, in older colonies irregularly-shaped. Cells: 8.0 - 11.8 µm wide, spherical, hemispherical, occasionally angular, dark blue-green to olive-green. Sheath: thick, brownish-red, occasionally with a rough outer surface. Spores: 12.9 - 15.3 µm wide with a firm, rough red-brown outer sheath.
- B) Geitler (1932) gave the size ranges as - cells: 8.8 - 16.5 µm wide. Spores: 10.0 - 17.7 µm wide.
- C) 5 populations studied:
- ^A
 Île Picard: W104, W107, 0600 + 0900
- Takamaka: T2
- Grande Terre Central: SC101
- D) Recorded from terrestrial and pool situations, widespread and occasionally very abundant. From films, filamentous sheets and algal felts. One of the major constituents of terrestrial rock communities.



Gloeotheca rupestris



10µm

012703 Gloeotheca rupestris (Lyngbye) Børnet

- A) Colony: verrucose, gelatinous, yellow to brown.
 Cells: 4.1 - 6.5 μm wide; 6.4 - 13.7 μm long; ellipsoid to cylindrical, blue-green to yellow-brown. Sheath: colourless non-lamellate, later yellow to brown and distinctly lamellate. Nannocytes present.
 As it was felt that this species was well-known and well-defined it was allocated its own 'species' number. Potts (1977) allocated this binomial to a 'species' number size range.
- B) Geitler (1932) gave the size range as - cells:
 4.0 - 5.5 μm wide; up to 3 times longer than broad.
 Sheath: colourless at the periphery of the colony, yellow to brown towards the centre, non-lamellate or lamellate.
- C) Ten populations studied:
 Île Picard: W1, W7, W9, 0600 + 0900, 0591 + 0921
 Île Malabar: 1394 + 1233
 Cinq Cases: CC5, 3841 + 0622
 Takamaka: T102, 3367 + 0631
- D) Widespread and occasionally abundant. From films over rock, among the filaments of other algae, among algal felts and as macroscopic colonies, free-floating and attached.
- E) Recorded by Potts (1977) from Île Picard only; present among a community dominated by Lyngbya confervoides in a tidal pool.
- F) From damp stones and rocks, at the edge of thermal springs (Frémy, 1929).

012732 Gloeothece palea (Kützing) Rabenhorst $> 2 \leq 4 \mu\text{m}$

- A) Colony: spherical, later formless, mucilaginous, blue-green. Cells: 2.8 - 4.0 μm wide; 6.0 - 7.0 μm long; cylindrical, almost colourless to dark blue-green. Sheath: colourless, later yellow to brown, non-lamellate. Nannocytes present. As the upper size range for this species is given as 4.5 μm , this 'species' number and size range exclude that part of the size range 4.1 - 4.5 μm . Cells in this size range would be coded under 012733

Gloeothece membranacea (Rabenh.) Bornet.

The size range of this 'species' number also includes the relevant size ranges of the following species: Gloeothece goeppertiana (Hilse) Forti.

- B) Geitler (1932) gave the size ranges as - cells: 2.5 - 4.5 μm wide; 1.5 - 3 times longer than broad. Sheath: non-lamellate.

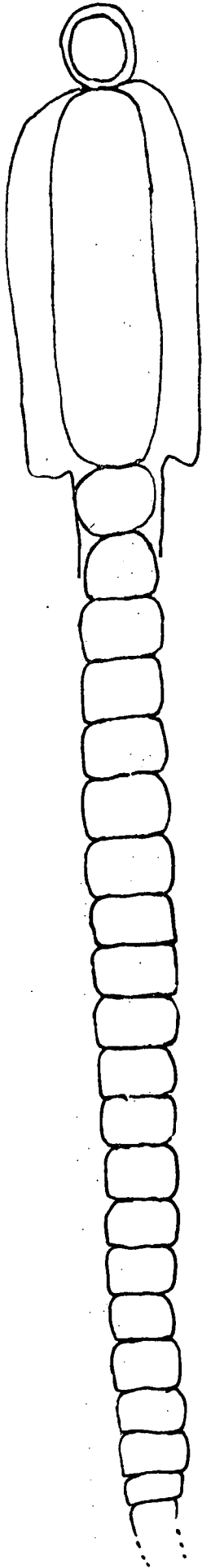
- C) Three populations studied:

Île Picard: W1, 0600 + 0900

Cinq Cases: CC13

- D) Widespread but rare, recorded on only three occasions. From films over rock, on dead wood and the plankton.

- E) Recorded by Potts (1977) on only one occasion from Île Picard; abundant, the second dominant species with Aphanothece microscopica over sand at La Gigi.



Gloeotrichia ghosei

10 μ m



012802 Gloeotrichia ghosei R.N. Singh

- A) Colonies: up to 2 cm in diameter, spherical, later verrucose, dark brown in colour. Filaments: up to 20.0 μm wide at their bases. Trichomes: 9.5 - 10.5 μm wide at their bases tapering to a long hair which was not seen to protrude outside the colony. Cells: 0.5 - 0.3 times as long as broad; barrel-shaped, slightly constricted at the cross-walls. Heterocysts: 10.5 - 11.0 μm in diameter, spherical, single, dark blue-green. Sheath: wide, brown to purple, distinctly lamellate. Spores: 15.0 - 20.0 μm wide, 45.0 - 53.0 μm long, oval to cylindrical; epispore smooth, golden brown in colour.
- B) Desikachary (1959) gave the size ranges as - colony: 4 - 5 cm in diameter. Trichome: 9.0 - 11.0 μm wide at their bases. Cells: shorter than broad to quadratic. Heterocysts: 9.9 - 13.2 μm in diameter. Spores: 13.2 - 16.5 μm wide; 42.0 - 50.0 μm long.
- C) Four populations studied:
Cinq Cases: CC9, CC13, CC16, CC18
- D) Recorded only from the Cinq Cases region of Grande Terre. Epiphytic on Chara zeylanica.
- E) Not recorded.

012901 Gomphosphaeria aponina Kützing

- A) Colony: spherical to oval, almost colourless to light blue-green. Cells: of average width 4.2 μm at their widest point; 8.0 - 12.0 μm long, heart shaped, light blue-green, yellowish or olive-green, usually with a distinct mucilaginous envelope placed at the ends of a regularly branched, radiating mucilage stalk.
- B) Desikachary (1959) gave the size range as - cells:
4.0 - 14.0 μm wide; 8.0 - 20.0 μm long.
- C) Two populations studied:
Île Picard: W2
Cinq Cases: CC15
- D) Recorded only on two occasions, in the plankton of two widely separated pools.
- F) From stagnant water, with other algae in the plankton, brackish waters, damp rock, damp soil, thermal waters, (Frémy, 1929).

012969 Gomphosphaeria aponina Kützing var multiplex Nygaard

A) Colony: spherical to oval, almost colourless to light blue-green. Cells: 5.0 - 8.0 wide at their widest points; light blue-green to yellow-green with distinct individual sheaths, contents often granular; towards the centre of the colony it is difficult to distinguish individual cells.

This variety has been given a separate 'species' number due to it being very different in appearance to the type.

B) Geitler (1932) gave the size range as - cells: 5.0 - 8.0 μm wide; up to 17.0 μm long.

C) One population studied:

Cinq Cases: CC15

D) Recorded only once in the plankton of a pool in the Cinq Cases region of Grande Terre.

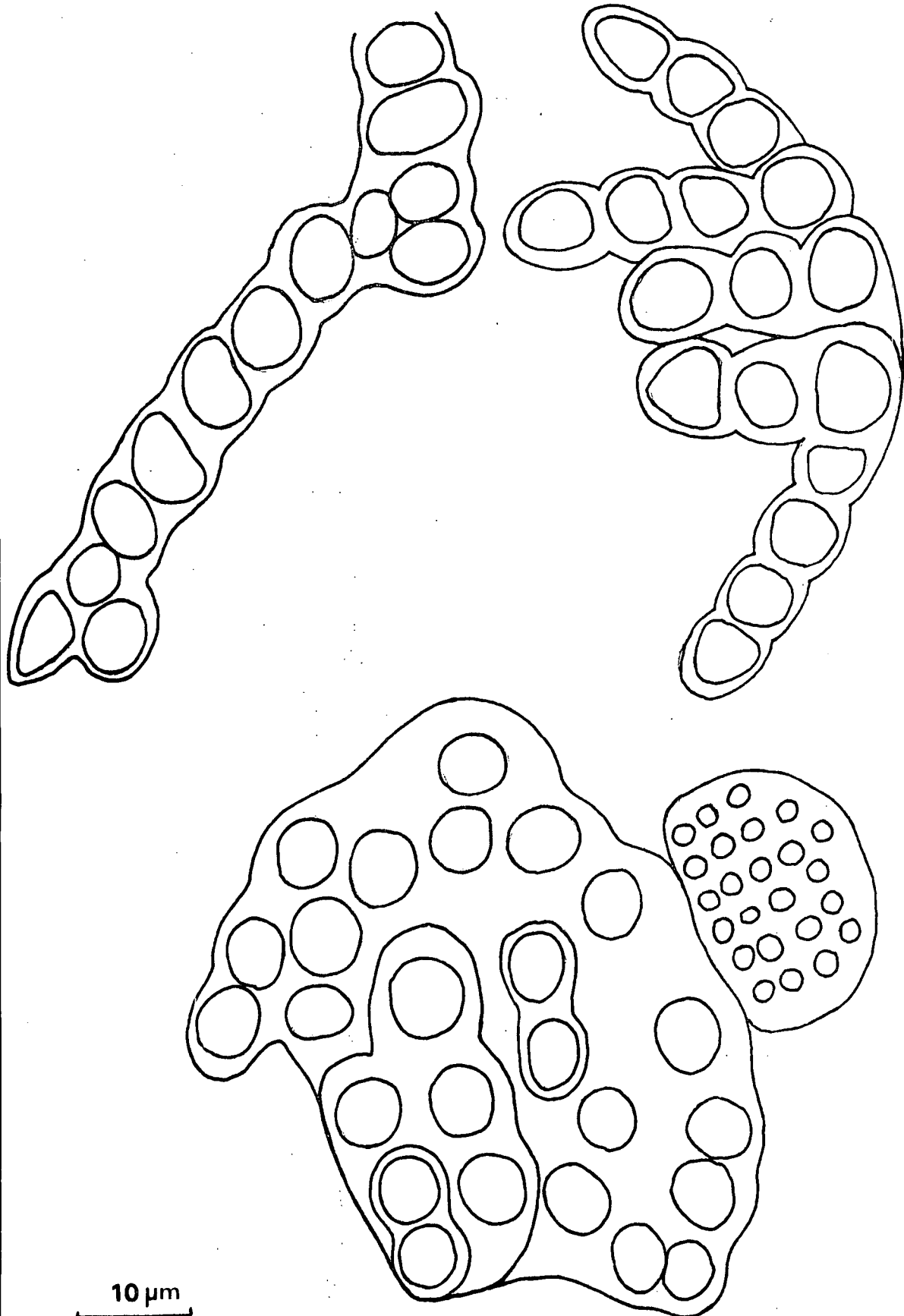
013107 Hapalosiphon welwitschii W. et G. S. West

- A) Colony: loose, formed by spreading filaments intertwined with non-living material and other algae. Main filaments: 7.0 - 10.0 μm wide; branches: 4.0 - 7.0 μm wide. Cells: 3.8 - 9.8 μm wide; 2.5 - 9.0 μm long. Heterocysts: 5.0 - 7.0 μm wide; 6.0 - 9.0 μm long; almost spherical to rounded-quadratic. Sheath: colourless, tight-fitting. Spores: not seen.
- B) Desikachary (1959) gave the size range as - filaments: 5.5 - 7.5 μm wide; branches: 3.5 - 7.5 μm wide. Cells: 0.5 - 3 times longer than broad. Heterocysts: 6.0 μm wide, 6.0 - 8.0 μm long. Spores: 5.0 μm wide; 1 - 2 times longer than broad.
- Rao (1937) described a form - cells: 3.0 - 7.5, rarely up to 9.0 μm wide; 4.5 - 15.0 rarely up to 16.8 μm long. Heterocysts: 4.5 - 7.0 μm wide; 7.5 - 10.0 μm long. Spores: 6.0 - 12.0 μm wide; 5.2 - 12.5 μm long.
- C) 36 populations studied:
- Île Picard: W1, W2, W3, W4, W5, W6, W7, W107, W112, W113,
W114, W118, W119, 0600 + 0900, 0500 + 0900,
0580 + 0966
- Île Malabar: MW103, ME107, ME108
- Anse Cèdres: AC4, AC101, AC112
- Île Malabar CC2, CC3, CC5, CC9, CC13, CC14, CC16, CC104,
3841 + 0623
- Takamaka: T103, T118, T124, T125
- Grande Terre Central: SC101

- D) Widespread and often abundant. From terrestrial and pool situations, encrusting (possibly endolithic), occasionally recorded growing over and penetrating dead wood.
- F) From slow flowing waters and among other algae (Frémy, 1929).

013313 Homoeothrix varians Geitler

- A) Colony: an expanded sheet of horizontal or vertical filaments, dark blue-green to almost black. Filaments: 3.0 - 5.0 μm wide at their bases. Trichomes: rarely ending in a hair. Cells: 2.8 - 4.8 μm wide at the base; 1.9 - 3.1 μm long; blue-green, occasionally orange or pink. Sheath: tight-fitting, colourless, pink, later yellow. The size range given for this species is 2.5 - 3.0 μm , the Aldabran material occasionally exceeded this range, though in any one population the whole of the size range was represented.
- B) Geitler (1932) gave the size range as - filaments: 2.5 - 3.0 μm wide at their bases. He suggested that a hair was only absent in younger material.
- C) 41 populations studied:
- Île Picard: W2, W3, W5, W6, W7, W111, W119, W120
 - Île Malabar: MW1, MW101, MW102, MW103, ME104, ME107, ME111
 - Anse Cèdres: AC1, AC2, AC3, AC4, AC101, AC103, AC109, AC111
 - Cinq Cases: CC3, CC8, CC10, CC13, CC14, CC16, CC17, CC18, CC102, CC104, CC109, CC112
 - Takamaka: T1, T103, T108, T124, T125
 - Île Esprit: 1000 + 0600
- D) Widespread, very common and often the dominant alga covering submerged rock surfaces. From films and filamentous sheets over rock surfaces, occasionally found floating free, often as an abundant epiphyte over Gongrosira spp.
- E) Recorded by Whitton (1969)

Hyella caespitosa

013601 Hyella caespitosa Bornet et Flahault

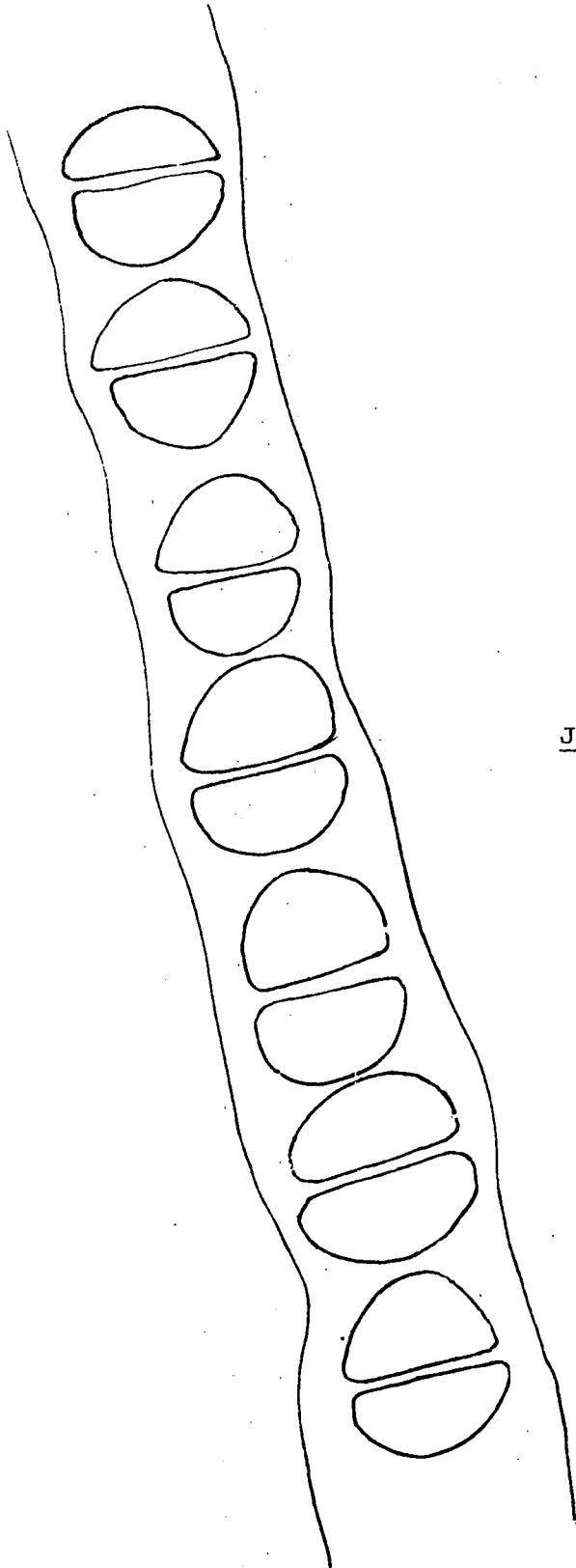
- A) Colony: forming dark blue-green to brown areas on rock, initially forming flakes, later globular, gelatinous 'cushions'. Cells: 4.0 - 7.0 μm wide; at the surface 4.0 - 9.0 μm wide; up to 40.0 μm long in perforating filaments; bright green, dark blue-green to olive green, occasionally branched. Sheath: wide, colourless. Sporangia: 7.0 - 8.0 μm wide; up to 12.0 μm long, spores: 2.0 - 3.0 μm in diameter.
- B) Geitler (1932) gave the size ranges as - cells: 4.0 - 10.0 μm ; up to 60.0 μm long in perforating filaments.
- C) Twelve populations studied:
 Île Picard: W2, 1000 + 0500
 Île Malabar: MW103, ME103, 1394 + 1233
 Anse Cédres: AC1, AC2, AC101, AC103
 Takamaka: T1, T3, T102
- D) Widespread but rare, occasionally abundant. Endolithic in submerged rock.

013602 Hyella fontana Huber et Jardin

- A) Colony: forming a film with penetrating endolithic filaments, blue-green to almost black. Cells: 5.0 - 10.1 μm broad; 5.0 - 33.6 μm long; blue-green, end cells much longer than others. Sporangia: 15.0 - 30.0 μm wide; cells at the surface of the colony often breaking down to form nannocytes.
- B) Geitler (1932) gave the size range as - cells: 5.0 - 10.0 μm wide; end cells 3 - 4 times longer than broad.
- C) 44 populations studied:
- Île Picard: W1, W2, W3, W4, W5, W6, W7, W114, W115, W118, W119, W120, W127
- Île Malabar: MW1, MW101, MW102, MW104, ME111
- Anse Cèdres: AC1, AC3, AC4, AC109, AC111
- Cinq Cases: CC2, CC3, CC5, CC8, CC9, CC13, CC14, CC109, 3841 + 0623
- Takamaka: T2, T102, T108, T124, T125
- Grande Terre Central: SC101, SC102, 2652 + 0378
- D) Widespread, locally common and often very abundant. Endolithic in submerged rock.
- F) From calcareous rock, snail shells, from mountain springs and streams, cosmopolitan (Frémy, 1929).

013604 Hyella balani Lehmann

- A) Colony: forming circular blue-green, brown to almost black circular patches over substrate. Filaments: 7.5 - 9.0 μm , penetrating filaments short, often multiseriate near the surface. Cells: average diameter 6.0 μm ; up to 18.0 μm long at the ends of filaments. Sheath: colourless. Sporangia: 12.0 - 18.0 μm wide; ellipsoid to spherical.
- Le Campion-Alsumard (1969) considered this species to be a form of Hyella caespitosa.
- B) Geitler (1932) gave the size ranges as - cells: 4.0 - 8.0 μm wide; up to 20.0 μm long in end cells of perforating filaments. Sporangia: ellipsoid 7.0 - 8.0 μm wide; 13.0 μm long.
- C) Nine populations studied:
- Anse Cèdres: AC112
- Cinq Cases: CC9, CC12, CC15, CC18, CC104
- Takamaka: T3, T103, T108
- D) Recorded only from the eastern end of the atoll, endolithic in submerged and damp rock.
- E) Recorded by Potts (1977) from Île Picard, Île Malabar, Grande Terre, Îles Moustique, Île Sylvestre; frequent in the majority of rock samples from the upper intertidal zone and very abundant at La Gigi beach where a large expanse of sand flat was coloured green by the presence of this alga.



100μm

Johannesbaptistia pellucida

013801 Johannesbaptistia pellucida (Dickie) Taylor et Drouet

A) Filaments: 3.8 - 10.0 μm wide. Cells: 3.6 - 7.5 μm wide;
4.0 - 4.8 μm long. Sheath: colourless mucilaginous,
gelatinous.

The size range given for this species is 3.9 - 5.2 μm ,
the Aldabran material occasionally exceeded this range,
though in any one population the whole of the size range
was represented.

B) Desikachary (1959) gave the size range as - filaments:
3.0 - 20.0 μm wide. Cells: 3.9 - 5.2 μm wide;
2.6 - 3.9 μm long.

C) Two populations studied:

Cinq Cases: CC9

Takamaka: T3

D) Recorded from only two pools, forming free floating
mucilaginous mats. From bottom mud and the aufwuchs of
larger plant growths. Possibly restricted to brackish
situations.

E) Recorded by Potts (1977) on only one occasion, from a
mixed community dominated by Hyella balani and
Schizothrix calcicola over sand flats close to Île
Sylvestre.

014202 Lyngbya allorgei Frémy

- A) Filaments: 3.2 - 5.5 μm ; solitary or intertwined to form a light green filamentous sheet. Cells: 3.0 - 5.0 μm wide; 4.5 - 7.0 μm long almost quadratic to 1.5 times longer than broad; constricted at the cross-walls, end cell round, calyptra not known. Sheath: very thin, tight-fitting, colourless.
- B) Frémy (1929) gave the size range as - cells: 3.5 - 4.0 μm wide, quadratic to 1.5 times longer than broad. Dixit (1936) recorded a form with the size range - cells: 4.6 - 6.4 μm wide; 4.6 - 8.3 μm long.
- C) 21 populations studied:
 Île Picard: W1, W2, W4, W5, W7, W9, 0600 + 0900,
 0619 + 0990, 0562 + 1035
 Île Malabar: 1394 + 1233
 Anse Cédres: AC3
 Cinq Cases: CC2, CC5, CC9, CC17
 Takamaka: T2, T3, T125, 3300 + 0300, 3343 + 0590, 3367 + 0631
- D) Widespread and occasionally abundant. From films over rock and mud, among filaments of other algae, among algal felts, from the aufwuchs of larger plant growths, more rarely among other algae over terrestrial rock.
- E) Recorded by Potts (1977) from Île Picard and Grande Terre; occasional among other algal communities.
- F) From among other algae in stagnant water (Frémy, 1929). From submerged mud and stones in flowing waters, Bombay (Dixit, 1936).

014203 Lyngbya aerigineo-coerulea (Kütz.) Gomont

- A) Filaments: solitary, occasionally intertwining to form a spreading dark blue-green colony. Cells: 4.0 - 5.8 μm wide; 1.6 - 4.5 μm long; light to dark blue-green, end cell conical or rounded. Sheath thin and almost colourless.
- B) Geitler (1932) gave the size range as - cells: 4.0 - 6.0 μm wide; 1 - 0.5 times as long as broad; end cell conical, rounded, with a slightly thickened membrane.
- C) 13 populations studied:
 ^
 Ile Picard: W5, W6, W115, W119, 0562 + 1035
 ^
 Ile Malabar: MW101
 Anse Cèdres: AC3, AC111
 Cinq Cases: CC5, CC9, CC13, CC104
- D) Widespread, occasionally abundant. From films over mud and rock, forming filamentous sheets, among algal felts, the plankton and the aufwuchs of larger plant growths.
- F) From the stagnant water of ponds and pools, ditches and often on decaying vegetation (Frémy, 1929). Desikachary (1959) listed many records from stagnant and flowing waters, in cultures of paddy-field soils, on moist rocks, soil, and on the barks of trees, in Burma, India and Pakistan.

014204 Lyngbya confervoides C. Agardh ex Gomont

- A) Filaments: solitary or more often forming a dense sheet of intertwined filaments, to form a bright light green or olive green colony. Cells: 10.0 - 19.5 μm wide; 2.0 - 5.3 μm long; with many gas-vacuoles, cross-walls not constricted, often granular, end cell broadly rounded. Sheath: up to 6.5 μm thick; lamellate in older filaments, occasionally encrusted with calcium carbonate.
- B) Geitler (1932) gave the size ranges as - cells: 9.0 - 25.0 μm wide, usually 10.0 - 16.0 μm wide; 2.0 - 4.0 μm long.
- C) 25 populations studied:
- Île Picard: W2, W3, W4, W6, W7, W104, W110, W113, W115,
W116, W117, W122, 0500 + 0900, 0610 + 1140
- Cinq Cases: CC2, CC3, CC5, CC9, CC12, CC13, CC14, CC15,
3841 + 0622
- Takamaka: T3
- D) Widespread and often abundant, occasionally the dominant alga within a pool. Forming sheets over mud, rock and on the surface of pools, from films over mud and rock, algal felts, the plankton, and in the aufwuchs of larger plant growths.
- E) Recorded by Potts (1977) from Île Picard, Grande Terre, Îles Moustique; very abundant as sheets over sediment; widespread inside the lagoon.
- F) From tide pools, Hispaniola, Île de la Tortue (Taylor, 1937); surfbeaten rocks, Isla de Lobos, Uruguay (Taylor, 1939); in the lagoon, Onotoa Atoll (Moul, 1957); sediment

crusts, Texas lagoons (Sorenson & Conover, 1959); on coral rock, Clipperton Island (Dawson, 1959); crusts and sediments southwest Gulf Coasts, Texas (Conover, 1962).

014205 Lyngbya digueti Gomont

- A) Filaments: 1.8 - 3.0 μm ; many intertwining to form an expanded sheet. Cells: 1.0 - 4.0 μm wide; 2.0 - 4.0 μm long; blue-green, end-cell rounded. Sheath: thin and almost colourless.
- B) Geitler (1932) gave the size ranges as - filaments:
 2.5 - 3.0 μm wide. Cells: 2.0 - 3.0 μm wide;
 1.0 - 3.7 μm long; quadratic sometimes shorter than broad.
- C) 42 populations studied:
 Île Picard: W1, W2, W3, W4, W5, W6, W7, W9, W103, W107,
 W110, W111, W112, W118, W119, 0600 + 0900,
 0564 + 1017, 0575 + 0976, 0590 + 0920
 Île Malabar: MW103, ME103, ME109, 3142 + 1185
 Anse Cédres: AC3, AC4, AC112
 Cinq Cases: CC5, CC9, CC13, CC18, CC101, CC102, 3841 + 0622
 Takamaka: T1, T118, T121, 3345 + 0551, 3343 + 0590
 Grande Terre: SC101
- D) Very common, widespread and often very abundant. Forming filamentous sheets over rock and mud, from films, algal felts, the plankton, and the aufwuchs of larger plant growths.
- E) Recorded by Potts (1977) from Île Picard, Grande Terre and Îles Moustique; widespread and frequent among other algal communities.
- F) From stagnant waters and on submerged plants and insects (Frémy, 1929).

014206 Lyngbya epiphytica Hieronymus

- A) Filaments: 1.4 - 2.8 μm wide; solitary or a few together attached at the middle or along their whole length to other algae and larger plants. Cells: 1.4 - 2.0 μm wide; shorter than broad to quadratic. Sheath: thin and almost colourless.
- I have extended the definition to include cells up to 2.8 μm wide.
- B) Geitler (1932) gave the size range as - filaments: 1.5 - 2.0 μm wide. Cells: 1.0 - 1.5 μm wide; 1.0 - 2.0 μm long.
- C) 11 populations studied:
- Île Picard: W1, W4, W5, W104, W107, W115, 0600 + 0900,
1000 + 0500, 0591 + 0921
- Île Malabar : MW104
- Cinq Cases: 3841 + 0622
- D) Widespread but uncommon, never very abundant. From terrestrial and aquatic situations, in films over mud and rock, algal felts, loose colonies, various larger plant growths and in the plankton attached to Scytonema, Tolypothrix byssoidea, Tolypothrix distorta and Oedogonium spp.
- E) Recorded by Potts (1977) from Île Picard, Grande Terre and Îles Moustique; widespread and a frequent epiphyte on Scytonema and Rhizoclonium.
- F) From standing waters, an epiphyte on various filamentous algae such as: Oedogonium, Cladophora, Tolypothrix and Lyngbya (Frémy, 1929). He described its distribution as 'probably' cosmopolitan.

014208 Lyngbya kuetszingii Schmidle

- A) Filaments: 2.0 - 2.5 μm wide; attached at the base.
Cells: 1.2 - 1.7 μm wide; generally shorter than broad, occasionally quadratic. Sheath: thin and almost colourless.
- B) Geitler (1932) gave the size ranges as - filaments:
2.0 - 3.5 μm wide; 30 - 70 μm long. Cells: 1.5 - 2.0 μm wide; 0.5 - 0.3 as long as broad.
- C) Two populations studied:
Île Picard: W2, W5
- D) Recorded only for Île Picard, epiphytic on other algae, occasionally epizoic.
- E) Recorded by Potts (1977) only from Île Picard;
frequent epiphyte on Cladophora.

014209 Lyngbya limnetica Lemmermann

- A) Filaments: 1.9 - 2.0 μm wide; solitary or a few together intertwined. Cells: 1.0 - 1.8 μm wide; 0.9 - 4.5 μm long; blue-green, end cell round. Sheath: thin and almost colourless.
- B) Geitler (1932) gave the size ranges as - filaments: 1.0 - 2.0 μm wide. Cells: 1.0 - 1.5 μm wide; 1.0 - 3.0 μm long.
- C) 22 populations studied:
 ^
 Ile Picard: W1, W4, W6, W7, W9, W107, W115, W127,
 0600 + 0900, 0575 + 0976
 ^
 Ile Malabar: ME102, ME107
 Anse Cédres: AC2, AC112
 Cinq Cases: CC2, CC9, CC12, CC13
 Takamaka: T122, 3345 + 0551
 Grande Terre Central: SC101
- D) Widespread, locally common and often abundant. From films over mud and rock, among the filaments of other algae, among algal felts, the plankton, free-floating at the surface of pools and in the aufwuchs of larger plant growths.
- E) Recorded by Potts (1977) only on one occasion, present among a community dominated by Calothrix contarenii, La Gigi, ^
 Ile Picard.
- F) Desikachary (1959) listed many records of other authors from reservoirs, soil cultures, lakes, ponds and tanks in Burma, Ceylon, India and Pakistan.

014210 Lyngbya majuscula Harvey ex Gomont

- A) Filaments: intertwined to form an olive-green to brown expanded sheet. Cells: 20.8 - 36.5 μm wide; 4.0 - 7.3 μm long; blue-green to olive-green, end cell broadly rounded, calyptra not noted. Sheath: up to 15.0 μm thick; almost colourless to light brown, distinctly lamellate in older filaments.
- B) Geitler (1932) gave the size ranges as - cells: 16.0 - 60 μm wide; 2.0 - 4.0 μm long.
- C) Three populations studied:
Cinq Cases: CC9, CC13, CC14
- D) Recorded only from the Cinq Cases area of Grande Terre from what seemed to be brackish pools, occasionally abundant. From bottom mud, later rising to float at the surface, occasionally over drying mud or among other algae over rock.
- E) Recorded by Potts (1977) only from Île Picard; abundant among other algal communities; in the plankton in central parts of the lagoon.
- F) Considered as an indicator species for the edge of the sublittoral zone, Raroia Atoll (Newhouse, 1954); lagoon shores, Curaçao (van den Hoek et al., 1972). Desikachary (1959) noted that it was recorded in both freshwater and marine situations in Burma, Ceylon and India.

014211 Lyngbya martensiana Meneghini ex Gomont

- A) Filaments: of average width 9.0 μm wide interwoven to form a mat. Cells: of average width 8.0 μm ; average length 2.6 μm ; generally shorter than broad; blue-green, blue-grey to almost violet, cross-walls occasionally granular, end cell round. Sheath: almost colourless to light-yellow.
- B) Geitler (1932) gave the size ranges as - cells: 6.0 - 10.0 μm rarely 13.0 μm) wide; 0.5 - 0.25 as long as broad.
- C) 11 populations studied:
 Île Picard: 0600 + 0900, 0564 + 1017
 Île Malabar: 3143 + 1185, 3143 + 1186
 Cinq Cases: CC2, CC3, CC5, CC13
 Takamaka: T102, T103, 3345 + 0551
- D) Widespread, uncommon but occasionally very abundant. From terrestrial and aquatic situations, films over mud and rock, free-floating in pools, on the branches of trees and over sand. This species was found to be the main alga forming crusts up to 1 cm thick over sand, La Gigi, Île Picard.
- E) Recorded by Potts (1977) from Île Picard and Grande Terre; frequent among algal mat communities, never becoming abundant.

014212 Lyngbya nordgardhii Wille

A) Filaments: 1.3 - 2.0 μm wide; solitary or a few together attached at the middle or along their whole length.

Cells: 1.5 - 2.0 μm wide; 1.2 - 2.0 μm long; cross-walls constricted end cell rounded. Sheath: thin and almost colourless.

B) Geitler (1932) gave the size ranges as - cells:

1.5 - 2.0 μm wide, 0.8 - 2.0 μm long.

C) Three populations studied:

Île Picard: W1, W2, E107

D) Recorded only from Île Picard. Epiphytic on Oedogonium spp., other larger algal species, Portulaca sp. and often epizooic on ostracods.

E) Recorded by Potts (1977) only from Île Picard; present among other algal communities.

014214 Lyngbya pusilla (Rabenhorst) Hansgirg

- A) Filaments: $< 1.0 \mu\text{m}$ wide attached by their bases, cross-walls indistinct. Sheath: thin and colourless.
- B) Geitler (1932) gave the size ranges as - filaments: about $1.0 \mu\text{m}$ wide; about $74.0 \mu\text{m}$ long. Cells: almost as long as broad, occasionally longer.
- C) 20 populations studied:
 Île Picard: W1, W2, W4, W5, W6, W7, W104, W107, W112, W115, W127
 Île Malabar: MW103, ME102, ME107
 Cinq Cases: CC9, CC102
 Takamaka:T1
- D) Widespread and often very abundant, locally common on Île Picard. Epiphytic on Plectonema gloeophilum, Plectonema tomasinianum, Tolypothrix distorta, Closterium spp., Phacotus lenticularis, Coelastrum cambricum, Coelastrum microporum, Nautococcus caudatus, Gongrosira spp., Pithophcra oedogonia and epizooic on ostracods.
- E) Recorded by Potts (1977) from Île Picard and Grande Terre; frequent among other algal communities.

014215 Lyngbya rigidula (Kütz.) Hansgirg

- A) Filaments: 1.4 - 22 μm wide, attached by their bases.
 Cells: 1.3 - 2.0 μm wide; 0.6 - 3.5 μm long; blue-green,
 end cell rounded. Sheath: thin and almost colourless.
- B) Geitler (1932) gave the size ranges as - filaments:
 1.5 - 2.0 μm wide; (rarely up to 2.5 μm wide). Cells:
 0.5 - 1.5 times longer than broad.
- C) 12 populations studied:
 Île Picard: W1, W2, W4, W5, W6, W7, W104, W112
 Île Malabar: MW103, ME102
 Anse Cèdres: AC1
 Cinq Cases: CC102
 Grande Terre Central: SC101
- D) Widespread and often very abundant. Epiphytic on
Plectonema gloeophilum, Plectonema tomasinianum,
Oedogonium spp., and Chara zeylanica, also attached
 to dead plant and animal material.

014220 Lynqbya ocreata Gardner

- A) Filaments: of average width 8.0 μm ; solitary or a few together. Cells: 6.3 - 7.4 μm wide; 1.5 - 2.0 μm long; blue-green to yellow-green, end cell rounded with a thickened membrane. Sheath: yellow to brown, distinctly lamellate, extending beyond the trichome in the shape of a trumpet.
- B) Geitler (1932) gave the size ranges as - filaments: 7.0 - 8.5 μm wide. Cells: 5.6 - 7.2 μm ; 1.0 - 1.4 μm long.
- C) One population recorded:
^
Île Picard: 0600 + 0900
- D) Recorded only once from among a mat of Scytonema over sand, La Gigi, ^
Île Picard.

014223 Lyngbya rivulariarum Gomont

- A) Filaments: 0.5 - 1.0 μm wide; densely intertwined within the mucilage of other algae. Cells 0.5 - 0.9 μm wide; quadratic to longer than broad; end-cell rounded.
- B) Geitler (1932) gave the size ranges as - filaments: 0.75 - 0.8 μm wide. Cells: 2.3 - 3.2 μm long.
- C) Four populations studied:
Île Picard: W9, 0600 + 0900, 0564 + 1017
Takamaka: T102
- D) Recorded from within the mucilage of Microcoleus chthonoplastes in terrestrial and aquatic situations.
- F) From the sheaths of Rivulariaceae, Nostocaceae (Frémy, 1929).

014224 Lyngbya palmarum (Martens) Bruhl et Biswas

- A) Filaments: 6.3 - 10.4 μm wide, densely intertwined to form a mat. Cells: 5.3 - 9.4 μm wide; 4.1 - 13.6 μm long; contents granular, end-cell broadly rounded. Sheath: almost colourless to light yellow.
- B) Desikachary (1959) gave the size ranges as - filaments: 6.0 - 10.0 μm wide. Cells: 5.0 - 9.4 μm wide; 4.5 - 8.0 μm long.
- C) Seven populations studied:
- ^
Ile Picard: W6, W7, 0609 + 0900
Cinq Cases: CC2, CC5
Takamaka: 3345 + 0551
- D) Widespread, uncommon, occasionally very abundant. From terrestrial and aquatic situations forming sheets over sand, rock and the branches of trees.
- F) On palm trees, Calcutta (Desikachary, 1959).

014631 Merismopedia warmingiana Lagerheim $\leq 1 \mu\text{m}$

A) Cells: average width $0.9 \mu\text{m}$; pale blue-green, seldom many within the colony.

Potts (1977) attributed the binomial Mersimopedia minima G. Beck to this 'species' number size range. In fact Merismopedia warmingiana is the earlier binomial.

B) Geitler (1932) gave the size range as - cells:
 $0.75 - 1.0 \mu\text{m}$ wide; 4 - 16 cells within the colony.

C) One population studied:

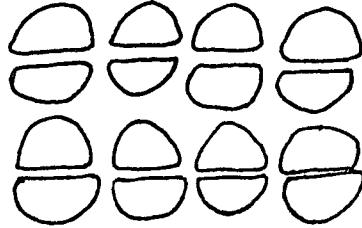
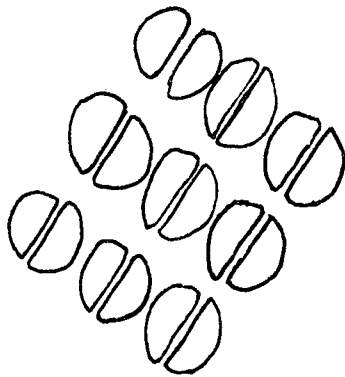
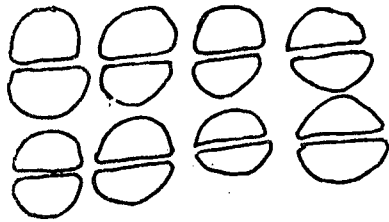
Anse Cédres: AC3

D) Recorded on only one occasion, from the plankton.

E) Recorded by Potts (1977) from only one location, among other algal communities.

014632 Merismopedia tenuissima Lemmermann $>1 \leq 2 \mu\text{m}$

- A) Cells: 1.3 - 1.5 μm blue-green, a few together in almost colourless mucilage
- B) Geitler (1932) gave the size range as - cells: 1.3 - 2.0 μm wide.
- C) 6 populations studied:
Anse Cèdres: AC3
Cinq Cases: CC3, CC5, CC14
Takamaka: T2, T108
- D) Recorded from films and filamentous flocs on rock and other substrates in pools. Seemingly restricted to Grande Terre.
- E) Recorded by Potts (1977) from only one location, the inland tidal pool, Bassin Lebine [^]Ile Picard, present amongst other algal communities.



10μm

Merismopedia punctata

014633 Merismopedia punctata Meyen $> 2 \leq 4 \mu\text{m}$

- A) Cells: 2.0 - 4.0 μm wide, average width 3.5 μm ;
2.0 - 2.8 μm long, average length 3.1 μm , light
blue-green.
- B) Geitler (1932) gave the size range as - cells:
2.5 - 3.5 μm wide, light blue-green.
- C) 20 populations studied:
Île Picard: W3
Anse Cédres: AC2, AC3, AC104
Cinq Cases: CC2, CC5, CC9, CC12, CC13, CC14, CC18,
CC102, CC105
Takamaka: T1, T2, T103, T121, T124, T125
- D) Recorded only from pool situations, widespread, never
abundant. From films, filamentous flocs on rock and
other substrata, aufwuchs of larger plant material and
the plankton.
- E) Recorded by Potts (1977) from only one location on
Île Picard, frequent among other algal communities.

014634 Merismopedia glauca (Ehrenb.) Nägeli $> 4 \leq 6 \mu\text{m}$

A) Cells: 4.3 - 5.0 μm wide; 3.0 - 3.5 μm long, light blue-green.

B) Geitler (1932) gave the size range as - cells:
3.0 - 6.0 μm wide.

C) Three populations studied:

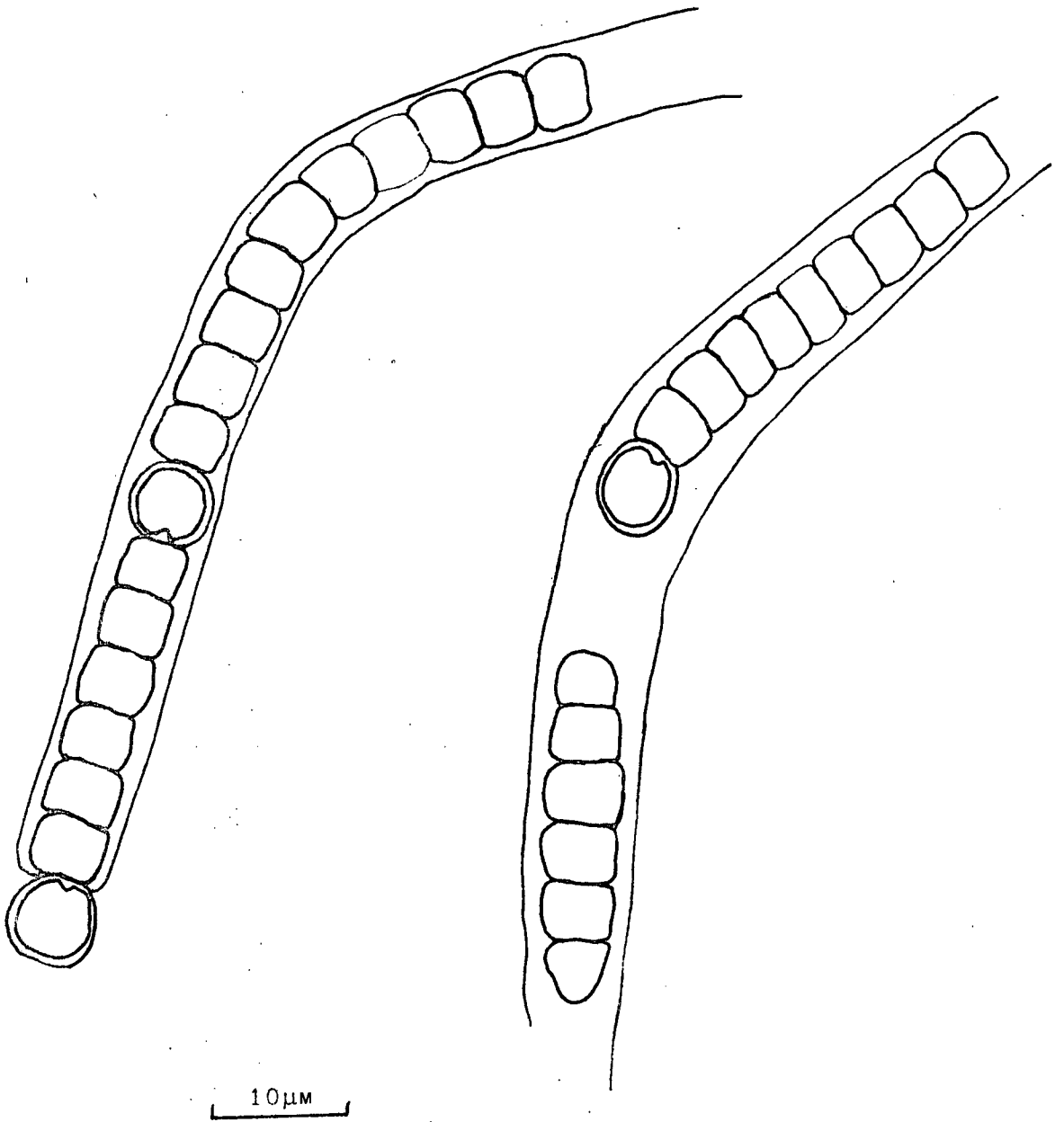
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Île Picard: W120

Cinq Cases: CC9

Takamaka: T3

D) Rare and seemingly restricted to what may be termed the more 'brackish' pools. From films on rock and other substrata and the aufwuchs of larger plant growths.

E) Recorded by Potts (1977) from only one location, present among other algal communities, Bassin Lebine, ^
Île Picard.



Microchaete tenera

014707 Microchaete tenera Thuret

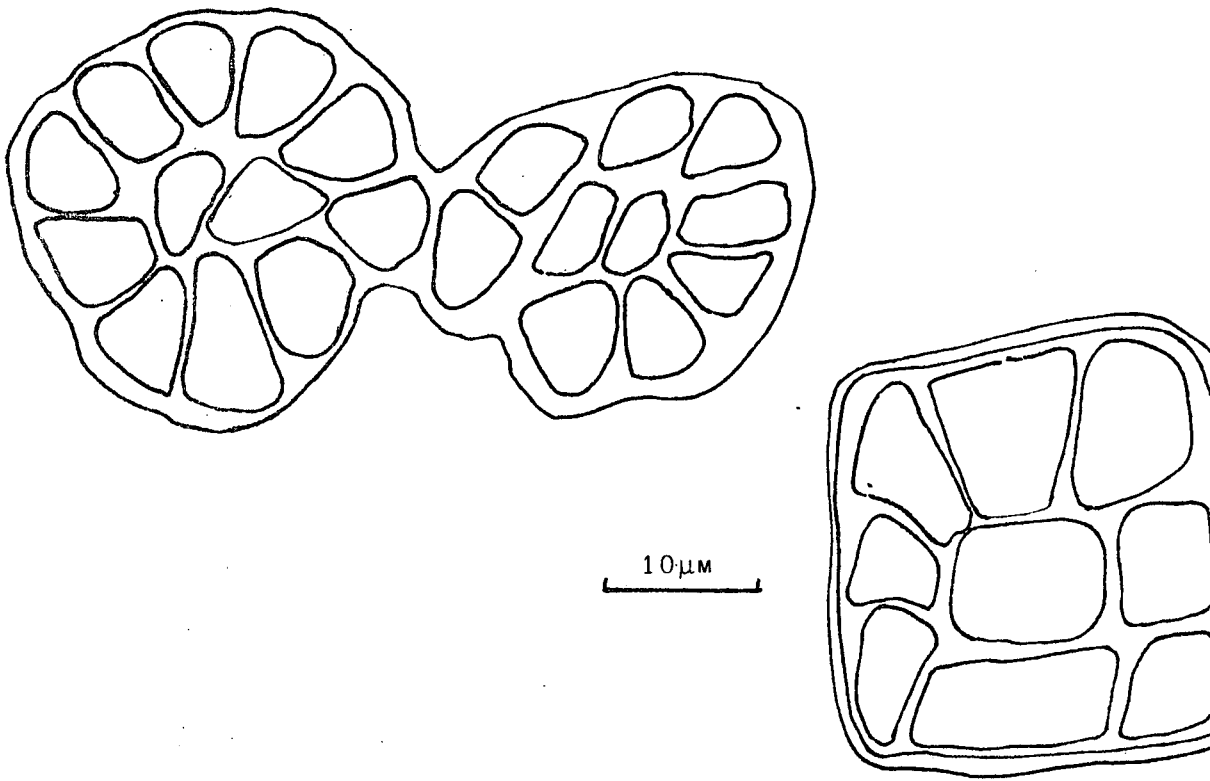
- A) Colony: a red brown expanded mucilaginous sheet, free-floating or over substrata. Filaments: average width 7.0 μm . Cells: average width 6.0 μm ; up to twice as long as broad at the bases; shorter than broad to quadratic at the apices. Heterocysts: average width 5.5 μm ; 6.0 - 8.0 μm long. Spores: 7.0 - 8.0 μm wide; 10.0 - 15.0 μm long; basal or intercalary, in series, episporic brown, smooth and shiny. Sheath: tight-fitting, thin and almost colourless.
- B) Desikachary (1959) gave the size ranges as - filaments: 6.0 - 8.5 μm wide. Cells: 5.0 μm wide; at the apices quadratic. Heterocysts: 6.0 μm wide; 6.0 - 8.5 μm long; spherical or cylindrical. Spores: 6.0 - 7.5 μm wide; 13.0 - 17.0 μm long; cylindrical.
- C) Four populations studied:
 Île Picard: 0598 + 0910, 0598 + 0911
 Cinq Cases: CC13, CC14
- D) Widespread but uncommon, where recorded very abundant. Forming free-floating or attached mucilaginous sheets in the two pools at Cinq Cases, in concrete reservoirs and the gutters of solar stills, Île Picard.
- F) From standing waters, occasionally from marshy ground, among the filaments of other algae, occasionally on damp rock. (Frémy, 1929).

014801 Microcoleus chthonoplastes Thuret

- A) Colony: a dark blue-green expanded sheet of intertwined filaments, when dry white at the edges, with a ragged appearance when overlying substrate. Filaments: with closed pointed ends, or open with trichomes protruding, composed of a sheath which is generally diffluent, surrounding almost colourless mucilage in which many trichomes are densely packed. Cells: 2.5 - 5.6 μm wide, average width 4.0; 6.1 - 10.3 μm long, average length 8.2 μm ; dark blue-green, constricted at the cross-walls, end-cell sharply pointed, conical.
- B) Geitler (1932) gave the size ranges as - cells:
2.5 - 6.0 μm wide; 3.6 - 10.0 μm long; constricted at the cross-walls, end cell pointed, conical.
- C) Eight populations studied:
Île Picard: W1, W9, 0600 + 0900, 0610 + 1140, 0619 + 0991
Île Malabar: 3143 + 1185, 3143 + 1186
- D) Recorded only for Île Picard and Île Malabar, generally very abundant. Forming dark blue-green sheets over sand and damp rock.
- E) Recorded by Whitton (1969). Recorded by Potts (1977); very abundant in many areas of the lagoon, typically forming bright green films over sediment and forming stratiform stromatolites with Schizothrix calcicola at Îles Moustique, covering areas of several km^2 .
- F) Desikachary (1959) listed many records of other authors from sea coasts, brick walls, soils, salt water areas, salt lakes, and with other algae in freshwaters from Burma, Ceylon, India and Pakistan.

014902 Microcystis flos-aquae (Wittr.) Kirchner

- A) Colony: subspherical to spherical bright-green.
Cells: 3.0 - 7.0 μm in diameter; blue-green, often heavily gas-vacuolate, evenly distributed within almost colourless homogeneous mucilage.
- B) Geitler (1932) gave the size range as - cells: 3.0 - 7.0 μm in diameter.
- C) 13 populations studied:
Anse Cédres: AC3, AC104
Cinq Cases: CC1, CC2, CC3, CC5, CC8, CC9, CC12, CC17, CC104
Takamaka: T103, 3300 + 0300
- D) Recorded only for the eastern region of Grande Terre.
From films over rock, dead wood, the plankton and in the aufwuchs of larger plant growths. Often recorded as the major element of the plankton, occasionally forming dense blooms which caused some pools to appear bright green.
- E) Recorded by Whitton (1969).



Myxosarcina sp.

015051 Myxosarcina sp., $\leq 4 \mu\text{m}$

- A) Colony: globular, three-dimensional, pseudoparenchymatous.
 Cells: 3.5 - 4.0 μm wide, angular, wedge-shaped, cubic to rounded. Sheath: in younger cells thin, and almost colourless, later thicker and yellow to brown.
 Populations of Myxosarcina were seen with cells ranging from 3.2 - 12.0 μm , suggesting the presence of only one species. The material resembled Myxosarcina chroococcoides Geitler. Geitler (1932) gave the size range as - older cells: 9.0 - 10.0 μm including sheath. He does not give a size range for younger cells but states that they were proportionately smaller.
- C) Seven populations studied:
- Île Picard: W1, W104, W107, 0580 + 0966, 0599 + 0901,
 0609 + 0900
- Île Malabar: MW1
- Grande Terre Central: SC101
- D) Widespread but rare. From films, filamentous sheets and occasionally in the aufwuchs of larger plant growths.

015052 Myxosarcina sp., $> 4 \leq 6 \mu\text{m}$

- A) Colony: globular, three-dimensional, pseudoparenchymatous.
Cells: 4.1 - 6.0 μm wide, angular wedge-shaped, cubic to rounded. Sheath: in younger cells thin, and almost colourless, later thicker and yellow to brown.

See also 015051 Myxosarcina sp., $\leq 4 \mu\text{m}$

- C) Seven populations studied:

Île Picard: W1, W104, W107, 0599 + 0901, 0600 + 0900

Île Malabar: MW1

Grande Terre Central: SC101

- D) Widespread, rare. From films, filamentous sheets and felts.

015053 Myxosarcina sp., $> 6 \leq 8 \mu\text{m}$

A) Colony: globular, three-dimensional, pseudoparenchymatous.

Cells: 6.1 - 8.0 μm wide, angular, wedge-shaped, cubic to rounded. Sheath: in younger cells thin and almost colourless, later thicker and yellow to brown.

See also 015051 Myxosarcina sp., $\leq 4 \mu\text{m}$.

C) Four populations studied:

Île Picard: W1, 0500 + 0900, 0600 + 0900

Takamaka: T2

D) From among the filaments of other algae and algal felts.

015054 Myxosarcina sp., $> 8 \mu\text{m}$

A) Colony: globular, three-dimensional, pseudoparenchymatous.

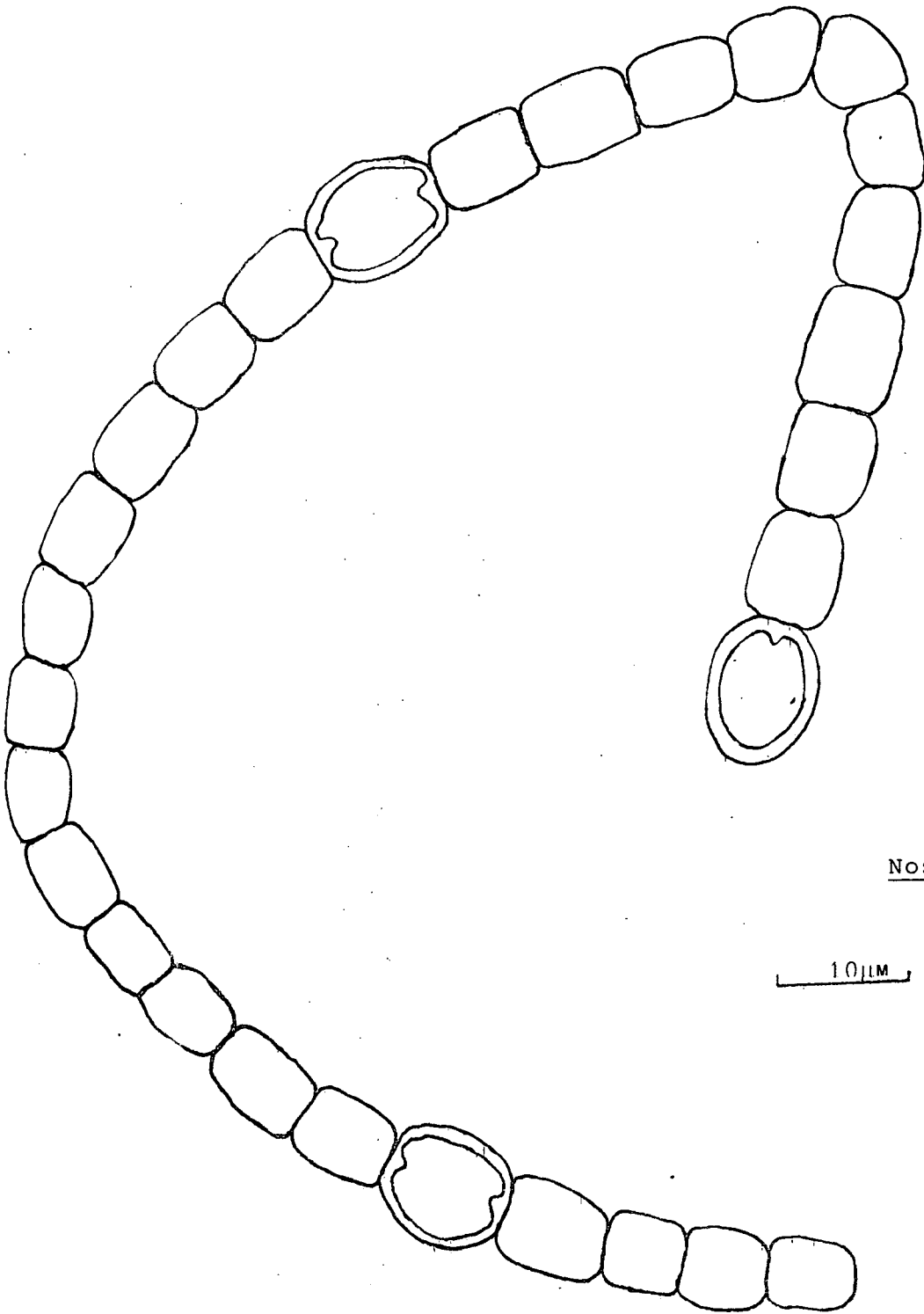
Cells: 8.1 - 12.0 μm wide, angular, wedge-shaped, cubic to rounded. Sheath: in younger cells thin and almost colourless, later thicker and yellow to brown.

See also 015051 Myxosarcina sp., $\leq 4 \mu\text{m}$.

C) Four populations studied:

^
Ile Picard: W1, 0500 + 0900, 0600 + 0900

Takamaka: T2



Nostoc carneum

10 μ m

015201 Nostoc carneum Agardh

- A) Colony up to 2 cm; spherical, later lobed, red-brown to almost black. Filaments: 3.2 - 4.8 μm wide; flesh coloured to red brown. Cells: 3.1 - 4.8 μm wide; 3.3 - 7.8 μm long; barrel-shaped to cylindrical. Heterocysts: 6.3 - 8.5 μm wide; 8.5 - 10.0 μm long. Sheath: almost colourless, diffluent, indistinct. Spores: 5.5 - 7.0 μm wide; 7.5 - 10.5 μm long; ellipsoidal, epispore smooth, formed in chains.
- B) Geitler (1932) gave the size ranges as - cells: 3.0 - 4.0 μm wide; almost twice as long as broad. Heterocysts: 6.0 μm wide. Spores: 6.0 wide; 8.0 - 10.0 μm long.
- C) Ten populations studied:
 Île Picard: W1, W2, W6, W111, W115
 Île Malabar: ME102, ME103
 Cinq Cases: CC13, CC18, CC102
- D) Widespread but uncommon, never very abundant. From films on rock and wood, among the filaments of other algae, the plankton and the aufwuchs of larger plant growths.
- F) Free-floating and on submerged rocks in stagnant pools, Africa (Frémy, 1929).

015202 Nostoc commune Vaucher.

- A) Colony: up to many cm² in area; firm, leathery, initially globular, later irregular, flattened sheets, olive-green, yellow to brown, black when dry. Filaments: densely arranged, less dense in older colonies. Cells: 3.7 - 6.7 μm wide, average width 5.1 μm; 2.7 - 9.8 μm long, average length 5.6 μm; spherical to barrel-shaped, blue-green, yellow-green or olive-green. Heterocysts: 4.4 - 7.3 μm wide; 4.8 - 7.3 μm long; oval to spherical. Spores: not noted.

Nostoc commune Vaucher var. flagelliforme (Berk. et Curtis) Bornet et Flahault occurred in Cocos nucifera groves.

- B) Geitler (1932) gave the size ranges as - cells: 4.5 - 6.0 μm wide; mostly shorter than broad. Heterocysts: 7.0 μm in diameter; spherical. Sheath: only distinct at the periphery of the colony; thick, yellow to brown.

- C) 21 populations studied:

Île Picard: W1, W3, W4, W117, 0600 + 0900, 0609 + 0900,
0564 + 1017, 0562 + 1035, 1000 + 0500

Île Malabar: 1394 + 1233, 3142 + 1185

Takamaka: T1, T2, 3300 + 0300, 3343 + 0590, 3367 + 0631,
3420 + 0640, 3400 + 0600

Île Esprit: 1000 + 0600

- D) Widespread and often very abundant. From platin, where it often formed thick, dense colonies in depressions, champignon and sand, where it never formed large colonies. Not recorded for the Cinq Cases region of Grande Terre.

015203 Nostoc commune Vaucher var. flagelliforme (Berk. et Curtis)

Bornet et Flahault

- A) Colony: 2 - 3 mm wide; 20 cm long, olive-green to brown, black when dry. Cells: 4.0 - 6.5 μ m wide; 3.0 - 9.5 μ m long; barrel-shaped. Heterocysts: 4.5 - 7.5 μ m long; oval to spherical. Sheath: indistinct. Spores: not noted.
- B) Geitler (1932) gave the size ranges as - cells: 4.5 - 6.0 μ m wide; mostly shorter than broad. Heterocysts: 7.0 μ m in diameter; spherical. Sheath: only distinct at periphery of the colony: thick, yellow to brown.
- C) One population studied:
Île Picard: 0609 + 0900
- D) Recorded only for Île Picard. Forming filamentous colonies over sand in Cocos nucifera groves. This species is probably more widespread than the records suggest as only one Cocos nucifera grove was studied in detail.
- E) Recorded by Whitton (1969).

- E) Recorded by Whitton (1969) from Île Picard and Takamaka regions.
- F) From soils, meadows, paths, depressions in rock, the edges of salt pools; cosmopolitan (Geitler, 1932); Desikachary (1959) listed many records from moist soils, rocks and stagnant waters; in Burma, India and Pakistan.

015207 Nostoc microscopicum Carm. sec. Harvey

- A) Colony: only visible with microscope, spherical, blue-green to olive-green. Cells: average width 6.0 μm ; average length 7.0 μm ; barrel-shaped to almost spherical, blue-green to olive-green. Heterocysts: 6.5 μm in diameter, spherical. Spores not noted.
- B) Geitler (1932) gave the size ranges as - cells: 5.0 - 8.0 μm wide, barrel-shaped, bright blue-green to olive-green. Heterocysts: 7.0 μm wide, almost spherical. Spores: 6.0 - 7.0 μm wide, 9.0 - 15.0 μm long.
- C) Six populations studied:
- ^
Île Picard: W1, 0590 + 0920, 0600 + 0900
- Cinq Cases: CC13
- Takamaka: T1, 3420 + 0640
- D) Widespread, rare. From films, among the filaments of other algae, felts and in the aufwuchs of larger plant growths.

015211 Nostoc punctiforme (Kütz.) Hariot

- A) Colony: only visible with a microscope, rounded to elongate. Filaments: densely arranged within colourless to yellow-brown mucilage such that individual filaments cannot be distinguished. Cells: 3.5 - 4.2 μm wide; 3.0 - 6.0 μm long; barrel-shaped, blue-green to almost brown. Heterocysts: 4.6 μm wide; spherical to hemispherical. Sheath: tight-fitting and indistinct. Spores: not noted.
- B) Geitler (1932) gave the size ranges as - cells: 3.0 - 4.0 μm wide; spherical to ellipsoid. Heterocysts: 4.0 - 6.5 μm wide; spherical. Spores: 5.0 - 6.0 μm wide; 5.0 - 8.0 μm long; spherical to elongate, membrane almost colourless and smooth.
- C) 15 populations studied:
- Île Picard: W1, W2, W4, W5, W6
 - Île Malabar: MW101
 - Anse Cèdres: AC2, AC103
 - Cinq Cases: CC8, CC9, CC12, CC13, CC112
 - Takamaka: 3345 + 0551
- D) Widespread, though never abundant. From films, among filaments of other algae, felts, occasionally as a component of the plankton and the aufwuchs of larger plants.

015213 Nostoc sphaericum Vaucher

- A) Colony: up to 2 cm in diameter; spherical, olive-green to yellow-green, with a firm outer skin. Filaments: densely arranged around the periphery of the colony. Cells: 4.0 - 6.0 μm wide; shorter than broad to quadratic, barrel-shaped to almost spherical. Heterocysts: 6.0 μm long in diameter; spherical. Spores: 5.0 - 7.0 μm wide; 6.0 - 8.0 μm long; spherical to elliptical, with a smooth almost colourless membrane, formed in chains. Sheath not visible.
- B) Geitler (1932) gave the size ranges as - cells: 4.0 - 5.0 μm wide. Heterocysts: 6.0 μm in diameter; spherical. Spores: 5.0 μm wide; 7.0 μm long; oval with a smooth brown sheath.
- C) 3 populations studied:
Cinq Cases: CC11
- D) Recorded only from the Bassin Flamant area of Grande Terre. From the bottom of shallow pools, older colonies free-floating.

015218 Nostoc piscinale Kützing

- A) Colonies: up to 2 cm; light green, mucilaginous or diffluent. Filaments: 4.0 μm wide. Cells: average width 3.8 μm ; quadratic to longer than broad; barrel-shaped, light blue-green in colour. Heterocysts: average width 4.5 μm ; spherical to ellipsoid. Sheath: almost colourless, loose-fitting, only distinct at periphery. Spores: 5.5 - 7.5 μm wide; oval with smooth almost colourless membrane, formed in chains.
- B) Geitler (1932) gave the size ranges as - cells: 3.7 - 4.0 μm wide. Heterocysts: 4.5 - 6.0 μm wide; spherical to ellipsoid. Spores: 6.0 - 8.0 μm wide.
- C) Three populations studied:
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Île Picard: W6
^
Île Malabar: MW102, MW104
- D) Recorded only from the north western areas of the atoll.
Free-floating or attached colonies in pools.
- F) In standing water, initially attached, later free-floating; very cosmopolitan (Geitler, 1932).

015504 Oscillatoria amphibia Agardh

- A) Trichomes: 2.0 - 2.8 μm wide; single or a few together, never seen to form a colony. Cells: 2.5 - 5.3 μm long; not constricted at the cross-walls, end-cell rounded, not capitate and without calyptra.
- B) Geitler (1932) gave the size ranges as - trichome: 2.0 - 3.5 μm wide. Cells: 4.0 - 8.5 μm long; not constricted at the cross-walls; light blue-green, end-cell rounded, not capitate, without calyptra.
- C) Five populations studied:
Île Malabar: MW101
Anse Cèdres: AC103
Cinq Cases: CC2, CC9
Takamaka: T3
- D) Widespread, never abundant. From films, filamentous flocs, the plankton and the aufwuchs of larger plant growths.
- F) In standing waters, from damp soil in greenhouses, thermal springs and brackish waters; cosmopolitan (Geitler, 1932); planktonic in freshwater tanks, lakes and ponds; in plankton of rivers and salt lakes; on moist soil and submerged objects (Desikachary, 1959).

015505 Oscillatoria angusta Koppe

- A) Trichomes: 0.9 - 1.5 μm wide; single or a few together, pale blue-green. Cells: 2.8 - 7.5 μm long; not constricted at the cross-walls; end-cell round, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 0.8 - 1.2 μm wide. Cells: 5.0 - 7.0 μm long; not constricted at the cross-walls.
- C) 12 populations studied:
Île Picard: W2, W5, W6, W7, W9, W102, W111
Anse Cèdres: AC3
Cinq Cases: CC5, CC14, CC105
- D) Widespread but never abundant. From films, filamentous flocs on rock and other substrata, occasionally the plankton and the aufwuchs of larger plant growths.

015506 Oscillatoria animalis Agardh

- A) Trichomes: 3.0 - 5.0 μm wide, average width, 3.8 μm ; tapered towards the apex, many intertwined to form an expanded blue-green to olive-green sheet. Cells: 1.5 - 3.1 μm long, average length 2.3 μm ; not constricted at the cross-walls, end cell conical, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 3.0 - 4.0 μm wide. Cells: 1.6 - 5.0 μm long, mostly shorter than broad, up to half as long as broad, seldom longer than broad.
- C) 28 populations studied:
- ^
Île Picard: W1, W2, W5, W6, W7, W9, W107, W112, W115, W122,
0600 + 0900, 0500 + 0900, 0562 + 1035
- ^
Île Malabar: MW101, ME 102, ME103, ME107
- Anse Cèdres: AC103
- Cinq Cases: CC5, CC15, CC18, CC101
- Takamaka: 3367 + 0631
- Grande Terre Central: SC101, SC102
- D) Widespread and often very abundant, from terrestrial and aquatic situations. Forming sheets over damp mud rock and other substrata, and the surfaces of pools. Also from the aufwuchs of larger plant growths. Oscillatoria animalis, and a similar species, O. brevis were found to be two of the first species to develop after a previously dried-out pool was rewetted. These species were seen to form dark blue-green to olive-green sheets over the surface of the damp mud. As the pool filled with water

these sheets were seen to lift off the mud and float at the surface.

F) In stagnant cold and warm waters, sulphur springs and on the walls of greenhouses; cosmopolitan (Geitler, 1932); in ponds and ditches, paddy fields, road slimes, river plankton, the barks of trees and on moist soil; Ceylon (West and West, 1902).

015508 Oscillatoria brevis (Kütz.) Gomont

- A) Trichomes: 4.2 - 6.8 μm wide, average width, 5.1 μm tapered towards the apex, many intertwined to form a dark blue-green to olive-green expanded sheet.
Cells: 1.5 - 5.0 μm long, average length 2.9 μm ; not constricted at the cross-walls, occasionally granulate at cross-walls, end-cell rounded or conical, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 4.0 - 6.5 μm wide. Cells: 1.5 - 3.0 μm long, 0.5 - 0.3 times as long as broad; cross-walls granulate, end-cell rounded or conical.
- C) 12 populations studied:
Île Picard: W1, W2, W3, W6, W7, W9, W103, W104, W111, W116, W117, W120
- D) Recorded only from Île Picard as widespread and often abundant. Forming extensive filamentous sheets over mud, rock and other substrata. One of the first colonizers of rewetted pools (see 015506 Oscillatoria animalis).
- F) In stagnant water, brackish water, lake muds, damp masonry; cosmopolitan (Geitler, 1932); from puddles, tanks, pools, salt lakes, creeks, in soil cultures, India (for references see Desikachary, 1959).

015509 Oscillatoria chalybea (Mertens) Gomont

- A) Trichomes: average width 10.3 μm slightly attenuated towards the apex, single or a few intertwined, rarely forming a colony. Cells: average length 4.0 μm ; slightly constricted at the cross-walls, end-cell rounded.
- B) Geitler (1932) gave the size ranges as - trichomes: 8.0 - 13.0 μm wide. Cells: 0.5 - 0.3 as long as broad: cross-walls occasionally slightly granulate, end-cell broadly rounded, longish.
- C) One population studied:
Takamaka: T102
- D) Only recorded once, from among a film of algae in a pool.
- F) From a pond, Ceylon (Gomont, 1892); from a pond, Malaya (Biswas, 1929); in salt lakes, tanks, rainwater, puddles, drains, rice fields, Calcutta (Biswas, 1926); in standing waters, mud, on stones, sticks, soil, brackish waters, thermal springs; cosmopolitan (Geitler, 1932).

015510 Oscillatoria chlorina Kützing

- A) Trichomes: 3.4 - 6.0 μm wide, average width 4.5 μm ; single or a few intertwined, rarely forming a colony, distinctly yellow-green in colour. Cells: 3.5 - 8.0 μm long, average length 5.9 μm ; not constricted at the cross-walls, the latter occasionally indistinct, end-cell rounded, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 3.5 - 4.0 μm wide, occasionally up to 6.0 μm wide. Cells: 3.7 - 8.0 μm long; end-cell occasionally possessing a hyaline cap.
- C) Eight populations studied:
 Île Picard: W1, W5, W7, W111
 Cinq Cases: CC14
 Takamaka: T2, T102, T121
- D) Slightly restricted in distribution but widespread, occasionally fairly abundant. From films, and filamentous flocs over mud, rock and other substrata, occasionally planktonic.
- F) Planktonic in backwaters, lakes and lagoons, Ceylon (Crow, 1923); from rotting mud, brackish waters, Europe, North America, Antarctica, Africa (Geitler, 1932); in a filter tank India (Gupta, 1956).

015511 Oscillatoria claricentrosa Gardner

- A) Trichomes: average width 2.5 μm ; attenuate towards the apex, single or a few together. Cells: average length 5.4 μm ; pale blue-green, slightly constricted at the cross-walls, end-cell conical, pointed.
- B) Geitler (1932) gave the size ranges as - trichomes: 2.3 - 2.5 μm wide; attenuating to a point at the apex. Cells: 6.0 - 8.0 μm long, occasionally up to 11.0 μm long; slightly constricted at the cross-walls.
- C) One population studied:
Cinq Cases: CC5
- D) Recorded only once in a filamentous floc overlying rock.

015514 Oscillatoria geminata Meneghini

- A) Trichomes: 2.0 - 3.9 μm wide, average width 2.6 μm ;
light blue-green to yellow-green, single or many inter-
twined to form an expanded light blue-green sheet.
Cells: 2.0 - 12.0 μm long; distinctly constricted at
the cross-walls, cross-walls thick, end-cell rounded, not
capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes:
2.3 - 4.0 μm wide. Cells: 2.3 - 16.0 μm long; con-
stricted at the cross-walls, cross-walls thick, end-cell
rounded.
- C) Seven populations studied:
^
Île Picard: W1, W111, W115, W122
Cinq Cases: CC107
Takamaka: T1
Grande Terre Central: SC102
- D) Widespread and occasionally abundant. From the surface
of rock mud and other substrata, also in plankton.
- F) From peat bogs, greenhouses, thermal springs, brackish
water; very cosmopolitan (Geitler, 1932).

015517 Oscillatoria limosa Agardh

- A) Trichomes: 12.3 - 16.8 μm wide; many intertwined to form a dark blue-green to olive-green expanded mat.
Cells: 2.0 - 4.3 μm long, not constricted at the cross-walls, cross-walls occasionally granulate, cells often heavily gas-vacuolate, end-cell broadly rounded, occasionally possessing a slightly thickened membrane.
- B) Geitler (1932) gave the size ranges as - trichomes: 11.0 - 22.0 μm wide, mostly 13.0 - 16.0 μm wide.
Cells: 2.0 - 5.0 μm long.
- C) Seven populations studied:
Île Picard: W4, W7, W9, W122, 0619 + 0991
Takamaka: T3, T103
- D) Recorded only from Île Picard and the Takamaka region of Grande Terre, occasionally very abundant. Forming large sheets over damp mud.
- F) From standing or slow-flowing waters, attached or free-swimming, also from salt waters; cosmopolitan (Geitler, 1932); Desikachary (1959) listed many records from standing fresh and salt waters in Burma, Ceylon, India and Malaya.

015520 Oscillatoria princeps Vaucher

- A) Trichomes: 32.5 - 42.0 μm wide; abruptly attenuate towards the apex, single or a few together in a common homogeneous, almost colourless mucilage. Cells: 4.5 - 8.3 μm long, not constricted at the cross-walls, cross-walls occasionally granulate, end-cell rounded, occasionally capitate.
- B) Geitler (1932) gave the size ranges as - trichomes: 16.0 - 60.0 μm wide. Cells: 3.5 - 7.0 μm long.
- C) Four populations studied:
Cinq Cases: CC12, CC13, CC14, CC15
- D) Recorded only from the Cinq Cases region of Grande Terre, usually in the aufwuchs of Chara zeylanica, occasionally free-floating.
- F) From standing and flowing waters, beach mud, attached or free-swimming, from thermal springs; cosmopolitan (Geitler, 1932); Desikachary (1959) listed many records from Burma, Ceylon and Pakistan.

015521 Oscillatoria proboscidea Gomont

- A) Trichomes: average width 13.4 μm ; attenuate towards the apex, intertwined to form a light blue-green, gelatinous sheet. Cells: average length 2.5 μm ; not constricted at the cross-walls, end cell rounded, capitate.
- B) Geitler (1932) gave the size ranges as - trichomes: 12.0 - 15.0 μm wide, distinctly attenuate, occasionally hooked or spiralled. Cells: 2.0 - 4.0 μm long, end-cell rounded, capitate.
- C) One population studied:
Takamaka: T1
- D) Recorded only once, large gelatinous colonies floating at the surface of a pool.
- E) In standing water, over mud, among Oscillatoria princeps, thermal springs; Europe, North America, Antilles, Africa (Geitler, 1932); Desikachary (1959) listed a number of records from standing waters, drains, moist soil in Burma, Ceylon and India.

015523 Oscillatoria pseudogeminata Schmidle

- A) Trichomes: 1.2 - 2.6 μm wide, average width 1.8 μm ; generally single or a few together. Cells: 1.5 - 3.5 μm long, average length 2.2 μm ; not constricted at the cross-walls, cross walls very thick, end-cell rounded, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.3 - 2.2 μm wide. Cells: 2.6 μm long; quadratic, longer or shorter than broad.
- C) 41 populations studied:
- Île Picard: W1, W2, W3, W4, W5, W6, W7, W103, W104, W111, W114, W116, W116, W117, W120
- Île Malabar: MW101, ME102, ME103
- Anse Cédres: AC2, AC3, AC103, AC104, AC109, AC111, AC112
- Cinq Cases: CC3, CC5, CC9, CC12, CC13, CC17, CC101, CC102
- Takamaka: T1, T2, T108, T122, T124
- Grande Terre: SC101
- D) Widespread and common in pool situations. From films, filamentous flocs, as small floating colonies, the plankton, in the aufwuchs of larger plant growths.

015530 Oscillatoria subtilissima Kützing

- A) Trichomes: 0.8 - 1.3 μ m wide; single or a few intertwined, yellow-green to light blue-green.
Cells: 1.0 - 3.9 μ m long; not constricted at the cross-walls, cross-walls indistinct.
- B) Geitler (1932) gave the size ranges as - trichomes:
1.0 - 1.5 μ m wide; cross-walls indistinct.
- C) Four populations studied:
Île Picard: W6, W118
Cinq Cases: CC9
Takamaka: T1
- D) Widespread but rare. From films, felts and the aufwuchs of larger plant growths.
- F) Planktonic in brackish water, freshwater ponds and lakes; Ceylon (Crow, 1923.); in filter beds, slimy patches on roadways; India (Bruhl and Biswas, 1922).

015585 Oscillatoria tenuis Agardh

- A) Trichomes: 3.9 - 10.5 μm wide, average width 6.9 μm ; many intertwined to form a thin expanded sheet which is often ragged at the edges. Cells: 2.3 - 5.0 μm long, average length 3.7 μm ; slightly constricted at the cross-walls, end-cell rounded, transparent, occasionally very pointed.
- B) Geitler (1932) gave the size ranges as - trichomes: 4.0 - 10.0 μm wide; bent back at the apex. Cells: 2.5 - 5.0 μm long, up to 0.3 as long as broad; slightly constricted at the cross-walls, granulate at the cross-walls, end-cell hemispherical with slightly thickened outer membrane.
- C) 11 populations studied:
^
Ile Picard: W1, W4, W112
Cinq Cases: CC5, CC9, CC14, CC15, CC105
Takamaka: T1, T2, T102
- D) Widespread and occasionally abundant. From films, filamentous flocs, floating at the surface of pools, over rock, mud and other substrata. This species was one of the first algae to appear when previously dry pools were rewetted.
- F) Desikachary (1959) listed many records from freshwater ponds, tanks, shallow pools, rainwater puddles, springs, rivers, salt lakes, moist soils and the barks of trees in Burma, Ceylon, India and Pakistan.

015586 Oscillatoria acuta Bruhl et Biswas

- A) Trichomes: average width 4.9 μm ; slightly attenuate towards the apex, single or a few together. Cells: 3.4 - 4.0 μm long; not constricted at the cross-walls, end cell conical, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 4.0 - 6.0 μm wide; singles or in bundles. Cells: 3.0 - 4.0 μm long; not constricted at the cross-walls, end cell sharply pointed, not capitate, without calyptra.
- F) Five populations studied:
Cinq Cases: CC9, CC14, CC15
Takamaka: T2, T102
- D) Recorded from only two regions, never abundant.
From damp mud and the aufwuchs of larger plant growths.
- F) From the bark of trees (Ficus, Terminalia and others); Calcutta (Bruhl and Biswas, 1922); from mud slimes, attached to blades of grass and in rainwater pools, India (Biswas, 1935).

015587 Oscillatoria acuminata Gomont

- A) Trichomes: average width 4.5 μm ; briefly tapering towards the apex. Cells: average length 6.5 μm ; not constricted at the cross-walls, end-cell conical, sharply pointed, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 3.0 - 5.0 μm wide. Cells: 5.5 - 8.0 μm wide; quadratic to longer than broad, cross-walls occasionally granulate.
- C) One population studied:
Cinq Cases: CC5
- D) Recorded only once, among other algae over damp mud.
- F) In thermal springs, cold waters; Europe, Ceylon, Africa (Geitler, 1932).

015588 Oscillatoria acutissima Kuff

- A) Trichomes: average width 1.7 μm ; slightly attenuate towards the apex, blue-green, single or a few together. Cells: average length 3.9 μm ; slightly constricted at the cross-walls, end-cell conical, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.5 - 2.0 μm wide; slightly attenuate towards the apex, recurved. Cells: 3.0 - 7.0 μm long; slightly constricted at the cross-walls.
- C) One population studied:
Takamaka: T102
- D) Recorded only once from a film of algae on the surface of the bottom mud of a pool.

015589 Oscillatoria amphigranulata Woronich

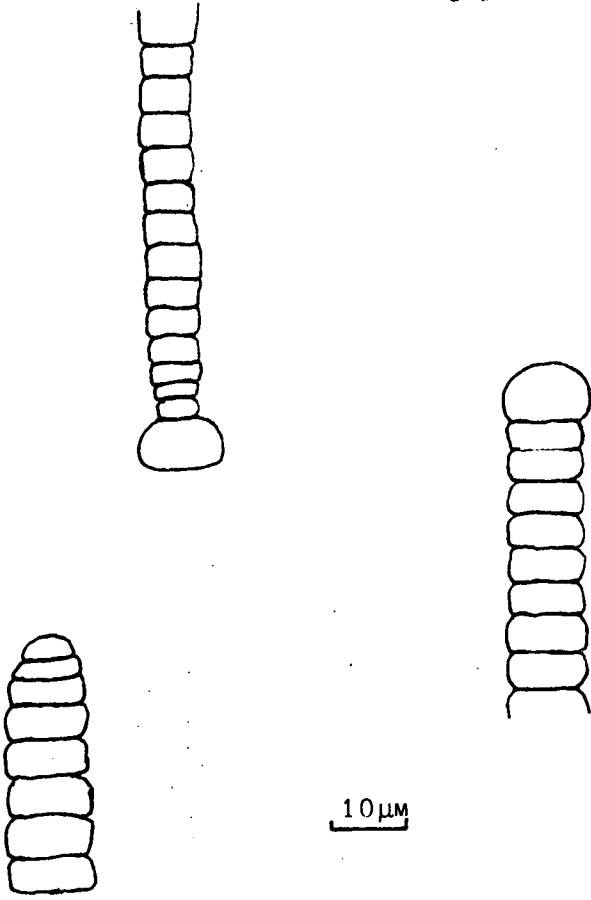
- A) Trichomes: 1.6 - 2.0 μm wide; light blue-green, single or a few together. Cells: 1.5 - 5.0 μm long; distinctly constricted at the cross-walls, end-cell round, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.5 - 2.0 μm wide. Cells: 2.5 - 5.0 μm long, up to twice as long as broad; distinctly constricted at the cross-walls, cross-walls possessing two gas-vacuoles, end-cell rounded, not capitate, without calyptra.
- C) Six populations studied:
^
Île Picard: W2, W6
Cinq Cases: CC2, CC3, CC18, CC104
- D) Recorded from only two areas of the atoll. From films, filamentous flocs, and felts, over rock, mud and other substrata.
- F) With Oscillatoria limosa, Oscillatoria chalybea and purple bacteria in mud, in small lakes in Holland (Geitler, 1932); planktonic in rivers in India (Desikachary, 1959).

015590 Oscillatoria guttalata van Goor

- A) Trichomes: average width 4.0 μm ; single or a few together. Cells: average length 5.5 μm ; not constricted at the cross-walls, occasionally granulate at the cross-walls, end-cell rounded, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 2.0 - 4.5 μm wide, mostly 3.0 - 4.0 μm wide. Cells: 3.5 - 8.0 μm ; quadratic or up to twice as long as broad, mostly 6.0 μm long; cross-walls indistinct, gas-vacuoles present.
- C) One population studied:
Takamaka: T102
- D) Recorded only once from the surface of the bottom mud of a pool.
- F) With Oscillatoria chlorina, Oscillatoria limosa and purple bacteria over beach mud, free-swimming in a lake in Holland (Geitler, 1932).

015591 Oscillatoria jatorvensis Vouk

- A) Trichomes: average width 2.7 μm ; single or a few together. Cells: average length 2.5 μm ; not constricted at the cross-walls, end-cell rounded, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 2.5 - 3.0 μm wide. Cells: quadratic.
- C) Two populations studied:
Île Picard: W5
Cinq Cases: CC14
- D) Recorded only on two occasions from two widely separated pools. From floating clumps of Oscillatoria tenuis and in the plankton.



Oscillatoria koetlitzi

015592 Oscillatoria koetlitzii F. E. Fritsch

- A) Trichomes: 7.5 - 8.1 μm wide. Cells: 4.0 - 5.0 μm long; not constricted at the cross-walls, occasionally granulate at the cross-walls, end-cell rounded, more often swollen, clearly capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 7.0 - 9.0 μm wide. Cells: 3.0 - 4.5 μm long, 0.3 to 0.5 as long as broad; disc-shaped, cross-walls rarely constricted, granulate, end-cell \pm swollen, often colourless.
- C) Three populations studied:
Cinq Cases: CC14, CC18
Takamaka: T1
- D) Recorded only on three occasions. From film overlying bottom mud of pools and in the aufwuchs of Chara zeylanica.

015593 Oscillatoria lacustris (Kleb.) Geitler

A) Trichomes: 6.0 - 7.2 μm wide; attenuate towards the apex, single or many intertwined to form a thin, dark-blue-green, expanded sheet. Cells: 3.5 - 8.5 μm long, end-cell up to 14.5 μm long; slightly constricted at the cross-walls, barrel-shaped, cylindrical, not capitate, without calyptra.

B) Geitler (1932) gave the size ranges as - trichomes: 5.0 - 7.0 μm wide; slightly attenuate towards the apex, many intertwined in free-swimming bundles. Cells: 3.0 - 7.0 μm long, gas vacuolate, end-cell up to 12.0 μm long, almost cylindrical.

Desikachary (1959) included this alga under Trichodesmium. Geitler (1932) and Starmach (1966) included this alga under Oscillatoria.

C) Four populations studied:

Cinq Cases: CC5, CC14, CC15

Grande Terre Central: SC102

D) Recorded from only two regions of Grande Terre. Forming expanded sheets over damp mud, free-floating sheets and in the aufwuchs of larger plant growths.

015596 Oscillatoria obscura Bruhl et Biswas

- A) Trichomes: average width 4.0 μm , light blue-green.
Cells: average width 1.5 μm ; not constricted at the cross-walls, gas vacuolate.
- B) Geitler (1932) gave the size ranges as - trichomes: 4.0 μm wide; blue-green. Cells: up to 0.2 times as long as broad, not constricted at the cross-walls.
Desikachary (1959) gave the size ranges as - 3.3 - 4.8 μm wide. Cells: 1.0 - 1.6 μm long.
- C) One population studied:
Cinq Cases: CC9
- D) Recorded only on one occasion, free-floating in a pool.

015597 Oscillatoria okeni Agardh.

- A) Trichomes: single or a few together. Cells: average width 6.0 μm ; average length 2.8 μm , blue-green, end-cell rounded, without calyptra.
- B) Geitler (1932) gave the size range as - cells: 5.5 - 9.0 μm wide; 2.7 - 4.5 μm long, up to 8.0 μm long at the ends; end-cell rounded or slightly pointed.
- C) One population studied:
Cinq Cases: CC13
- D) Recorded on only one occasion from among the filaments of other algae over rock.

015598 Oscillatoria tambi Woronich

- A) Trichomes: average width 3.4 μm ; light blue-green, single or a few together. Cells: average length 3.2 μm ; slightly constricted at the cross-walls, end-cell rounded, not capitate, without calyptra.
- B) Geitler (1932) gave the size ranges as - trichomes: 3.2 - 3.5 μm wide. Cells: quadratic; occasionally slightly constricted at the cross-walls, end-cell rounded, not capitate, without calyptra.
- C) Three populations studied:
Île Picard: W1, W3, W112
- D) Recorded only for Île Picard. Free-floating or in films over mud.

015704 Phormidium foveolarum Gomont

- A) Filaments: average width 1.5 μm ; many intertwined to form a mucilaginous, membranous sheet. Cells: average width 1.5 μm , average length 1.0 μm ; constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: thin, almost colourless, diffluent. Includes also Phormidium africanum Lemmermann.
- B) Geitler (1932) gave the size ranges as - trichomes: average width 1.5 μm . Cells: 0.8 - 2.0 μm wide; shorter than broad to quadratic; constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: thin, smooth, almost colourless, diffluent.
- C) 13 populations studied:
- ^
Île Picard: W1, W2, W5, W6, W7, W107, W115, 0609 + 0900,
0599 + 0901
- ^
Île Malabar: MW103
- Cinq Cases: CC5
- Grande Terre Central: SC101
- D) Recorded from terrestrial and pool situations, widespread and occasionally abundant, especially on Île Picard. From films over rock, forming filamentous sheets over rock and other substrata, among other algal felts, occasionally free-floating.
- F) From damp soil, damp calcareous rock, stagnant waters (Gomont, 1892); Desikachary (1959) listed many records from, moist soils, paddy and wheatfield soils, and rocks in a shallow stream in India.

015705 Phormidium hendersonii Lemmermann

- A) Filaments: average width 1.6 μm ; many intertwined to form an expanded sheet. Cells: average width 1.6 μm ; average length 8.8 μm ; cross-walls; not constricted, wide, very distinct, end-cell rounded, without calyptra. Sheath: thin, diffluent, almost colourless.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.5 - 1.8 μm wide, 3.0 - 9.0 μm long, 2 - 6 times longer than broad; not constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: thin, indistinct, diffluent, almost colourless.
- C) 18 populations studied:
- Île Picard: W1, W9, W119, 0600 + 0900
 - Île Malabar: MW101, MW104, ME103, ME111
 - Anse Cédres: AC1, AC112
 - Cinq Cases: CC5, CC18, CC102, CC104
 - Takamaka: T102
 - Grande Terre Central: SC101, SC102
- D) Recorded from terrestrial and aquatic habitats, widespread and occasionally fairly abundant. From algal films over rock and other substrata, forming filamentous sheets, among algal felts.

015707 Phormidium jenkelianum Schmidle

- A) Trichomes: average width, 2.2 μm ; many intertwined to form a mucilaginous thallus. Cells: average length 0.9 μm , distinctly constricted at the cross-walls, end-cell rounded, without calyptra. Sheath not seen.
- B) Geitler (1932) gave the size ranges as - trichomes: 2.0 - 2.6 μm wide. Cells: 0.6 - 1.3 μm wide; 0.3 - 0.5 as long as broad; cross-walls distinctly constricted, end-cell, truncated, rounded, without calyptra. Sheath: delicate.
- C) 27 populations studied:
- ^ Ile Picard: W1, W3, W4, W5, W9, W107, W113, W116,
W117, W119, 0600 + 0900
- ^ Ile Malabar: ME108
- Anse Cédres: AC101, AC103, AC104, AC112
- Cinq Cases: CC2, CC5, CC8, CC13, CC101, CC102
- Takamaka: T108, T122, 3420 + 0640, 3400 + 0600
- Grande Terre/Central: SC101
- D) One of the commonest and most widespread species on the atoll, often very abundant. From terrestrial and pool situations from films, filamentous flocs, algal felts, the aufwuchs of larger plant growths, occasionally free-floating, also forming an association with Nostoc sp. overlying platin near Bassin Cabri, ^ Ile Picard.

015708 Phormidium mucicola Huber-Pestalozzi et Naumann

- A) Trichomes: average width 1.7 μm . Cells: average length 2.8 μm ; cross walls not constricted, wide, end-cell rounded, without calyptra. Sheath: thin, diffluent.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.5 - 2.0 μm wide. Cells: up to twice as long as broad; \ddagger constricted at the cross-walls, end-cell rounded. Sheath very thin.
- C) 23 populations studied:
 ^ Ile Picard: W1, W4, W5, W6, W7, W104, W115, W117,
 0600 + 0900, 0500 + 0900
 ^ Ile Malabar: MW101, MW104
 Cinq Cases: CC2, CC5, CC8, CC18, CC102
 Takamaka: T1, T2, T125, 3345 + 0551
- D) Widespread, common and occasionally fairly abundant.
 From the mucilage of other algae, Anabaena sp.,
Aphanocapsa spp., Aphanothece spp., Calothrix sp.,
Gloeocapsa sp., Gloeothece sp.
- E) Recorded by Whitton (1969).

015713 Phormidium rubroterricola Gardner

A) Trichomes: average width 2.0 μm ; many together forming mucilaginous sheets. Cells: average length 1.8 μm , not constricted at the cross-walls, end-cell rounded or conical, without calyptra. Sheath: indistinct, thin, diffluent.

B) Geitler (1932) gave the size ranges as - trichomes: 2.2 - 2.4 μm wide. Cells: quadratic, shorter or longer than broad; end-cell bluntly-conical. Sheath: distinct, firm.

Though the Aldabran material in most respects was very similar to that described in Geitler (1932), it differed in that the sheath was not distinct and tended to be diffluent.

C) Four populations studied:

Île Picard: W4, W115

Île Malabar: 3143 + 1186

Anse Cédres: AC112

D) Widespread but rare. From terrestrial and pool situations, among algal felts, occasionally encrusting.

015769 Phormidium bohneri Schmidle

- A) Filaments: average width 1.9 μm ; many intertwined to form an expanded sheet or occasionally a colonial ball. Cells: average width 1.8 μm ; average length 1.0 μm ; not constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: indistinct, diffluent.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.7 - 2.0 μm wide. Cells: quadratic to longer than broad; end-cell rounded, without calyptra, sheath \pm diffluent.
- C) 23 populations studied:
- Île Picard: W4, W5, W6, W7, W107, W110, W113, 0564 + 1017,
0500 + 0900
 - Île Malabar: MW, MW103, ME101, ME102
 - Anse Cèdres: AC1, AC103, AC111
 - Cinq Cases: CC9, CC14, CC15, CC102, 3912 + 0615
 - Takamaka: 3420 + 0640
 - Grande Terre Central: SC101
- D) Recorded from terrestrial and pool situations, widespread and occasionally abundant. From films, filamentous sheets and felts.
- F) From damp soil; India, Cameroons (Schmidle, 1901); moist soil, submerged objects; Rangoon, Burma (Ghose, 1927a, 1927b).

015770 Phormidium corium Gomont

- A) Filaments: 3.4 - 4.5 μm wide; grey-blue to blue-green, many intertwined to form a thick mat. Cells: average width 3.5 μm ; average length 5.7 μm ; not constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: thick, almost colourless, often extending beyond the apex of the trichome, many empty sheaths form matrix of the colony.
- B) Geitler (1932) gave the size ranges as - trichomes: 3.0 - 4.5 μm ; briefly attenuate towards the apex. Cells: 3.4 - 8.0 long, quadratic up to twice as long as broad; not constricted at the cross-walls, end-cell truncate-conical, without calyptra. Sheath: thin, often mucilaginous.
- C) Six populations studied:
 A
 Ile Picard: W4, 0600 + 0900, 0591 + 0921
 Cinq Cases: CC9
 Takamaka: 3343 + 0590, 3400 + 0600
- D) Recorded from terrestrial and pool situations. From algal felts, aufwuchs of larger plant growths, bark of trees, especially well-developed on the undersides of branches of Calophyllum trees in Takamaka grove.
- F) In stagnant and flowing waters, bases of tree trunks, damp masonry, edges of thermal springs (Geitler, 1932); Desikachary (1959) listed many records from, moist soils, walls, paddy-fields and estuarine areas in India.

015771 Phormidium molle Gomont

- A) Filaments: average width 3.4 μm , many intertwined to form a mucilaginous expanded sheet. Cells: average width 3.2 μm ; average length 5.0 μm ; distinctly constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: indistinct, diffluent.
- B) Geitler (1932) gave the size ranges as - trichomes: 2.7 - 3.3 μm wide. Cells: 3.0 - 8.0 μm long, quadratic, shorter or longer than broad; distinctly constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: almost colourless, \pm diffluent, delicate.
- C) Nine populations studied:
 Île Picard: W1, W5, W6
 Cinq Cases: CC3, CC9, CC102, CC104
 Takamaka: T1, 3343 + 0590
- D) Recorded in terrestrial and pool situations. From films, filamentous sheets, algal felts, floating at the surface of pools, the aufwuchs of larger plant growths.
- E) Recorded by Potts (1977) from Île Picard, Île Malabar, and Grande Terre; very abundant at Passe Houareau, forming bright green films over the surface of silt in tidal depressions.

015772 Phormidium usterii Gomont

- A) Filaments: 3.0 - 3.8 μm wide; many intertwined to form a mucilaginous or membranous expanded sheet. Cells: 2.8 - 3.8 μm wide; 2.5 - 3.5 μm long; constricted at the cross-walls, end-cell rounded, without calyptra. Sheath: thin, indistinct, diffluent.
- B) Geitler (1932) gave the size ranges as - trichomes: 3.0 - 4.0 μm wide. Cells: shorter than broad; constricted at the cross-walls, end-cell rounded. Sheath: thin and tight-fitting or thick and diffluent.
- C) Three populations studied:
^
Ile Picard: W1
Takamaka: T102, 3343 + 0590
- D) Recorded only from two widely separated areas. From films, filamentous sheets and algal felts.

015773 Phormidium fragile Gomont

- A) Filaments: 1.4 - 2.8 μm wide; attenuate towards the apex, many intertwined to form an expanded, mucilaginous sheet. Cells: 1.3 - 2. μm wide; distinctly constricted at the cross-walls, end-cell rounded or conical, without calyptra. Sheath: indistinct, almost colourless, diffluent.
- B) Geitler (1932) gave the size ranges as - trichomes:
1.2 - 3.0 μm wide; attenuate towards the apex. Cells:
1.2 - 3.0 μm long; distinctly constricted at the cross-walls, end-cell conical, without calyptra, sheath diffluent.
- C) 43 populations studied:
 ^
 Île Picard: W1, W2, W3, W4, W6, W7, W107, W110, W113,
 W114, W115, W122, 0564 + 1017, 0600 + 0900
 ^
 Île Malabar: MW101, ME104, ME107, 1394 + 1233
 Anse Cèdres: AC1, AC103
 Cinq Cases: CC3, CC5, CC8, CC12, CC16, CC17, CC18, CC102,
 CC104, CC107, CC109
 Takamaka: T1, T2, T102, T122, 3367 + 0631, 3343 + 0590,
 3300 + 0300, 3420 + 0640, 3400 + 0600
 Grande Terre Central: 2652 + 0378
 ^
 Île Esprit: 1050 + 0620
- D) Recorded from terrestrial and pool situations, widespread, very common and often abundant. From films, filamentous sheets, algal felts, floating at the surface of pools, and in the aufwuchs of larger plant growths.

015802 Plectonema boryanum Gomont

- A) Filaments: 1.5 - 2.5 μm . Cells: 1.3 - 2.3 wide;
1.0 - 2.3 μm long, longer towards the apex of branches;
distinctly constricted at the cross-walls, end-cell
rounded. Sheath: thin, almost colourless. Branches:
single and double.
- B) Geitler (1932) gave the size ranges as - trichomes:
1.3 - 2.0 μm wide. Cells: quadratic or shorter than
broad; distinctly constricted at the cross-walls. Sheath:
thin, almost colourless.
- C) 11 populations studied:
Île Picard: W1, W4, W9, W110, W119
Île Malabar: ME107, 1394 + 1233
Anse Cèdres: AC1
Cinq Cases: CC12, CC112
Île Esprit: 1000 + 0600
- D) Recorded from terrestrial and aquatic situations, wide-
spread but rare, occasionally abundant. From films,
filamentous sheets, algal felts, over mud, rock and other
substrata, the aufwuchs of larger plant growths, the plankton.

015806 Plectonema gloeophilum Borzi

- A) Filaments: 2.0 - 2.4 μm wide; many intertwined to form pink spherical colonies or expanded sheets. Cells: 1.9 - 2.3 μm wide; 0.8 - 2.0 μm long; occasionally slightly constricted at the cross-walls, end-cell rounded. Sheath: thin, almost colourless, often heavily calcified. Branches: single, rare.
- B) Geitler (1932) gave the size ranges as - cells: 2.0 - 2.5 μm wide; quadratic or shorter than broad. Sheath: tight-fitting, almost colourless. Branches: mostly single.
- C) 35 populations studied:
- Île Picard: W1, W3, W4, W7, W9, W103, W104, W112, W113, W114, W119, W122, W127, 0500 + 0900
- Île Malabar: MW1, MW101, MW104, ME102
- Anse Cédres: AC103, AC109
- Cinq Cases: CC1, CC5, CC12, CC13, CC14, CC15, CC16, CC17, CC18, CC102, CC104
- Takamaka: T1, T118, T122
- D) Widespread, common and often abundant. From films, filamentous sheets, algal felts, over silt, mud, soil and rock, the aufwuchs of larger plant growths, the plankton. This species often formed the major algal constituent in pools, especially those which dried out quickly. It initially formed sheets over bottom mud, these eventually lifted off forming globular pink colonies floating at the surface.

015807 Plectonema gracillimum (Zopf.) Hansgirg

- A) Filaments: average width 2.9; many intertwined to form a thin mucilaginous or membranous expanded sheet. Cells: average width 2.7 μm ; average length 3.8 μm ; slightly constricted at the cross-walls, end-cells rounded. Sheath: thin, almost colourless. Branches: single and double, numerous.
- B) Geitler (1932) gave the size ranges as - filaments: 2.0 - 4.0 μm wide. Cells: 1 - 3 times longer than broad. Sheath: thin, almost colourless. Branches: single and double.
- C) Seven populations studied:
^
Île Picard: W1, 0500 + 0900
Cinq Cases: CC104, 3900 + 0500
Takamaka: T3, 3343 + 0590
^
Île Esprit: 1000 + 0600
- D) Recorded from terrestrial and aquatic situations, widespread but not common, occasionally abundant. From films, filamentous sheets and algal felts over rock and other substrata.

015811 Plectonema notatum Schmidle

- A) Filaments: 1.7 - 2.0 μm wide; generally a few together within a common mucilage. Cells: 1.5 - 1.8 μm wide; quadratic to longer than broad; not constricted at the cross-walls, end-cell rounded. Sheath: thin, almost colourless. Branches: single and double, rare.
- B) Geitler (1932) gave the size ranges as - filaments: 1.7 - 2.0 μm wide; rarely building a thallus. Cells: 2 - 3 times longer than broad; cylindrical, not constricted at the cross-walls, end-cell rounded. Sheath: thin, almost colourless. Branches: single and double, rare.
- C) Two populations studied:
^
Ile Malabar: 3143 + 1185, 3143 + 1186
- D) Recorded only from two terrestrial sites. Forming filamentous sheets over rock.
- E) Recorded by Potts (1977); present among Scytonema mats, La Gigi, ^
Ile Picard.

015815 Plectonema tomasinianum Bornet

- A) Filaments: 13.3 - 27.3 μm wide, many intertwined to form a dense olive-green, brown or almost black colony. Cells: 11.0 - 25.0 μm wide; 3.0 - 4.0 μm long; slightly constricted at the cross-walls, end-cell rounded. Sheath: thick, occasionally lamellate, initially colourless, later yellow to brown. Branches: single and double.
- B) Geitler (1932) gave the size ranges as - filaments: 11.0 - 18.0 μm wide, occasionally up to 24.0 μm wide. Cells: 11.0 - 22.0 μm wide; 3.0 - 9.0 μm long; constricted at the cross-walls, occasionally granulate, end-cell rounded. Sheath: up to 3.0 μm thick, lamellate, initially colourless, later yellow-brown.
- C) Two populations studied:
^
Île Malabar: MW1
Cinq Cases: CC101
- D) Recorded from only two well-separated sites. Forming dense colonies floating at the surface of pools.

015931 Pleurocapsa sp. $\leq 4 \mu\text{m}$

A) The Aldabran populations were extremely variable in form and size range. Descriptions of species in the literature often merged without any clear guidelines as to how to separate them. For these reasons no attempt has been made to allocate binomials at present. Forms were observed on Aldabra which resembled the following species: Pleurocapsa aurantiaca Geitler, P. crepidinium Collins, P. fluviatilis Lagerheim, P. fuliginosa Hauck, P. minor Hansgirg emend. Geitler.

C) 88 populations studied:

Île Picard: W1, W2, W3, W4, W5, W6, W7, W9, W103, W104, W107, W110, W111, W113, W114, W115, W116, W117, W119, W120, W122, W127, 0600 + 0900, 0565 + 1014, 0500 + 0900, 0619 + 0900, 0590 + 0920, 0619 + 0991, 0575 + 0976, 0564 + 1017

Île Malabar: MW1, MW101, MW103, MW104, ME101, ME102, MW103, ME104, ME107, ME108, ME111, 1394 + 1233, 3143 + 1186

Anse Cèdres: AC1, AC2, AC3, AC4, AC101, AC103, AC109, AC111, AC112

Cinq Cases: CC2, CC3, CC5, CC9, CC10, CC13, CC14, CC15, CC17, CC18, CC101, CC102, 3841 + 0622, 3841 + 0623, 3962 + 0581, 3912 + 0615

Takamaka: T1, T2, T3, T102, T103, T108, T122, T124, T125, 3345 + 0551, 3300 + 0300, 3343 + 0590, 3367 + 0631, 3400 + 0600

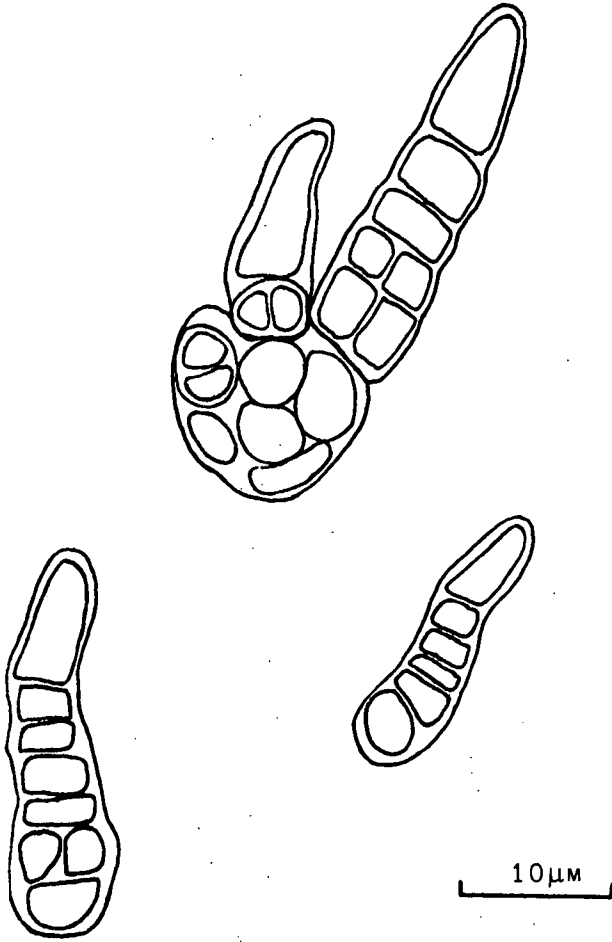
Grande Terre Central: SC101, SC102

^
Ile Esprit: 1000 + 0600

- D) Widespread, common and often very abundant. From films, filamentous sheets, felts on rock and other substrata, more rarely among larger algal colonies, the plankton and the aufwuchs of larger plant growths.

Pleurocapsa sp.,

>4 ≤ 8 μm



015932 Pleurocapsa sp. $>4 \leq 8 \mu\text{m}$

A) See also 015931 Pleurocapsa sp. $\leq 4 \mu\text{m}$.

C) 68 populations studied:

Île Picard: W1, W2, W3, W4, W6, W7, W110, W112, W113,
W114, W115, W116, W119, W120, W127, 0600 + 0900,
0564 + 1017, 0565 + 1014, 0500 + 0900, 0590 +
0920.

Île Malabar: MW1, MW103, MW104, ME101, ME102, ME103, ME104,
ME107, ME108, ME111, 1394 + 1233, 3143 + 1186

Anse Cèdres: AC1, AC2, AC3, AC4, AC101, AC103, AC109, AC111,
AC112

Cinq Cases: CC2, CC3, CC5, CC9, CC12, CC13, CC14, CC17, CC18,
CC102, CC104, 3841 + 0622, 3841 + 0623, 3962 +
0581, 3912 + 0615

Takamaka: T2, T102, T103, T122, T125, 3345 + 0551,
3343 + 0590, 3400 + 0600

D) Widespread, common and often abundant. From films,
filamentous sheets and felts on rock and other substrates.

015933 Pleurocapsa sp. $> 8 \leq 16 \mu\text{m}$

A) See also 015931 Pleurocapsa sp. $\leq 4 \mu\text{m}$

C) Three populations studied:

Île Picard: W1, 0600 + 0900

Anse Cèdres: AC112

D) Widespread but uncommon. From filamentous sheets and felts on rock.

015934 Pleurocapsa sp. $> 16 \mu\text{m}$

A) See also 015931 Pleurocapsa sp. $\leq 4 \mu\text{m}$

C) One population studied:

Anse Cèdres: AC112

D) Recorded only on one occasion, among other algae in
a filamentous sheet on rock.

016003 Porphyrosiphon notarisii (Menegh.) Kützing

- A) Filaments: many together, densely aggregated. Cells: average width 14.0 μm ; average length 6.0 μm ; slightly constricted at the cross-walls, end-cell rounded. Sheath: thick, lamellate, red to purple, in younger filaments almost colourless.
- B) Geitler (1932) gave the size ranges as - cells: 8.0 - 19.0 μm wide; 4.5 - 12.0 μm long, constricted or not constricted at the cross-walls.
- C) One population studied:
Cinq Cases: 3900 + 0500
- D) Recorded only on one occasion, from algal filaments growing over rocks and shells at the bottom of a deep hole in champignon.

016101 Pseudanabaena catenata Lauterborn

- A) Trichomes: average width 2.5 μm ; single or a few together. Cells: average length 3.0 μm ; cylindrical, end cell truncated.

It is possible that a number of the records for this species were hormogonia of other algae such as Anabaena, Cylindrospermum and Nostoc, as hormogonia of these genera seen in culture were almost identical to the forms of Pseudanabaena recorded on Aldabra.

- B) Geitler (1932) gave the size ranges as - trichomes: 2.0 μm wide. Cells: 3.0 μm long; end-cells truncated.

- C) 24 populations studied:

Île Picard: W1, W4, W120

Anse Cèdres: AC1, AC2, AC3, AC101, AC103

Cinq Cases: CC2, CC3, CC5, CC9, CC12 CC105, CC107

Takamaka: T1, T2, T102, T103, T118, T121, T122, T125

- D) Widespread and common. From films, filamentous flocs, over mud, rock, wood and other substrata, the aufwuchs of larger plant growths, the plankton.

016103 Pseudanabaena schmidlei Jaag

- A) Trichomes: 5.0 - 7.4 μm wide; average width 6.2 μm .
Cells: average length 4.7 μm ; deeply constricted at the cross-walls, broadly ovate to hemispherical.
- B) Desikachary (1959) gave the size ranges as - trichomes: 6.0 - 7.0 μm wide. Cells: generally as long as broad.
- C) Two populations studied:
^AIle Picard: W3, W4
- D) Recorded only from ^AIle Picard, in algal felts over rock and the plankton.

016104 Pseudanabaena schmidlei Jaag var. gracilis Skuja

- A) Trichomes: average width 3.7 μm . Cells: average length 3.5 μm ; broadly-ovate to hemispherical.
- B) Desikachary (1959) gave the size ranges as - trichomes: 3.5 - 4.0 μm wide. Cells: generally as long as broad.
- C) One population studied:
Cinq Cases: CC2
- D) Only recorded once, from an algal film overlying mud.

016301 Radaisia cornuana Sauvageau

- A) Colony: a brown to black film or crust consisting of a basal section of densely packed cells and an upper section of upright, radiating filaments. Cells: 3.3 - 4.2 μm wide; 4.0 - 5.5 μm long; bright blue-green with a thin almost colourless membrane.
- B) Geitler (1932) gave the size ranges as - cells: 4.0 - 6.0 μm wide; 2.0 - 5.0 μm long. Radiating filaments: 60.0 - 120.0 μm long. Colony: encrusting, bright blue-green.
- C) Five populations studied:
Île Picard: W1, W2, W5, W6
Anse Cèdres: AC111
- D) Recorded from only two widely separated areas. From among other algae in films, filamentous sheets and felts overlying rock, occasionally on dead wood.

016602 Schizothrix arenaria (Berk.) Gomont

- A) Filaments: up to 10.0 μm wide; often containing many trichomes, many intertwined to form a thin, blue-green expanded sheet. Trichomes: 2.0 - 3.0 μm wide; 3.0 - 5.7 μm long; occasionally slightly constricted at the cross-walls, end-cell pointed, conical, very rarely rounded. Sheath in lower portions thick and lamellate, in upper portions thin and non-lamellate, almost colourless to light brown. Branches: numerous finger-like.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.5 - 3.0 μm wide. Cells: up to 5.0 μm long; not constricted or constricted at the cross-walls.
- C) 12 populations studied:
 Île Picard: W2, W4, W7, W104, W107, 0600 + 0900, 0564 + 1017
 Île Malabar: 1394 + 1233
 Cinq Cases: 3900 + 0500
 Takamaka: T3, T102
 Grande Terre Central: SC101
- D) Recorded from terrestrial and aquatic situations, often forming the main algal constituent in some samples. From among other algae in films, filamentous sheets, and algal felts over sand and rock.
- E) Recorded by Potts (1977) from Île Picard, Île Malabar and Grande Terre, abundant among other algal communities, especially those dominated by Schizothrix calcicola.

016604 Schizothrix calcicola (Agardh) Gomont

A) Filaments: 1.5 - 8.0 μm wide; never containing many trichomes. Trichomes: 1.0 - 2.0 μm wide. Cells: 1.5 - 5.0 μm long; not constricted at the cross-walls, end-cell rounded or conical. Sheath: tight-fitting, occasionally lamellate. Branches: rare.

I have extended the definition of this species to include cells up to 2.0 μm .

B) Geitler (1932) gave the size ranges as - trichomes: 1.0 - 1.7 μm wide. Cells: 2.0 - 6.0 μm long; not constricted at the cross-walls, end-cell rounded or conical. Sheath: initially thin and tight-fitting, later wide and slightly lamellate.

C) Three populations studied:

Île Picard: 0591 + 0921

Île Malabar: 1394 + 1233

Takamaka: 3367 + 0631

D) Recorded only from terrestrial situations. From among the liverwort Riccia overlying soil.

E) Recorded by Potts (1977) from Île Picard, Île Malabar, Grande Terre, Île Sylvestre and Îles Moustique; abundant on Îles Moustique, forming stratiform stromatolites with Microcoleus chthonoplastes, elsewhere very abundant as the dominant species in pink-coloured crusts and mats.

016752 Scytonema sp., $>8 \leq 12$ μm sheaths having parallel layers

- A) Colony: composed of horizontal and erect filaments forming cushions, felts or thin horizontal sheets, olive-green, brown to almost black. Filaments: average width 18.0 μm . Cells 8.0 - 16.0 μm wide; up to 14.0 μm long, generally shorter than broad. Sheath: with parallel lamellations, initially colourless, later brown. Probably only one species present. The size range of this species covered two other 'species' number size range categories: 016753 Scytonema sp., $>12 \leq 16$ μm sheaths having parallel layers and 016754 Scytonema sp. > 16 μm sheaths having parallel layers. Possibly S. ocellatum Lyngbye.

- C) One population studied:
Grande Terre Central: SC101
- D) Recorded only on one occasion, from filaments overlying rock.

016753 Scytonema sp., $> 12 \leq 16$ μm sheaths having parallel layers

A) Probably the same species described under 016752

Scytonema sp., $> 8 \leq 12$ μm sheaths having parallel layers.

C) One population studied:

Grande Terre Central: SC101

D) Recorded only on one occasion, from filaments overlying rock.

016754 Scytonema sp., $> 16 \mu\text{m}$ sheaths having parallel layers

A) Probably the same species described under 016752

Scytonema sp., $> 8 \leq 12 \mu\text{m}$ sheaths having parallel layers.

C) One population studied:

^
Île Picard: 0610 + 1140, 0618 + 0991

D) From algal felts overlying rock, soil and on the trunks of Cocos nucifera.

016901 Spirulina subsalsa Oersted ex Gomont

- A) Trichomes: average width 1.5 μm ; single or a few together.
Winds of trichome: average width 4.0 μm ; tightly wound together, cross-walls indistinct.
- B) Geitler (1932) gave the size ranges as - trichomes: 1.0 - 2.0 μm wide. Spirals: 3.0 - 5.0 μm wide; very close together.
- C) Seventeen populations studied:
Île Malabar: MW101
Anse Cèdres: AC3, AC103
Cinq Cases: CC2, CC3, CC5, CC9, CC12, CC15, CC17, CC107
Takamaka: T1, T103, T118, T121, T124, T125
- D) Widespread common and occasionally abundant. Though absent from freshwater pools on Île Picard it was abundant in the brackish waters at La Gigi, Île Picard. From films over mud, rock and other substrata, occasionally in the aufwuchs of larger plant growths and in the plankton.
- E) Recorded by Potts (1977) from Île Picard, Île Malabar and Grande Terre; very abundant, often forming bright blue-green sheets over the surface of silt.
- F) Desikachary (1959) listed many records from among other algae, on dead leaves in stagnant waters, wet soil, and brackish ponds in Burma, Ceylon and India; from salt pans, Curaçao (Koster, 1963); littoral zone, Oahu, Pacific (Khan, 1969).

016933 Spirulina gigantea Schmidle $> 2 \leq 4 \mu\text{m}$

- A) Trichomes: 3.0 - 3.3 μm wide. Spirals: average width 10.0 μm ; distance between spirals 2.5 μm ; cross-walls indistinct.
- B) Geitler (1932) gave the size ranges as - trichomes: 3.0 - 4.0 μm wide. Spirals: 11.0 - 16.0 μm wide; regularly tapered towards the apex.
- C) One population studied:
Cinq Cases: CC17
- D) Recorded only once, among other algae floating at the surface of a pool.

017452 Synechococcus cedrorum Sauvageau $> 2 \leq 4 \mu\text{m}$

- A) Cells: average width 3.0 μm ; average length 6.0 μm ; dark blue-green. I have extended the definition of this species to include cells 2.5 - 2.9 μm wide. The size range of this 'species' number also includes the relevant size ranges of the following species:
Synechococcus minuscula Woronichin S. pavlekii Ercegović,
S. salina Wislouch.
- B) Geitler (1932) gave the size ranges as - cells: 3.0 - 4.0 μm wide; 5.0 - 10.0 μm long.
- C) Five populations studied:
 Île Picard: W2, W104
 Anse Cèdres: AC103
 Takamaka: T2
- D) Widespread, rare and never abundant. From films overlying mud, occasionally in the plankton.

017453 Synechococcus sp. not above $> 4 \leq 6 \mu\text{m}$

- A) Cells: 5.0 - 6.0 μm wide; average length 7.8 μm ;
light blue-green.
- B) There is no suitable binomial which would cover this
'species' number size range category.
- C) Two populations studied:
^
Île Picard: W107

Takamaka: T125
- D) Recorded on only two occasions from widely separated
pools. From films overlying mud.

017454 Synechococcus brunneolus Rabenhorst $> 6 \leq 8 \mu\text{m}$

A) Cells: average width $6.5 \mu\text{m}$; average length $8.5 \mu\text{m}$; single or two together, dark olive-green.

As the lower size range for this species is given as $5.0 \mu\text{m}$, this 'species' number and size range exclude that part of the cell range $5.0 - 6.0 \mu\text{m}$. Cells in this range would thus be coded under the previous number, 017453 Synechococcus $> 4 \leq 6 \mu\text{m}$. As the upper size range for this species is given as $11.0 \mu\text{m}$, this 'species' number and size range exclude that part of the cell range $8.1 - 11.0 \mu\text{m}$. Cells in this range would be included under 017455 Synechococcus aeruginosus $> 8 \leq 16 \mu\text{m}$.

B) Geitler (1932) gave the size ranges as - cells: $5.0 - 11.0 \mu\text{m}$ wide; up to twice as long as broad; single or two to four together, brownish blue-green.

C) One population studied:

Anse Cèdres: AC2

D) Recorded only once, in a film overlying mud.

E) Recorded by Potts (1977), present among other algal communities Basin Lebine, Île Picard.

017455 Synechococcus aeriginosus Nägeli $> 8 \leq 16 \mu\text{m}$

- A) Cells: 8.5 - 15.5 μm wide; 10.0 - 12.0 μm long; single, occasionally two together, hemispherical to elliptical, dark blue-green to olive-green. As the lower size range of this species is given as 7.0 μm , this 'species' number and size range exclude that part of the cells range 7.0 - 8.0 μm . Cells in this range would be coded under the previous number 017454 Synechococcus brunneolus $> 6 \leq 8 \mu\text{m}$.
- B) Geitler (1932) gave the size ranges as - cells: 7.0 - 16.0 μm wide; up to twice as long as broad; ellipsoid to cylindrical, cells mostly single, later dividing into two.
- C) 11 populations studied:
 Île Picard: W1, W2, W104, W116, W120
 Île Malabar: ME103
 Cinq Cases: CC5, CC15, CC16, CC105
 Takamaka: T102
- D) Widespread and occasionally abundant. From films over mud, in the aufwuchs of larger plant growths and occasionally the plankton.

017456 Synechococcus euryphyes G. Beck >16 ≤ 32 μm

- A) Cells: 17.0 - 31.5 μm wide; 20.0 - 35.0 μm long; broadly rounded, hemispherical to ovate, dark blue-green to olive-green. As the lower size range of this species is given as 20.7 μm, I have extended the size range to include cells in the size range 16.1 - 20.7 μm. As the upper size range of this species is given as 41.0 μm, this 'species' number and size range exclude that part of the cell range 32.1 - 41.0 μm. Cells in this range would be coded under 017457 Synechococcus maior Schröter > 32 ≤ 64 μm.
- B) Geitler (1932) gave the size ranges as - cells: 20.7 - 41.0 μm wide (mostly 31.0 - 32.7 μm); 22.4 μm long.
- C) 16 populations studied:
- ^ Ile Picard: W1, W6, W103, W111, W115
 - ^ Ile Malabar: MW101
 - Anse Cedres: AC101
 - Cinq Cases: CC3, CC9, CC14, CC15
 - Takamaka: T1, T103
 - Grande Terre: SC102
- D) Widespread, never very abundant. From films, filamentous sheets over mud, rock and other substrata, the aufwuchs of larger plant growths and the plankton.

017457 Synechococcus maior Schröter >32 µm

A) Cells: 33.0 - 41.0 µm wide; hemispherical to ellipsoidal, solitary or two together, dark olive-green.

As the lower size range for this species is given at 19.0 µm this 'species' number and size range exclude that part of the cell range 19.0 - 32.0 µm. Cells in this range would be coded under 017456 Synechococcus euryphes G. Beck sp. >16 ≤ 32 µm.

The size range of this 'species' number also includes the relevant size ranges of the following species:

Synechococcus euryphes G. Beck.

B) Starmach (1966) gave the size range as - cells: 19.0 - 42.0 µm wide.

C) Two populations studied:

^ Ile Picard: W122

Takamaka: T3

D) Widespread, rare. From among floating filamentous flocs.

017469 Synechococcus sp. (A. D.) A.

- A) Cells single or two together, light to bright blue-green, hemispherical to almost spherical, 10.0 - 12.0 μm wide, 8.0 - 14.0 μm long. The cell surface covered with evenly distributed spines, 3.0 - 6.0 μm long. Actively motile.
- C) 2 populations studied:
- Anse Cèdres: AC1
- Takamaka: T103
- D) Recorded only for two pools, abundant over the surface of mud in pool T103, among other algae. Over mud and among other algae in filamentous sheets on rock pool AC1.
- E) Not recorded.

017602 Tolypothrix byssoidea (Berkeley) Kirchner

- A) Filaments: 10.9 - 15.0 μm wide; many intertwined to form felts or cushions with a lower section of horizontal filaments and an upper section of vertical filaments. Cells: 8.1 - 11.4 μm wide; 3.9 - 7.5 μm long. Heterocysts: 9.9 - 16.5 μm wide; 5.3 - 23.8 μm long; intercalary heterocysts cylindrical, double-pored; heterocysts at the bases of branches, hemispherical, single pored. Sheath: initially almost colourless and non-lamellate, later yellow to brown, and lamellate.
- B) Geitler (1932) gave the size ranges as - filaments: 10.0 - 15.0 μm wide. Cells 9.0 - 11.0 μm wide; 0.5 - 0.3 times as long as broad; barrel shaped. Heterocysts: single or double. Sheath: thin, tight-fitting, wrinkled, lamellate, yellow to brown.
- C) 58 populations studied:
- ^
Ile Picard: W1, W2, W3, W4, W5, W7, W9, W104, W107, W110, W114, W115, W117, W118, W119, 0600 + 0900, 0609 + 0900, 0599 + 0901, 0500 + 0900, 0618 + 0991, 0564 + 1017, 0575 + 0976, 0594 + 0956, 0595 + 0962, 0605 + 0962, 0607 + 0965, 0606 + 0963, 0500 + 1000, 0610 + 1140, 0619 + 0990, 0591 + 0921, 0590 + 0920.
- ^
Ile Malabar: 1394 + 1233, 3142 + 1185, 3143 + 1186
- Anse Cèdres: AC3
- Cinq Cases: CC5, CC9, CC112, 3900 + 0500, 3841 + 0623, 3980 + 0590
- Takamaka: T2, T102, 3345 + 0551, 3343 + 0590, 3367 + 0631, 3400 + 0600, 3420 + 0640

Grande Terre Central: SC101, 2652 + 0378

Île Esprit: 1050 + 0620, 1000 + 0600

- D) Probably the commonest blue-green alga on the atoll. Forming felts especially near the edge of pools, cushions in depressions in platin, thin horizontal sheets over champignon and the base of trunks of Cocos nucifera. Its occurrence in pools probably due to inwash as pool material tended to be dead or very unhealthy. Many other algae living within the thallus.
- E) Recorded by Potts (1977) from Île Picard, and Grande Terre, over rocks at the extreme upper part of the intertidal zone of tidal depressions.
- F) From damp rocks, and tree trunks and such like; cosmopolitan, (Geitler, 1932); on tree trunks and on moist soil; Lahore (Ghose, 1919); Calcutta (Bruhl and Biswas, 1922).

017603 Tolypothrix byssoidea (Berkeley) Kirchner var. polycladus

Fremy

- A) Filaments: 11.0 - 23.3 μm wide; forming horizontal sheets. Cells: 9.0 - 15.0 μm wide; 4.0 - 6.7 μm long. Heterocysts: 10.0 - 17.0 μm wide; 7.0 - 25.0 μm long; intercalary; cylindrical, double pored; basal; hemispherical, single-pored. Sheath: initially almost colourless and non-lamellate, later yellow to brown and lamellate.
- B) Geitler (1932) gave the size ranges as - filaments: up to 22.0 μm wide. Cells: up to 16.0 μm wide.
- C) One population studied:
Takamaka: T2
- D) Recorded only on one occasion. Forming thin horizontal sheet over rock.

017606 Tolypothrix distorta Kützing

- A) Filaments: 9.0 - 13.0 μm wide; many intertwined to form a thin, blue-green, mucilaginous sheet. Cells: 9.0 - 11.0 μm wide; average length 5.0 μm ; slightly constricted at the cross-walls, bright-blue-green. Heterocysts: average width 11.0 μm ; up to 21.0 μm long, intercalary heterocysts, cylindrical and double-pored, heterocysts at the bases of branches, hemispherical and single pored. Sheath: thin, non-lamellate, initially almost colourless later yellowish.
- B) Geitler (1932) gave the size ranges as - filaments: 10.0 - 15.0 μm wide; intertwined to form, grass-like tufts, cushions or flakes. Cells: 9.0 - 12.0 μm wide; shorter than broad to quadratic, slightly constricted at the cross-walls. Heterocysts: almost spherical to cylindrical, two or three together. Sheath: thin, tight-fitting, initially colourless, later brown.
- C) Eight populations studied:
 ^ Ile Picard: W5, W9, 0500 + 0900
 ^ Ile Malabar: 1394 + 1233, 3143 + 1185, 3143 + 1186
 Cinq Cases: CC5, CC13
- D) Widespread but rare, where present fairly abundant. Forming filamentous sheets and felts over rock, and more rarely over dead wood.
- F) In standing water, more rarely in slow-flowing waters, attached or free-swimming; cosmopolitan (Geitler, 1932); Desikachary (1959) listed many records from stagnant and very slow-flowing waters, and tanks in India.

017801 Westiellopsis prolifica Janet

- A) Filaments: average width 9.0 μm ; intertwined to form a blue-green to blue-grey powdery sheet. Cells: average length 10.0 μm , quadratic to longer than broad; barrel-shaped to cylindrical, slightly constricted at the cross-walls. Heterocysts: average width, 5.0 μm ; average length 15.0 μm . Branches: average width 5.0 μm ; average length 8.0 μm ; generally thinner than cells of main filaments. Thallus: producing dense clusters of 'pseudohormocysts' in which gonidia are produced in single cells, average diameter 8.0 μm .
- B) Desikachary (1959) gave the size ranges as - filaments: 8.0 - 12.0 μm wide. Cells: quadratic to slightly longer than broad; not constricted at the cross-walls. Heterocysts: 5.5 - 6.0 μm wide; 10.5 - 22.0 μm long; oblong-cylindrical. Branches: 4.0 - 6.0 μm wide. 'Pseudohormocysts': 8.5 - 9.0 μm wide.
- C) Three populations studied:
 Île Picard: W1, 0590 + 0920
- D) Recorded only from Île Picard, abundant where recorded. Over rock at the edges of pools and under rocks next to the soil.
- F) From cultures of garden soil; Madras, India (Janet, 1941).

018053 Xenococcus keneri Hansgirg > 4 ≤ 6 μm

- A) Cells: 4.2 - 6.0 μm wide; up to 7.1 μm long; light blue-green, cell-membrane; thick, unlamellate, almost colourless to yellow, with a diffluent gelatinous envelope.
- B) Geitler (1932) gave the size ranges as - cells:
3.5 - 6.0 μm wide; up to 10.0 μm long; cell membrane, thick, unlamellate or lamellate.
- C) Two populations studied:
Cinq Cases: CC8
Grande Terre Central: SC101
- D) Recorded only on two occasions. From the surface of dead wood and epiphytic on submerged Stachytarpheta.
- E) Recorded by Potts (1977) from Île Picard and Île Malabar; epiphytic on Scytonema.

018101 Chroococcopsis gigantea Geitler

- A) Cells: 7.0 - 14.0 μm in diameter; more or less spherical, bright blue-green to olive-green, many aggregated in an irregular mass within a common diffluent mucilage, often a great range in size within a particular colony, cell membrane thin, colourless, cell contents often dividing to form endospores, average diameter 3.1 μm .
- B) Geitler (1932) gave the size ranges as - cells:
7.0 - 36.0 μm wide; spherical, ellipsoid, irregularly shaped, often polygonal, cell-membrane; thick, firm, more or less distinctly lamellate, almost colourless.
Endospores: 1.5 - 2.5 μm wide.
- C) Eight populations studied:
Île Picard: W1, W2, W107, W111, W117
Anse Cédres: AC2, AC3
Cinq Cases: CC9
- D) Widespread, rare. From films, filamentous sheets, occasionally planktonic.
- E) Recorded by Potts (1977) from only one location; among a surface film of Microcoloeus chthonoplastes,
Île Malabar.

018201 Dalmatella buaënsis Ercegović

- A) Epilithic filaments: average width 7.0 μm ; endolithic filaments average width 15.0 μm . Cells: average width 4.0 μm ; average length 8.0 μm ; many together within gelatinous, homogeneous mucilage.
- B) Geitler (1932) gave the size ranges as - epilithic filaments: 6.0 - 10.0 μm wide; endolithic filaments 12.0 - 30.0 μm wide. Epilithic cells: 2.0 - 6.0 μm wide 2.0 - 8.0 μm long; endolithic cells: 3.0 - 7.0 μm wide, 4.0 - 15.0 μm long.
- C) One population studied:
Takamaka: 3400 + 0600
- D) Recorded only on one occasion, endolithic in terrestrial rock.

021103 Chrootheca richteriana Hansgirg

- A) Colony: up to 2.0 mm; globular, gelatinous or mucilaginous, yellow-brown to orange. Cells: average width 20.0 μm ; average length 30.0 μm ; cylindrical, broadly-rounded at the ends, with large central pyrenoid; cell-membrane; 4.0 - 6.0 μm wide, gelatinous, distinctly lamellate, almost colourless, hyaline; arranged in a linear manner within almost colourless, homogeneous mucilage to form radiating 'pseudo-filaments'.
- B) Pascher (1925) gave the size ranges as - colony: 2.0 - 4.0 μm . Cells: 18.0 μm - 24.0 μm in size; elliptical or cylindrical.
- C) One population studied:
^
Île Picard: 0564 + 1017
- D) Recorded only on one occasion forming a felt with Schizothrix arenaria on the vertical wall of a disused mineshaft.

030201 Euglena acus Ehrenberg

A) Cells: average width 8 μm ; average length 110 μm ; spindle-shaped, tapering to a point, cell membrane; spirally striated, chloroplasts; many disc-shaped oval plates, paramylon bodies; rod-shaped.

The Aldabran material tended to be generally smaller than the forms described in the literature.

B) Pascher (1925) gave the size ranges as - cells: 10.0 μm wide; 140 - 180 μm long.

C) 14 populations studied:

Île Picard: W1, W2, W3, W6, W111, W118, W120

Île Malabar: MW101

Anse Cèdres: AC101

Cinq Cases: CC3, CC13, CC18

D) Widespread and often very abundant. From films, filamentous flocs, the plankton and the aufwuchs of larger plant growths.

030202 Euglena gracilis Klebs

- A) Cells: 5.0 - 12.0 μm wide; 35.0 - 40.0 μm long; spindle-shaped to slightly egg-shaped, slightly pointed towards the rear, chloroplasts; many disc-shaped bodies, evenly distributed throughout the cell; pyrenoids and paramylon bodies; not observed. Spores: spherical with thick brown membrane.
- B) Pascher (1913) gave the size ranges as - cells: 6.0 - 22.5 μm wide; 37.0 - 45.0 μm long.
- C) 42 populations studied:
 Île Picard: W1, W2, W3, W4, W5, W6, W7, W9, W102, W103, W110, W111, W112, W113, W115, W117, W118, W127
 Île Malabar: MW1, MW103, MW104, ME102, ME103, ME104, ME108
 Anse Cèdres: AC3, AC103, AC109, AC111
 Cinq Cases: CC3, CC9, CC13, CC15, CC16, CC17, CC105, CC107
 Takamaka: T103, T108, T122
 Grande Terre Central: SC101
- D) Widespread, locally common and occasionally very abundant. From films over mud, among filamentous sheets, the plankton and occasionally the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969).

030205 Euglena spirogyra Ehrenberg

- A) Cells: average width 6.0 μm ; average length 90 μm ;
cylindrical, ending in a bent point, cell membrane;
spirally striated, chloroplasts; many disc-shaped
plates. Paramylon bodies; rod-shaped.
- B) Pascher (1925) gave the size ranges as - cells:
8.0 μm wide; 80 μm long.
- C) One population studied:
^
Île Picard: W2
- D) Recorded only from one pool, in films over mud,
filamentous flocs and the plankton.

030206 Euglena minuta Prescott

- A) Cells: 5.0 - 9.0 μm wide; up to 18.0 μm long; fusiform, posterior blunt, cells membrane; smooth, chloroplast; a single plate, almost filling the cell, paramylon bodies; rod-shaped.
- B) Prescott (1962) gave the size ranges as - cells:
5.0 - 6.0 μm wide; 12.0 - 14.0 μm long.
- C) 34 populations studied:
 ^
 Ile Picard: W1, W2, W3, W4, W5, W6, W7, W9, W102, W110,
 W111, W114, W115, W117, W118, W119, W120
 ^
 Ile Malabar: MW104, ME102, ME104, ME107, ME108, ME111
 Anse Cédres: AC3, AC101
 Cinq Cases: CC1, CC12, CC13, CC15, CC17, CC104
 Takamaka:T1
- D) Widespread and common, especially on ^ Ile Picard. From films over mud and rock, filamentous flocs, the plankton and occasionally in the aufwuchs of larger plant growths.

030207 Euglena oxyuris Schmarida var. minor Prescott

- A) Cells: 14.0 - 22.0 μm wide; up to 85 μm long; cylindrical, twisted, rounded at the posterior, occasionally ending in a short stump, cell-membrane; longitudinally striated, chloroplasts; many disc-like plates, paramylon bodies; two, large, flattened rings.
- B) Prescott (1962) gave the size ranges as - cells:
15.0 - 18.0 μm wide; 77.0 - 85.0 μm long.
- C) Nine populations studied:
^
Île Picard: W5, W6, W102, W111
^
Île Malabar: MW1
Anse Cédres: AC101
Cinq Cases: CC5, CC14
Takamaka: T121
- D) Widespread, never very abundant. From films over mud and rock, filamentous flocs and the plankton.

030469 Lepocinclis sphagnophilia Lemmermann

- A) Cells: average width 12.0 μm ; average length 23.0 μm , oval, slightly tapered posteriorly to a short caudus, apex broadly rounded, bipapillate, periplast; distinctly spirally striated, chloroplasts; ovoid discs, paramylon bodies; four plates, two on either side of cell, flagellum; equal to the length of the cell.
- B) Pascher (1914) gave the size ranges as - cells: 12.0 μm wide; 33.0 μm long. Prescott (1962) gave the size ranges as - cells: 8.0 - 10.0 μm wide; 22.0 - 25.0 μm long.
- C) Four populations studied:
- ^A
Ile Picard: W5, W6, W7
- Takamaka: T125
- D) Widespread but rare, never very abundant. From films overlying mud and the plankton.

030502 Phacus orbicularis Hübner

- A) Cells: average width 39.0 μm ; average length 60.0 μm , broadly ovate to circular in outline with short caudus curved to the right (when seen in ventral view), periplast; longitudinally striated, paramylon bodies; one to several, large disc-shaped plates, flagellum; equal to the length of the cell or longer.
- B) Pascher (1914) gave the size ranges as - cells: 45.0 μm wide; 70.0 μm long. Prescott (1962) gave the size ranges as - cells: 39.0 - 45 μm wide; 60.0 - 100 μm long.
- C) 37 populations studied:
- ^
Ile Picard: W1, W2, W3, W4, W5, W6, W7, W102, W111, W113,
W114, W115, W118, W119
- ^
Ile Malabar: ME102, ME103, ME107, ME108, ME111
- Anse Cèdres: AC2, AC3, AC101, AC109, AC111
- Cinq Cases: CC2, CC12, CC14, CC105
- Takamaka: T1, T2, T102, T121, T124, T125
- D) Widespread, common and occasionally abundant. From films overlying mud, the plankton and the aufwuchs of larger plant growths.

030601 Trachelomonas hispida (Perty) Stein var. coronata

Lemmermann

- A) Test: 19.5 - 22.0 μm wide; 28.0 - 32.0 μm long; ovate, thick, covered uniformly with short spines, flagellum aperture; surrounded by a short collar with the margin bearing a short circle of spines.
- B) Prescott (1962) gave the size range as - test: 20.0 μm wide; 29.0 - 32.0 μm long.
- C) Two populations studied:
Cinq Cases: CC13, CC104
- D) Recorded only from the Cinq Cases region of Grande Terre, from among the floating filaments of other algae and the plankton.

030602 Trachelomonas volvocina Ehrenberg

- A) Test: 18.0 - 22.0 μm in diameter; spherical, smooth, dark-brown flagellum aperture; circular, thickened, occasionally with a short collar.
- B) Pascher (1914) gave the size range as - test: 7.0 - 21.0 μm in diameter.
- C) Six populations studied:
^
Île Picard: W4, W6, W7, W110
^
Île Malabar: ME101
Cinq Cases: CC104
- D) Widespread and occasionally very abundant especially on Île Picard. From films overlying mud and the plankton.

049951 Cryptophyta sp., $\leq 8 \mu\text{m}$ long, blue-green

- A) Cells: slipper-shaped or conical, tapering towards the posterior of the cell, chromatophore; a single parietal plate, blue-green. Probably only one species present, which would include those cells recorded under 049952 Cryptophyta sp., $> 8 \leq 16 \mu\text{m}$ blue green.
- C) One population studied:
Île Picard: W110
- D) Recorded only on one occasion, from the plankton.

049952 Cryptophyta sp., $> 8 \leq 16$ μm blue-green

A) Cells recorded under this 'species' number and size category were very similar to those described under 049952 Cryptophyta sp., ≤ 8 μm blue-green and are probably the same species.

C) Ten populations studied:

^
Île Picard: W2, W5, W6, W7, W110, W118

^
Île Malabar: ME108

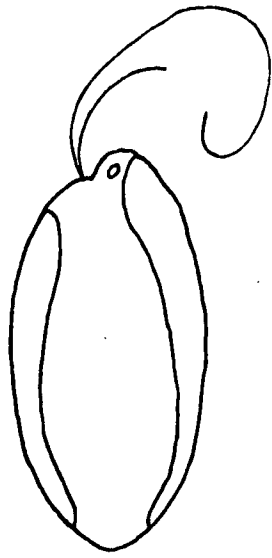
Anse Cédres: AC1, AC109

Grande Terre Central: SC102

D) Widespread, never very abundant. From the plankton, films over mud and the aufwuchs of larger plant growths.

049954 Cryptophyta sp., $\leq 8 \mu\text{m}$ long, brown

- A) Cells: slipper-shaped, dorsiventrally flattened with broad longitudinal furrow extending from anterior gullet, chromatophores: two parietal elongate plates, brown. Starch grains present, as short rods. Probably only one species present, which would include those cells recorded under 049955 Cryptophyta $> 8 \leq 16 \mu\text{m}$ brown and 049955 Cryptophyta $> 16 \mu\text{m}$ brown.
- C) One population studied:
- Cinq Cases: CC9
- D) Recorded on only one occasion, from the aufwuchs of larger plant growths.



Cryptophyta sp.,

>8 ≤ 16 μm long, brown

10μm

049955 Cryptophyta sp., $> 8 \leq 16$ μm long, brown

A) Cells recorded under this 'species' number and size category were very similar to those described under 049954 Cryptophyta sp., ≤ 8 μm long, brown and are probably the same species.

C) Four populations studied:

^
Ile Picard: W115

Cinq Cases: CC9, CC17, CC109

D) Widespread, rare, never very abundant. From films overlying mud and the plankton

049956 Cryptophyta sp., > 16 μ m long, brown

A) Cells recorded under this 'species' number and size range category were very similar to those described under 049954 Cryptophyta sp., \leq 8 μ m long, brown and are probably the same species.

C) Three populations studied:

^
Île Picard: W118

Cinq Cases: CC1

Takamaka: T3

D) Widespread, rare, never very abundant. From the plankton, films over mud and amongst the floating filaments of other algae.

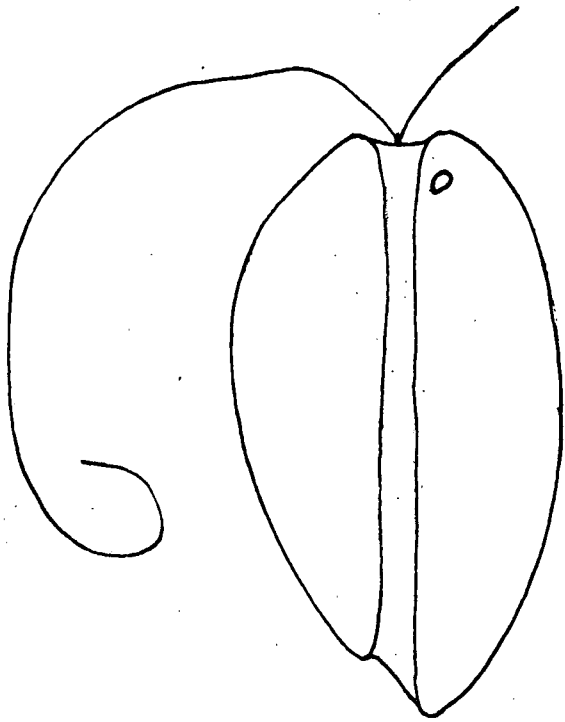
049957 Cryptophyta sp. $\leq 8 \mu\text{m}$ long, green

- A) Cells: slipper-shaped, dorsiventrally flattened with a longitudinal furrow extending the length of the cell, chromatophores; two parietal plates, bright green. Probably only one species present, which would include those cells recorded under 049958 Cryptophyta sp., $>8 \leq 16 \mu\text{m}$ long, green and 049959 Cryptophyta sp., $>16 \mu\text{m}$ long, green.
- C) One population studied:
Takamaka: 3300 + 0300
- D) Recorded on only one occasion, planktonic.

049958 Cryptophyta sp., $>8 \leq 16$ μm long, green

- A) Cells recorded under this 'species' number and size range category were very similar to those described under 049957 Cryptophyta sp., ≤ 8 μm , and are probably the same species.
- C) One population studied:
^
Ile Malabar: ME104, ME108
- D) Recorded only for ^
Ile Malabar. From the plankton and films overlying mud.

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Cryptophyta sp., >16 μm
long green

10 μm

049959 Cryptophyta sp., $> 16 \mu\text{m}$ long, green

A) Cells recorded under this 'species' number and size category were very similar to those described under 049957 Cryptophyta $\leq 8 \mu\text{m}$ and are probably the same species.

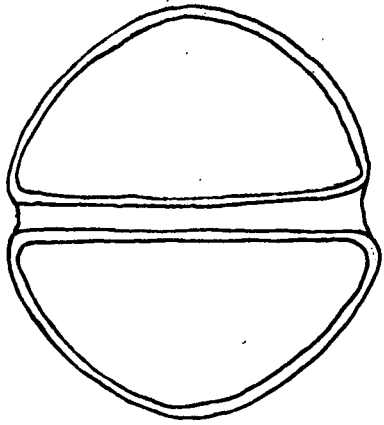
C) Three populations studied

^
Île Malabar: ME104

Anse Cèdres: AC103

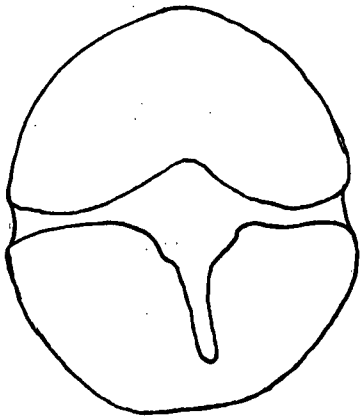
Takamaka: T1

D) Widespread, rare, never very abundant. From films overlying mud and the plankton.



Pyrrophyta sp., (A.D.) A

10μm



Pyrrophyta sp., (A.D.) B

10μm

059969 Pyrrophyta sp., (A.D.), A

A) Cells: average width 9.0 μm ; average length 12.0 μm ; plates; indistinct; epicone; broadly rounded, transverse furrow; complete, chromatophores; numerous green plates, pigment spot; in posterior half of cell. It has not been possible to make a positive identification due to lack of material.

C) Two populations studied:

^
Île Picard: W6, W104

D) Recorded only from Île Picard. From films overlying mud and among the floating filaments of other algae.

059970 Pyrrophyta sp., (A.D.), B

A) Possibly Glenodinium sp. Cells: average width 23.0 μm ; average length 26.0 μm ; plates; indistinct; epicone; rounded to slightly pointed, transverse furrow; complete, chromatophores; elongate, fretted, brown, pigment spot; in posterior half of cell. It has not been possible to make a positive identification due to insufficient material.

C) Seven populations studied:

^
Île Picard: W4, W6, W110

^
Île Malabar: MW103

Anse Cèdres: AC109

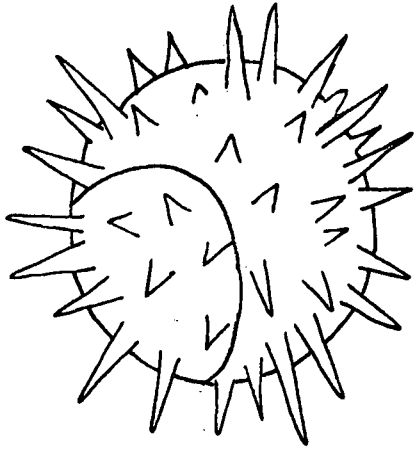
Takamaka: T3, T103

D) Widespread, rare, never abundant. From the plankton, films, overlying mud, floating filaments of other algae.

061150 Goniochloris sp.

- A) Cells: average width 6.5 μ m, angular, with apices bluntly rounded, cell-wall; pitted, chromatophores; 2 - 4 parietal plates.
- C) 21 populations studied:
- Île Picard: W1, W4, W6, W110
 - Île Malabar: ME108, ME111
 - Anse Cèdres: AC2, AC3, AC103
 - Cinq Cases: CC1, CC5, CC9, CC14, CC17, CC102
 - Takamaka: T1, T2, T108, T125
- D) Widespread, never very abundant. From the plankton, films overlying mud and the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969).

Akanthochloris sp.



10 μ m

062050 Akanthochloris sp.

- A) Cells: 10.0 μm in diameter, spherical, cell-wall; covered with spines average length 1.0 μm , chromatophores; 1 - 2 parietal plates.
- C) Seven populations studied:
^
Ile Picard: W1, W4, W5, W6, W7, W9
Takamaka: T108
- D) Widespread but rare except on ^Ile Picard, never very abundant. From the plankton.

090750 Chaetoceros sp.

A) Probably only one species. Cells: 3.6 μm wide; 6.3 μm long; 'chaetae' 18.0 - 38.0 μm long. A complete description of this alga has not been possible due to insufficient material.

C) One population studied:

Takamaka: 3300 + 0300

D) Recorded on only one occasion, from a film overlying mud.

099950 Centrales genus not known, sp.

- A) Cells: valve view; 5.0 - 14.7 μm in diameter; girdle view; 8.5 - 12.0 μm wide. Probably at least two species present.
- C) Four populations studied:
Cinq Cases: CC3, CC12, CC107
Takamaka: T124
- D) Recorded only from Grande Terre. From films overlying mud, among floating filaments of other algae, the plankton and the aufwuchs of larger plant growths.

100250 Amphora sp.

A) Where this genus was recorded it was almost always low in abundance. This has made the task of obtaining 'cleared' frustules for identification difficult. Probably three species present.

C) 14 populations studied:

Île Picard: W1, 0600 + 0900

Anse Cèdres: AC1

Cinq Cases: CC9, CC18, CC101, CC102, CC107, CC109

Takamaka: T1, T2, T3, T102, T124

D) From films overlying mud and rock and dead plant material, among the filaments of other algae and in the aufwuchs of larger plant growths.

101849 Navicula not above

A) Probably only one species present in this population,
of which only a few cells were seen.

C) One population studied:

Anse Cédres: AC2

D) Recorded only one occasion from an alga felt overlying
rock.

101901 Nitzschia acicularis (Kütz.) W. Smith

A) This species was identified on return to Durham by
J. Carter.

C) One population studied:

Cinq Cases: CC2

D) Recorded on only one occasion from the plankton.

101904 Nitschia palea (Kütz.) W. Smith

- A) It was not possible to make positive identification of diatoms on Aldabra. This species was identified on return to Durham by J. Carter.

In the Durham recording system this computer number also includes N. paleacea as they cannot be distinguished when live.

- C) 22 populations studied:

Île Picard: W5, W6, W7, W9, W103, W113, W114, W115, W118,
W119

Île Malabar: ME108

Anse Cédres: AC1, AC3, AC103, AC104

Cinq Cases: CC13, CC18

Takamaka: T1, T103, T118, T124

- D) Widespread, common and occasionally very abundant, especially on Île Picard. From films overlying mud, among larger algal colonies, the plankton and the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969)

109950 Pennales, genus not known, sp.

A) Cells recorded under this 'species' number included at least four species and possibly up to fourteen. Where pennate diatoms were recorded they were almost always very low in abundance.

C) 44 populations studied:

Île Picard: W1, W7, W103, W112, W117, W119, W120, 0600 +
0900

Île Malabar: MW101, ME102, ME103, ME107, ME108

Anse Cèdres: AC1, AC2, AC101, AC103, AC104, AC109, AC112

Cinq Cases: CC1, CC2, CC3, CC5, CC8, CC9, CC12, CC13, CC14,
CC15, CC102, CC104, CC105, CC107

Takamaka: T1, T2, T3, T102, T103, T121, T122, T124, T125

Grande Terre Central: SC101

D) Widespread, common, rarely abundant. From films overlying mud and rock, among the filaments of other algae, the plankton and the aufwuchs of larger plant growths.

120201 Closterium acerosum (Schrank) Ehrenberg

A) Cells: average width 44.0 μm ; average length 400.0 μm , almost straight or slightly curved, gradually tapering to slightly pointed apices, chloroplast; ridged with a single line of up to 9 pyrenoids, apical vacuoles; with moving granules.

This species was identified by K. Handke, who suggested that the size and shape (especially curvature) of the cells and the striation of the cell wall was particularly variable in the Aldabran material.

B) West (1908) gave the size ranges as - cells: 26.0 - 48.0 μm wide; 300 - 460 μm long, cell wall; delicately striate in older cells.

C) 28 populations studied:

^
Ile Picard: W1, W2, W4, W5, W6, W7, W9, W103, W104, W107,
W110, W111, W113, W114, W118, W119.

^
Ile Malabar: MW1, ME107, ME108

Anse Cèdres: AC103, AC109, AC112

Cinq Cases: CC16, CC105

Takamaka: T1, T118, T121

Grande Terre Central: SC101

D) Widespread, common and often very abundant. From films over mud, the plankton and the aufwuchs of larger plant growths.

120204 Closterium dianae Ehrenberg

- A) Cells: average width 20.0 μm ; average distance between apices 300 μm , strongly curved, gradually tapering towards obtusely rounded apices, chloroplast; with a single series of up to six pyrenoids, apical vacuoles; with moving granules.
- B) West (1908) gave the size ranges as - cells: 16.0 - 36.0 μm wide; distance between apices: 270.0 - 380.0 μm ; breadth of apices 6.0 μm .
- C) Five populations studied:
Cinq Cases: CC5, CC9, CC12, CC13, CC102
- D) Recorded only from the Cinq Cases region of Grande Terre, from among the filaments of floating algae and the aufwuchs of larger plant growths.

120306 Cosmarium ornatum Ralfs

- A) Cells: average width 37.0 μm ; average length 30.0 μm , isthmus; average width 10.0 μm , semicells; reniform, lateral margins with granules, cell wall; granular, chloroplasts; axial, one in each semicell with two pyrenoids.
- B) West (1908) gave the size ranges as - cells: 33.0 - 41.0 μm wide; 32.0 - 41.0 μm long; 22.0 - 24.0 μm thick, isthmus; 10.0 - 11.5 μm wide.
- C) Nine populations studied:
Anse Cèdres: AC101, AC104
Cinq Cases: CC5, CC9, CC12, CC13, CC14, CC16, CC102
- D) Recorded only from the eastern area of the atoll. From films over mud, among the filaments of other algae, the plankton and in the aufwuchs of larger plant growths.

120369 Cosmarium subcostatum Nordst var. minor West et G. S. West

- A) Cells: average width 19.3 μm ; average length 21.0 μm ,
isthmus; average width 4.5 μm , semicells; subtrapeziform-
reniform, sides convex and crenulate with granules,
chloroplast; axial with one pyrenoid.
- B) West (1908) gave the size ranges as - cells: 18.5 - 21.0
 μm wide; 19.0 - 24.0 μm long; 10.5 - 12.5 μm thick,
isthmus; 4.2 - 5.5 μm wide.
- C) 26 populations studied:
- ^
Île Picard: W1, W4, W6, W104, W107, W110, W112, W118
- ^
Île Malabar: ME102, ME103, ME107, ME111
- Anse Cèdres: AC2, AC101, AC112
- Cinq Cases: CC3, CC5, CC12, CC13, CC14, CC15, CC18,
CC102, 3841 + 0622
- Takamaka: T1
- Grande Terre Central: SC101
- D) Widespread, never very abundant. From films over mud,
among the filaments of other algae, algal felts, larger
gelatinous colonies, the plankton, and in the aufwuchs
of larger plant growths.
- E) Recorded by Whitton (1969).

120370 Cosmarium regnelli Wille

- A) Cells: average width 16.0 μm ; average length 17.0 μm , isthmus; average width 5.0 μm , semicells; trapezoid, hexagonal, cell wall; smooth, chloroplasts; axial one in each semicell with a central pyrenoid.
- B) West (1908) gave the size ranges as - cells: 15.0 - 22.0 μm wide; 14.0 - 22.0 μm long; 6.5 - 11.0 μm thick, isthmus; 4.0 - 7.0 μm wide.
- C) 14 populations studied:
Île Picard: W1
Anse Cèdres: AC1, AC104
Cinq Cases: CC3, CC5, CC9, CC12, CC13, CC14, CC15, CC16,
CC18, CC102
- D) Widespread, locally common in the Cinq Cases region of Grande Terre, never very abundant. From films over mud, among the filaments of other algae, algal felts, the plankton and in the aufwuchs of larger plant growths.

120372 Cosmarium tinctum Ralfs

- A) Cells: average length 13.0 μm ; isthmus; average width 7.5 μm ; semicells; elliptical; cell wall; smooth; chloroplasts; axial with one pyrenoid.
- B) West (1908) gave the size ranges as - cells: 7.5 - 11.6 μm wide; 10.0 - 15.0 μm long; 5.0 - 9.0 μm thick, isthmus; 4.5 - 8.4 μm wide, cells wall; smooth, red-brown.
- C) Two populations studied:
Cinq Cases: CC9, CC13
- D) Recorded only from two pools in the Cinq Cases region of Grande Terre. From among the filaments of other algae and in the aufwuchs of larger plant growths.

120373 Cosmarium pseudoholmii Borge

- A) Cells: average width 55.0 μm ; average length 31.0 μm ,
isthmus average width 15.0 μm . This species was
identified on return to Durham by K. Handke.
- C) Three populations studied:
- Anse Cédres: AC2
- Cinq Cases: CC5, CC102
- D) Recorded only from the eastern region of Grande Terre,
never very abundant. From films overlying mud and the
aufwuchs of larger plant growths.

121451 Mougeotia $\leq 8 \mu\text{m}$

- A) Cells: average width $7.0 \mu\text{m}$, three to four times as long as broad, chloroplast; a single, broad, axial plate. As no reproductive structures were seen a full identification of this alga has not been possible. Probably only one species present.
- C) One population studied:
^
Île Malabar: ME109
- D) Recorded only on one occasion, forming an almost unialgal growth in water storage tank (oil-drum).
- E) Recorded by Whitton (1969).

122169 Spirogyra mirabilis (Hass.) Kützing (A.D.)

- A) Colony: many filaments aggregated to form bright-green floating 'clouds'. Cells: 26.0 - 36.0 μm wide, up to 116.0 μm long, cross-walls; flat, chromatophore: a single 'ribbon'. Spores: not seen. This species was identified on return to Durham by K. Handke.
- B) Kolkwitz and Krieger (1941) gave the size ranges as - cells: 21.0 - 33.0 μm wide, cross-walls; flat, chromatophore; single. Zygote formation: unknown. Parthenospores: 23.0 - 45.0 μm wide, 33.0 - 88.0 μm long, exospore; thin, smooth, almost colourless.
- C) 7 populations studied:
- Anse Cèdres: AC2
- Cinq Cases: CC3, CC13, CC15, CC16, CC101, CC102
- D) Recorded only from the eastern areas of Grande Terre; especially common in the Cinq Cases area, often very abundant. Forms floating 'clouds' in pools, also from the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969).

122401 Staurastrum alternans Brébisson

- A) Cells: average width 26.0 μm ; average length 27.0 μm ; isthmus; average width 8.0 μm , semicells; ovate, lateral angles rounded, apex; flattened to slightly convex, cell-wall; granulate.
- B) West (1908) gave the size ranges as - cells: 21.0 - 31.0 μm wide; 22.0 - 33.0 μm long; breadth of isthmus; 7.5 - 9.5 μm .
- C) One population studied:
Cinq Cases: CC5
- D) Recorded on only one occasion, from the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969).

122469 Staurastrum cyrtocerum Brébisson

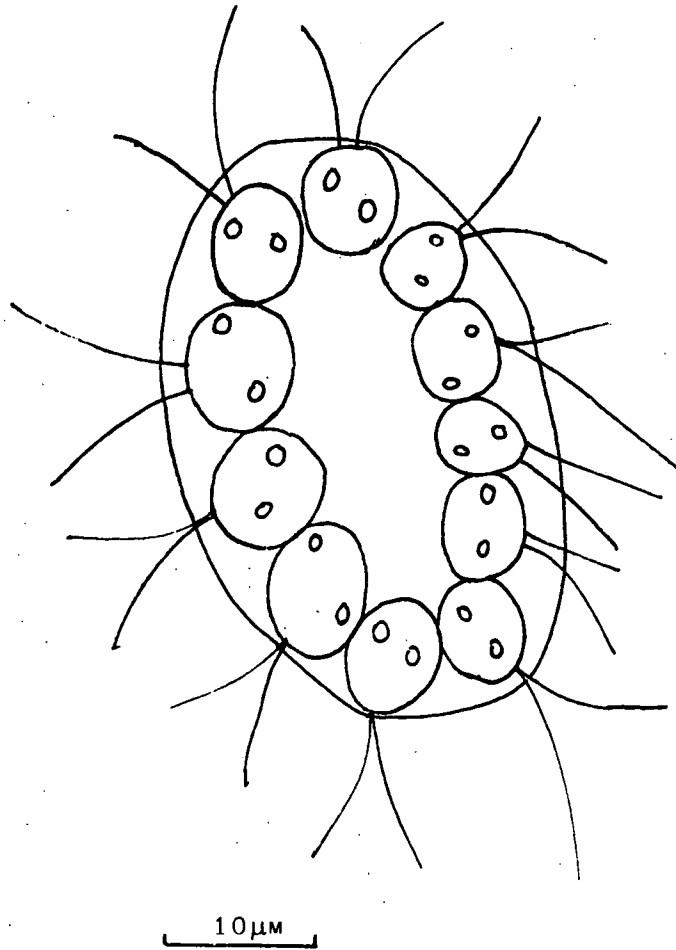
- A) Cells: average width 45.0 μm ; average length 25.0 μm , isthmus; average width 9.0 μm , semicells; cup-shaped, upper angles produced to form short stout converging, tapered processes ending in short spines, cell wall; rough, covered with minute granules.
- B) West (1908) gave the size ranges as - cells: 33.0 - 60.0 μm wide; 23.0 - 29.0 μm long; isthmus; 8.0 - 11.0 μm wide.
- C) Six populations studied:
Anse Cèdres: AC3, AC104
Cinq Cases: CC5, CC13, CC14, CC102
- D) Recorded only from the eastern region of Grande Terre.
From films over mud, among the filaments of other algae and the aufwuchs of larger plant growths.

130201 Carteria globosa Korshikov

- A) Cells: average diameter 23.0 μm ; cell-membrane; thin, without papillae, chloroplast; large, cup-shaped, dense with an axial pyrenoid, contractile vacuoles; two, situated near to the base of the flagellae, pigment spot; small, central.
- B) Pascher (1927) gave the size ranges as - cells: 18.0 - 28.0 μm in diameter, flagellae as long as the cell or longer.
- C) One population studied:
Anse Cèdres: AC3
- D) Recorded on only one occasion, from films over mud and the plankton.

130469 Chlamydomonas globosa Snow

- A) Cells: average diameter 7.0 μm ; average length 14.0 μm ,
ovate to almost spherical, sheath; hyaline, anterior
papillae absent, chloroplast; a parietal cup with basal
pyrenoid, a single anterior contractile vacuole, pigment-
spot; lateral, median.
- B) Prescott (1962) gave the size ranges as - cells: 5.0 -
7.0 μm wide; 10.0 - 19.0 μm long.
- C) 27 populations studied:
- Île Picard: W1, W2, W3, W4, W6, W7, W9, W102, W103, W110,
W110, W113, W117, W118, W120.
- Île Malabar: MW1, MW103, MW104, ME103, ME111
- Anse Cédres: AC101, AC109
- Cinq Cases: CC105
- Takamaka: T3, T122, T124, T125
- D) Widespread and often abundant. From films overlying
mud and rock, among the filaments of other algae, the
plankton and the aufwuchs of larger plant growths.

Eudorina elegans

130901 Eudorina elegans Ehrenberg

- A) Colony: containing 4 - 32 cells, spherical to ovate.
Cells: 16.0 - 18.5 μm in diameter, spherical, tightly packed.
- B) Pascher (1927) gave the size ranges as - colony:
60.0 - 200.0 μm in diameter. Cells: 16.0 - 24.0 μm in diameter, often widely separated or tightly packed.
- C) 15 populations studied:
^
Île Picard: W1, W4, W6, W7, W9, W104, W110, W113
Anse Cédres: AC2
Cinq Cases: CC5, CC15, CC102, CC105
Takamaka: T1, T108
- D) Widespread, occasionally abundant. From films over rock and mud, among the filaments of floating algae, the plankton and the aufwuchs of larger plant growths.

131601 Phacotus lenticularis (Ehrenberg) Stein

- A) Cells: 8.5 - 10.3 μm wide; 13.6 - 16.0 μm long, valves of lorica much wider than cells, dark brown, sculptured, chloroplast; cup-shaped with a basal pyrenoid.
- B) Pascher (1927) gave the size ranges as - cells: 13.0 - 20.0 μm long, valves; much wider than the cell, sculptured, papillate, occasionally smooth, chloroplast; large, cup-shaped with basal pyrenoid.
- C) 35 populations studied:
- ^
Île Picard: W1, W4, W5, W7, W9, W104, W110, W117
- ^
Île Malabar: ME107
- Anse Cèdres: AC1, AC2, AC3, AC4, AC101, AC103, AC104, AC109, AC111, AC112
- Cinq Cases: CC3, CC5, CC12, CC13, CC14, CC15, CC18, CC101, CC102, CC105
- Takamaka: T1, T103, T108, T121, T122
- D) Widespread, common and often very abundant. From films overlying mud and rock, among the floating filaments of other algae, the plankton and the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969).

132601 Pleodorina californica Shaw

- A) Colony: spherical. Cells: 13.5 - 25.0 μm in diameter spherical, evenly distributed within almost colourless homogeneous mucilage.
- B) Pascher (1927) gave the size ranges as - colony: 250 - 450 μm in diameter. Cells 13.0 - 27.0 μm diameter.
- C) Two populations studied:
Anse Cèdres: AC103
Takamaka: T124
- D) Rare, never very abundant. From algal films overlying mud.

140201 Ankistrodesmus acicularis (A. Br.) Korshikov

- A) Cells: average width 3.0 μm ; average length 50.0 μm ; single, almost straight or occasionally slightly bent, attenuate from the middle of the cell ending in sharp points; chloroplasts; completely filling cell; daughter-cells; emerge from diagonal split in mother-cell wall.
- B) Korshikov (1953) gave the size ranges as - cells: up to 4.5 μm wide; generally up to 80.0 μm long, occasionally up to 210.0 μm long.
- C) 36 populations studied:
- ^
Île Picard: W1, W4, W5, W7, W9, W110, W117
- ^
Île Malabar: MW104, ME107
- Anse Cèdres: AC1, AC2, AC3, AC4, AC101, AC103, AC104, AC109, AC111, AC112
- Cinq Cases: CC3, CC5, CC12, CC13, CC14, CC15, CC18, CC101, CC102, CC105
- Takamaka: T1, T103, T121, T122
- D) Widespread and locally common. From films over mud, the plankton, the aufwuchs of larger plant growths.

140205 Ankistrodesmus braunii (Näg.) Brünnthaler

- A) Cells: average width 5.0 μm ; 21.0 - 30.0 μm long; spindle-shaped, slightly rounded or pointed at the ends; daughter cells; emerge through a diagonal split in the mother-cell wall.
- B) Korshikov (1953) gave the size ranges as - 5.0 - 8.0 μm wide; 20.0 - 56.0 μm long.
- C) Ten populations studied:
Île Picard: W1, W2, W4, W5, W6, W7, W9, W102, W111, W127
- D) Recorded only from Île Picard. From films and filamentous sheets over mud and rock, the plankton, among larger algal colonies, and the aufwuchs of larger plant growths.

140206 Ankistrodesmus falcatus (Corda) Ralfs

- A) Cells: 2.0 - 5.0 μm wide; up to 80.0 μm long; straight or occasionally twisted, gradually tapered towards the poles ending in a sharp point, single or a few intertwined.
- B) Korshikov (1953) gave the size ranges as - cells: 3.5 - 4.5 μm wide; up to 80.0 μm long. Prescott (1961) gave the size ranges as - cells: 2.0 - 6.0 μm wide; 25.0 - 100.0 μm long.
- C) 19 populations studied:
Île Picard: W2, W4, W6, W7, W110
Île Malabar: ME108
Anse Cèdres: AC1, AC3, AC103
Cinq Cases: CC9, CC12, CC14, CC102, CC107
Takamaka: T2, T103, T121, T124, T3
- D) Widespread and common but rarely very abundant. From films over mud, as a constituent of the plankton and in the aufwuchs of higher plant growths.
- E) Recorded by Whitton (1969).

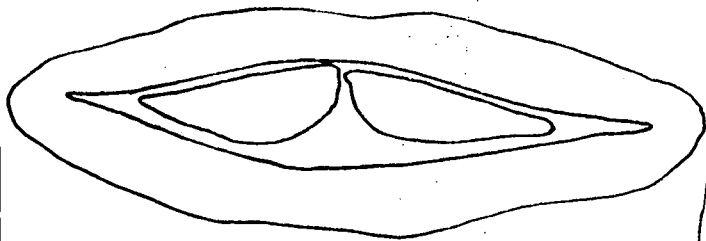
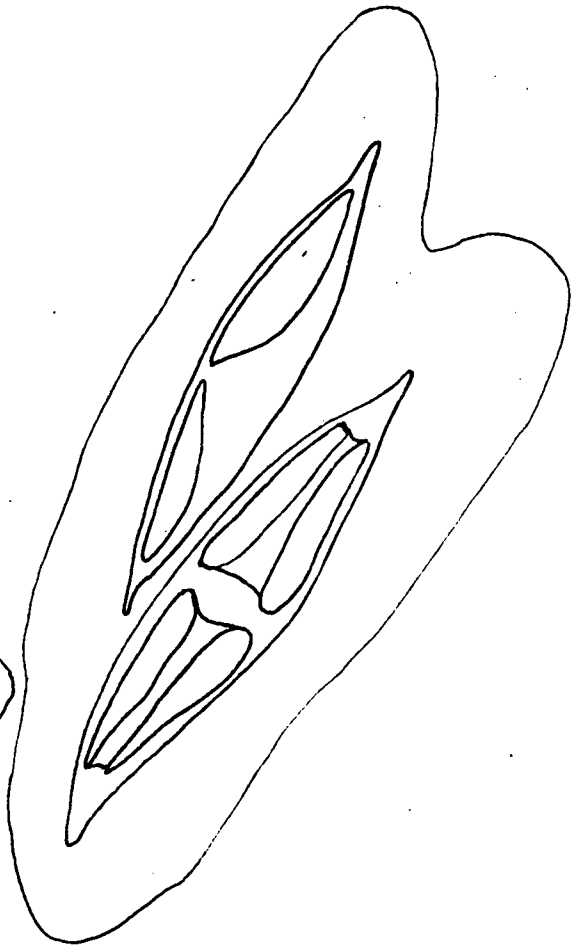
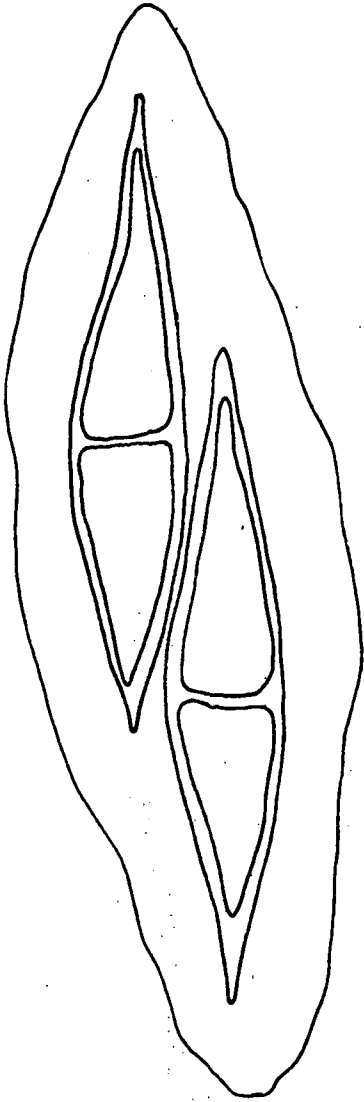
140207 Ankistrodesmus longissimus (Lemmermann) Wille

- A) Cells: average width 2.5 μm ; average length 30.0 μm ; straight or occasionally bent, tapering to sharp points at the poles, bright green, solitary; chloroplasts; a few small plates; pyrenoids; generally two, clearly visible.
- B) Korshikov (1953) gave the size ranges as - cells:
3.8 - 7.5 μm wide; up to 225.0 μm long.
- C) One population studied:
^
Île Picard: W2
- D) Recorded only once. From films over bottom mud, among floating filaments and the plankton.

140208 Ankistrodesmus minutissimus Korshikov

- A) Cells: 1.5 - 3.0 μm wide; 4.5 - 11.0 μm long; bow-shaped, poles bluntly pointed, pale blue-green, solitary.
- B) Korshikov (1953) gave the size ranges as - cells:
2.8 - 5.0 μm wide; up to 11.0 μm long.
- C) 35 populations studied:
Île Picard: W1, W2, W3, W4, W5, W7, W114, W110, W113,
W118, W120, W127
Île Malabar: MW103, ME103, ME108
Anse Cèdres: AC3, AC101, AC103, AC104, AC109, AC112
Cinq Cases: CC3, CC5, CC12, CC14, CC15, CC18, CC102, CC107
Takamaka: T1, T2, T108, T121, T122
- D) Widespread, common and occasionally abundant. From the plankton and the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969).

Ankistrodesmus mucosus



10µm

140209 Ankistrodesmus mucosus Korshikov

- A) Cells: average width 3.0 μm ; average length 15.0 μm ; spindle-shaped with rounded poles, single or a few together in almost colourless mucilage.
- B) Korshikov (1953) gave the size ranges as - cells:
1.8 - 2.3 μm wide; 14.0 - 21.0 μm long.
- C) Two populations studied:
^
Ile Picard: W2
Anse Cèdres: AC3
- D) Recorded only twice from two widely separated pools.
From films over bottom mud and the plankton.

140210 Ankistrodesmus pseudomirabilis Korshikov

- A) Cells: 1.5 - 3.0 μm wide; 25.0 - 50.0 μm long; solitary, spiral or 'S' shaped.
- B) Korshikov (1953) gave the size ranges as - cells: up to 2.6 μm wide; up to 60.0 μm long.
- C) 18 populations studied:
^
Île Picard: W4, W104, W110, W112, W113, W116, W118, W127
Cinq Cases: CC5, CC9, CC14, CC107
Takamaka: T1, T108, T121, T124
- D) Widespread, common and occasionally abundant. From films over mud, the plankton and the aufwuchs of larger plant growths.

140454 Characium sp., cells obviously curved, length times
breadth > three

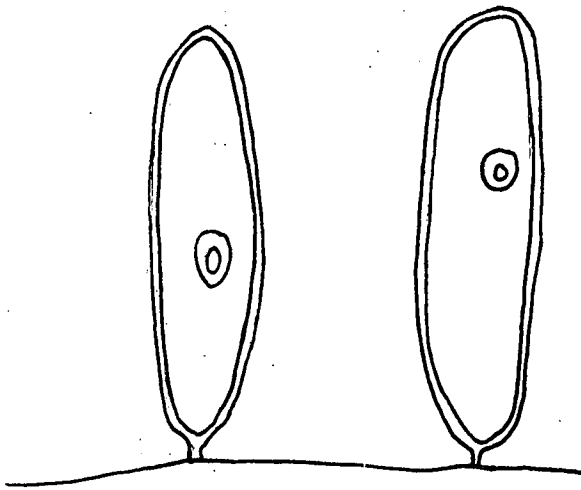
A) Cells: average width 2.0 μm ; average length 12.0 μm ,
curved, end of cell slightly pointed.

It has not been possible to allocate a suitable binomial
due to insufficient material. Probably only one species.

C) One population studied:

Île Picard: W6

D) Recorded on only one occasion, attached to a dead twig
on bottom of pool.



Characium strictum

10μm

140470 Characium strictum A. Braun

- A) Cells: average width 7.0 μm ; average length 25.0 μm ; straight, symmetrical, oval to cylindrical, broadly rounded at the apex, stipe; 1.2 μm long with small basal attaching disc, chromatophore; a diffuse parietal plate with a single pyrenoid.
- B) Korshikov (1953) gave the size ranges as - cells: 6.0 - 7.0 μm wide; 23.0 - 30.0 μm long.
- C) One population studied:
^
Ile Picard: W5
- D) Recorded on only one occasion, attached to a dead twig at the bottom of a pool.

140501 Chlorella ellipsoidea Gerneck

- A) Cells: average width 6.0 μm ; average length 7.5 μm ; ellipsoid, a few together in an almost colourless common mucilage; chloroplasts; single, parietal with a single pyrenoid.
- B) Korshikov (1953) gave the size ranges as - cells: 4.2 - 7.4 μm wide; 5.3 - 9.0 μm long.
- C) One population studied:
Cinq Cases: CC5
- D) Recorded only once in an algal film over mud.

140504 Chlorella vulgaris Beyer

A) Cells: average diameter 6.5 μm , spherical, generally solitary.

B) Korshikov (1953) gave the size ranges as - cells:
4.2 - 10.5 μm in diameter.

C) 12 populations studied:

^
Île Picard: W1, W2, W3, W4, W5, W7, W104, W107, 0600 + 0900

^
Île Malabar: MW103

Takamaka: T108, T124

D) Widespread, locally common on ^Île Picard, occasionally abundant. From films, and filamentous sheets over mud and rock and the plankton.

140505 Chlorella mucosa Korshikov

A) Cells: average diameter 3.9 μm ; spherical, few or many together within almost colourless mucilage.

B) Korshikov (1953) gave the size ranges as - cells: 2.7 - 5.8 μm wide.

C) One population studied:

^
Île Picard: W2

D) Recorded only once. From an algal felt.

141003 Coelastrum cambricum Archer

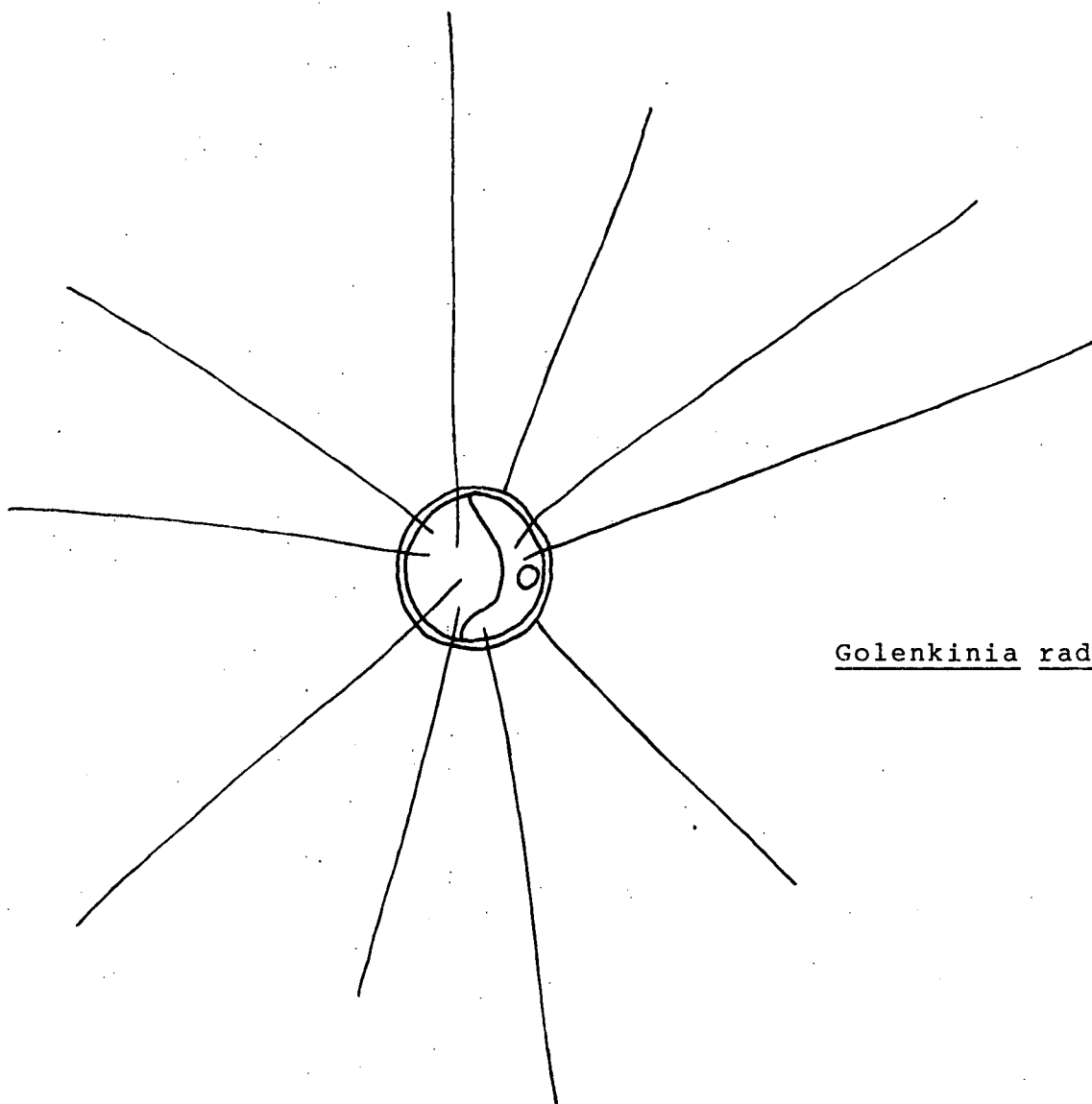
- A) Cells: 6.0 - 12.0 μm wide; globular to conical, joined by short projections to form a colony with triangular intercellular spaces; cell wall; rough.
- B) Korshikov (1953) gave the size range for cells as - cells: 9.0 - 12.0 μm in diameter.
- C) Twelve populations studied:
Île Picard: W1, W2, W3
Anse Cèdres: AC1, AC104
Cinq Cases: CC1, CC2, CC3, CC5, CC13, CC14, CC18
- D) Widespread but rare. From films, among floating filaments, planktonic and from the aufwuchs of larger plant growths.
- F) Philipose (1967) listed many records from paddy-fields, ponds, ditches, and shallow pools in Burma, Ceylon and India. He described its distribution as Africa, America, Australia, Ceylon, Europe, India, Japan, Java.

141009 Coelastrum microporum Nägeli

- A) Cells: average diameter 13.8 μm ; spherical, united by very short mucilaginous projections with up to six other cells to form a spherical colony.
- B) Korshikov (1953) gave the size range as - cells: 6.0 - 27.0 μm , usually 16.0 - 18.0 μm in diameter.
- C) Twenty-two populations studied:
- ^
Île Picard: W2, W113, W120
 - ^
Île Malabar: ME111
 - Anse Cèdres: AC1 AC2, AC3, AC104
 - Cinq Cases: CC2, CC5, CC12, CC13, CC15, CC16, CC102, CC104,
CC107
 - Takamaka: T1, T2, T108, T118, T122
- D) Widespread and locally common. From films, over mud, among floating filaments, planktonic and in the aufwuchs of larger plant growths.
- F) Philipose (1967) listed many records from, rock pools, tanks, ditches and ponds in Burma, Ceylon and India. He described its distribution as ubiquitous.

141501 Dimorphococcus lunatus A. Braun

- A) Cells: 4.0 - 8.0 μm wide, 8.0 - 12.0 μm long; oval to reniform, broadly rounded at the poles, few or many together within almost colourless mucilage.
- B) Philipose (1967) gave the size ranges as - cells:
4.0 - 15.0 μm wide; 9.0 - 25.0 μm long.
- C) Eleven populations studied:
 ^
 Ile Malabar: MW101
 Anse Cédres: AC3
 Cinq Cases: CC3, CC5, CC104
 Takamaka: T1, T103, T108, T118, T122, T124
- D) Not recorded for ^
 Ile Picard, elsewhere widespread and locally common. From films overlying mud, among floating filaments, the plankton, and the aufwuchs of larger plant growths. Often forming the major constituent of the plankton in some pools.
- F) Philipose (1967) listed many records from, ponds and tanks in Burma and India. He described its distribution as Africa, Burma, Europe, Formosa, India, Japan, Java, North America, Siam.



Golenkinia radiata

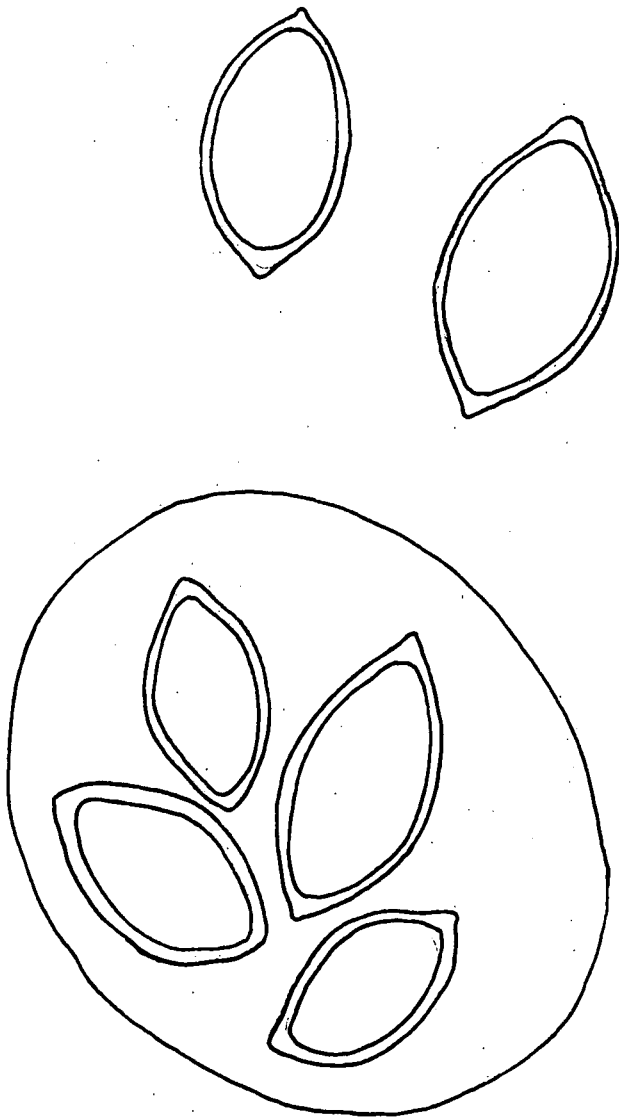
10μm

142102 Golenkinia radiata Chodat

- A) Cells: 10.0 - 12.0 μm wide; spherical, solitary; cell wall; covered with a number of bristles of average length 38.0 μm ; chloroplasts; cup-shaped, single with a single pyrenoid.
- B) Korshikov (1953) gave the size ranges as - cells: 10.0 - 18.0 μm wide; bristles; 40.0 - 45.0 μm long. Philipose (1967) gave the size ranges as - cells: 7.0 - 15.0 μm wide; bristles; 25.0 - 45.0 μm long.
- C) Twenty-six populations studied:
 Île Picard: W1
 Anse Cédres: AC1, AC2, AC3, AC103, AC104
 Cinq Cases: CC1, CC2, CC5, CC8, CC9, CC12, CC13, CC14, CC15, CC17, CC18, CC104, CC107
 Takamaka: T1, T102, T103, T118, T122, T124
- D) Widespread, locally common in the Cinq Cases region, occasionally abundant. From films overlying mud, among floating filaments, the plankton and in the aufwuchs of larger plant growths.
- F) Philipose (1967) described its distribution as Ceylon, Europe, India, Japan, North America, South Africa.

142701 Nautococcus caudatus Korshikov

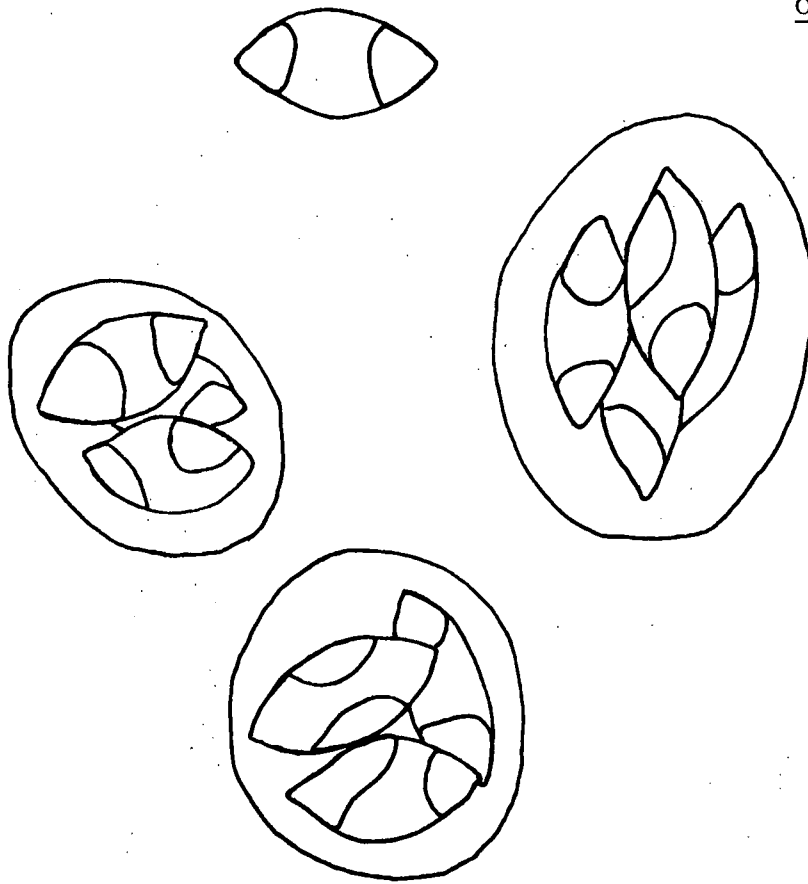
- A) Cells: 20.0 - 27.0 μm wide; spherical to onion-shaped, with a well developed 'swimming-cap', solitary; chloroplasts; irregularly globular with a central pyrenoid.
- B) Korshikov (1953) gave the average diameter as 20.0 μm
- C) Thirteen populations studied:
- ^
Île Picard: W1, W4, W5, W6, W7, W113, W115, W127
- ^
Île Malabar: MW101
- Cinq Cases: CC9, CC15, CC16
- Takamaka: T1
- D) Widespread, locally common on Île Picard, occasionally very abundant. From films overlying mud, among floating filaments, the plankton and the aufwuchs of larger growths, occasionally seen as a yellow film completely covering the surfaces of pools.

Oocystis crassa10 μ m

142902 Oocystis crassa Wittrock

- A) Cells: 7.0 - 10.0 μm wide; up to twice as long as broad; ovate, broadly rounded at the poles, single or in colonies of 2 - 8 enclosed in the much swollen and gelatinized mother cell wall; cell membrane; thickened at the poles; chloroplasts; 3 - 5, large parietal discs with pyrenoids.
- B) Korshikov (1953) gave the size ranges as - cells: 10.0 - 20.0 μm wide; 14.0 - 26.0 μm long.
- C) Seven populations studied:
^
Ile Picard: W4, W6
Cinq Cases: CC9, CC12, CC13, CC18, CC102
- D) Recorded only from two widely separated areas of the atoll. From films overlying mud, among floating filaments, the plankton, and the aufwuchs of larger plants growths.
- F) In shallow pools overgrown with weeds; Burma (West, W. and G. S., 1907); from rock pools and tanks; Ceylon (Crow, 1923); Philipose (1967) described its distribution as Australia, Burma, Ceylon, Europe, Madagascar, North America, Siberia.

Oocystis parva



10μm

142907 Oocystis parva W. et G. S. West

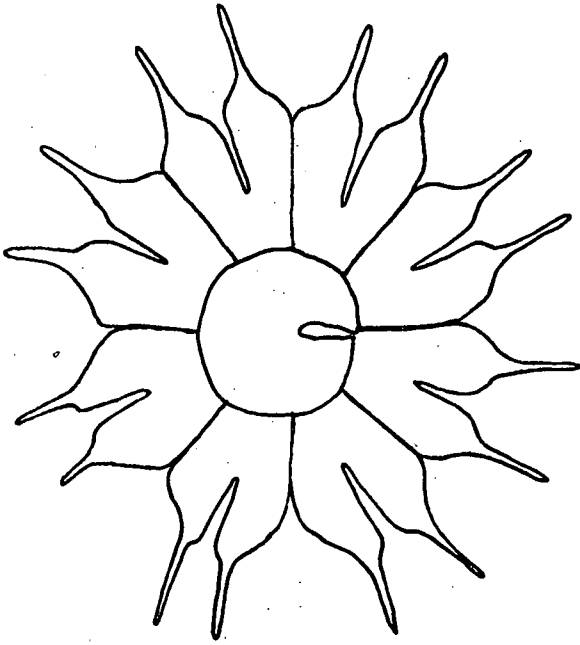
- A) Colony: up to 8 cells enclosed within the gelatinized wall of the mother cell. Cells: 3.9 - 4.3 μm wide; 6.0 - 9.0 μm long; oval to spindle-shaped, pointed at the poles; chloroplasts; 1 - 3 without pyrenoids.
- B) Korshikov (1953) gave the size range as - cells: 4.0 - 7.0 μm wide; 6.0 - 12.0 μm long.
- C) Fourteen populations studied:
- Île Picard: W1, W4, W7, W113
 - Île Malabar: MW103
 - Anse Cédres: AC111, AC112
 - Cinq Cases: CC3, CC5, CC13, CC18
 - Takamaka: T108, T118, T124
- D) Widespread, locally common, never very abundant. From films overlying mud, among floating filaments, algal felts, larger gelatinous colonies, the plankton and the aufwuchs of larger plant growths.

142910 Oocystis pusilla Hansgirg

- A) Cells: average width 4.0 μm ; average length 8.0 μm ; up to twice as long as broad, cylindrical, broadly-rounded at the ends, solitary, occasionally up to 8 cells remaining within the gelatinized mother cell wall; chloroplasts: 2 - 3, without pyrenoids.
- B) Korshikov (1953) gave the size range as - cells: 4.5 - 6.4 μm wide; 8.0 - 12.0 μm long. Philipose (1967) gave the size range as - cells: 3.0 - 7.5 μm wide; 6.0 - 12.0 μm long.
- C) Three populations studied:
Île Picard: W1, W4, W107
- E) Recorded only from three pools on Île Picard. From films overlying mud, among algal felts and larger gelatinous colonies, the plankton and the aufwuchs of larger plant growths.

143103 Pediastrum boryanum (Turpin) Meneghini

- A) Colony: circular without intercellular spaces. Cells: average width 8.0 μm ; polygonal, outer surface slightly to deeply emarginate with two short processes usually ending in short spines; cell wall; usually granulate, occasionally smooth.
- B) Philipose (1967) gave the size range as - cells: 7.0 - 40.0 μm in diameter.
- C) One population studied:
Cinq Cases: CC102
- D) Recorded from only one pool in the Cinq Cases region of Grande Terre. From among floating filaments.
- F) From an artificial tank; Ceylon (West and West, 1902); shallow pools overgrown with weeds; Burma (West and West, 1907). Philipose (1967) described its distribution as ubiquitous.



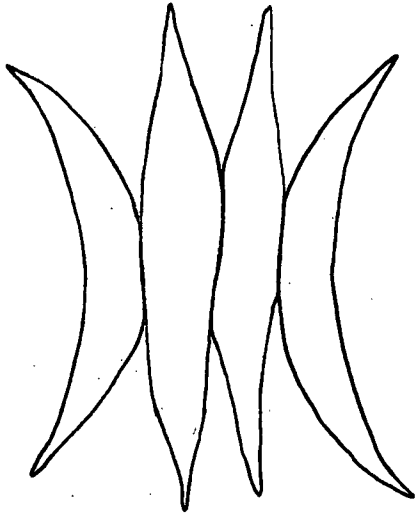
Pediastrum tetras

10 μ m

143109 Pediastrum tetras (Ehrenberg) Ralfs

- A) Colony: circular without intercellular spaces. Cells: average width 7.0 μm ; marginal cells; divided into two lobes by a deep linear incision, which may reach the middle of the cell, each lobe is truncated and slightly emarginated; inner cells; four to six sided with a single linear incision.
- B) Philipose (1967) gave the size range as - cells: 5.0 - 27.0 μm in diameter and stated that the lobes of the marginal cells may be further divided into two lobes.
- C) One population studied:
Cinq Cases: CC102
- D) Recorded on only one occasion, from a film overlying mud.
- F) Philipose (1967) listed many records from paddyfields, ponds, pools, streams, tanks, and lakes in Burma, Ceylon and India. He described its distribution as ubiquitous.

Scenedesmus acuminatus



10μm

143501 Scenedesmus acuminatus (Lagerheim) Chodat

- A) Cells: 2.0 - 5.0 μm wide; 20.0 - 30.0 μm long; spindle-shaped lunate, sharply pointed at the poles; cell-walls; smooth; 4 - 8 cells within colony.
- B) Philipose (1967) gave the size range as - cells:
2.0 - 7.0 μm wide; 12.0 - 48.0 μm between the apices.
- C) Five populations studied:
^
Ile Picard: W1

Cinq Cases: CC1, CC3, CC5, CC12

Takamaka: T102
- D) A rare species, never very abundant though widespread.
From films overlying mud, among floating filaments, planktonic and in the aufwuchs of larger plant growths.
- F) Philipose (1967) listed many records from tanks, lakes, pools, ponds, and swamps in Burma, Ceylon and India. He described its distribution as widespread including:
Africa, Australia, Burma, Ceylon, Europe, India, Japan, Java, North America, Singapore.

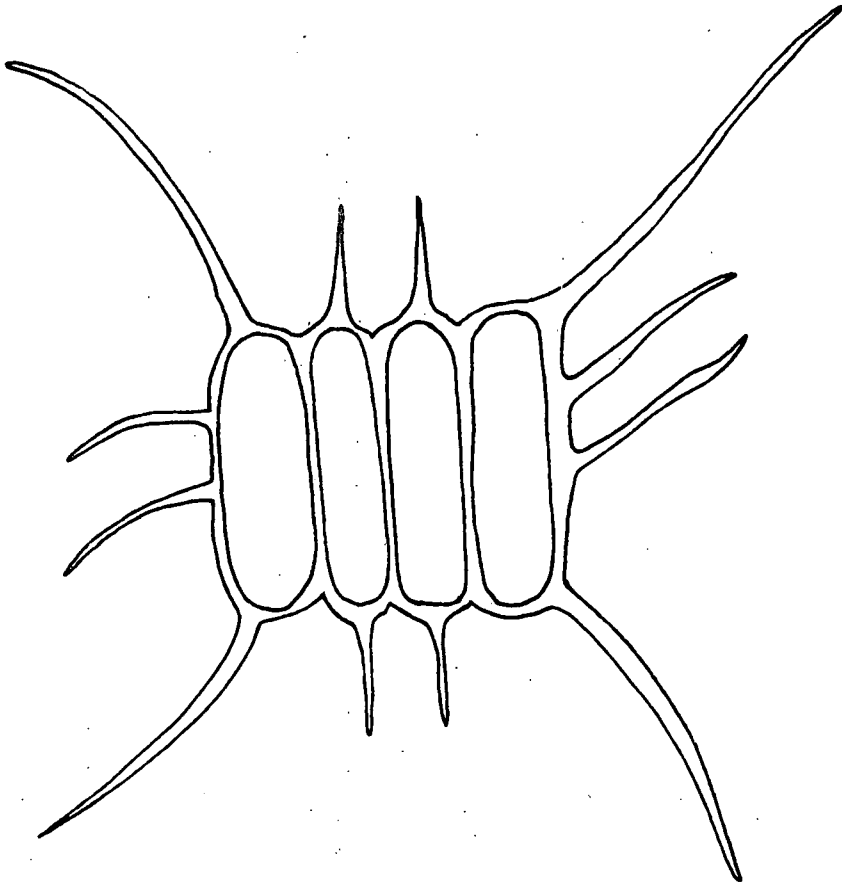
143502 Scenedesmus bijugatus (Turpin) Kützing

- A) Cells: 3.0 - 6.0 μm wide; 6.0 - 18.0 μm long, oblong, oval, or ellipsoid, broadly rounded at the ends; up to 16 cells in a flat linear series.
- B) Philipose (1967) gave the size ranges as - cells:
3.5 - 7.0 μm wide; 7.0 - 23.0 μm long.
- C) 42 populations studied:
 ^
 Île Picard: W1, W4, W6, W7, W9, W102, W104, W110, W112,
 W113, W117, W118, W119, W120, W127
 ^
 Île Malabar: ME102, ME103, ME104, ME108, ME111
 Anse Cèdres: AC1, AC2, AC3, AC103, AC104, AC109
 Cinq Cases: CC1, CC3, CC5, CC12, CC13, CC14, CC16, CC17,
 CC18, CC102
 Takamaka: T122, T124
- D) Widespread, locally common and often abundant. From films overlying mud and rock, among floating filaments, algal felts and larger gelatinous growths, the plankton and in the aufwuchs of larger plant growths.
- F) Philipose (1967) listed many records from streams, stagnant water ditches, canals, ponds, tanks, rainwater pools, cement cisterns and attached to larger plant growths in Burma, Ceylon and India.

143508 Scenedesmus obliquus (Turpin) Kützing

- A) Cells: average width 6.0 μm ; average length 15.0 μm ; spindle-shaped to fusiform, outer cells bow-shaped, almost lunate, ends of cells acutely or slightly rounded, usually sides straight, cell-walls; smooth, 2-4 occasionally up to 8 cells within colony.
- B) Philipose (1967) gave the size ranges as - cells:
2.0 - 9.0 μm wide; 5.0 - 27.0 μm long.
- C) One population recorded:
Takamaka: T124
- D) Recorded only once, from an algal film overlying bottom mud.
- F) Philipose (1967) listed many records from paddyfields, tanks, stagnant waters, ditches, ponds and cement cisterns in Ceylon and India. He described its distribution as ubiquitous.

Scenedesmus quadricauda



10µm

143510 Scenedesmus quadricauda (Turpin) Brébisson

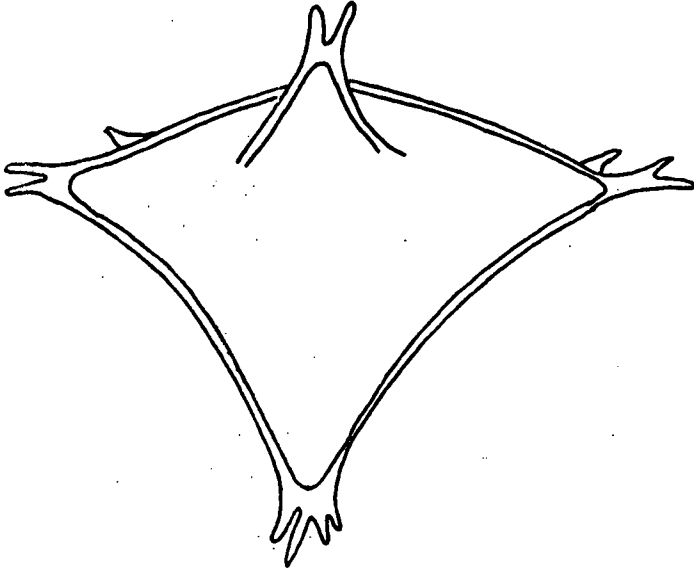
- A) Cells: 2.8 - 15.0 μm wide; 8.0 - 31.0 μm long; oblong to cylindrical, broadly rounded at the poles, cell walls; smooth; end-cells possessing a long curved or straight spine at each pole.
- B) Korshikov (1953) gave the size ranges as - cells:
2.5 - 15.0 μm wide; 7.0 - 43.0 μm long.
- C) 49 populations studied:
 ^
 Île Picard: W1, W2, W3, W4, W6, W7, W9, W102, W104, W112,
 W113, W117, W118
 ^
 Île Malabar: ME103, ME108
 Anse Cédres: AC1, AC2, AC3, AC101, AC103, AC104, AC109
 Cinq Cases: CC1, CC2, CC3, CC5, CC8, CC9, CC12, CC13,
 CC14, CC15, CC16, CC17, CC18, CC102, CC104,
 CC105, CC107
 Takamaka: T1, T2, T102, T103, T108, T118, T121, T122, T124,
 T125, 3300 + 0300
- D) Widespread, locally common and occasionally abundant.
 From films overlying mud and rock, floating filaments, larger gelatinous colonies, plankton and the aufwuchs of larger plant growths
- E) Recorded by Whitton (1969).
- F) Philipose (1967) listed many records from paddy-fields, lakes, stagnant waters, ponds, tanks and swamps in Burma, Ceylon and India. He described its distribution as ubiquitous.

144102 Tetraedron incus (Teiling) G. M. Smith

- A) Cells: 14.0 - 20.0 μm wide; solitary, tetragonal, flat or pyramidal, the poles produced to form lobes each ending in a spine 7.0 - 18.0 μm long.
- B) Philipose (1967) gave the size ranges as - cells: 15.0 - 20.0 μm wide; spines; 7.0 - 8.0 μm long.
- C) 14 populations studied:
Île Malabar: ME102
Anse Cédres: AC2
Cinq Cases: CC3, CC5, CC13, CC14, CC15, CC102, CC104,
CC107
Takamaka: T1, T2, T104
- D) Recorded only from the eastern end of the atoll, where it was locally common. From films overlying mud, among floating filaments, the plankton, and the aufwuchs of larger plant growths.

144103 Tetraedron minimum (A. Br.) Hansgirg

- A) Cells: average diameter: 9.0 μm ; solitary, quadrangular, with concave sides and rounded poles.
- B) Korshikov (1953) gave the size ranges as - cells:
6.0 - 20.0 μm wide.
- C) 23 populations studied:
^
Ile Picard: W1
Anse Cédres: AC1, AC2, AC3, AC103, AC104
Cinq Cases: CC3, CC5, CC9, CC12, CC14, CC16, CC17,
CC18, CC102, CC104
Takamaka: T1, T103, T118, T122, T124, T125
- D) Widespread, though only one record from the western end of the atoll, locally common in the eastern region.
From films over mud and rock, among floating filaments of other algae, the plankton and the aufwuchs of larger plant growths.
- E) Recorded by Whitton (1969).
- F) Philipose (1967) listed many records from filter beds, ditches, ponds, tanks, lakes and swamps in Afghanistan, Burma, Ceylon and India. He described its distribution as ubiquitous.

Tetraedron triangulare

10μm

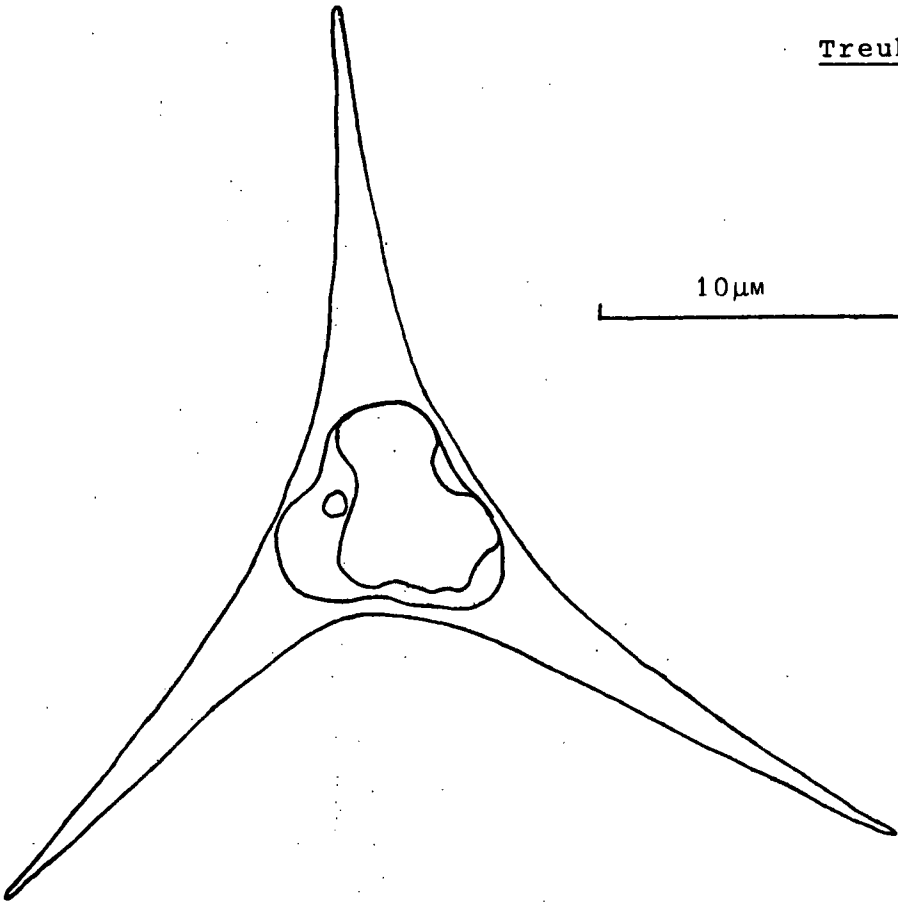


144104 Tetraedron triangulare Korshikov

- A) Cells: average diameter 7.5 μm ; distance between poles 12.0 μm ; flat, triangular, with slightly concave sides and rounded poles, cell walls; covered evenly with papillae, with larger papillae at the poles, chloroplasts; single with a single pyrenoid.
- B) Korshikov (1953) did not give the diameter but gave the range for the distance between the poles as 12.5 - 14.0 μm .
- C) Seven populations studied:
^
Ile Picard: W4, W6, W7
Cinq Cases: CC9, CC18, CC107
Takamaka: T103
- D) Widespread but rare, never abundant. From films over mud, among floating filaments, the plankton and the aufwuchs of larger plant growths.

Treubaria triappendiculata

10μm



144403 Treubaria triappendiculata Bernard

- A) Cells: 12.0 - 16.0 μm wide; extended into 3 poles each produced into a long hyaline spine with a broad base up to 12.0 μm long; chloroplasts; 1 - 3, each with a pyrenoid.
- B) Philipose (1967) gave the size ranges as - cells: 6.0 - 13.0 μm wide; spines; 12.0 - 40.0 μm long.
- C) Two populations studied:
Cinq Cases: CC2, CC5
- D) Recorded only from two pools in the Cinq Cases region of Grande Terre. From films over mud and among the filaments of other algae.
- F) Philipose (1967) described its distribution as Europe, India, Java, and North America.

144703 Sorastrum spinulosum Nägeli

- A) Cells: average width 12.0 μm ; average length 14.0 μm ; reniform or cuniform, with two relatively short spines at the apex of each angle, up to 32 cells within almost colourless, diffluent mucilage.
- B) Korshikov (1953) gave the size ranges as - cells: 12.0 μm - 18.) μm wide; 6.0 - 18.0 μm long.
- C) One population studied:
Cinq Cases: CC18
- D) Recorded only once from the aufwuchs of Chara zeylanica.
- F) Philipose (1967) listed many records from among aquatic vegetation in paddy-fields, ditches, ponds, pools, and cement cisterns in India. He described its distribution as; Africa, Ceylon, China, Europe, India, Jamaica, Japan, Java, New Zealand, North and South America.

150101 Apatococcus lobatus (Chodat) Boye-Petersen

- A) Colony: an expanded light-green sheet. Cells: average width 7.5 μm ; average length 9.0 μm ; chloroplast; a single parietal plate.
- B) Printz (1964) gave the size ranges as - cells: 7.0 - 12.0 μm wide, rarely up to 15.0 μm wide.
- C) Four populations studied:
^
Île Picard: 0564 + 1017, 0600 + 0900
Takamaka: 3343 + 0590, 3345 + 0551
- D) Widespread, occasionally abundant. From the bark of trees, occasionally planktonic. This species was especially common and often very abundant on the bark of the Calophyllum trees near Bassin Takamaka (T2).

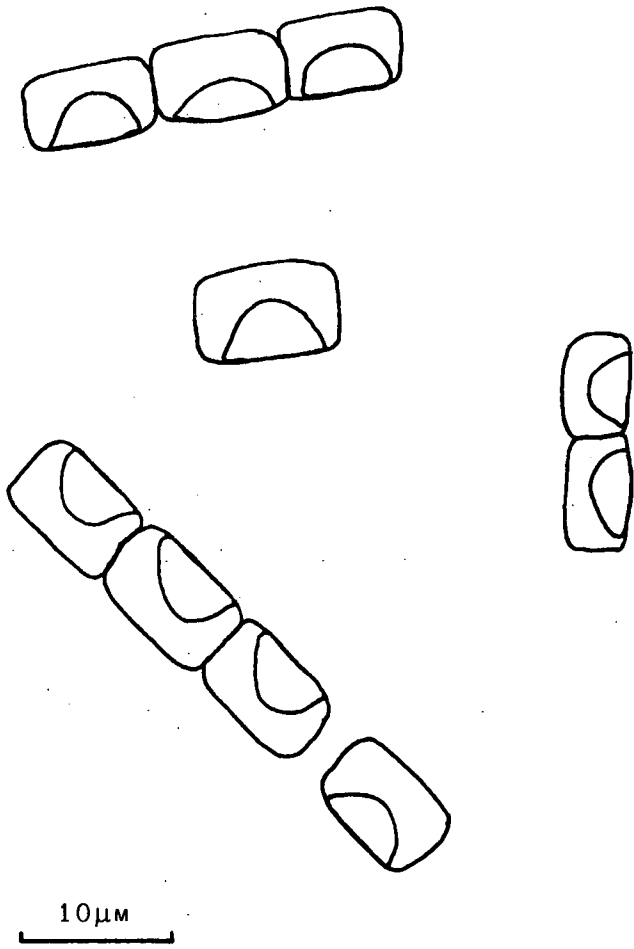
152801 Gongrosira debaryana Rabenhorst

- A) Colony: forming an expanded green sheet over the substrate with filaments rising vertically from the base. Filaments: average width 25.0 μm short, rarely branching. Cells: 16.0 - 26.0 μm wide; 28.0 - 34.0 μm long; chloroplast: a single parietal plate with a single pyrenoid. Sporangia: average diameter 30.0 μm .
- B) Printz (1964) gave the size ranges as - cells: 15.0 - 50.0 μm wide. Sporangia: up to 150.0 μm in diameter.
- C) Seven populations studied:
^
Île Picard: W1, W2, W3, W6, W7
^
Île Malabar: MW104
- D) Often the dominant species where it occurs. Forming expanded sheets over rock, wood and occasionally other algae. It is likely that this species is more common and widespread than the above data suggest as many records had to be coded under 152850 Gongrosira sp., due to lack of identifiable characters.
- E) Recorded by Whitton (1969).

152901 Hormidium fluitans (Gray) Heering

- A) Filaments: yellow-green densely aggregated, geniculately bent. Cells: 7.5 - 8.5 μm ; 7.0 - 24.0 μm long; cylindrical to barrel-shaped; a single parietal plate with indistinct pyrenoid.
- B) Ramanathan (1964) gave the size ranges as - cells: 6.5 - 9.0 μm wide; one - three times as long as broad.
- C) One population studied:
Anse Cèdres: AC2
- D) Recorded on only one occasion, forming filamentous sheets over rock and on submerged Chara zeylanica.

Stichococcus bacillaris



154455 Stichococcus bacillaris Nägeli + cylindrical $> 2 \mu\text{m}$

- A) Filaments: composed of 4 - 16 cells. Cells: average width $3.2 \mu\text{m}$; average length $5.5 \mu\text{m}$; chloroplast; a single parietal plate; without pyrenoid.
- B) Ramanathan (1964) gave the size ranges as - cells:
 $2.0 - 3.8 \mu\text{m}$ wide; two to six times longer than broad.
- C) Two populations studied:
Île Picard: 0600 + 0900, 0609 + 0900
- D) Recorded only from Île Picard, from algal crusts over sand and the bark of trees.

154603 Trentepohlia iolithus (L.) Wallroth

- A) Colony: composed of horizontal and vertical filaments forming bright pink, orange or green sheets over substrate. Cells: average width 20.0 μm ; average length 24.0 μm . Sporangia: 18.0 - 30.0 μm diameter.
- B) Prescott (1962) gave the size ranges as - cells: 14.0 - 35.0 μm wide; 24.0 - 50.0 μm long. Sporangia: 20.0 - 48.0 μm in diameter.
- C) Nine populations studied:
- ^A
 Île Picard: W1, 0600 + 0900, 0621 + 0997
- Cinq Cases: CC2, 3841 + 0623
- Takamaka: T1, 3300 + 0300, 3345 + 0551
- ^A
 Île Esprit: 1000 + 0600
- D) Widespread, occasionally very abundant. Forming bright pink, orange or green expanded sheets over rock and wood.

160751 Oedogonium sp., $\leq 8 \mu\text{m}$

A) Observation of the Aldabran material suggested the presence of two species:

a) Cells: 7.0 - 20.5 μm wide at widest point. Oospores: average width 23.0 μm ; average length 25.0 μm , ovate, wall; smooth. This species seemed widespread occurring in every area of the atoll sampled.

b) Cells: 5.0 - 10.5 μm at the widest point. Oospores: average diameter 23.0 μm spherical, wall; smooth. This species seemed restricted to the Cinq Cases area of Grande Terre.

C) 14 populations studied:

^
Île Picard: W1, W4, W107, W110

^
Île Malabar: MW104

Cinq Cases: CC2, CC5, CC12, CC13, CC14, CC16, CC18,
CC101, 3841 + 0623

D) Widespread, occasionally very abundant. From films, filamentous flocs, the plankton and epiphytic on other algae and larger plant growths.

160752 Oedogonium sp., $> 8 \leq 12 \mu\text{m}$

A) See also 160751 Oedogonium sp., $\leq 8 \mu\text{m}$

B) 25 populations studied:

Île Picard: W1, W4, W6, W7, W103, W104, W110, W111,
W112, W113

Île Malabar: MW1, MW103, MW104

Anse Cédres: AC2, AC103, AC112

Cinq Cases: CC5, CC8, CC13, CC14, CC15, CC101, CC102

Takamaka: T1, T125

D) Often the dominant alga in certain habitats. From films over mud and rock, forming filamentous flocs, from algal felts, the plankton and epiphytic on other algae and larger plant growths.

160753 Oedogonium sp., $> 12 \leq 16 \mu\text{m}$

A) See also 160751 Oedogonium sp., $\leq 8 \mu\text{m}$

C) 17 populations studied:

Île Picard: W1, W2, W4, W7, W104, W107, W112, 1000 + 0500

Île Malabar: MW1, MW104

Anse Cèdres: AC1, AC2, AC4

Cinq Cases: CC102

Takamaka: T1

Grande Terre Central: SC101, 2652 + 0378

D) Often the dominant alga in certain habitats. From films overlying mud and rock, forming filamentous flocs, from algal felts, the plankton and epiphytic on other algae and larger plant growths.

160754 Oedogonium sp., $> 16 \leq 20 \mu\text{m}$

A) See also 160751 Oedogonium sp., $\leq 8 \mu\text{m}$

C) Four populations studied:

Île Picard: W1, W4, W6

Île Malabar: ME102

D) Widespread but rare. From films, filamentous flocs, the plankton and epiphytic on other algae and larger plant growths.

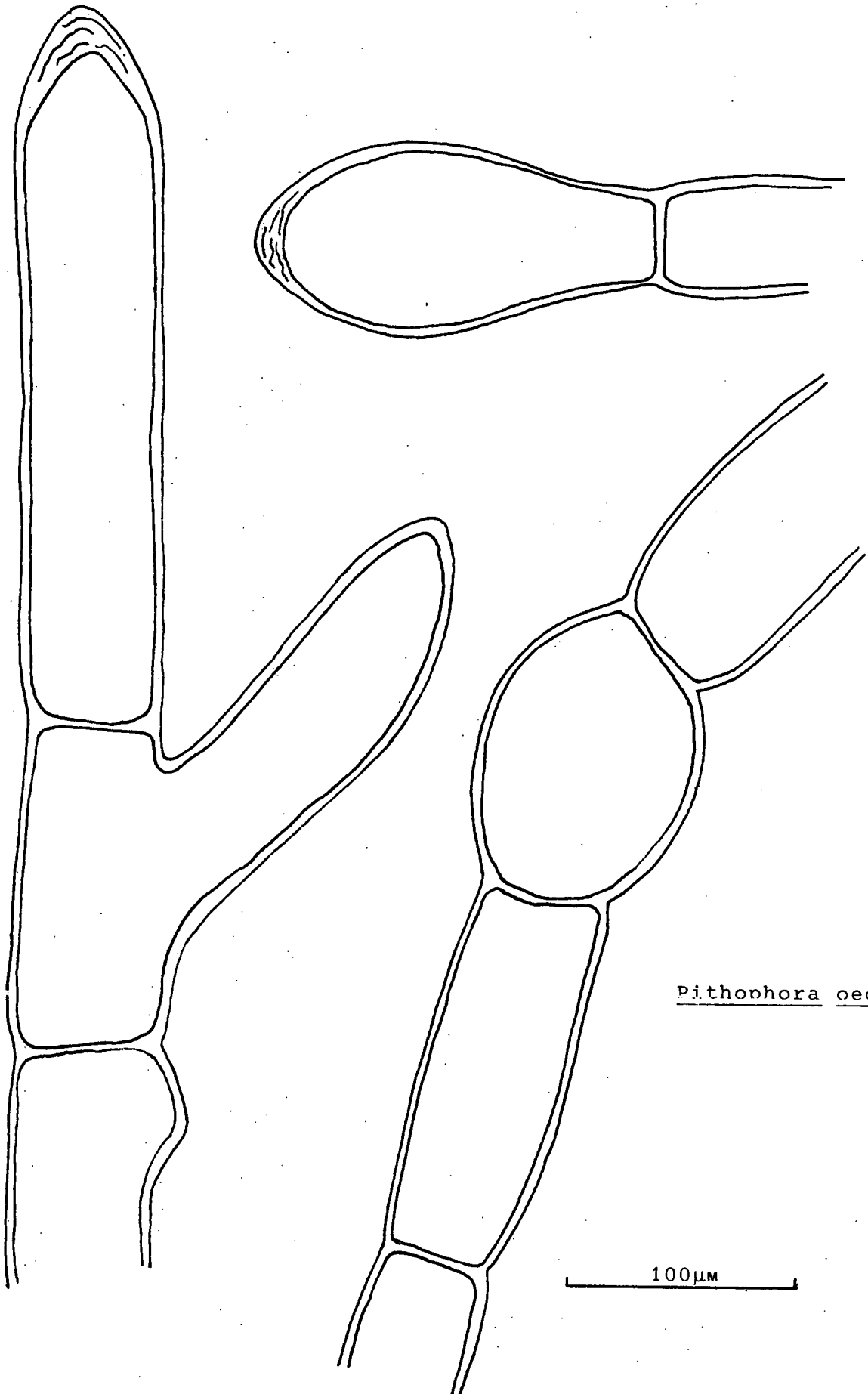
160755 Oedogonium sp., $> 20 \leq 24 \mu\text{m}$

A) See also 160751 Oedogonium sp., $\leq 8 \mu\text{m}$

C) One population studied:

Takamaka: T2

D) Recorded only on one occasion, planktonic.



Pithophora oedogonia

100 μm

160801 Pithophora oedogonia (Mont.) Wittrock

- A) Colony: a dense aggregation of filaments. Cells: average width 64.0 μm , average length 500.0 μm , cylindrical. Akinetes: average width 82.0 μm ; average length 184.0 μm , apical akinetes ovate, intercalary akinetes barrel-shaped.
- B) Prescott (1962) gave the size ranges as - cells: 45.0 - 70.0 μm wide, up to 20 times longer than broad. Akinetes: 57.0 - 144.0 μm wide, 95.0 - 380.0 μm long.
- C) Nine populations studied:
- ^
Ile Picard: W4, W7, W9, W102, W104, W111
- ^
Ile Malabar: MW102, ME107
- Cinq Cases: CC101
- D) Widespread and occasionally very abundant. From films over mud and rock, forming filamentous sheets over mud, rock and decaying vegetation.

170106 Chara zeylanica Kl. ex Willd. var. diaphana (Meyer)

R. D. Wood

A) The Aldabran material was identified by R. D. Wood.

C) Five populations studied:

Anse Cèdres: AC2

Cinq Cases: CC5, CC12, CC13, CC102

D) Recorded only from the eastern regions of Grande Terre,
where it was widespread, common and often very abundant.

E) Recorded by Whitton (1969).

Table 4.3 Computer number categories used as 'dumping grounds' for material for which insufficient taxonomic data were available.

010250	<u>Anabaena</u> sp.		
010550	<u>Aphanocapsa</u> sp.		
010650	<u>Aphanothece</u> sp.		
010950	<u>Calothrix</u> sp.		
012249	<u>Entophysalis</u> not above		
013650	<u>Hyella</u> sp.		
014231	<u>Lyngbya</u> not above	≤ 1 μm	
014232	<u>Lyngbya</u> not above	>1	≤ 2 μm
014233	<u>Lyngbya</u> not above	>2	≤ 4 μm
014234	<u>Lyngbya</u> not above	>4	≤ 6 μm
015250	<u>Nostoc</u> sp.		
015531	<u>Oscillatoria</u> not above	>1	≤ 2 μm
015532	<u>Oscillatoria</u> not above	>2	≤ 4 μm
015535	<u>Oscillatoria</u> not above	>8	≤ 12 μm
015538	<u>Oscillatoria</u> not above	>32	μm
015550	<u>Oscillatoria</u> sp.		
015551	<u>Oscillatoria</u> sp.,	>1	≤ 2 μm
015552	<u>Oscillatoria</u> sp.,	>2	≤ 4 μm
015553	<u>Oscillatoria</u> sp.,	>4	≤ 6 μm
015555	<u>Oscillatoria</u> sp.,	>8	≤ 12 μm
015558	<u>Oscillatoria</u> sp.,	>32	μm
015731	<u>Phormidium</u> not above	>1	≤ 2 μm
015732	<u>Phormidium</u> not above	>2	≤ 4 μm
015736	<u>Phormidium</u> not above	>1	μm
015750	<u>Phormidium</u> sp.		
015751	<u>Phormidium</u> sp.,	>1	≤ 2 μm
015849	<u>Plectonema</u> not above		
015850	<u>Plectonema</u> sp.		
015950	<u>Pleurocapsa</u> sp.		

- 016931 Spirulina not above $\leq 1 \mu\text{m}$
- 016952 Spirulina sp., $>1 \leq 2 \mu\text{m}$
- 017650 Tolypothrix sp.
- 017850 Westiellopsis sp.
- 030250 Euglena sp.
- 030251 Euglena sp., $>32 \mu\text{m}$ long
- 059950 Pyrrophyta, genus not known sp.
- 099951 Centrales sp., $\leq 8 \mu\text{m}$ diameter
- 130432 Chlamydomonas not above $\leq 8 \mu\text{m}$ long not palmelloid
- 130450 Chlamydomonas sp.
- 140550 Chlorella sp.
- 149950 Chlorococcales, genus not known, sp.
- 149953 Chlorococcales sp., $>8 \leq 16 \mu\text{m}$ narrowest diameter
- 152850 Gongrosira sp.
- 152949 Hormidium not above
- 152950 Hormidium sp.
- 159950 Ulotrichales + Chaetophorales, genus not known, sp.
- 159953 Ulotrichales + Chaetophorales sp., Chaetophorales,
no upright filaments, $\leq 8 \mu\text{m}$
- 159954 Ulotrichales + Chaetophorales sp., Chaetophorales,
no upright filaments, $\leq 8 \mu\text{m}$

- D) Ecological notes on distribution, abundance, and habitat.
- E) Whether recorded by Whitton '1969' or Potts (1977).
- F) Review of the relevant literature, giving ecological data and distribution. The literature is not comprehensive, only including references to species of particular interest or relevant to atoll habitats.

Table 4.3 lists species numbers of groups which were not possible to describe in detail due to lack of taxonomic information e.g. reproductive structures, and which are therefore excluded from the detailed description of the species. It is possible that some species in the table may be the same as those described in species descriptions and that some may be new species not yet recorded for the island.

4.3 Statistical Analysis

For the purposes of all statistical analyses each different 'species' number has been regarded as a separate 'species'. This may lead to slight over representation within some species e.g. Lyngbya, Oscillatoria and slight under representation within some species e.g. pennate diatoms. As the taxonomy of some phyla is still incomplete however, it is felt that this approach would give a more accurate picture than carrying out analyses on only those species fully described, which would lead to a total lack of representation of some phyla.

The composition of the Aldabran terrestrial and freshwater algae is given in Table 4.4. The data of Whitton (1971) are included for comparison.

Table 4.4 Species composition of terrestrial and freshwater algae of Aldabra (total number of six-digit computer numbers)

	present survey	% age total	data of Whitton (1971)	% age total
total species	292		149	
Myxophyta	188	64%	90	60%
heterocystous Myxophyta	28	9%	--	not assessed
Rhodophyta	1	0.4%	0	
Euglenophyta	11	4%	5	3%
Cryptophyta	8	2.7%	1	0.7%
Pyrrophyta	3	1%	0	
Xanthophyta	2	0.7%	1	0.7%
Bacillariophyta	8	2.7%	14	9%
Conjugatophyta	12	4%	9	6%
Chlorophyta	58	20%	37	25%
Charophyta	1	0.4%	1	0.7%

Preliminary observations of the computer data suggested that the terrestrial and freshwater algal habitats could be divided into 12 major categories for the purposes of statistical analysis. Computer queries were devised (2.383) which allocated every algal record into one of these habitat categories (Table 4.5). The habitat categories are highly subjective but are used here as an example of the type of analysis which may be carried out using the terrestrial and freshwater data bank.

Data are presented as follows:

- A) Table 4.6 summary of numbers of species recorded for major taxa.
- B) Table 4.7 total records for major taxa.
- C) Table 4.8 summary of species from major biological groups. (As preliminary observations suggested that blue-green algae were the most abundant phylum, with other phyla being sparsely represented, species were divided into blue-green algae and eukaryotic algae.)

In all cases lichens, higher plants and heterotrophs were left as broadly grouped categories but were included for comparative purposes.

- D) Table 4.9 total records for major biological groups.
- E) Table 4.10 summarizes the above data.

Table 4.5 Environmental categories and relevant computer queries analysed in this thesis

<u>environmental category</u>	<u>computer query</u>
<u>terrestrial</u>	
limestone rock	PNOS = \emptyset SUB = 3
limestone soil and humic soil	PNOS = \emptyset & SUB = 17 OR PNOS = \emptyset & SUB = 18
sand	PNOS = \emptyset & SUB = 19
live bark or other plant	PNOS = \emptyset & SUB = 20 OR PNOS = \emptyset & SUB = 21
other	PNOS = \emptyset & SUB \neq 3 & SUB \neq 17 & SUB \neq 18 & SUB \neq 19 & SUB \neq 20 & SUB \neq 21
<u>aquatic</u>	
limestone rock	PNOS \geq 1 & SUB = 3
dead plant or other plant	PNOS \geq 1 & SUB = 16 OR PNOS \geq 1 & SUB = 21
limestone soil	PNOS \geq 1 & SUB = 17
humic soil	PNOS \geq 1 & SUB = 18
plankton	PNOS \geq 1 & PHY > 14 & PHY \leq 43
aufwuchs	PNOS \geq 1 & PHY > 43
other	PNOS \geq 1 & PHY < 15 & SUB \neq 3 & SUB \neq 16 & SUB \neq 17 & SUB \neq 18 & SUB \neq 21

Table 4.6 Summary of numbers of species recorded for major taxa from 521 1 cm² samples (2.383). For the purposes of the present study each 'species' number is regarded as a separate species.

Table 4.6

TERRESTRIAL
(92 samples)

AQUATIC

429 samples)

Number of samples	TERRESTRIAL (92 samples)				AQUATIC 429 samples)						
	lime- stone humic soil	sand	live bark & other plant sub- strata	other	lime- stone	humic soil	dead plant & other plant	lime- stone soil	plankton	aufwuchs	other
01 Myxophyta	53	9	20	6	4	164	37	22	68	22	45
02 Rhodophyta	63	20	46	23	18	116	67	62	73	69	95
03 Euglenophyta	1	-	-	-	-	-	-	-	-	-	-
04 Cryptophyta	-	-	-	-	1	5	8	3	9	4	8
05 Pyrrophyta	-	-	-	-	-	-	-	2	6	1	2
06 Xanthophyta	-	-	-	-	-	-	-	1	1	-	3
09,10 Bacillariophyta	-	-	-	-	-	1	1	1	1	1	1
12 Conjugatophyta	-	-	2	-	1	3	2	2	5	4	4
13,14,15,16 Chlorophyta	5	1	2	4	4	32	8	3	4	10	8
17 Charophyta	-	-	-	-	-	-	33	25	33	29	34
21 Lichens	1	-	-	1	-	-	1	-	-	-	1
22 Liverworts	-	1	-	-	-	1	-	-	-	-	-
23 Mosses	-	-	-	1	1	1	-	-	-	-	-
26 Dicotyledons	-	-	-	-	-	-	-	-	-	-	-
31 Colourless prokaryotes	1	2	1	1	3	6	3	4	6	6	5
32 Colourless eukaryotes	3	1	4	2	2	5	4	4	6	5	7

4.7 Total records for major taxa recorded for 521 1 cm²
samples (2.383).

Table 4.7

Number of samples	TERRESTRIAL (92 samples)					AQUATIC (429 samples)					
	lime- stone humic soil	lime- stone & humic soil	sand	live bark & other plant sub- strata	other	lime- stone	dead plant & other plant	humic soil	lime- stone soil	plankton	aufwuchs
53	9	20	6	4	164	37	71	22	68	22	45
01 Myxophyta	333	141	42	25	1102	246	448	176	282	205	328
02 Rhodophyta	1										
03 Euglenophyta					11	42	114	7	53	16	49
04 Cryptophyta				1		4	7	2	12	1	2
05 Pyrrophyta							2	1	2		9
06 Xanthophyta					2	5	15	1	7	3	5
09,10, Bacillariophyta		5		1	10	8	47	8	25	19	13
12 Conjugatophyta					17	21	54	12	28	52	37
13,14,15,16, Chlorophyta	13	3	8	11	234	117	301	76	242	152	182
17 Charophyta						1	2			5	
21 Lichens	2		1		3						
22 Liverworts											
23 Mosses			2	1	1						
26 Dicotyledons											
31 Colourless prokaryotes	3	2	1	2	22	16	92	8	31	22	15
32 Colourless eukaryotes	25	1	3	3	73	31	37	8	31	17	27

Table 4.8 Summary of species from major biological groups from 521 1 cm² samples (2.383). For the purposes of the present study each 'species' number is regarded as a separate species.

Table 4.8

	TERRESTRIAL (92 samples)				AQUATIC (429 samples)						
	lime- stone humic soil	sand	live bark & other plant sub- strata	other	lime- stone	dead plant other plant	humic soil	lime- stone soil	plankton	aufwuchs	other
Total samples	53	20	6	4	164	37	71	22	68	22	45
Total species	74	55	32	30	177	128	169	107	144	131	167
Total phototrophs	70	50	30	25	166	121	156	99	132	120	155
Total algae	69	50	27	24	164	121	156	99	132	119	155
Total eukaryotic algae	6	4	4	6	48	54	8	37	59	50	60
Total blue-green algae	63	46	23	18	116	67	88	62	73	69	95
Total heterocystous blue-greens	6	4	4	2	15	10	13	6	12	11	14
Total heterotrophs	4	5	3	5	11	7	13	8	12	11	12
Lichens	1		1		1						
Liverworts (<u>Riccia</u>)	1										
Mosses			1	1	1						
Dicotyledons											
% Blue-greens of total species	85%	84%	72%	60%	66%	52%	52%	58%	51%	53%	57%
% Blue-greens of total algae	91%	92%	85%	75%	71%	55%	56%	64%	55%	58%	61%
% heterocystous blue-greens of total species	8%	7%	13%	7%	8%	8%	8%	6%	8%	8%	8%
% heterocystous blue-greens of blue greens	10%	9%	17%	11%	13%	15%	15%	10%	16%	16%	15%
% heterocystous blue-greens of total algae	9%	15%	15%	8%	9%	8%	8%	6%	9%	9%	9%
% heterotrophs of total species	5%	9%	9%	17%	6%	5%	8%	7%	8%	8%	7%

Table 4.9 Total records for major biological groups
from 521 1 cm² samples (2.383).

Table 4.9

	TERRESTRIAL (92 samples)					AQUATIC (429 samples)						
	lime- stone humic soil	lime- stone & humic soil	sand bark & other plant sub- strata	live bark & other plant sub- strata	other	lime- stone	dead plant & other plant	humic soil	lime- stone soil	plankton	aufwuchs	other
Total samples	53	9	20	6	4	164	37	71	22	68	22	45
Total records	377	67	158	57	44	1475	493	1119	299	713	493	667
Total phototrophs	349	63	150	51	38	1380	446	989	283	653	454	625
Total algae	347	61	149	50	37	1376	446	989	283	653	453	625
Total blue-green algae records	333	60	141	42	25	1102	246	448	176	282	205	328
Total non-heterocystous blue-greens	269	47	124	34	22	966	216	413	164	237	167	287
Total heterocystous blue-greens	64	13	17	8	3	136	30	35	12	45	38	41
Total eukaryotic algae	14	1	8	8	13	274	200	542	107	369	249	297
Total heterotrophs	28	4	9	6	5	95	47	129	16	62	39	42
Total lichens	2			1		3						
Total liverworts (Riccia)	2											
Total mosses					1	1						
Total dicotyledons (Portulaca)												
% blue-greens of total records	88%	90%	90%	77%	58%	75%	50%	40%	59%	40%	42%	50%
% heterocystous blue-greens of total records	17%	19%	11%	14%	7%	9%	6%	3%	4%	6%	8%	6%
% heterocystous blue-greens of total blue-greens	19%	22%	12%	5%	12%	12%	12%	8%	7%	16%	19%	13%
% blue-greens of photoautotrophs												
% blue-greens of all algae	95%	95%	94%	82%	68%	80%	55%	45%	62%	43%	45%	52%
% heterocystous blue-greens of all algae	18%	21%	11%	16%	8%	10%	7%	4%	4%	7%	8%	7%
Mean algae/sample	6.5	7.8	7.5	8.3	9.5	8.4	12.1	13.9	12.9	9.6	20.6	13.9
Mean blue-green records/sample	6.3	6.7	7.1	7.0	6.3	6.7	6.6	6.3	8.0	4.1	9.3	7.3
Mean heterocystous blue-green/sample	1.2	1.4	0.9	1.3	0.8	0.8	0.8	0.5	0.5	0.7	1.7	0.9
% heterotrophs of total	7%	6%	6%	11%	12%	6%	10%	12%	5%	9%	8%	6%

Table 4.10 Summary of data from Tables 4.6 - 4.9

	terrestrial			aquatic		
	max	mean	min	max	mean	min
number of algae recorded from any one habitat	69 (lime-stone)	38.2	21 (soil)	164 (lime-stone)	135.1	99 (limestone soil)
percentage of blue-green algae of total algae	92% (sand) 91% lime-stone and soil)	86.8%	75% (other)	71% (lime-stone)	60%	55% (dead plant, other plant, plankton)
algal records per sample	9.5 (other)	7.9	6.5 (lime-stone)	20.6 (Aufwuchs)	13.1	8.4 (limestone)
percentage records of blue-green algae of total algae	98% (soil)	88.2%	86% (other)	80% (lime-stone)	54.6%	43% (plankton)

5 ACETYLENE REDUCTION STUDIES

Initial observations of the algal flora showed a range of communities of Nostoc occupying habitats ranging from terrestrial to submerged for long periods and often covering large areas. It was decided therefore to use the limited equipment (2.37) for a comparative study of nitrogen fixation in four distinctive Nostoc communities in the hope that the data obtained might be useful for comparative studies with Nostoc from other regions. A brief study was also made on Tolypothrix byssoidea, the most widespread terrestrial alga on the atoll. The communities studied were as follows:

- A) 015203 Nostoc commune var. flagelliforme: early in the wet season this form grows directly over shaded sand, but later occurs connecting the leaves of sedges and grasses
- B) 015202 Nostoc commune: material intermediate between A and C; growing over coarse sand later in the wet season
- C) 015202 Nostoc commune: material representing the original description of the species
- D) 015202 Nostoc commune: forming small, firm, verrucose colonies, always including 015707 Phormidium jenkelianum. As a result of microscopy observations, the assumption was made that for the colonies of this form used in assays, only 70% total chlorophyll a was associated with Nostoc commune. These colonies grew in shallow

depressions receiving about the same amount of wetting as C but in an area with particularly high phosphate levels (3.272)

- E) 015202 Nostoc commune: round colonies intermediate between C and F, associated with pools that were more permanent than those where C occurred.
- F) 015213 Nostoc sphaericum: from pools which often held water for many days.
- G) 017602 Tolypothrix byssoidea: cores were taken from old 'cushions' overlying limestone pavé.

Three main types of field experiment on rates of acetylene reduction were planned: time course in individual serum bottles in the light; incubation of various communities in situ for 1 to 2 h; changes in a particular population during the day.

The results of the time course studies (Fig. 5.3) indicated that the periods of 1 to 2 h were suitable for the standard assay. Marked changes in rate during this incubation would seem to be mostly due to changes in light intensity and/or temperature, rather than anything that might have been caused by incubation in a limited volume such as CO₂ deficiency. It was not possible however to assess the effects of raised temperatures in those cases where the temperature inside the incubation vessel was slightly higher than the ambient temperature (Table 5.1). The results of the incubations for 1 to 2 h periods are

shown in Table 5.1 and those of changes taking place in the day in Fig. 5.1. Table 5.1 also includes estimates of the rates of acetylene reduction per unit area for those instances where it was considered that the biomass in the serum bottles corresponded closely to the similar area of community around the bottles. The results of assays carried out on Aldabra by M. Potts and B. A. Whitton in 1975 on similar communities are also included in Table 5.1 for ease of comparison. Although both species and environment varied, the results of the assays summarized in Table 5.1 show that all the rates for Nostoc in the light were rather similar. The rates for all the experiments starting between 0930 and 1230 h range only from 0.0239 to 0.0567 nM C₂H₄ μg chl a⁻¹ min⁻¹ (\bar{x} = 0.0388, S.D. 1 ± 0.0123).

It was planned to determine if higher rates than these could be obtained by artificial enrichment of the incubation medium. It had been noted that algal growth was particularly luxuriant around the outlet pipe which drained the wash bowls of the research station (1.35). It was decided therefore to enrich the incubation medium with 0.5 mg l⁻¹ of the toilet soap used at the research station. The mean rate between 1000 and 1200 h was raised from 0.0325 to 0.0805 nM C₂H₄ μg chl a⁻¹ min⁻¹ (P > 0.01). All the rates found during the standard morning assays are much higher than those found during the three assays on Tolypothrix byssoidea (\bar{x} = 0.00180 nM C₂H₄ μg chl a⁻¹ min⁻¹).

The two studies on changes in rates during the day (Figs 5.1 A, B) show that much higher rates occurred in the early afternoon than in the morning, with a maximum rate for Nostoc

commune (Fig. 5.1A) of $0.170 \text{ nM C}_2\text{H}_4 \mu\text{g chl a}^{-1} \text{ min}^{-1}$.

The rates of fixation in the dark were relatively uniform throughout the day, but there was an increase in the rate of (dark) fixation by N. commune in the evening.

Laboratory experiments were carried out on the effects of re-wetting dried Nostoc colonies about one year after they had been collected on Aldabra (2.334). Three types of colony were used, type N. commune (C), Nostoc - Phormidium (D) and N. sphaericum (F). When dry, colonies of all three were hard and brittle, but within a few minutes of medium being added, they became soft and pliable and had clearly increased in size. It was visually obvious that this response was more rapid in 'type' Nostoc commune than in the Nostoc - Phormidium or Nostoc sphaericum. This effect was shown clearly in time course studies (Fig. 5.2), in which N. commune reached 80% saturation in 5 minutes, whereas the other two types took longer than 1 h to reach this level.

All populations of Nostoc showed more or less linear rates of C_2H_4 production during the second day of 2 - 3 day assays (Fig. 5.3). The behaviour with respect to C_2H_4 production did not correspond to that shown by moisture uptake. In contrast with the water uptake results there was no indication that the lag in C_2H_4 production was shorter for 'type' N. commune than for the other colonies. The rates during the linear phases of C_2H_4 production by the three types are summarized in Table 5.2.

Fig. 5.1 Changes in rates of acetylene reduction during the day by (A) Nostoc commune and (B) N. sphaericum, together with changes in ambient temperature and (for A) dissolved oxygen. Rates are plotted for the mid-point of the period during which the assay was made. (Part of the dissolved oxygen curve omitted because the levels of supersaturation were above those for which instrument was calibrated; part of the night-time curve for B not shown because all rates were very low and similar to those at 2300 and 0300 h).

Fig. 5.2 Time course of water uptake by dry Nostoc colonies.

Fig. 5.3 Time course of C_2H_4 production when dry Nostoc colonies are rewetted. Colonies dried for one year, incubated at 32° , 3000 lx.

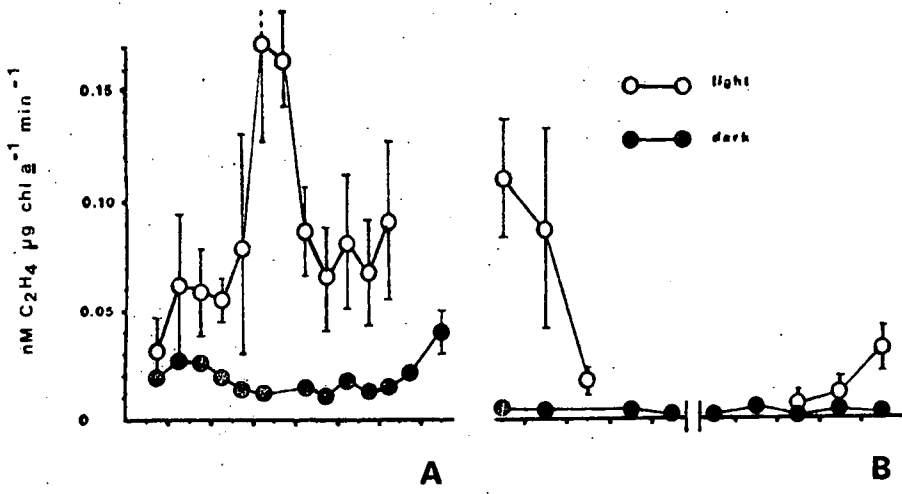


Fig. 5.1A

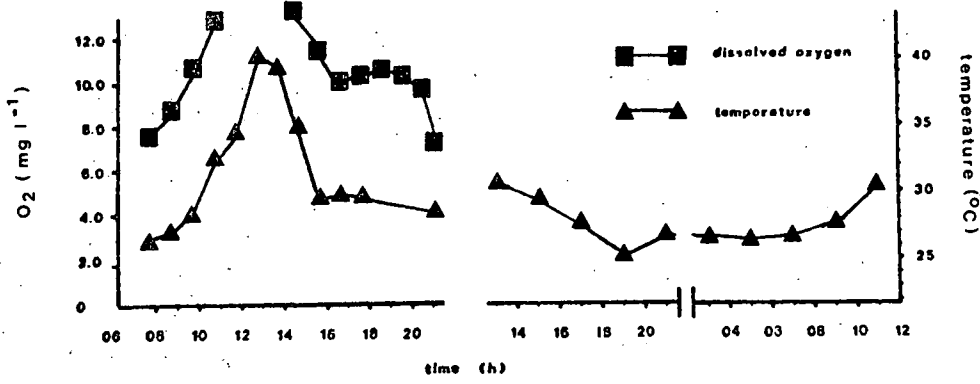


Fig. 5.1B

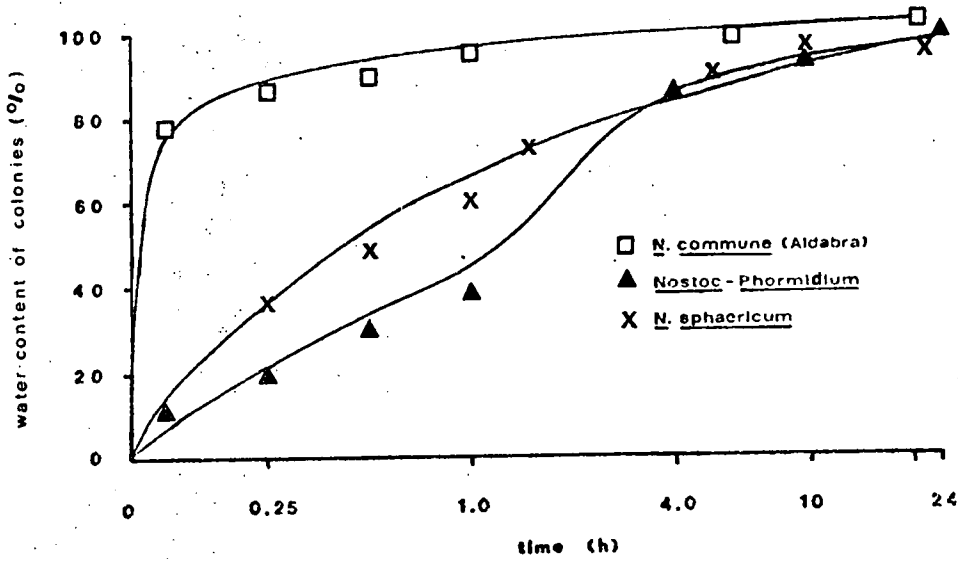


Fig. 5.2

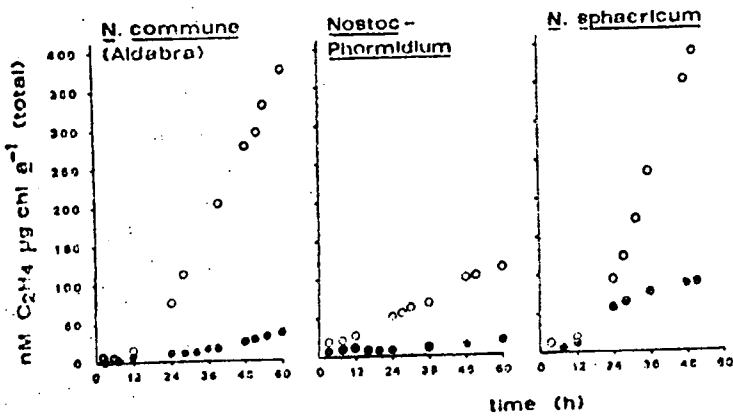


Fig. 5.3

Table 5.2 C_2H_4 production by Nostoc 1-2 days after re-wetting (see Fig. 5.3)

<u>type</u>	<u>rate</u> (nM C_2H_4 μ g chl a^{-1} min^{-1})
<u>Nostoc commune</u> (Aldabra)	0.0531
<u>Nostoc - Phormidium</u>	0.0143
<u>N. sphaericum</u>	0.0744

6 DISCUSSION

6.1 Species composition

It is evident from the present study that blue-green algal species predominate on Aldabra. The observations of various authors (Section 1) that tropical conditions and carbonate deposits may favour the growth of this phylum are fully supported (Table 4.4). Of the 292 algal species recorded from the 521 1 cm² samples, 64% are blue-green algae (Table 4.4). Of the other groups only species of Chlorophyta were present in significant numbers (20% of the total species recorded (Table 4.4)) The percentage composition of the algal flora (Table 4.4) was comparable to that recorded by Whitton (1971) (Table 4.4). Of the 149 species recorded by him, 60% were blue-green algae and 25% were Chlorophyta (Table 4.4).

Most of the genera listed by Taylor (1950) and Newhouse (1954) in their studies of atolls were represented on Aldabra (1.12) (Table 6.1), often occurring in similar habitats (Section 1.11) (Section 4). One species recorded by Taylor (1950) and described as one of the most important elements of the algal flora, Tolypothrix byssoidea, was also one of the most widespread and abundant species on Aldabra (page 350). Newhouse (1954) did not record T. byssoidea but noted Nostoc commune as a 'ground covering species'. The latter was also an important element of the Aldabran algal flora (page 276). N. commune was not recorded by Taylor (1950). One marked contrast between the floras of Taylor (1950) and Newhouse (1954) and that of Aldabra was their

Table 6.1 Comparison of terrestrial and freshwater blue-green algae recorded from Aldabra with those recorded from Bikini Atoll (Taylor, 1950), Raroia Atoll (Newhouse, 1954) and Heron Island (Cribb, 1964).

+ species recorded

* genus recorded

** very similar species recorded

Brackets denote a species revised by Drouet and Daily (1.4) which may include numerous other species some of which were recorded on Aldabra.

^aTaylor (1950) used the synonym for this species Hassallia byssoidea.

Computer numbers have not been included as the species were not recorded using the Durham recording system (2.383).

	Bikini Atoll Taylor (1950)	Raroi Atoll Newhouse (1954)	Heron Island Cribb (1964)	Aldabra Atoll (present survey)
<u>Anacystis montana</u>		(+)		
<u>Calothrix parietina</u>	+	+		+
<u>Coccolithorax aeruginosa</u>		(+)		*
<u>Gloeocapsa alpicola</u>				**
<u>G. turgida</u>	+			+
<u>Entophysalis granulosa</u>	+			
<u>Fischerella ambigua</u>	+			
<u>Gomphosphaeria aponina</u>	+			+
<u>Hapalosiphon pumilus</u>		+		*
<u>Microcoleus acutissimus</u>	+	+		*
<u>M. chthonoplastes</u>		+		+
<u>Nostoc commune</u>		+		+
<u>Oscillatoria subuliformis</u>			+	*
<u>Phormidium autumnale</u>			+	*
<u>P. corium</u>			+	+
<u>P. jadinianum</u>			+	+
<u>P. molle</u>			+	+
<u>P. retzii</u>			+	*
<u>P. tenue</u>			+	+
<u>P. papyraceum</u>			+	*
<u>Plectonema golenkinianum</u>	+			*
<u>Porphyrosiphon fuscus</u>	+			*
<u>Schizothrix calcicola</u>	+			+
<u>S. giuseppi</u>		+		+
<u>S. lacustris</u>				*
<u>S. longiarticulata</u>	+	+		*
<u>Scytonema crustaceum</u>		+		*
<u>S. guyanense</u>		+		**
<u>S. hofmannii</u>		+		*
<u>S. ocellatum</u>				*
<u>Symploca kieneri</u>	+	+		+
<u>S. muralis</u>				*
<u>S. muscorum</u>	+			*
<u>Tolypothrix byssoidea</u> ^a	+			+

record of Symploca a genus so far not recorded for Aldabra. Preliminary studies of the terrestrial and fresh-water algae of three western Indian Ocean islands (Astove, Farquhar and St Pierre) (Whitton and Donaldson, 1977c) and three islands in the Chagos Archipelago, Indian Ocean (Whitton et al., 1977) suggested species compositions similar to those of Aldabra (Table 6.2), though one major difference was the presence of Stigonema hormoides on Astove and St Pierre (1.11). This genus has so far not been recorded for Aldabra. In all six islands Tolypothrix byssoidea and Nostoc commune were important elements of the algal floras.

6.2 Environmental factors

Platin, pavé and champignon (1.33) account for much of the land area of Aldabra. A few large expanses of soil exist and these are generally restricted to the eastern areas of Île Grande Terre. The majority of algal species are restricted to these terrestrial habitats and pools. Using the habitat categories devised for computer analyses of Aldabran data (Table 2.8) a computer 'query' (2.38) was devised which placed the data contained in each 1 cm² into one of 12 habitat categories (Table 4.5). Although highly subjective the categories chosen represent the most frequently used habitat categories of the computer recording system (Table 2.2).

For the purpose of this analysis each computer species number was regarded as a separate species (2.383). This would probably lead to slight under estimation in certain groups where it has not been possible to determine the numbers of species present and a 'dumping ground' has been used (2.383) e. g. 099950 Centrales genus not known, sp. It would

Table 6.2 Comparison of algal species found in seven Indian Ocean Islands (all lists except for that of Aldabra are preliminary)

+ species present

* similar species recorded

	Astove	Danger Is.	Eagle Is.	Egmont	Farquhar	St Pierre	Aldabra
010551 <u>Aphanocapsa</u> > 1 ≤ 2 μm	+		+	+	+	+	+
010552 <u>A. montana</u> > 2 ≤ 4 μm	+	+		+	+	+	+
010553 <u>A. grevillei</u> > 4 ≤ 6 μm					+	+	+
010602 <u>Aphanothece pallida</u>	+				+	+	
010652 <u>A. microspora</u> > 2 ≤ 4 μm			+	+		+	
010650 <u>Aphanothece</u> sp.							+
010902 <u>Calothrix braunii</u>			+	+			+
010910 <u>C. marchica</u>	+					+	+
010911 <u>C. parietina</u>	+			+			+
010950 <u>Calothrix</u> sp.			+				+
011558 <u>Chroococcus minutus</u> > 4 ≤ 6 μm, non-lamellate sheath				+	+		+
011554 <u>C. turgidus</u> > 8 ≤ 16 μm, lamellate sheath	+		+	+	+	+	+
011560 <u>C. turicensis</u> > 8 ≤ 16 μm, non-lamellate sheath	+		+	+	+	+	+
011561 <u>C. spelaeus</u> > 16 ≤ 32 μm, non-lamellate sheath	+			+	+	+	+
011811 <u>Cylidrospermum muscicola</u>			+			+	+

	Astove	Danger Is.	Eagle Is.	Egmont	Farquhar	St Pierre	Aldabra
012201 <u>Entophysalis granulosa</u>				+			+
012660 <u>Gloeocapsa dermochroa</u> > 2 ≤ 4 μm, sheath yellow-brown		+	+				+
012661 <u>G. kutzingiana</u> > 4 ≤ 6 μm, sheath yellow-brown		+					+
012665 <u>Gloeocapsa compacta</u> > 2 ≤ 4 μm, sheath orange/red/violet		+					+
012667 <u>G. sanguinea</u> > 6 ≤ 8 μm, sheath orange/red/violet	+				+	+	+
012668 <u>G. magma</u> > 8 μm, sheath orange/ red/violet	+					+	+
012732 <u>Gloeotheca palea</u> > 2 ≤ 4 μm			+				+
012733 <u>G. rupestris</u> > 4 ≤ 6 μm			+			+	+
012850 <u>Gloeotrichia</u> sp.						+	*
013107 <u>Hapalosiphon welwitschii</u>			+			+	+
013602 <u>Hyella fontana</u>	+			+		+	+
014202 <u>Lyngbya allorgei</u>			+				+
014205 <u>L. digueti</u>				+			+
014211 <u>L. martensiana</u>		+	+				+
014252 <u>Lyngbya</u> sp. > 1 ≤ 2 μm			+				+
014707 <u>Microchaete tenera</u>						+	*
014801 <u>Microcoleus chthonoplastes</u>		+	+				+
015201 <u>Nostoc carneum</u>	+					+	+
015202 <u>N. commune</u>	+	+	+	+	+	+	+
015203 <u>N. commune</u> var. <u>flagelliforme</u>	+				+		+

	Astove	Danger Is.	Eagle Is.	Egmont	Farguhar	St Pierre	Aldabra
015207 <u>Nostoc microscopicum</u>	+				+		+
015218 <u>N. piscinale</u>			+				+
015211 <u>N. punctiforme</u>			+				+
015511 <u>Oscillatoria claricentrosa</u>			+				+
015702 <u>Phormidium angustissimum</u>				+			+
015704 <u>P. foveolarum</u>			+	+			+
015802 <u>Plectonema boryanum</u>	+	+	+	+	+		+
015806 <u>P. gloeophilum</u>					+		+
015807 <u>P. gracillimum</u>						+	+
015814 <u>P. terebrans</u>						+	+
015817 <u>P. notatum</u>		+			+		+
015931 <u>Pleurocapsa</u> sp. $\leq 4 \mu\text{m}$		+	+	+	+		+
015932 <u>Pleurocapsa</u> sp. $> 4 \leq 6 \mu\text{m}$				+			+
016602 <u>Schizothrix arenaria</u>			+				+
016631 <u>Schizothrix</u> sp. $\leq 1 \mu\text{m}$				+			+
016650 <u>Schizothrix</u> sp. (c. $4.5 \mu\text{m}$ wide)		+					+
016931 <u>Spirulina subtilissima</u> $\leq 1 \mu\text{m}$				+			+
017203 <u>Stigonema hormoides</u>	+					+	
017451 <u>Synechococcus elongatus</u> $\leq 2 \mu\text{m}$							+
017455 <u>S. aeriginosus</u> $> 8 \leq 16 \mu\text{m}$						+	+
017601 <u>Tolypothrix byssoidea</u>	+	+	+		+		+
017606 <u>T. distorta</u>			+				+
017616 <u>T. tenuis</u>	+				+	+	+

	Astove	Danger Is.	Eagle Is.	Egmont	Farquhar	St Pierre	Aldabra
017801 <u>Westiellopsis prolifica</u>	+				+		+
062050 <u>Akanthochloris</u> sp.			+				*
120250 <u>Closterium</u> sp.			+				*
122150 <u>Spirogyra</u> sp.			+				*
palmelloid green alga (c. 13 μ m diameter)			+				
160752 <u>Oedogonium</u> sp. $> 8 \leq 12 \mu$ m			+				*
160801 <u>Pithophora oedogonia</u>			+				+
101904 <u>Nitzschia palea</u>							+
101950 <u>Nitzschia</u> sp.							

also lead to slight over estimation of species numbers where groups have been artificially divided into size categories e.g. Oedogonium (pages 456-459).

The total number of algal species recorded for any one habitat was greater in aquatic habitats than terrestrial habitats (Table 4.6, Table 6.3). The maximum for terrestrial habitats was substantially less than the minimum for aquatic habitats (Table 6.3). The mean number of algal records per sample (2.383) in aquatic habitats was almost double that for terrestrial habitats (Table 6.3). In both terrestrial and freshwater habitats blue-green algal species were predominant (Table 6.3, Table 6.4), although there was a marked difference in the percentage of blue-green algal species of total algal species for all habitats (Table 6.3). Blue-green algal species were present almost to the exclusion of other groups in terrestrial habitats (Table 6.3, Table 6.4). The difference was much less marked in aquatic habitats, other algal species clearly predominating in 3 out of the 7 habitats (Table 6.3, Table 6.4).

The predominance of blue-green algal species in subaerial habitats (85% of total algal species) (Table 6.4), on Aldabra supports the views of various authors (Fritsch, 1907; West, 1916; Strøm, 1924; Prescott, 1956) that they are important in these habitats in tropical regions. Samples obtained from the branches of the Calophyllum trees near pool T1 in the Takamaka region of Île Grande Terre were similar in species composition to those recorded by Cribb (1964) from trees on Heron Island (pages 316,449).

Luxuriant growths of Oedogonium, Spirogyra and Pithophora were occasionally noted in freshwater pools, though Spirogyra

Table 6.3 Summary of the occurrence of algal species in
terrestrial and aquatic habitats.

	terrestrial			aquatic		
	max.	mean	min.	max.	mean	min.
total species	69	38	21	164	135	99
percentage of blue- green algal species of total algal species	92%	86.8%	75%	66%	60%	51%
mean number of algal records per sample	9.5	7.9	6.5	20.6	13.1	9.6

was only recorded from ^AÎle Grande Terre (page 399).

Such growths were noted by Fritsch (1907) as being characteristic of tropical regions, and that where it was found, narrow rather than wide forms of Oedogonium were more common (1.22). This would seem to be the situation on Aldabra, as the widest form of Oedogonium recorded was 20.5 μm (page 455) and this genus may attain widths of over 90 μm .

In terrestrial habitats blue-green algal species were especially abundant on limestone, soil and sand. On soil 91% of the species recorded were blue-green algae (Table 6.4). Similar observations were made by Shields and Durrell (1964), from dry, alkaline desert soils, in which they found blue-green algal species to be consistently present and often abundant. Many terrestrial rock samples collected on Aldabra contained only blue-green algal species. Such a predominance of blue-green algal species is in agreement with the observations of Strøm (1924), Koster (1939), Fritsch (1945), Jaag (1945) and Golubić (1973) that carbonate deposits may favour the growth of blue-green algae over other phyla (Section 1.23), and those of Treub (1888) and Mishustin and Shil'nikova (1971) who noted that blue-green algal species may play an important pioneer role on bare rock.

Many authors have suggested that blue-green algae may play an important role in the deposition and erosion of carbonate (1.23). Decrease in dissolved CO_2 , a rise in temperature, increasing pH and combinations of these factors are all regarded as causing precipitation of carbonate, the reverse of these causing solution of carbonate (1.231). Photosynthesis during the daytime would result in a decrease

Table 6-4 Percentage of blue-green algal species of total algal species in 12 selected habitats

% blue-green algae of total algae	terrestrial						aquatic					
	limestone			other			limestone			other		
	soil	sand	other plants	live bark	other	limestone	dead plant	other plant	soil	humic soil	plankton	aufwuchs
91%	91%	92%	85%	75%	71%	55%	55%	56%	64%	55%	58%	61%

in CO₂, and an increase in O₂ levels and pH. Such changes were recorded during 24 h surveys of pool chemistry (Fig. 3.1) and were usually accompanied by an increase in temperature. The reverse of these changes were recorded during the night. Though the data are somewhat fragmentary they suggest that a cycle of carbonate erosion and deposition may take place in pools and they are supported by a possible diurnal cycle of Ca in pool W1 (Fig. 3.1). Certain algae, especially in pool W1 and a number of other pools (4) often possessed sheaths or cell walls encrusted with calcium carbonate deposits. Analyses of these deposits on Plectonema gloeophilum collected from pool W127 (Table 2.1) made by Riding (1977) showed them to be calcite. A number of algal species recorded in the present study are regarded as endolithic (Hyella balani, H. caespitosa and H. fontana). These species actively penetrate into carbonate substrata and therefore cause direct erosion of carbonate (Golubić, 1973). Indirect erosion may be caused by epilithic (living on rock surface) and chasmolithic (living in rock cavities) algal species retaining water and releasing acidic solutions and chelating agents (Golubic, 1973). Epilithic and chasmolithic species were also recorded in the present survey (Section 4). These observations, together with those of Trudgill (1972) (1.22), tentatively suggest that blue-green algae especially may play some role in the deposition and erosion of carbonate on Aldabra.

6.3 Climate

Observations made during excursions to various regions of Aldabra suggest that climate may have local as well as

overall effects on the algal species present. During the months from August to October the barometric pressure is high and the Southeast Trade Winds blow strongly, while in other months the barometric pressure is low and the winds lighter and north westerly. R. Hnatiuk (pers. comm.) noted that the sea spray in the Cinq Cases region of [^]Ile Grand Terre could be carried well inland during the Trade Wind season, and that this effect was less marked in other regions of the atoll. It is possible that the spray would have a marked effect on the chemistry of local algal habitats and account for the restriction of certain species to certain regions of the atoll (Table 6.5).

The lowest minimum and highest maximum temperatures recorded for Aldabra at the synoptic observation station are 17.5 and 36.3°C respectively (Appendix I). Measurements of temperatures of terrestrial and aquatic habitats showed local variations from ambient temperature. A difference of 8.7°C (30.9°C - 39°C) was found between two algal habitats measured within a few minutes of each other (Table 3.3). The minimum and maximum temperatures recorded in pools were 23.0°C and 41.2°C respectively (Table 3.10). It is likely that terrestrial species may be subjected to extreme fluctuations in temperature, the maximum range for one habitat recorded for this survey being 13.6°C (24.7°C - 38.3°C).

Stoddart and Mole (1977) noted that rainfall may vary markedly from region to region. Such local variations would have marked effect on the moisture available to terrestrial algal communities and the water levels of pools. The effect

Table 6.5 Numbers of species recorded only from certain regions of Aldabra (Fig. 1.1)

Area recorded (island code. Fig. 2.2 in brackets)	number of species	percentage of total Aldabran species (Table 4.5)
^ Île Picard (W)	28	10%
^ Île Malabar (MW + ME)	2	0.7%
Anse Cèdres (AC)	6	2.0%
Cinq Cases (CC)	27	9.0%
Takamaka (T)	10	3.5%
Grande Terre, Central (SC)	2	0.7%
Grande Terre, Eastern (= Anse Cèdres, Cinq Cases, Takamaka)	53	18.0%

of the dry and wet seasons on Aldabra was perhaps the most important climatic effect on the algal population (1.32). During the dry season the pools frequently became completely dry, often for many days, and terrestrial communities could dry out and be rewetted many times throughout the year, although during the dry season the periods of dryness could last many days. The longest dry spell recorded is 88 days (Stoddart and Mole, 1977). Many authors have suggested that such conditions favour the growth of blue-green algal species rather than other algal species (1.22). The ability of algae to withstand such conditions was discussed by Lund (1965) (1.21). All three groups which he listed in relation to perennation were represented on Aldabra:

- a) those never producing organs of perennation; Lyngbya spp., Oscillatoria spp.
- b) those occasionally producing organs of perennation; Gloeocapsa magma.
- c) those regularly producing organs of perennation; Anabaena spp., Oedogonium sp., Pithophora oedogonia.

Of the 31 species seen to produce distinct organs of perennation (Table 6.6) none were recorded solely from terrestrial habitats and only six were recorded from terrestrial or aquatic habitats (Table 6.6), the majority being recorded from aquatic habitats only.

Observations were made on pools soon after they were rewetted following a period of dryness. Oscillatoria animalis and O. brevis (pages 285,287) and members of the Chroococcales (Aphanocapsa spp., Chroococcus spp.) appeared to be the first species to develop, while species producing distinct organs of perennation apparently took some time to produce substantial growths. The latter were absent from the more transient pools such as W3 and W127

Table 6.6 Species recorded on Aldabra as producing distinct organs of perennation

species	terrestrial	aquatic	terrestrial and aquatic
010215 <u>Anabaena variabilis</u>		+	
010269 <u>Anabaena sp. (A.D.) A</u>		+	
010301 <u>Anabaenopsis arnoldii</u>		+	
011811 <u>Cylindrospermum muscicola</u>		+	
012667 <u>Gloeocapsa sanguinea</u>			+
012668 <u>G. magma</u>			+
012802 <u>Gloeotrichia ghosei</u>			+
014707 <u>Microchaete tenera</u>			+
015201 <u>Nostoc carneum</u>		+	
015213 <u>N. sphaericum</u>		+	
015218 <u>N. piscinale</u>		+	
017801 <u>Westiellopsis prolifica</u>			+
030201 <u>Euglena acus</u>		+	
030202 <u>E. gracilis</u>		+	
030205 <u>E. spirogyra</u>		+	
030206 <u>E. minuta</u>		+	
030207 <u>E. oxyuris</u>		+	
030469 <u>Lepocinclis sphagnophilia</u>		+	
030502 <u>Phacus orbicularis</u>		+	
030601 <u>Trachelomonos hispida var. coronata</u>		+	
030602 <u>T. volvocina</u>		+	

Table 6.6 (contd)

species	terrestrial	aquatic	terrestrial and aquatic
120369 <u>Cosmarium subcostatum</u> var. <u>minor</u>		+	
152801 <u>Gongrosira debaryana</u>		+	
154603 <u>Trentepohlia iolithus</u>			+
160751 <u>Oedogonium</u> sp., $\leq 8 \mu\text{m}$		+	
160752 <u>Oedogonium</u> sp., $> 8 \leq 12 \mu\text{m}$		+	
160753 <u>Oedogonium</u> sp., $> 12 \leq 16 \mu\text{m}$		+	
160754 <u>Oedogonium</u> sp., $> 16 \leq 20 \mu\text{m}$		+	
160755 <u>Oedogonium</u> sp., $> 20 \leq 24 \mu\text{m}$		+	
160801 <u>Pithophora oedogonia</u>		+	
170106 <u>Chara zeylanica</u> var. <u>diaphana</u>		+	

(Table 2.1). These observations suggest that only species which are rapidly able to resume growth on rewetting (e.g. Fig. 5.2) and tolerate rapid drying out, during which period there would be no available time to produce a distinct organ of perennation, could tolerate the very transient supplies of moisture, available in terrestrial habitats and shallow pools.

The ability of blue-green algal species to tolerate rapid drying and rewetting is an obvious reason for their success on Aldabra. The view of Fritsch (1945) that their ability to tolerate such extremes was due to 'the peculiar characteristics of their protoplasts' is undoubtedly true in its broad sense. Experimental drying down and rewetting showed no significant change in chlorophyll a content of Nostoc commune (Table 2.5). This species is most abundant in exposed terrestrial situations (page 276). Presumably such species are able to commence photosynthesis and other physiological activities rapidly as on Aldabra they may experience complete drying within hours of rewetting. Time course studies (Fig. 5.2) showed extremely rapid water uptake in N. commune. In contrast to this however laboratory studies showed no indication that the lag in the onset of acetylene reduction was shorter in terrestrial species (N. commune) than in aquatic species (N. sphaericum) (Fig. 5.3). It is likely however that this was due to the length of time that the samples were stored between collection on the atoll and assay in Durham and it is perhaps dangerous to extrapolate at this time.

Heavy rainfall often occurred at times of high temperature. Such occurrences led to conditions of high humidity.

Relative humidity values in local algal habitats on ⁴Île Picard (2.31, 3.1) showed marked variations. Morning values showed a range of 84.4 - 100% and afternoon values a range of 45.4% - 99.4% (Table 3.4). Observations from the present studies support the views of various authors (1.21) that increased humidity may lead to well developed subaerial floras on rocks, soil, bark and leaves. In woodland or scrub where humidity tended to be high (Table 3.4) subaerial algal growths were well developed. This was especially noticeable on the Calophyllum trees in Takamaka Grove near pool T1 (Fig. 2.1) (pages 316, 449).

Taylor (1950) noted that Tolypothrix byssoidea formed 'abundant crusts' in depressions. On Aldabra these crusts when wet took the form of 'felts' forming in depressions. When T. byssoidea was found growing on exposed bare rock it formed only a thin horizontal covering over the surface of the substrata.

6.4 Flora

The larger plants had two possible effects on the algal vegetation:

- a) provision of microhabitats
- b) influence on local environmental conditions.

Algal species were recorded from among various communities of higher plants, on the trunks and branches of trees, epiphytic on submerged macrophytes and on the surface of dead and decaying vegetation.

It was suggested in Section 3.222 that the colour of the water in Casuarina forest (1.341) may be affected by the

presence of Casuarina 'needles'. It is possible also that decaying leaves in general would affect other aspects of water chemistry. Decaying vegetation was recorded from many pools, especially those in Casuarina forest, mixed scrub and scrub forest (1.34). As well as the obvious effect on water chemistry, the larger vegetation often had a marked influence on other environmental conditions. Heavy shading effects were noted in mixed scrub, scrub forest and Guettarda speciosa scrub (1.341). This was often accompanied by an attendant drop in ambient temperature (3.23) and higher relative humidity values (3.1).

6.5 Fauna

Land birds, waders, rats, tortoises and landcrabs were seen frequently to visit pools (Fig. 2.12). Ibis, egrets, tortoises and landcrabs spent long periods in pools, in particular the crabs which often lived in burrows at the edges of the larger pools. All these were seen often to excrete and defaecate into pools. Smaller pools often smelt strongly of ammonia or guano. Such processes must have a marked effect on the chemistry of the pools. Though the chemical data was somewhat fragmentary (2.32, 3.2) tentative conclusions as to the effects of faunal activity may be discussed here. The high levels of both dissolved phosphate and inorganic combined nitrogen (the latter being represented mostly by ammonia - N), are perhaps the most striking features of the Aldabran freshwater pools. The excreta of the various animals visiting the pools is likely to be a possible source of both the phosphate and ammonia.

As these animals carry out the bulk of their feeding away from these freshwater pools there may be a net transfer of nutrients from the surrounding ecosystem to the pools. Ganning and Wulff (1969) investigated the effects of bird droppings on the chemical and biological dynamics in brackish water rock pools. They always recorded high concentrations of phosphate which resulted in extremely low N/P ratios, reflecting the composition of the bird faeces. Ammonia was always the dominating inorganic nitrogen compound and only during periods of maximum algal growth were considerable amounts of nitrate found. They suggested that the accumulation of ammonia was possibly a result of the inhibition of the nitrification process.

Copeman and Dillman (1937) found that 85% of a guano sample was converted to ammonia in 4 days. Ganning and Wulff (1969) determined that in bird faeces most nitrogen occurred as excreted uric acid and amino compounds contained in undigested food residues. 60 - 87% of the total nitrogenous waste material in marine crustaceans was recorded as in the form of ammonia (Lockwood 1968). It is widely assumed in the literature that in an aerobic environment ammonia will become oxidized quite rapidly as a result of microbial activity first to nitrite and then to nitrate. It is possible that the low values of nitrite and nitrate were due to interference of analysis by as yet unknown reducing substances, but it seems unlikely that the near absence of such a process on Aldabra could be explained entirely by interference. Ganning and Wulff (1969) suggested that the lack of nitrification in rockpools

of the Baltic Sea was due to inhibitory substances present due to the high input of bird excreta. The pool carrying the highest levels of phosphate and combined nitrogen in this survey was W2 (Fig. 3.32). This pool held water even till late into the dry season and was thus visited frequently by birds and other animals (1.34) as a reliable source of water.

In one four hour period the pool was visited by 20 birds, consisting mainly of egrets and ibis (birds of large size in relation to the pool, Table 2.1), (C. B. Frith pers. comm.). It is difficult to find any reports in the literature of waters carrying similar levels of phosphate and combined nitrogen and which are not polluted by sewage or some other human activity. A pond in Hyderabad studied by Seenayya (1971) provides a fairly close parallel, but this pond (Golkonda Pond) was heavily polluted by human sewage.

As well as the effect of the fauna on pool chemistry, the fauna may well play a role in the redistribution of species. The feet of birds, tortoises and crabs were often seen covered in drying mud and occasionally algae. Mud transported by the fauna to different regions may provide the inocula for species in certain pools.

6.6 Influence of man

Though the main settlement and research station are situated on ^AÎle Picard recent studies on the atoll have necessitated the establishment of bases in various regions of the atoll. It is possible therefore that humans are involved in the redistribution of algal species between the various areas visited by workers (1.35). A number of tracks

had been cleared in scrub (1.35) thus allowing light to penetrate areas previously shaded, and algal species to colonize habitats along these tracks. The reverse of this was true in the pools covered to conserve potable water (McKenzie, 1971) (1.35). The heavy shading caused by the large slabs of rock placed over these pools greatly reduced algal growth. Algal growths were recorded from the various concrete structures present on Île Picard. Blooms of Microchaete tenera were recorded in the reservoirs and gutters of the solar stills (page 266) and Calothrix marchica (page 194) was recorded frequently from the walls of buildings. Two algal species were recorded only from man-made structures. Chrootheca richteriana was recorded from the walls of a mine shaft in Casuarina forest, Île Picard (page 358). This shaft has now been filled in. Mougeotia sp. was recorded only from a water storage tank at Middle Camp near Passe Houareau (Fig. 2.1) where it was the dominant species (page 398).

Experiments were carried out to observe what effect the various soaps and detergents used on the atoll may have on the growth of certain algal species. 'Radiant', 'Teepol' and toilet soap were included at levels of 0.5 mg l^{-1} in the incubation medium of acetylene reduction assays. In all three cases the level of fixation was raised (Table 6.7), though only the toilet soap was significant when tested with the Mann-Whitney U Test, the level being raised from 0.325 to $0.805 \text{ nM C}_2\text{H}_4 \text{ } \mu\text{g chl a}^{-1}$, ($P > 0.05$).

6.7 The chemistry of pools

No pool on Aldabra is far from the possible influence of the sea. Many pools close to the lagoon are tidal (Potts,

Table 6.7 Acetylene reduction rates of Nostoc sphaericum
with and without added 'soap' products

	\bar{x}	S.D.	
no additive	0.0325	0.0114	n = 4
+0.5 mg l ⁻¹ 'Radiant'	0.0408	0.0201	n = 4
+0.5 mg l ⁻¹ 'Teepol'	0.0463	0.0066	n = 4
+0.5 mg l ⁻¹ toilet soap	0.0805	0.0070	n = 4

1977) and McKenzie (1971) suggested that the area near fresh-water in the area of Bassin Flamant formed a lens floating on top of seawater. As seawater has a lower K/Na and a higher Mg/Ca ratio than any of the pools studied in the present survey, it would be expected that the more a terrestrial pool is subjected to the influence of added seawater, then the nearer its ratios for these ions would approach those of seawater. Only Bassin Flamant, the largest pool on Aldabra (CC9), combined both low K/Na with high Mg/Ca (3.326). This suggests the possibility, either that this pool was influenced by seawater more directly than any other pool.

Its geographical situation means that it is subjected to the full effects of the South East Trade winds. This pool covers a large area (80 x 90 m) and is always less than 2 m deep. It is likely therefore that sea spray could have a substantial effect on cation ratios. As this pool already has a higher cation level than many of the other pools studied, additions such as animal excreta would presumably have less effect on the overall ratios than it would in pools with lower cation levels. Though there was a considerable amount of animal activity associated with CC9 it seems probable that visiting animals are of much less quantitative importance in relation to the volume of the pool than they are for smaller pools such as W2.

Pools which were sampled on a number of different occasions showed increase of Na and K through the season. These increases closely paralleled the increases in Cl (3.26). It is possible that the most likely cause for this would be evaporation, but animal excreta may play a part in

increasing the levels. Data for the three occasions in W2 when the depth of water was almost the same are summarized in Table 3.9. The increase in K as a fraction of seawater, was four times greater than that for Na and Cl. This suggests that bird excreta in this pool may be an important source of K. Increases of Na, K and Cl would suggest that the pools would eventually increase greatly in salinity. Losses due to overflow after periods of heavy rain and loss of bottom detritus due to wind erosion when the pools were dry are possible sources of depletion of these ions. The increasing levels suggest that organisms present immediately prior to drying out would suffer extremely high external osmotic levels and that this might prove a critical factor of survival in particular pools.

6.8 Nitrogen fixation

Few surfaces on Aldabra lacked species of blue-green algae and it has long been established that many species of this phylum are capable of fixing atmospheric nitrogen (Stewart, 1973). Acetylene reduction assays were carried out to assess the nitrogen fixing-potential of selected blue-green algal species (5)

When compared with other data in the literature the rates for Aldabran Nostoc species are high (Table 6.8). No obvious indication of differences in rates of reduction in the light were noted between the various types of colony. In view of the range and forms of habitats which were sampled, the rates are remarkably similar. The rates for Nostoc were all much higher than those for mature cushions of Tolypothrix byssoidea,

Table 6.8

Comparison of rates found in in situ nitrogen fixation in the light with those of other authors. For purposes of conversion of data to standard format, it is assumed that the rate of C_2H_4 reduction is 3 x rate of N_2 fixation (Hardy, Burns & Holm-Hansen, 1975), chl a = 1% d.wt., N = 6% d.wt. and protein = 37.5% d.wt.

<u>alga</u>	<u>reference</u>	<u>location</u>	<u>experiment</u>	<u>quoted rate</u>	<u>rate, converted to standard format</u>	
<u>Nostoc commune</u>	this paper	Aldabra	9°S 46°E	terrestrial: afternoon peak	0.171 nM C_2H_4 μg chl a^{-1} min $^{-1}$	0.016 (
<u>Nostoc</u> (various)	"	"	"	terrestrial: morning assays (mean)	0.0388	0.0036
<u>Nostoc</u>	Mague & Holm-Hansen, 1975	Eniwetok	10°N 162°E	marine: range	2.83-5.00 nM C_2H_4 mg N $^{-1}$ min $^{-1}$	0.0016 - 0.0028
<u>Nostoc</u>	Bunt <u>et al.</u> , 1970	off Florida	c. 26°N 80°W	laboratory culture assayed in sea	11.5 nM C_2H_4 mg protein $^{-1}$ h $^{-1}$	0.00067
<u>Nostoc</u>	Horne, 1975	California	39°N 123°W	stream (site 3), clear-day: mid morning	c. 1.6 nM C_2H_4 mg d.wt. $^{-1}$ h $^{-1}$	0.00025
<u>N. commune</u>	Horne, 1972	Signy Is.	60°S 45°W	phytoplankton	0.05 μg N 3.6 μg chl <u>a</u> day $^{-1}$	0.00000965

although the differences were less marked when expressed on a unit area basis rather than per unit chlorophyll a basis (Table 5.1). Considerable variation was noted during the morning assays in the rates of reduction in the dark as compared with those in the light (Table 5.1). It is evident from Fig. 5.2 that rates in the light varied so markedly that without readings taken throughout the day it is difficult to make meaningful comparisons. Low rates of reduction in the dark were noted for N. sphaericum (Fig. 5.1). It is possible that this was due to the experiments being carried out several days after the colonies were first collected, when cellular levels of photosynthate were low. Fig. 5.2 suggests a rise in the rate of reduction after dusk. This was similar to that found by Horne (1975) in a stream Nostoc from sunny sites just prior to the onset of darkness. Time course experiments were not carried out in the dark within single serum bottles and it is uncertain whether there would be a similar rise in the rates over several hours if the colonies had been transferred to the dark earlier in the day, or whether this effect is apparent only at the end of the daylight period when stored products are at their highest level.

Comparisons of rates obtained by other workers are difficult due to the many different methods used and also the lack of information as to the time of day and environmental conditions (Table 6.8). The rates per unit chlorophyll a recorded for some of the terrestrial Nostoc populations from Aldabra are apparently higher than any previously recorded for in situ studies of blue-green algae. Comparisons with

rates obtained by other workers converted to a standard format are given in Table 6.8. Rates obtained by Potts and Whitton (unpublished data) from their visit to Aldabra in 1975 are included in Table 5.1 for ease of comparison.

Renaut et al., (1975) in studies on acetylene reduction by certain Moroccan blue-green algae (1.5) found marked effects due to environmental factors. Artificially wetted Nostoc samples from terrestrial habitats showed a decreased reduction rate around midday possibly due to high temperature and/or high light intensities, though they do not state whether or not these values were measured inside or outside the assay vessels. They found that after the decrease, the acetylene reduction rate increased during the late afternoon. They noted a similar effect in the activity of lake plankton assays, acetylene reduction rates reaching a maximum just before midday and a decrease in mid afternoon, followed by an increase during the early evening. A similar afternoon decrease in acetylene reduction was found in N. commune on Aldabra. Renaut et al. (1975) suggested that such a decrease in acetylene reduction might be due to high temperatures and/or high light intensities (1.5). Such decreases may also be due to high dissolved oxygen levels (See Stewart, 1971). The inhibition of acetylene reduction by oxygen is reversible. Stewart (1971) noted that acetylene reduction in Anabaena flos-aquae exposed to oxygen levels above 0.2 atm. was rapidly inhibited. If however the alga was then placed in a gas phase containing 0.2 atm. oxygen, acetylene reduction activity returned within 5 h. Such an effect might also explain the afternoon decrease in acetylene reduction, in

Nostoc commune on Aldabra (Fig. 5.1). The decrease occurred around midday when oxygen levels were high and the rate of acetylene reduction increased during late afternoon by which time oxygen levels had decreased considerably.

Future studies

Though the present study represents the results of 9 months field work and the collection of 1053 samples there is no doubt that the data presented are in many ways fragmentary and would benefit from further studies. Much of the data could be analysed only on return to Durham and, though it was not apparent in the field, wherever data were analysed it was frequently apparent in Durham that a few more readings, measurements and samples would have made them more complete. Reflections on possible future studies are included below.

Many species have not as yet been allocated binomials and in order to produce a complete floristic list more selective sampling is required. It may be possible to identify some species fully from further observations of samples already in Durham but where specimens lacked sufficient identifiable characters e.g. reproductive structures, or where insufficient material had been obtained, further collections are required. Certain species will require detailed cultural studies e.g. Pleurocapsa in order to establish the numbers of species present, though as suggested by Komarék (1973) (1.4) such studies must be related to material studied in the field.

Only one computer-orientated statistical analysis is given in the present study. As shown in Section 2.383 the 'query'

system developed possesses a very free format nature and presents numerous possibilities for future analyses concerning various environmental parameters, individual species, groups of species and possible associations. Environmental data have suggested some interesting possible investigations: e.g. the tolerance of certain species to desiccation, especially the stability of physiological systems in terrestrial blue-green algae, and the possible tolerances of species to osmotic stress during the drying out of certain pools.

Future studies on the onset of metabolic processes on rewetting may also confirm whether or not species remain dormant for long periods during the dry season or respond rapidly even to small amounts of available moisture e.g. dew.

The experiments to assess the nitrogen fixing potential of blue-green algal species were limited to two heterocystous genera. Many authors have demonstrated that non-heterocystous species also fix atmospheric nitrogen (Stewart, 1973). Potts and Whitton (1977) demonstrated nitrogen fixing potential in non-heterocystous blue-green algal species in the lagoon on Aldabra. Future work should include studies on the nitrogen fixing potential of non-heterocystous species. The apparent stability of chlorophyll a in terrestrial species suggests that some quantitative estimates on the contribution made by the more extensive species to the primary productivity of the atoll could be obtained.

SUMMARY

A study was made of the terrestrial and freshwater algae of Aldabra Atoll, Indian Ocean. Field work, which was carried out between September 1972 and June 1973 included wide ranging excursions to various regions of the atoll and the collection of 1053 samples, 521 of which were complete with detailed taxonomic and environmental data, physico-chemical and descriptive data from representative habitats. Data from the 521 detailed samples were stored on computer in Durham. A taxonomic checklist is given of the 292 species; this includes: descriptions of these species; comparisons with descriptions of other authors; the areas of Aldabra from which they were recorded; notes on distribution on Aldabra; habitats; abundance; comparisons with records of other workers.

Blue-green algae constitute 64% of the total terrestrial and freshwater algal flora. Of other phyla, only Chlorophyta are present in significant numbers, accounting for 20% of the total algal species. A statistical analysis is presented which allocates algal records into any one of five terrestrial and seven freshwater habitats. In both terrestrial and freshwater habitats blue-green algae were predominant though the maximum percentage recorded for terrestrial habitats (92%) was far greater than the maximum recorded for freshwater habitats (64%).

Tolypothrix byssoidea, Nostoc commune, members of the Chroococcales and Oedogonium spp. are the most widespread and abundant species. Spirogyra mirabilis is always abundant and often dominant where recorded, though this species seems to be restricted only to the eastern regions of Grande Terre.

A number of other species are recorded only for certain regions. It is suggested that local environmental conditions such as rainfall, seaspray and the activity of animals may be responsible for influencing such restrictions.

Data on the chemistry of pools are presented. A number of pools show diurnal cycles of various parameters. It is suggested that high levels of $\text{NH}_4 - \text{N}$ are the result of animal activity around pools.

The nitrogen fixing potential of Tolypothrix byssoidea and several Nostoc spp. is assessed using the acetylene reduction assay technique. The rates for various Nostoc species are very similar and are high compared with rates in the literature. A study of acetylene reduction over 24 h in Nostoc commune shows a diurnal cycle with fluctuations during this period similar to those recorded by other workers. The rate for Tolypothrix byssoidea, the most widespread and abundant species, is low compared to those of the Nostoc spp.

APPENDIXAI Meteorological

Data obtained from the Royal Society Synoptic observation station on Île Picard for the period 1967-1974 are listed in tables A1.1 - A1.6.

AII Environmental data on pools

Additional environmental data on pools studied for water chemistry are given in table A2.1.

Table A1.1 Mean monthly wind speed, kts

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
1967	-	-	-	-	-	-	-	-	-	6.4	4.1	5.2
1968	5.8	5.1	5.5	6.3	6.8	9.3	9.3	12.4	14.4	12.1	11.1	5.9
1969	4.9	5.2	4.3	3.7	7.0	7.8	10.2	13.0	9.1	7.5	6.3	5.1
1970	6.4	7.3	4.5	5.8	7.7	7.6	5.7	5.9	7.9	7.7	5.2	4.2
1971	6.5	16.6	19.5	7.3	10.6	10.3	13.4	12.1	10.9	10.5	4.5	4.9
1972	5.0	10.1	5.8	10.0	11.9	12.4	14.4	14.2	17.3	15.1	8.9	5.2
1973	10.1	6.7	7.2	6.4	8.2	8.5	7.1	8.0	7.1	7.2	4.2	3.6
1974	2.5	3.4	3.7	6.1	5.5	4.7	6.3	6.5	6.8	5.1	2.9	2.0

Table A1.2 . Highest maximum temperatures in each month at Aldabra

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967	-	-	-	-	-	-	-	-	-	-	33.4	34.0
1968	36.3	36.0	32.9	32.9	31.3	30.6	29.1	28.5	30.6	30.7	31.2	33.0
1969	33.5	33.0	34.0	33.0	32.0	30.0	28.7	28.7	29.4	29.7 ¹	-	-
1970	-	-	-	32.5	31.5	29.5	29.0	29.0	30.0	30.5	32.0	34.8
1971	32.4	31.4	31.4	33.8	30.1	28.4	27.4	27.4	27.8	30.2	31.8	32.3
1972	31.6	32.3	32.2	32.0	31.2	30.0	28.8	28.9	29.9	31.2	32.4	32.6
1973	35.9	32.2	33.2	32.5	33.6	30.0	28.9	31.7	29.8	32.2	32.5	32.4
1974	32.3	33.1	33.0	31.6	31.1	30.0	28.8	28.5	29.3	30.6	32.1	33.0

1. 4 days record only

Table A1.3 Mean maximum monthly temperatures at Aldabra

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
1967	-	-	-	-	-	-	-	-	-	-	30.81	32.04
1968	31.64	32.09	31.14	31.27	30.18	28.94	27.49	27.86	28.81	29.89	30.35	31.11
1969	31.61	31.60	32.05	31.63	30.59	28.77	27.98	27.57	28.33	29.48 ¹	-	-
1970	-	-	-	31.37	30.08	28.83	28.35	28.31	28.54	29.46	30.52	31.21
1971	30.71	30.31	30.28	30.45	29.08	27.18	26.81	26.69	27.07	28.07	30.15	30.95
1972	30.23	31.07	30.67	30.91	30.19	27.89	27.50	28.08	28.50	29.75	30.64	30.97
1973	31.06	30.57	31.40	31.33	30.08	28.49	27.50	28.00	28.58	29.62	31.13	30.85
1974	29.80	30.97	31.03	30.19	30.03	28.59	27.68	27.22	28.13	29.40	30.91	31.53
Mean	30.84	31.10	31.10	31.02	30.03	28.38	27.62	27.68	28.28	29.36	30.64	31.24

¹ 4 days of record only: disregarded in mean

Table A1.4 Mean minimum monthly temperatures at Aldebra

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967	-	-	-	-	-	-	-	-	-	-	24.38	25.67
1968	24.91	25.59	24.68	24.35	23.77	23.09	21.86	22.01	22.59	23.46	24.07	24.40
1969	24.30	25.72	25.49	24.92	25.08	23.49	22.45	21.84	21.85	23.55	24.46	24.53
1970	26.08	26.02	26.11	25.26	24.52	23.36	23.26	21.89	22.10	22.93	23.98	24.66
1971	24.82	25.40	24.73	25.13	24.67	22.70	22.43	21.85	22.35	23.26	23.84	24.19
1972	24.50	25.98	24.75	25.13	25.22	23.82	22.94	22.85	23.61	24.52	25.50	24.28
1973	25.87	25.99	26.36	25.86	25.03	23.62	22.86	22.45	22.91	23.98	24.42	24.26
1974	24.15	24.71	24.59	24.92	24.75	23.35	22.42	22.14	22.61	23.50	24.37	24.48
Mean	24.95	25.63	25.24	25.08	24.72	23.35	22.60	22.15	22.57	23.60	24.38	24.56

Table A1.5 . Lowest minimum temperatures in each month at Aldeabra

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
1967	-	-	-	-	-	-	-	-	-	-	22.5	23.0
1968	21.6	22.8	23.1	22.0	21.3	19.5	20.2	19.6	21.2	22.0	22.8	22.4
1969	22.7	23.0	23.0	23.5	22.5	17.5	20.6	19.5	17.9	22.2	22.3	21.6
1970	22.6	23.0	23.7	22.8	22.0	21.0	20.5	20.0	20.0	21.5	22.2	23.0
1971	22.2	21.3	21.5	23.0	22.6	20.1	20.7	18.8	21.0	22.0	21.8	22.0
1972	22.4	23.6	21.9	21.9	22.8	21.0	21.8	21.5	22.4	23.5	23.6	22.8
1973	21.4	23.8	24.0	23.9	23.5	22.2	21.3	20.2	21.1	22.8	23.4	22.7
1974	22.3	22.8	22.8	22.4	22.4	21.1	20.3	19.8	20.9	22.0	22.6	22.0

Table A1.6 Aldebra: Monthly rainfall (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
1949	-	-	-	-	-	2	26	0	0	0	13	57	-
1950	95	219	423	272	6	24	0	16	37	10	23	67	1192
1951	92	60	-	221	46	-	13	32	0	7	70	-	-
1952	160	306	29	250	13	18	4	0	-	-	-	-	-
1953	-	-	54	67	30	38	-	-	-	-	-	-	-
1958	92	101	40	36	2	2	9	8	4	2	45	40	381
1959	102	199	6	1	0	1	1	4	4	0	19	12	349
1967	-	-	-	-	-	-	-	-	-	3	147	5	-
1968	12	28	133	72	21	38	70	15	10	7	57	85	547
1969	153	147	152	394	176	37	39	14	19	12	55	57	1254
1970	48	85	140	211	32	30	34	26	7	21	13	56	700
1971	245	57	286	193	35	66	14	19	9	6	90	202	1220
1972	225	15	112	162	28	100	55	75	4	13	26	240	1035
1973	261	287	263	57	57	48	81	25	22	34	9	78	1221
1974	291	115	381	346	50	29	52	32	2	1	19	149	1467
1975	131	163	111	167	77	41	16	15	15	3	92	136	966
1976	358	177	261	87	67	64	65	35	5	0	17	104	1241
n	14	14	14	15	15	15	15	15	14	15	15	14	12
mean	162	140	171	169	43	36	32	21	9	8	46	92	966

Table A2.1 Additional environmental data on pools.

no.	bottom of pool	approx. max surface (m ²)	max. depth of water recorded (m)	degree of permanence 72/73 wet season	animal activity in relation to size of pool	no. of times water sampled
				crab	tortoise	bird
W1	detrital mud	3.5 x 1.5	0.72	++		7
W2	detrital mud	2.0 x 0.5	0.31	++	+++	6
W3	calcareous mud	2.0 x 2.0	0.075	+	+	3
W4	calcareous mud	2.9 x 1.2	0.76	+++		6
W5	Casuarina needles	2.4 x 1.3	0.91	+		6
W6	Casuarina needles	1.5 x 1.0	0.19	+		4
W7	Casuarina needles	6.0 x 4.3	0.51	++	+	3
W9	Casuarina needles	1.7 x 1.4	0.73	++		3
W10	calcareous mud	3.0 x 1.5	0.10	+		1
W102	detrital mud	1.0 x 0.5	0.07	+		1
W103	detrital mud	0.75x 0.5	0.05	+		1
<u>Takamaka</u>						
T1	detrital mud	60 x 35	0.75	+	+++	1
T2	fine sediment	20 x 15	0.80	+	+++	2
<u>Cino Cases</u>						
CC2	detrital mud	5 x 2	0.15	++		1
CC5	detrital mud	6 x 5	0.15	+	++	2
CC8	calcareous mud	1 x 1	0.4	+	+	1
CC9	fine sediment	c. 100 x 100	1.5 - 22.0	+	+	1
CC10	fine sediment	20 x 10	0.3	+	+++	1
CC11	fine sediment	10 x 10	0.1	+	++	1
CC12	detrital mud	5 x 4	0.1	+	+	1

↑
File Picard

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