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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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Allan Donaldson
30th November 1978
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 *Pseudonitella byssoides* 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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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 byssoides), Gloeocapsa alpicola, Scytonema ocellatum and Porphyrosiphon fuscus. Tolypothrix byssoides 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 giuseppi on heavily 'algalated' inland coral fragments, Scytonema guyanense from rotten debris, coral fragments and at the bases of coconut, Scytonema hofmannii 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 byssoidae and Gloeocapsa sanguinea formed a general cover over rocks. Occasionally Tolypothrix byssoidae 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 byssoidae 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 byssoidae 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 byssoides* 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; Ström, 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; Ström, 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; Ström, 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). Ström (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 Ström (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. Ström (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 byssoides* 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:

1) Those producing no known resting stage e.g. Microcystis, Gomphosphaeria, Oscillatoria and some desmids
2) those occasionally producing a perennating organ e.g. Aphanizomenon
3) 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. Ström (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 (Ström, 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; Bourrely, 1970).
relationships between blue-green algae and carbonate deposits have been reviewed by Fritsch (1945) and Golubic (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:

\[
\begin{align*}
\text{CaCO}_3 & \text{(solid)} \rightleftharpoons \text{Ca}^{++} + \text{CO}_3^{--} \quad \text{I} \\
\text{CO}_2 \text{(air, respiration)} + \text{H}_2\text{O} & \rightleftharpoons \text{H}_2\text{CO}_3 \quad \text{II} \\
\text{H}_2\text{CO}_3 & \rightleftharpoons \text{H}^+ + \text{HCO}_3^- \quad \text{III} \\
\text{HCO}_3^- & \rightleftharpoons \text{H}^+ + \text{CO}_3^{--} \quad \text{IV}
\end{align*}
\]

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\textsubscript{3} of 75 mg l\textsuperscript{-1}. Rainwater runoff collected from a clean corrugated zinc roof on Île Picard Aldabra had a mean solution potential for CaCO\textsubscript{3} of 90 mg l\textsuperscript{-1} (Trudgill 1971). Soil water contains much more dissolved CO\textsubscript{2} than rainwater, consequently it has a much higher solution potential for CaCO\textsubscript{3}. A solution potential for CaCO\textsubscript{3} of 175 mg l\textsuperscript{-1} has been calculated by Hem (1970) for soil water at 25°C containing 1% CO\textsubscript{2}.

A decrease in dissolved CO\textsubscript{2} due to photosynthesis or a rise in temperature may cause precipitation of CaCO\textsubscript{3} (equations I, II, III, IV). Initial deposition is rapid, but as less CaCO\textsubscript{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\textsubscript{2} deficit resulting from less CO\textsubscript{2} being returned at night than was removed during the day, removal of bicarbonate being more rapid than the precipitation of CaCO\textsubscript{3}.

The regulation of pH by CaCO\textsubscript{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\textsuperscript{-}, this in turn leading to an increase in pH (Ruttner 1963). The decrease in free CO\textsubscript{2} followed by a decrease in Ca(HCO\textsubscript{3})\textsubscript{2} is followed by more CaCO\textsubscript{3} coming into solution.

\[
\begin{align*}
\text{Ca(}\text{HCO}_3\text{)}_2 & \rightleftharpoons \text{CO}_2 (\text{to plant}) + \text{HCO}_3^- + \text{Ca}^{++} + \text{OH}^- \quad \text{V} \\
\text{CaCO}_3 + \text{H}_2\text{O} & \rightleftharpoons \text{Ca}^{++} + \text{HCO}_3^- + \text{OH}^- \quad \text{VI}
\end{align*}
\]
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 CaCO₃, as CaCO₃ 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 CO₂ released is only weakly dissociated and the overall increase in H⁺ is only slight (equation VII).

\[
\text{Ca(HCO}_3\text{)}_2 + \text{HCl} \rightleftharpoons \text{CaCl}_2 + 2\text{CO}_2 + 2\text{H}_2\text{O} \quad \text{VII}
\]

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

\[
\text{Ca(HCO}_3\text{)}_2 + \text{KOH} \rightleftharpoons \text{CaCO}_3 + \text{KHCO}_3 + \text{H}_2\text{O} \quad \text{VIII}
\]

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 Na₂CO₃ in contact with atmospheric CO₂. 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 waterfalls (Golubic, 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 (Golubic, 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 allochthonous or autochthonous.
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 Gongrosira incrustans, Phormidium incrustatum and Homoeothrix janthina (Golubic 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 (Golubic 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 (Golubic 1973). Direct erosion of the limestone takes place when endolithic
algae actively penetrate the rock (Golubic 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° 24'S, long. 46° 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.

1.3.1 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, naving-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 account for much of the total land area of the atoll and these terms will be used throughout the text. Champignon occupies much of Île Picard, Île 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 Houareau. Small areas of platin exists near Settlement on Île 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 résumé of the vegetation types is given here.

*Cocos nucifera* L. groves are found in a few sandy areas such as settlement, Île 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 spergula* 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 platin where there has been an appreciable accumulation of soil; species include *Cyperus*
ligularis L., Fimbristylis ferruginea Vahl and P. 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 platin and in poorly developed champignon and pave 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 birds 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 Ile 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 con-
tamination 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 Näge 1 (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); *Chroococcales* (Zehnder, 1960); *Gloeocapsa* (Golubic, 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 it's 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; Zenhder, 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°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 Ile 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 un-assimilated 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 METHODS

2.1 List of abbreviations and symbols

A = absorbance
A\text{max} = maximum absorbance
chl\text{a} = chlorophyll\text{a}
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
V. = versus
% = percent
%« = per thousand
2.2 Collection, preservation and examination of specimens

2.2.1 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 byssoides* 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 byssoides*, 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 micturate and defaecate into the pool.
Table 2.1 Aldabran pools included in the present survey

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

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 Casuarina 0.5 x 0.3

W124 0562,+1055  on top of tall residual at north edge of Casuarina forest north of settlement on track to Anse Var. 0.2 x 0.2

W125 0602,+1120  on south edge of Casuarina forest on track to Anse Var: large shallow pool 1.5 x 1.0
W126 0610,+1132 near first Pandanus 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

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 pave' between landing stage Passe Gionnet and in Casuarina forest 2.0 x 1.0

MW102 1392,+1250 pool in Casuarina 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 Casuarina forest north of Middle Camp; formed by fallen Casuarina tree 0.8 x 0.5
ME111 3150,+1212 pool in coastal champignon on path between Casuarina 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 Pandanus 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 Pandanus 100.0 x 50.0
AC101 3640,+1075 pool 10 m south of Macphersonia 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 Macphersonia 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 Côdres behind Casuarina forest 1.5 x 1.0
AC110 3598, +1122 shallow pool in scrub behind Casuarina forest Anse Côdres 0.5 x 0.5
AC111 3592, +1130 pool formed by fallen Casuarina in Casuarina forest Anse Côdres 0.8 x 0.5
AC112 3597, +1122 well behind Casuarina forest Anse Côdres 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 platin 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 platin 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 platin 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 platin 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 Ficus 20.0 x 10.0
CC14 3895, +0772 sunken into pavé west of Bassin Flamant steep sided pool bordered by Ficus 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 Pandanus  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 × 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 Ficus  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 Pandanus  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
Bassin Ibis south of camp Takamaka

T2  3345, +0550  Bassin Takamaka

T3  3372, +0525  south-east of Bassin Takamaka: large brackish pool

T101  3413, +0390  in scrub northern edge of coastal champignon near Anse Takamaka

T102  3374, +0524  very near T3; probably joined at high water levels

T103  3376, +0526  in pave east of T3: well-defined steep-sided pool

T104  3377, +0527  in pave east of T3

T105  3370, +0507  in scrub south of T3 on track to Anse Takamaka shaded by Macphersonia

T106  3362, +4990  in open area of Macphersonia south of T3 along track to Anse Takamaka

T107  3380, +0480  in large open area of platin south of Macphersonia zone

T108  3415, +0372  at edge of scrub almost at beginning of coastal champignon on track to Anse Takamaka

T109  3440, +0347  in coastal champignon north of Anse Takamaka

T110  3447, +0355  in coastal champignon at Anse Takamaka

T111  3303, +0580  south of Bassin Takamaka in pave

T112  3414, +0391  adjacent to T101: may be joined at high water levels

T113  3347, +0549  south of T2: large open pool in pave

T114  3347, +0550  near T2: shallow bowl-shaped pool in pave

T115  3344, +0550  on pave shelf west of T2: may joined at high water levels

T116  3344, +0592  in pave north of Bassin Ibis

T117  3344, +0594  in pave north of Bassin Ibis

T118  3367, +0632  in scrub south of Takamaka camp: small circular pool

T119  3375, +0526  near T103; may be joined at high water levels

T120  3367, +0655  north of Takamaka camp: small pool in champignon residual
<table>
<thead>
<tr>
<th>Code</th>
<th>Coordinates</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>T121</td>
<td>3368,+0652</td>
<td>in scrub near camp Takamaka</td>
<td>1.0 x 0.5</td>
</tr>
<tr>
<td>T122</td>
<td>3369,+0650</td>
<td>in scrub south of camp Takamaka, in pavé: well-defined steep-sided pool</td>
<td>2.0 x 1.0</td>
</tr>
<tr>
<td>T123</td>
<td>3367,+0649</td>
<td>near T122 may be joined at high water levels</td>
<td>0.5 x 0.5</td>
</tr>
<tr>
<td>T124</td>
<td>3367,+0650</td>
<td>in Maytenus scrub south of camp Takamaka</td>
<td>1.5 x 1.0</td>
</tr>
</tbody>
</table>

Grande Terre Central

<table>
<thead>
<tr>
<th>Code</th>
<th>Coordinates</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC101</td>
<td>2652,+0377</td>
<td>in champignon halfway along track between lagoonal stage and camp at Dune Jean Louis: U-shaped pool</td>
<td>1.5 x 0.4</td>
</tr>
<tr>
<td>SC102</td>
<td>2653,+0378</td>
<td>near SC101: smaller oval pool</td>
<td>0.8 x 0.6</td>
</tr>
</tbody>
</table>
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 (± round)
   4. Crack

g) Surface inclination (INC)
   0. Not known
   1. None
   2. Just detectable, visually $10^\circ$
   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

2.3.1 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

<table>
<thead>
<tr>
<th>Individual parameters</th>
<th>no. of pools sampled</th>
<th>no analyses in programme A</th>
<th>no analyses in programme B</th>
</tr>
</thead>
<tbody>
<tr>
<td>maximum possible</td>
<td>20</td>
<td>55</td>
<td>137</td>
</tr>
<tr>
<td>( \text{OD}_{420\text{nm}} )</td>
<td>16</td>
<td>24</td>
<td>92</td>
</tr>
<tr>
<td>temperature</td>
<td>17</td>
<td>52</td>
<td>134</td>
</tr>
<tr>
<td>( \text{O}_2 )</td>
<td>17</td>
<td>50</td>
<td>130</td>
</tr>
<tr>
<td>pH</td>
<td>20</td>
<td>54</td>
<td>135</td>
</tr>
<tr>
<td>Na</td>
<td>16</td>
<td>27</td>
<td>92</td>
</tr>
<tr>
<td>K</td>
<td>16</td>
<td>27</td>
<td>92</td>
</tr>
<tr>
<td>Mg</td>
<td>16</td>
<td>27</td>
<td>92</td>
</tr>
<tr>
<td>Ca</td>
<td>16</td>
<td>27</td>
<td>92</td>
</tr>
<tr>
<td>Cl</td>
<td>19</td>
<td>27</td>
<td>92</td>
</tr>
<tr>
<td>ortho ( \text{PO}_4\text{-P} )</td>
<td>20</td>
<td>55</td>
<td>94</td>
</tr>
<tr>
<td>poly ( \text{PO}_4\text{-P} )</td>
<td>11</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>organic ( \text{PO}_4\text{-P} )</td>
<td>11</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>ammonia-N</td>
<td>20</td>
<td>55</td>
<td>100</td>
</tr>
<tr>
<td>( \text{NO}_2\text{-N} )</td>
<td>20</td>
<td>55</td>
<td>100</td>
</tr>
<tr>
<td>( \text{NO}_3\text{-N} )</td>
<td>20</td>
<td>55</td>
<td>100</td>
</tr>
</tbody>
</table>
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°C. 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 Ile 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.

2.3.26 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).

2.3.27 Anions

Chloride was measured on return to U.K. using an argentometric technique (Strickland & Parsons, 1968; Standard Methods, 1971). Orthophosphate, polyphosphate, organic phosphate, \((\text{NH}_3 + \text{NH}_4)^-\) - N, NO\(_2^-\) - N, NO\(_3^-\) - 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 \(\mu g \text{ C}_2\text{H}_4\)
\(\mu g \text{ chl } a^{-1} \text{ min}^{-1}\). 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 com-
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 phaeo-
pigments, 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 demon-
strate 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)

<table>
<thead>
<tr>
<th>sample species</th>
<th>before storage</th>
<th>after storage</th>
<th>% decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nostoc commune</td>
<td>188.6</td>
<td>157.2</td>
<td>16.67</td>
</tr>
<tr>
<td>2. Nostoc commune</td>
<td>106.1</td>
<td>82.5</td>
<td>25.0</td>
</tr>
<tr>
<td>3. Nostoc commune</td>
<td>110.0</td>
<td>82.5</td>
<td>25.0</td>
</tr>
<tr>
<td>4. Nostoc commune</td>
<td>168.9</td>
<td>125.8</td>
<td>25.6</td>
</tr>
<tr>
<td>5. Nostoc commune</td>
<td>129.6</td>
<td>98.2</td>
<td>24.2</td>
</tr>
<tr>
<td>6. Nostoc commune</td>
<td>157.2</td>
<td>125.8</td>
<td>20.0</td>
</tr>
<tr>
<td>7. Nostoc commune</td>
<td>137.6</td>
<td>110.0</td>
<td>20.0</td>
</tr>
<tr>
<td>8. Nostoc commune</td>
<td>121.8</td>
<td>94.3</td>
<td>22.6</td>
</tr>
<tr>
<td>9. Nostoc sp.</td>
<td>451.9</td>
<td>373.4</td>
<td>17.4</td>
</tr>
<tr>
<td>10. Tolypothrix byssoidae</td>
<td>235.8</td>
<td>196.5</td>
<td>16.7</td>
</tr>
</tbody>
</table>

\[ R = 21.0 \pm 3.4 \]

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

<table>
<thead>
<tr>
<th>sample species</th>
<th>before storage</th>
<th>after storage</th>
<th>% decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nostoc commune</td>
<td>216.2</td>
<td>216.2</td>
<td>0</td>
</tr>
<tr>
<td>2. Nostoc commune</td>
<td>149.3</td>
<td>145.4</td>
<td>2.6</td>
</tr>
<tr>
<td>3. Nostoc commune</td>
<td>137.6</td>
<td>137.6</td>
<td>0</td>
</tr>
<tr>
<td>4. Nostoc commune</td>
<td>58.9</td>
<td>58.9</td>
<td>0</td>
</tr>
<tr>
<td>5. Nostoc commune</td>
<td>110.0</td>
<td>110.0</td>
<td>0</td>
</tr>
<tr>
<td>6. Nostoc commune</td>
<td>66.81</td>
<td>58.9</td>
<td>11.7</td>
</tr>
<tr>
<td>7. Nostoc sp.</td>
<td>314.4</td>
<td>314.4</td>
<td>0</td>
</tr>
<tr>
<td>8. Nostoc sp.</td>
<td>373.4</td>
<td>373.4</td>
<td>0</td>
</tr>
<tr>
<td>9. Tolypothrix byssoidae</td>
<td>294.8</td>
<td>294.8</td>
<td>0</td>
</tr>
<tr>
<td>10. Tolypothrix byssoidae</td>
<td>235.8</td>
<td>235.8</td>
<td>0</td>
</tr>
</tbody>
</table>

\[ R = 1.4 \pm 3.5 \]

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

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

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

Samples rewetted, dried, rewetted again

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

\[ \bar{x} = 2.04 \times 10^{-4} \pm 0.58 \times 10^{-4} \]
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 byssoida 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* (*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.

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

\[
\text{Constant} = \frac{R}{R - 1} = 2.17
\]

Where \( R = 1.85 \) (ratio shown above)

Thus the final equation would become:

\[
\text{chl } a = 2.17(\text{A}_b - \text{A}_a) \times (v/1) \times 13.1
\]

\( \text{A}_b \) = absorbance at 665 nm before acidification

\( \text{A}_a \) = 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 1 g\(^{-1}\) 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 re-wetted 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\(_4\)SO\(_4\) (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\(_2\)PO\(_4\): 2500 ml N-free H\(_2\)SO\(_4\)) and 3 g of anhydrous K\(_2\)SO\(_4\) 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 \textit{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\(_2\)O\(_2\) (B.D.H. Ltd.) added in a fume cupboard. A 'Kjeltab' (Thompson and Capper Ltd.) catalyst tablet was added (1.5 g K\(_2\)SO\(_4\), 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.

2.3.62 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.

2.3.63 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 NaNO₃ to six volumes of concentrated H₂SO₄. 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.

2.3.64 Sterilisation

Media, pipettes, flasks and Millipore filter apparatus were sterilised by autoclaving at 121°C and 10.35 KN m⁻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 μm. Innoculation 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.

2.3.65 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**

<table>
<thead>
<tr>
<th>Element</th>
<th>AAD - N</th>
<th>AAD + N</th>
<th>Medium of Allen &amp; Arnon (1955)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>-</td>
<td>0.144</td>
<td>-</td>
</tr>
<tr>
<td>P</td>
<td>44.5</td>
<td>44.5</td>
<td>61.9</td>
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<tr>
<td>S</td>
<td>26.0</td>
<td>26.0</td>
<td>32.0</td>
</tr>
<tr>
<td>Cl</td>
<td>171.8</td>
<td>171.8</td>
<td>177.3</td>
</tr>
<tr>
<td>Na</td>
<td>90.5</td>
<td>90.5</td>
<td>92.0</td>
</tr>
<tr>
<td>K</td>
<td>112.2</td>
<td>112.2</td>
<td>156.0</td>
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<tr>
<td>Ca</td>
<td>18.1</td>
<td>18.1</td>
<td>20.0</td>
</tr>
<tr>
<td>Mg</td>
<td>19.7</td>
<td>19.7</td>
<td>24.3</td>
</tr>
<tr>
<td>Si</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fe</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Mn</td>
<td>0.12</td>
<td>0.12</td>
<td>0.5</td>
</tr>
<tr>
<td>Mo</td>
<td>0.08</td>
<td>0.08</td>
<td>0.1</td>
</tr>
<tr>
<td>Zn</td>
<td>0.01</td>
<td>0.01</td>
<td>0.05</td>
</tr>
<tr>
<td>Cu</td>
<td>0.005</td>
<td>0.005</td>
<td>0.02</td>
</tr>
<tr>
<td>Co</td>
<td>0.0005</td>
<td>0.0005</td>
<td>0.01</td>
</tr>
<tr>
<td>B</td>
<td>0.09</td>
<td>0.09</td>
<td>0.5</td>
</tr>
<tr>
<td>V</td>
<td>-</td>
<td>-</td>
<td>0.01</td>
</tr>
<tr>
<td>W</td>
<td>0.005</td>
<td>0.005</td>
<td>0.01</td>
</tr>
<tr>
<td>Ni</td>
<td>0.002</td>
<td>0.002</td>
<td>0.01</td>
</tr>
<tr>
<td>Cr</td>
<td>0.001</td>
<td>0.001</td>
<td>0.01</td>
</tr>
<tr>
<td>Ti</td>
<td>-</td>
<td>-</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Table 2.7

<table>
<thead>
<tr>
<th>Salt</th>
<th>AAD - N</th>
<th>AAD + N</th>
<th>Medium of Allen &amp; Arnon (1955)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K$_2$HPO$_4$</td>
<td>250.0</td>
<td>250.0</td>
<td>348.4</td>
</tr>
<tr>
<td>MgSO$_4$</td>
<td>200.0</td>
<td>200.0</td>
<td>246.5</td>
</tr>
<tr>
<td>NaCl</td>
<td>230.0</td>
<td>230.0</td>
<td>233.8</td>
</tr>
<tr>
<td>CaCl$_2$.2H$_2$O</td>
<td>66.2</td>
<td>66.2</td>
<td>73.5</td>
</tr>
<tr>
<td>FeCl$_3$.6H$_2$O</td>
<td>0.97</td>
<td>0.97</td>
<td>?</td>
</tr>
<tr>
<td>Na$_2$EDTA.2H$_2$O</td>
<td>12.7</td>
<td>12.7</td>
<td>?</td>
</tr>
<tr>
<td>ratio EDTA:Fe(g)</td>
<td>13.1</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td>MnSO$_4$.4H$_2$O</td>
<td>2.03</td>
<td>2.03</td>
<td>2.03</td>
</tr>
<tr>
<td>Na$_2$MoO$_4$.2H$_2$O</td>
<td>0.25</td>
<td>0.25</td>
<td>-</td>
</tr>
<tr>
<td>MoO$_3$</td>
<td>-</td>
<td>-</td>
<td>0.15</td>
</tr>
<tr>
<td>ZnSO$_4$.7H$_2$O</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>CuSO$_4$.5H$_2$O</td>
<td>0.079</td>
<td>0.079</td>
<td>0.08</td>
</tr>
<tr>
<td>CoCl$_2$.6H$_2$O</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>H$_3$BO$_3$</td>
<td>2.86</td>
<td>2.86</td>
<td>2.86</td>
</tr>
<tr>
<td>NH$_4$Cl</td>
<td>-</td>
<td>500.0</td>
<td>-</td>
</tr>
<tr>
<td>NH$_4$VO$_3$</td>
<td>-</td>
<td>-</td>
<td>0.02</td>
</tr>
<tr>
<td>Na$_2$WO$_4$.2H$_2$O</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
</tr>
<tr>
<td>NiSO$_4$.6H$_2$O</td>
<td>-</td>
<td>-</td>
<td>0.045</td>
</tr>
<tr>
<td>NiSO$_4$.7H$_2$O</td>
<td>0.04785</td>
<td>0.04785</td>
<td>-</td>
</tr>
<tr>
<td>Cr(SO$_4$)$_3$.K$_2$SO$_4$.24H$_2$O</td>
<td>-</td>
<td>-</td>
<td>0.96</td>
</tr>
</tbody>
</table>
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, $pC_2H_2 = 0.17$ atm, and usually 3 colonies; the flasks were sealed with Subaseal closures and incubated under continuous illumination (warm white fluorescent source, 3000 lx) and a constant temperature of 32°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 $pC_2H_2 = 0.17$ 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 $pC_2H_2$ 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 (nM C₂H₄ mg N⁻¹ 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 (nM C₂H₄ μg chl a⁻¹ min⁻¹).

2.38 Statistics and computing

2.38.1 Parametric tests

The mean (X̄) 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 ≤ 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 byssoida). Solid circles (•) are colonies which had both chlorophyll $a$ and total nitrogen estimated.
and unknown variances \( (S_1^2 \text{ and } S_2^2) \) 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 \( \mu \) 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:

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

\[ U_2 = n_1 n_2 + n_1(n_2 + 1) - R_1 \]

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 cm\(^2\) 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 cm$^2$ 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 cm$^2$ 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 Zoosporangium, 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 \( > 4 \leq 6 \mu m \) and 014254 refers to any clearly recognizable Lyngbya which fits into the width category Lyngbya sp. \( > 4 \leq 6 \mu m \).

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 \( \mu m \). 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 ≤ 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 + 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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIES</td>
<td>six digit number with size range or binomial</td>
</tr>
<tr>
<td>LIVES</td>
<td>level 0-5 at which the species was recorded live</td>
</tr>
<tr>
<td>DEADS</td>
<td>level 0-5 at which the species was recorded dead</td>
</tr>
<tr>
<td>DAY</td>
<td>1-31 day on which sample was collected</td>
</tr>
<tr>
<td>MONTH</td>
<td>1-12 month during which sample was collected</td>
</tr>
<tr>
<td>YEAR</td>
<td>2-3 year during which sample was recorded</td>
</tr>
<tr>
<td>HOUR</td>
<td>00 01-12 00 time of day when sample was collected</td>
</tr>
<tr>
<td>GRID REF</td>
<td>grid reference from where sample was collected</td>
</tr>
<tr>
<td>SERAL</td>
<td>serial number allocated to the sample on the Aldabra</td>
</tr>
<tr>
<td>IC</td>
<td>island code of area of atoll from where sample was collected (Fig. 2.2)</td>
</tr>
<tr>
<td>PNOS</td>
<td>pool number from pool where sample was collected (terrestrial samples = Ø)</td>
</tr>
<tr>
<td>PHY</td>
<td>physiognomic form of sample when collected (Table 2.2)</td>
</tr>
<tr>
<td>PRO</td>
<td>proportion of substratum (living + non-living) contributed by the same physiognomic form as the sample (Table 2.2)</td>
</tr>
<tr>
<td>THI</td>
<td>thickness of sample (Table 2.2)</td>
</tr>
<tr>
<td>SUB</td>
<td>substrate (Table 2.2)</td>
</tr>
<tr>
<td>S.SI</td>
<td>substrate size (Table 2.2)</td>
</tr>
<tr>
<td>TOP</td>
<td>substrate microtopography (Table 2.2)</td>
</tr>
<tr>
<td>INC</td>
<td>surface inclination of sample (Table 2.2)</td>
</tr>
<tr>
<td>ASP</td>
<td>aspect of sample (Table 2.2)</td>
</tr>
<tr>
<td>DEP</td>
<td>depth of water at position of sample (Table 2.2)</td>
</tr>
<tr>
<td>LI</td>
<td>exposure to light at actual sample point (Table 2.2)</td>
</tr>
</tbody>
</table>
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°C, site 3), the minimum range 5.0°C (25.9 - 30.9°C, site 9).
Table 3.1 Meteorological data collected at the synoptic observation Île 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.)
<table>
<thead>
<tr>
<th></th>
<th>1972</th>
<th>1973</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean monthly atmospheric pressure (mb)</td>
<td>1014.8</td>
<td>1013.2</td>
<td>1013.2</td>
<td>1012.3</td>
<td>1011.4</td>
<td>1012.2</td>
<td>1012.4</td>
<td>1013.8</td>
<td>1016.1</td>
</tr>
<tr>
<td>Mean monthly wind speeds (kts)</td>
<td>15.1</td>
<td>8.9</td>
<td>5.2</td>
<td>10.1</td>
<td>6.7</td>
<td>7.2</td>
<td>6.4</td>
<td>8.2</td>
<td>8.5</td>
</tr>
<tr>
<td>Maximum wind speeds recorded each month (kts)</td>
<td>25</td>
<td>20</td>
<td>12</td>
<td>24</td>
<td>24</td>
<td>19</td>
<td>10</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Highest maximum temperatures each month (°C)</td>
<td>31.2</td>
<td>32.4</td>
<td>32.6</td>
<td>35.9</td>
<td>32.2</td>
<td>33.2</td>
<td>32.5</td>
<td>33.6</td>
<td>30.0</td>
</tr>
<tr>
<td>Mean maximum monthly temperature (°C)</td>
<td>29.75</td>
<td>30.64</td>
<td>30.97</td>
<td>31.06</td>
<td>30.57</td>
<td>31.40</td>
<td>31.33</td>
<td>30.08</td>
<td>28.49</td>
</tr>
<tr>
<td>Mean minimum monthly temperature (°C)</td>
<td>24.52</td>
<td>25.50</td>
<td>24.28</td>
<td>25.87</td>
<td>25.99</td>
<td>26.36</td>
<td>25.86</td>
<td>25.03</td>
<td>23.62</td>
</tr>
<tr>
<td>Lowest minimum temperatures each month (°C)</td>
<td>23.5</td>
<td>23.6</td>
<td>22.8</td>
<td>21.4</td>
<td>23.8</td>
<td>24.0</td>
<td>23.9</td>
<td>23.5</td>
<td>22.2</td>
</tr>
<tr>
<td>Monthly total rainfall (mm)</td>
<td>12.7</td>
<td>25.6</td>
<td>240.2</td>
<td>261.0</td>
<td>286.8</td>
<td>262.8</td>
<td>56.7</td>
<td>57.1</td>
<td>47.7</td>
</tr>
<tr>
<td>Year</td>
<td>Rainfall (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>---------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct. 1967 - July 1968</td>
<td>459.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct. 1968 - July 1969</td>
<td>1207.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct. 1971 - July 1972</td>
<td>939.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct. 1972 - July 1973</td>
<td>1250.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.2 Rainfall totals for periods October - June inclusive 1967 - 1974
Table 3.3 Temperature of selected terrestrial sites on Île Picard

<table>
<thead>
<tr>
<th>site</th>
<th>temperature (°C)</th>
<th>a.m. (06.15-07.15 h)</th>
<th>p.m. (15.30-16.30 h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 sandy patch amongst <em>Sporobolus virginicus</em> at synoptic observation station</td>
<td>25.6</td>
<td>33.2</td>
<td></td>
</tr>
<tr>
<td>2 perched cliff champignon near synoptic observation station</td>
<td>26.5</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>3 sandy patch amongst <em>Sclerodactylon macrostachyum</em> inland from small beach just south of synoptic observation station</td>
<td>24.7</td>
<td>38.3</td>
<td></td>
</tr>
<tr>
<td>4 open sand dune surface Passe Feme</td>
<td>25.1</td>
<td>35.6</td>
<td></td>
</tr>
<tr>
<td>5 sandy patch amongst <em>Sporobolus virginicus</em> in coconut grove north of research station</td>
<td>26.5</td>
<td>36.3</td>
<td></td>
</tr>
<tr>
<td>6 mixed herb vegetation on path behind research station sheltered by <em>Pemphis acidula</em> scrub</td>
<td>26.5</td>
<td>34.9</td>
<td></td>
</tr>
<tr>
<td>7 tall champignon pinnacle on path behind settlement</td>
<td>25.8</td>
<td>37.7</td>
<td></td>
</tr>
<tr>
<td>8 under dense <em>Pemphis acidula</em> scrub among leaf litter</td>
<td>26.3</td>
<td>32.7</td>
<td></td>
</tr>
<tr>
<td>9 small rock under dense <em>Pemphis acidula</em> scrub</td>
<td>25.9</td>
<td>30.9</td>
<td></td>
</tr>
<tr>
<td>10 open flat platin with an overlying layer of <em>Tolypothrix byssidea</em></td>
<td>27.6</td>
<td>39.6</td>
<td></td>
</tr>
<tr>
<td>11 open flat white platin without <em>Tolypothrix byssidea</em></td>
<td>27.5</td>
<td>39.2</td>
<td></td>
</tr>
<tr>
<td>12 pâvé among <em>Plumbago aphylla</em> in <em>Casuarina</em> forest behind settlement</td>
<td>26.6</td>
<td>34.7</td>
<td></td>
</tr>
<tr>
<td>13 surface of <em>Casuarina</em> &quot;needle&quot; soil in forest behind settlement</td>
<td>25.9</td>
<td>35.3</td>
<td></td>
</tr>
<tr>
<td>14 rock pinnacle projecting above soil in <em>Casuarina</em> forest behind settlement</td>
<td>25.9</td>
<td>35.7</td>
<td></td>
</tr>
<tr>
<td>15 sandy patch as measured in 1</td>
<td>26.6</td>
<td>33.7</td>
<td></td>
</tr>
</tbody>
</table>
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 59.4% (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 the 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.

3.2.1 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).

<table>
<thead>
<tr>
<th>site</th>
<th>wet bulb</th>
<th>dry bulb</th>
<th>relative humidity %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a.m.</td>
<td>p.m.</td>
<td>a.m.</td>
</tr>
<tr>
<td>RH1 open patch of sand amongst <em>Sporobolus virginicus</em> at synoptic observation station</td>
<td>g. 25.5</td>
<td>30.7</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td>1m 25.5</td>
<td>27.1</td>
<td>27.0</td>
</tr>
<tr>
<td>RH2 coastal perched cliff champignon near synoptic observation station</td>
<td>g. 25.6</td>
<td>28.0</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td>1m 25.6</td>
<td>27.2</td>
<td>27.3</td>
</tr>
<tr>
<td>RH3 south facing open area of sand dune, Passe Femme</td>
<td>g. 25.8</td>
<td>27.6</td>
<td>26.5</td>
</tr>
<tr>
<td></td>
<td>1m 25.8</td>
<td>28.4</td>
<td>27.0</td>
</tr>
<tr>
<td>RH4 south facing sheltered area of sand dune Passe Femme</td>
<td>g. 25.8</td>
<td>28.1</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td>1m 25.9</td>
<td>27.8</td>
<td>27.1</td>
</tr>
<tr>
<td>RH5 open sand amongst <em>Sclerodactylon macrostachyum</em> tufts inland from small beach near Passe Femme</td>
<td>g. 25.6</td>
<td>28.7</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td>1m 25.4</td>
<td>28.2</td>
<td>27.0</td>
</tr>
<tr>
<td>RH6 open sand amongst <em>Sporobolus virginicus</em> in coconut grove north of research station</td>
<td>g. 25.8</td>
<td>30.4</td>
<td>26.6</td>
</tr>
<tr>
<td></td>
<td>1m 25.3</td>
<td>28.4</td>
<td>27.3</td>
</tr>
<tr>
<td>RH7 at base of <em>Sporobolus virginicus</em> clump in coconut grove north of research station</td>
<td>g. 25.5</td>
<td>31.3</td>
<td>26.1</td>
</tr>
<tr>
<td></td>
<td>1m (not measured)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH8 mixed herb vegetation sheltered by mixed scrub, along track behind settlement</td>
<td>g. 26.1</td>
<td>40.9</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td>1m 25.3</td>
<td>29.2</td>
<td>26.6</td>
</tr>
</tbody>
</table>
## Table 3.4

<table>
<thead>
<tr>
<th>Site Description</th>
<th>Wet Bulb</th>
<th>Dry Bulb</th>
<th>Relative Humidity %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RH9</strong> depression in platin near W2 containing <strong>Lyngbya/Nostoc</strong> community</td>
<td>a.m.</td>
<td>p.m.</td>
<td>a.m.</td>
</tr>
<tr>
<td></td>
<td>g.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.2</td>
<td>28.3</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td><strong>1m</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.1</td>
<td>26.8</td>
<td>27.2</td>
</tr>
<tr>
<td><strong>RH10</strong> depression in platin similar to that in RH9 but lacking <strong>Lyngbya/Nostoc</strong> community</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.2</td>
<td>27.7</td>
<td>27.3</td>
</tr>
<tr>
<td></td>
<td><strong>1m</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.2</td>
<td>26.9</td>
<td>27.3</td>
</tr>
<tr>
<td><strong>RH11</strong> large boulder with thin surface layer of <strong>Tolypothrix byssoides</strong></td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.2</td>
<td>28.0</td>
<td>27.2</td>
</tr>
<tr>
<td></td>
<td><strong>1m</strong></td>
<td></td>
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<td></td>
<td>25.2</td>
<td>27.3</td>
<td>27.3</td>
</tr>
<tr>
<td><strong>RH12</strong> mixed herb vegetation along track to <strong>Bassin Cabri</strong></td>
<td>g</td>
<td></td>
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<td></td>
<td>25.8</td>
<td>36.0</td>
<td>26.2</td>
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<tr>
<td></td>
<td><strong>1m</strong></td>
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<td></td>
<td>25.3</td>
<td>27.6</td>
<td>26.9</td>
</tr>
<tr>
<td><strong>RH13</strong> amongst dense <strong>Pemphis acidula</strong> scrub along track to <strong>Bassin Cabri</strong></td>
<td>g</td>
<td></td>
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<tr>
<td></td>
<td>25.4</td>
<td>27.8</td>
<td>26.5</td>
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<tr>
<td></td>
<td><strong>1m</strong></td>
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<tr>
<td></td>
<td>25.3</td>
<td>27.2</td>
<td>27.0</td>
</tr>
<tr>
<td><strong>RH14</strong> in <strong>Casuarina</strong> forest over projecting rock surface near W5</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.4</td>
<td>28.5</td>
<td>26.8</td>
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<td></td>
<td><strong>1m</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.3</td>
<td>27.8</td>
<td>26.9</td>
</tr>
<tr>
<td><strong>RH15</strong> over algal &quot;felt&quot; attached to rock near W5</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.7</td>
<td>29.2</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td><strong>1m</strong></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(not measured)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RH16</strong> amongst tall grass near the entrance to <strong>Casuarina</strong> forest</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26.8</td>
<td>31.2</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td><strong>1m</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.8</td>
<td>27.3</td>
<td>26.3</td>
</tr>
<tr>
<td><strong>RH17</strong> open patch of sand amongst <strong>Sporobolus virginicus</strong> at synoptic observation station</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.6</td>
<td>29.7</td>
<td>27.2</td>
</tr>
<tr>
<td></td>
<td><strong>1m</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.6</td>
<td>27.0</td>
<td>27.2</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>Time</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1055 - 1150 h</td>
<td>2.0</td>
<td>2.0</td>
<td>16.5</td>
</tr>
<tr>
<td>1500 - 1530 h</td>
<td>2.0</td>
<td>2.0</td>
<td>16.5</td>
</tr>
<tr>
<td>1800 - 1830 h</td>
<td>2.0</td>
<td>2.0</td>
<td>16.3</td>
</tr>
</tbody>
</table>
Table 3.6 Total physical and chemical data collected for 20 pools on Aldabra
138
2

V v v W Q O O v ^ ' V Q O ^ ^ ^ ^ ' ^ ^ v i ^ ^ V ^>v^O vN>\>v>v>\>\>%>>>\> v^>^>^>^>v>^J•\>^J•^>^^>\>v>\>^>vis:.v•v.v•

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coco
CM coco
M
gf
S

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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>
<thead>
<tr>
<th>Pool</th>
<th>Mean Value</th>
<th>Min Value</th>
<th>Max Value</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W2</td>
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</tr>
<tr>
<td>W3</td>
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<td></td>
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<tr>
<td>W4</td>
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<td></td>
</tr>
<tr>
<td>W5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>W1</td>
<td>W2</td>
<td>W3</td>
<td>W4</td>
</tr>
<tr>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Na</td>
<td>no.</td>
<td>B 17</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>34.1</td>
<td>104</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>98.5</td>
<td>414</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>73.9</td>
<td>277</td>
<td>196</td>
</tr>
<tr>
<td>K</td>
<td>no.</td>
<td>B 17</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>2.4</td>
<td>18.1</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>11.9</td>
<td>64.0</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>5.1</td>
<td>44.5</td>
<td>11.7</td>
</tr>
<tr>
<td>Mg</td>
<td>no.</td>
<td>B 17</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>6.7</td>
<td>24.0</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>23.9</td>
<td>62.8</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>16.3</td>
<td>44.9</td>
<td>14.8</td>
</tr>
<tr>
<td>Ca</td>
<td>no.</td>
<td>B 17</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>26.3</td>
<td>65.3</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>59.2</td>
<td>112</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>43.6</td>
<td>90.3</td>
<td>99.0</td>
</tr>
<tr>
<td>Cl</td>
<td>no.</td>
<td>B 17</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>62</td>
<td>182</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>201</td>
<td>880</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>136</td>
<td>556</td>
<td>490</td>
</tr>
<tr>
<td>* ortho* PO&lt;sub&gt;4&lt;/sub&gt;-P</td>
<td>no.</td>
<td>B 11</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>0.17</td>
<td>3.3</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>0.40</td>
<td>10.0</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>0.38</td>
<td>6.1</td>
<td>0.40</td>
</tr>
<tr>
<td>*poly-*PO&lt;sub&gt;4&lt;/sub&gt;-P</td>
<td>no.</td>
<td>B 4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>0.01</td>
<td>1.3</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>0.50</td>
<td>2.3</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>0.19</td>
<td>1.79</td>
<td>0.11</td>
</tr>
<tr>
<td><em>organic</em> PO&lt;sub&gt;4&lt;/sub&gt;-P</td>
<td>no.</td>
<td>B 3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>0.10</td>
<td>2.3</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>0.23</td>
<td>2.7</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>0.17</td>
<td>2.34</td>
<td>0.22</td>
</tr>
<tr>
<td>ammonium-N</td>
<td>no.</td>
<td>B 17</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>0.2</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>1.2</td>
<td>45.0</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>0.52</td>
<td>19.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Fig. 3.1 Diurnal cycles of various parameters in six pools on Île Picard.
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.

<table>
<thead>
<tr>
<th></th>
<th>W1 5/6 June</th>
<th>W2 5/6 June</th>
<th>W5 2/3 May</th>
<th>W7 2/3 May</th>
<th>W10 29/30 March</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lower</td>
<td>upper</td>
<td>lower</td>
<td>upper</td>
<td>lower</td>
</tr>
<tr>
<td>temp</td>
<td>23.8</td>
<td>27.6</td>
<td>24.9</td>
<td>32.0</td>
<td>27.0</td>
</tr>
<tr>
<td>pH</td>
<td>7.1</td>
<td>8.7</td>
<td>7.5</td>
<td>8.0</td>
<td>7.4</td>
</tr>
<tr>
<td>O₂</td>
<td>2.8</td>
<td>11.4</td>
<td>0.4</td>
<td>10.6</td>
<td>0.9</td>
</tr>
<tr>
<td>Mg</td>
<td>20.9</td>
<td>23.9</td>
<td>c. 60, no cycle</td>
<td>c. 15, no cycle</td>
<td>18.9</td>
</tr>
<tr>
<td>Ca</td>
<td>50.0</td>
<td>58.0</td>
<td>c. 108, no cycle</td>
<td>c. 55, no cycle</td>
<td>73.4</td>
</tr>
<tr>
<td>ortho P</td>
<td>0.17</td>
<td>0.43</td>
<td>6.3</td>
<td>7.0</td>
<td>0.43</td>
</tr>
<tr>
<td>NH₄⁻N</td>
<td>0.6</td>
<td>1.2</td>
<td>25</td>
<td>30</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Table 3.9 Changes in pool W2 of various parameters over a 3-month period. Concentrations are in mg l\(^{-1}\).

<table>
<thead>
<tr>
<th></th>
<th>max. depth</th>
<th>Na</th>
<th>K</th>
<th>Mg</th>
<th>Ca</th>
<th>Cl</th>
<th>ortho-P</th>
<th>NH(_4)-N</th>
</tr>
</thead>
<tbody>
<tr>
<td>on 6.3.73</td>
<td>0.22</td>
<td>104</td>
<td>18.1</td>
<td>24.0</td>
<td>65.3</td>
<td>182</td>
<td>5.3</td>
<td>24</td>
</tr>
<tr>
<td>on 20.5.73</td>
<td>0.23</td>
<td>332</td>
<td>55.0</td>
<td>51.0</td>
<td>98.0</td>
<td>700</td>
<td>5.8</td>
<td>45</td>
</tr>
<tr>
<td>on 5.6.73</td>
<td>0.24</td>
<td>385</td>
<td>60.5</td>
<td>59.7</td>
<td>108</td>
<td>785</td>
<td>7.7</td>
<td>31</td>
</tr>
<tr>
<td>change between first and last</td>
<td>+0.02</td>
<td>+281</td>
<td>+42.4</td>
<td>+35.7</td>
<td>+33</td>
<td>+503</td>
<td>+2.4</td>
<td>+7</td>
</tr>
<tr>
<td>ratio of increase to conc. in seawater</td>
<td>.026</td>
<td>.11</td>
<td>.025</td>
<td>.09</td>
<td>.026</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean (including W2)</th>
<th>Mean (excluding W2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.D.(_{420}) temperature</td>
<td>0.021</td>
<td>0.273</td>
<td>0.084</td>
<td>0.088</td>
</tr>
<tr>
<td>pH</td>
<td>24.9(^\circ) (23.0(^\circ))</td>
<td>37.2(^\circ) (41.2(^\circ))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O(_2) (%)</td>
<td>6</td>
<td>(5)</td>
<td>255</td>
<td></td>
</tr>
<tr>
<td>O(_2) (conc.)</td>
<td>0.5</td>
<td>(0.4)</td>
<td>18.2</td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td>7.2</td>
<td>696</td>
<td>186</td>
<td>128</td>
</tr>
<tr>
<td>K</td>
<td>0.82</td>
<td>59.0</td>
<td>16.6</td>
<td>12.0</td>
</tr>
<tr>
<td>Mg</td>
<td>2.6</td>
<td>86.6</td>
<td>22.5</td>
<td>19.7</td>
</tr>
<tr>
<td>Ca</td>
<td>26.4</td>
<td>156</td>
<td>59.7</td>
<td>55.8</td>
</tr>
<tr>
<td>Cl</td>
<td>20</td>
<td>1590</td>
<td>286</td>
<td>255</td>
</tr>
<tr>
<td>orthophosphate-P</td>
<td>0.01</td>
<td>12.3</td>
<td>1.13</td>
<td>0.53</td>
</tr>
<tr>
<td>&quot;polyphosphate&quot;-P</td>
<td>0.01</td>
<td>3.8</td>
<td>0.58</td>
<td>0.40</td>
</tr>
<tr>
<td>organic phosphate-P</td>
<td>0.06</td>
<td>10.3</td>
<td>1.34</td>
<td>1.05</td>
</tr>
<tr>
<td>ammonia-N</td>
<td>0.2</td>
<td>45</td>
<td>3.46</td>
<td>1.47</td>
</tr>
</tbody>
</table>
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 platin area, with Pemphsis 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, \(0.146 \pm 0.055, n = 9\) vs \(0.048 \pm 0.025, n = 15\).

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 Ile Picard on various dates and at various times of day. The maximum recorded difference between the surface and bottom temperatures was \(6.0^\circ C\) (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 NO$_2^-$-N: minimum, 0.003; maximum, 0.53, mean including W2, 0.008, mean excluding W2, 0.003; for NO$_3^-$-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 Kutzing, 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.


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.
Cylindrospermum muscicola Kutzing, AAD-N, soil sample Cinq Cases. Cells: 3.0 - 3.5 \( \mu m \) wide; 3.4 - 4.0 \( \mu m \) long; oblong to cylindrical, slightly constricted at the cross-walls. Heterocysts: 2.5 - 3.5 \( \mu m \) wide; 3.5 - 4.5 \( \mu m \) long; elongate, oval to rounded triangular. Spores: 8.0 - 10.5 \( \mu m \) wide; 12.5 - 14.0 \( \mu m \) long; epispore smooth, golden-brown in colour.
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>
<thead>
<tr>
<th>Species</th>
<th>as recorded by</th>
<th>as recorded by</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Potts (1977)</td>
<td>Whitton &amp; Donaldson (1977)</td>
</tr>
<tr>
<td>O10215 Anabaena variabilis</td>
<td></td>
<td>010216 A. ambiguα</td>
</tr>
<tr>
<td>O10250 Anabaena sp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O10269 Anabaena sp., (A.D.) A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O10301 Anabaenopsis arnoldii</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O10550 Aphanocapsa sp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O10551 A. concharum  &gt; 1 ≤ 2 μm</td>
<td>010531</td>
<td>010531</td>
</tr>
<tr>
<td>O10552 A. montana  &gt; 2 ≤ 4 μm</td>
<td>010532</td>
<td>010532</td>
</tr>
<tr>
<td>O10553 A. grevillei  &gt; 4 ≤ 6 μm</td>
<td>010533</td>
<td>010533</td>
</tr>
<tr>
<td>O10554 A. roesana  &gt; 6 ≤ 8 μm</td>
<td>010534</td>
<td>010534</td>
</tr>
<tr>
<td>O10555 A. testacea  &gt; 8 μm</td>
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<td>O10602 Aphanorteche pallida</td>
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<td>O10631 A. saxicola  ≤ 2 μm</td>
<td>+</td>
<td></td>
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<tr>
<td>O10632 A. microspora  &gt; 2 ≤ 4 μm</td>
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<td>O10633 A. microscopica  &gt; 4 ≤ 6 μm</td>
<td>+</td>
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<td>O10910 C. marchica</td>
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<td></td>
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<tr>
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<td></td>
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<td>Species</td>
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<td>as recorded by Whitton &amp; Donaldson (1977)</td>
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<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------</td>
<td>------------------------------------------</td>
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<tr>
<td>011551 <em>Chroococcus varius</em> ≤ 4 μm, sheaths striated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>011553 <em>C. schizodermaticus</em> &gt; 6 ≤ 8 μm, sheaths striated</td>
<td>011533</td>
<td>011534</td>
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<tr>
<td>011554 <em>C. turgidus</em> &gt; 8 ≤ 16 μm, sheaths striated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>011555 <em>C. westii</em> &gt; 16 ≤ 32 μm, sheaths striated</td>
<td>011535</td>
<td></td>
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<td>011556 <em>C. macrococcus</em> &gt; 32 μm, sheaths striated</td>
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<td></td>
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<td>011557 <em>C. minor</em> ≤ 4 μm, sheaths not striated</td>
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<td>011558 <em>C. minutus</em> &gt; 4 ≤ 6 μm, sheaths not striated</td>
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<td>011560 <em>C. turicensis</em> &gt; 8 ≤ 16 μm, sheaths not striated</td>
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<td>011562 <em>Chroococcus sp.</em>, &gt; 32 μm, sheaths not striated</td>
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<td>011811 <em>Cylindrospermum muscicola</em></td>
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<td>012249 <em>Entophysalis</em> not above</td>
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<td></td>
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<td>012652 <em>G. arenaria</em> &gt; 4 ≤ 6 μm, sheath colourless, layered</td>
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<tr>
<td>012653 <em>G. caldariorum</em> &gt; 6 ≤ 8 μm, sheath colourless, layered</td>
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<td></td>
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<td>Species</td>
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<td>Whitton &amp; Donaldson (1977)</td>
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<td>012661 Gloecapsa kuttingiana &gt; 4 ≤ 6 µm, sheath yellow/brown</td>
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<tr>
<td>012668 G. magma &gt; 8 µm, sheath orange/red/violet</td>
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<td>012703 Gloeothecae rupestris</td>
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<td>012802 Gloeotrichia ghosei</td>
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<td></td>
<td>Potts (1977)</td>
<td>Whitton &amp; Donaldson (1977)</td>
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<td>014208</td>
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<td>L. limnetica (including subtilis)</td>
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<td>L. martensiana ( \leq 8 \mu m )</td>
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<td>M. minima</td>
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<td>015934 Pleurocapsa not above &gt; 16 µm</td>
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<td><em>Synechococcus</em> sp., $&gt;4 \leq 6 \mu m$</td>
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<td><em>S. brunneolus</em> $&gt;6 \leq 8 \mu m$</td>
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<td>017455</td>
<td><em>S. aeruginosus</em> $&gt;8 \leq 16 \mu m$</td>
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<td><em>S. eurypyhes</em> $&gt;16 \leq 32 \mu m$</td>
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Species

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017603 *T. bysoidea var. polycladus*
017606 *T. distorta*
017650 *Tolypothrix* sp.
017801 *Westiellopsis prolifica*
017850 *Westiellopsis* sp.
018053 *Xenococcus kernerii* > 4 ≤ 6 μm
018101 *Chroococcus gigantea*
018201 *Dalmatella buaënsis*
021103 *Chrootheca richteriana*
030201 *Euglena acus*
030202 *E. gracilis*
030205 *E. siphoglena*
030206 *E. minuta*
030207 *E. oxyuris*
030250 *Euglena* sp.
030251 *Euglena* sp., > 32 μm long
030401 *Lepocinclis sphagnophila*
030502 *Phacus orbicularis*
030601 *Trachelomonas hispida var. coronata*
030602 *T. volvocina*

as recorded by
Potts (1977)

as recorded by
Whitton & Donaldson (1977)

018033

030401 *L. ovum*

T. *hispida*
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<td>049951 8 μm long, blue-green</td>
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<tr>
<td>049952 8-16 μm long, blue-green</td>
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<td>049956 &gt;16 μm long, brown</td>
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<td>049957 8 μm long, green</td>
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<td>049959 &gt;16 μm long, green</td>
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<td>099950 Centrales genus not known, sp.</td>
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<td>101901 Nitzschia acicularis</td>
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<td>101904 N. palea + paleacea</td>
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<td>S. cyrtocerum (A.D.)</td>
<td>122469</td>
<td>Eudorina elegans 130491</td>
</tr>
<tr>
<td>Carteria globosa</td>
<td>130201</td>
<td>Phacotus lenticularis 131601</td>
</tr>
<tr>
<td>Chlamydomonas not above ( \leq 8 \mu ) long not palmelloid</td>
<td>130432</td>
<td>Pleodorina californica 132601</td>
</tr>
<tr>
<td>Chlamydomonas sp.</td>
<td>130450</td>
<td>Ankistrodesmus acicularis 140201</td>
</tr>
</tbody>
</table>
Species  as recorded by  as recorded by

Potts (1977)  Whitton & Donaldson

(1977)

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

140402 C. ornithocephalum

142750 Nautococcus sp.
Species

143103 **Pediastrum** boryanum
143109 **P. tetras**
143501 **Scenedesmus** acuminatus
143502 **S. bijugatus**
143508 **S. obliquus**
143510 **S. quadricauda**
144102 **Tetraedron** incus
144103 **T. minimum** (including **minutissimum**)
144104 **T. triangulare**
144403 **Trebearia triappendiculata**
144703 **Soraastrum** spinulosum
149950 Chlorococcales, genus not known, sp.
149953 Chlorococcales sp., > 8 ≤ 16 μm, narrowest diameter

as recorded by
Potts (1977)

as recorded by
Whitton & Donaldson (1977)

150101 **Apatococcus** lobatus
152801 *Gongrosira* debaryana
152850 *Gongrosira* sp.
152901 **Hormidium** fluitans
152949 **Hormidium** not above.
152950 **Hormidium** sp.

150150 **Apatococcus** sp.
<table>
<thead>
<tr>
<th>Number</th>
<th>Species</th>
<th>as recorded by</th>
</tr>
</thead>
<tbody>
<tr>
<td>154455</td>
<td>Stichococcus bacillaris cells + cylindrical $\leq 2 \mu$m</td>
<td>Potts (1977)</td>
</tr>
<tr>
<td>154603</td>
<td>Trentepohlia iolithus</td>
<td></td>
</tr>
<tr>
<td>159950</td>
<td>Ulotrichales + Chaetophorales, genus not known, sp.</td>
<td></td>
</tr>
<tr>
<td>159953</td>
<td>Ulotrichales + Chaetophorales sp., Chaetophorales, no upright filaments, $\leq 8 \mu$m</td>
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<tr>
<td>159954</td>
<td>Ulotrichales + Chaetophorales sp., Chaetophorales, no upright filaments, $\leq 8 \mu$m</td>
<td></td>
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<tr>
<td>160751</td>
<td>Oedogonium sp., $\leq 8 \mu$m</td>
<td></td>
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<tr>
<td>160752</td>
<td>Oedogonium sp., $&gt; 8 \leq 12 \mu$m</td>
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<td>160753</td>
<td>Oedogonium sp., $&gt; 12 \leq 16 \mu$m</td>
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<tr>
<td>160754</td>
<td>Oedogonium sp., $&gt; 16 \leq 20 \mu$m</td>
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<tr>
<td>160755</td>
<td>Oedogonium sp., $&gt; 20 \leq 24 \mu$m</td>
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<tr>
<td>160801</td>
<td>Pithophora oedogonia</td>
<td></td>
</tr>
<tr>
<td>170106</td>
<td>Chara zeylanica var. diaphana</td>
<td></td>
</tr>
</tbody>
</table>
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, nannocytes, 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.
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 Cédres: 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: 6.0 - 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.
Aphanocapsa concharum Hansgirg

A) Colony: spherical or irregularly-shaped. Cells: average diameter 1.5 \( \mu m \); 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 \( \mu m \) 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.

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:


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 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.
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:

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 Malabar: MW101, ME107
Anse Cèdres: 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.


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 ≤ 8 μm**

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 ≤ 6 μm. The size range of this 'species' number also includes the relevant size ranges of the following species: *A. biforis* 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.
Aphanocapsa testacea (A.Br.) Nageli > 8 µm

A) Colony: spherical, gelatinous, almost colourless. Cells: average diameter 8.8 µm; blue-green, evenly distributed within almost colourless homogeneous mucilage. As the lower size range for this species is given as 7.5 µm, this 'species' number and size range exclude that part of the cell range 7.5 - 8.0 µm. Cells in this range would thus be coded under 010554 A. roeseana de Bary > 6 ≤ 8 µm.

B) Geitler (1932) gave the size range as - cells: 7.5 - 9.5 µm 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.
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 browny-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 Gloeothece.

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.
Aphanothece saxicola Nägeli \( \leq 2 \mu m \)

A) Colony: formless, almost colourless. Cells:

1.4 - 2.0 \( \mu m \) 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 \( \mu m \) 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.
Aphanothece microspora (Menegh.) Rabenhorst > 2 µm < 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, 0600 + 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.
**Aphanothece microscopica Nageli > 4 ≤ 6 μm**

A) Colony: formless, almost colourless, mucilaginous. 
Cells: average width 5.6 μm; average length 8.5 μm; 
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 μm 
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.
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.
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:

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.
Chroococcus varius A. Braun \( \leq 4 \mu m \) sheath striated

A) Colony: spherical and gelatinous. Cells: 2.0 - 4.0 \( \mu m \) 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 \( \mu m \); 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 $> 6 \leq 8 \ \mu m$ sheaths striated

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

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

Cells in this size range would be coded under 011552 *Chroococcus montanus* Hansgirg $>4 \leq 6 \ \mu m$ sheaths striated.

As the upper size range is given as 11.0 $\mu m$, this 'species' number and size range exclude that part of the cell size range 8.1 - 11.0 $\mu m$. Cells in this size range would be coded under 011554 *Chroococcus turgidus* (Kätz.) Nägeli $>8 \leq 16 \ \mu m$ sheaths striated.

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

C) One population studied:

Ile 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 Ile Picard and Iles Moustique; abundant among *Scytonema* mats.
011554 **Chroococcus turgidus** (Kütz.) Nägeli $>16 \mu m$ sheaths striated

A) Colony: gelatinous, light-green to brown in colour. Cells: 11.0 - 16.0 $\mu m$ 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 $\mu m$, this 'species' number and size range exclude that part of the cell size range 16.1 - 32.0 $\mu m$. Cells in this size range would be coded under 011555 C. *westii* (W. West) Boye-Peterson $>16.0 \leq 32.0 \mu m$ 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 $\mu m$, in groups of 2 - 4, sheaths colourless.

C) 16 populations studied:

- Île 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.

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 ≤ 32 μm 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 ≤ 16 μm 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:

\[\text{Ile Picard: 0600 + 0900}\]

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

E) Recorded by Potts (1977) from Ile 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 Lévine.
Chroococcus minor (Kütz.) Nägeli ≤ 4 μm sheaths not striped

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 ≤ 6 μm 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 ≤ 8 μm sheath not striated and 011560 Chroococcus turicensis (Nägeli) Hansgirg > 8 ≤ 16 μm 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:

- Cinq Cases: CC5, CC9, CC12, CC13, CC15, CC102
D) Recorded from terrestrial and pool situations only from Île Picard and the Cinq Cases region of Grande Terre, locally very common on Île 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 Île Picard, Grande Terre, and Îles 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.
Chroococcus turicensis (Näg.) Hansgirg > 8 ≤ 16 μm
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* (Nag.) 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:

†Ile Picard: W1, W6, 0600 + 0900

D) Recorded only from †Ile Picard in both terrestrial and pool situations. From films over rock, amongst other loose colonies and the plankton.

E) Recorded by Potts (1977) from †Ile Picard, †Ile Malabar, Grande Terre and †Ile Sylvestre; widespread and in the lagoon frequent among other algal communities.
**Chroococcus** sp. > 32 μm sheath not striated

A) Colony: spherical, gelatinous. Cells: average width 33.0 μm; 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.
A) Cells: 1.0 - 3.0 \( \mu m \) wide; 5 - 8 times longer than broad; spindle-shaped, sigmoid or lunate, light blue-green, generally solitary, occasionally 2 - 3 together in a thin diffusent mucilage.

B) Geitler (1932) gave the size range as - cells: 1.0 - 3.0 \( \mu m \) wide; up to 25.0 \( \mu m \) long; spindle-shaped, 'S' shaped, or semicircular.

C) One population studied:

Ile 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.
A) Cells: 1.5 - 2.5 \( \mu \text{m} \) wide at their widest point; 9.0 - 15.0 \( \mu \text{m} \) 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 \( \mu \text{m} \) wide; 9.0 - 15.0 \( \mu \text{m} \) long, olive to light blue-green.

C) One population studied:
   \( \text{\textcircled{1}le \text{Picard: W1} \)}

D) Recorded only once; from a Tolypothrix byssonidea felt just above the high water mark.
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 Cèdres: 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.

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 diffusent, occasionally non-lamellate.

C) Three populations studied:

Île Picard: 0600 + 09000, 0500 + 0900

Grande Terre Central: SC101

D) Recorded from terrestrial and pool situations. From films over rock, and the plankton.
Gloeocapsa arenaria (Hassall) Rabenhorst > 4 ≤ 6 μm
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 ≤ 4μm 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.
Gloeocapsa caldariorum Rabenhorst > 6 ≤ 8 μm
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 ≤ 4 μm sheath colourless, and 012652
Gloeocapsa arenaria (Hassall) Rabenhorst > 4 ≤ 6 μm
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 Gloeothecae.

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.
0126.0 Gloeocapsa dermochroa Nägeli > 2 ≤ 4 μm 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.) Kützing ≤ 2 μm sheath yellow-brown.

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

Gloeocapsa kützingiana 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

Takaraaka: 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.
Gloeocapsa kutzingiana 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:
   Ile Malabar: 1394 + 1233, 3142 + 1185
   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 the filaments of other algae, among algal felts, among larger gelatinous colonies and the plankton.
0126.2 *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*
*nageli* Nageli > 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:
Île Picard: W1, W2, W3, W4, W5, W6, W9, W104, W107,
W115, W117, 0600 + 0900, 0565 + 1014,
1000 + 0500, 0618 + 0991
Île Malabar: 1394 + 1233
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 filaments of other algae,
algal felts and the plankton.
**Gloeocapsa gigas W. et G. G. West** > 8 µm sheath

yellow-brown

A) Colony: formless, gelatinous, yellow-brown in colour.
   Cells: 8.3 - 22.7 µm 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:

B) Geitler (1932) gave the size range as - cells:
   9.0 - 15.0 µm in diameter; 4 - 36 cells within a colony.
   Sheath: wide yellow to brown, often rough, non-lamellate.

C) Two populations studied:
   ^Ile Picard: W115
   ^Ile 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.
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. Nováček, 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.
Gloeocapsa alpina (Nag.) emend. Brand > 4 ≤ 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 ≤ 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:

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

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

E) Recorded by Potts (1977) only from Ile Picard, among Scytonema mats, La Gigi.
012667 Gloeocapsa sanguinea Ag. emend. Fr. Nováček > 6 ≤ 8 μm 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 (Brebisson) Kützing > 4 ≤ 4 μm sheath orange/red/violet or 012666 G. alpina (Näg.) emend. Brand > 4 ≤ 6 μm 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) Nováček > 8 μm 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 Cédres:** 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 conflervoides*, over silt in a tidal depression, close to the research station.
012668 Gloecapsa magma (Bréb) Kützing var. simmeri (Schmidle)

Novaček > 8 µm sheath orange/red/violet


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:

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 Gloeothecce rupestris (Lyngbye) Bornet

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 Gloeotheca palea (Kützing) Rabenhorst $> 2 \leq 4 \mu m$

A) Colony: spherical, later formless, mucilaginous, blue-green. Cells: 2.8 - 4.0 \mu m wide; 6.0 - 7.0 \mu m 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 \mu m, this 'species' number and size range exclude that part of the size range 4.1 - 4.5 \mu m. Cells in this size range would be coded under 012733 Gloeotheca membranacea (Rabenh.) Bornet.

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

B) Geitler (1932) gave the size ranges as - cells: 2.5 - 4.5 \mu m 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 Aphanotheca microscopica over sand at La Gigi.
Gloeotrichia ghosei

10 µm
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.


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.
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).
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.
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 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).
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*
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 Cèdres: AC1, AC2, AC101, AC103
- Takamaka: T1, T3, T102

D) Widespread but rare, occasionally abundant. Endolithic in submerged rock.
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 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).
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.
Johannesbaptistia pellucida
**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.
Lyngbya allorgei Fresy

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) Fresy (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 Cèdres: 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 (Fresy, 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:
   - Île Picard: W5, W6, W115, W119, 0562 + 1035
   - Île 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:
- 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 Malabar: MW103, ME103, ME109, 3142 + 1185
   - Anse Cedres: 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).
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 byssoides, 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 kuetzingii Schmidle

A) Filaments: 2.0 - 2.5 \( \mu \text{m} \) wide; attached at the base.
   Cells: 1.2 - 1.7 \( \mu \text{m} \) 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 \( \mu \text{m} \) wide; 30 - 70 \( \mu \text{m} \) long. Cells: 1.5 - 2.0 \( \mu \text{m} \)
   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:
   Île Picard: W1, W4, W6, W7, W9, W107, W115, W127, 0600 + 0900, 0575 + 0976
   Île Malabar: ME102, ME107
   Anse Cedres: 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, Île Picard.

F) Desikachary (1959) listed many records of other authors from reservoirs, soil cultures, lakes, ponds and tanks in Burma, Ceylon, India and Pakistan.
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.
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.
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 epizoic 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 μm wide attached by their bases, cross-walls indistinct. Sheath: thin and colourless.

B) Geitler (1932) gave the size ranges as - filaments: about 1.0 μm wide; about 74.0 μm long. Cells: almost as long as broad, occasionally longer.

C) 20 populations studied:
   - 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.*, *Pithophora oedogonia* and epizoic 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 *Lyngbya ocreata* Gardner

A) Filaments: of average width 8.0 \( \mu m \); solitary or a few together. Cells: 6.3 - 7.4 \( \mu m \) wide; 1.5 - 2.0 \( \mu m \) 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 \( \mu m \) wide. Cells: 5.6 - 7.2 \( \mu m \); 1.0 - 1.4 \( \mu m \) 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.*
*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.

E) From the sheaths of *Rivulariaceae, Nostocaceae* (Frémy, 1929).
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 $\leq 1 \mu m$

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

Potts (1977) attributed the binomial Merismopedia 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:

$0.75 - 1.0 \mu m$ wide; 4 - 16 cells within the colony.

C) One population studied:

Anse Cèdres: 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 $> 1 \leq 2 \mu m$

A) Cells: 1.3 - 1.5 $\mu m$ blue-green, a few together in almost colourless mucilage

B) Geitler (1932) gave the size range as - cells: 1.3 - 2.0 $\mu m$ wide.

C) 6 populations studied:
   - Anse Cédres: 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 Île Picard, present amongst other algal communities.
Merismopedia punctata
Merismopedia punctata Meyen > 2 ≤ 4 μm

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 Cedres: 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.
Merismopedia glauca (Ehrenb.) Nägeli > 4 ≤ 6 μm

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:
   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
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, epispore 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.

E) From standing waters, occasionally from marshy ground, among the filaments of other algae, occasionally on damp rock. (Frémy, 1929).
**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 km².

**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.
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 Cèdres: 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.

Myxosarcina sp.
015051 Myxosarcina sp., ≤ 4 μm

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., $> 4 \leq 6 \mu m$

A) Colony: globular, three-dimensional, pseudoparenchymatous. Cells: $4.1 - 6.0 \mu m$ 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., $\leq 4 \mu m$

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 ≤ 8 μm


C) Four populations studied:

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

*Takamaka:* T2

D) From among the filaments of other algae and algal felts.
015054 *Myxosarcina* sp., > 8 µm

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., ≤ 4 µm.

C) Four populations studied:

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

Takamaka: T2
Nostoc carneum

1.0 µm
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:
\[ \text{Île Picard: W1, W2, W6, W111, W115} \]
\[ \text{Île Malabar: ME102, ME103} \]
\[ \text{Cinq Cases: CC13, CC18, CC102} \]

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.
A) Colony: 2 - 3 mm wide; 20 cm long, olive-green to brown, black when dry. Cells: 4.0 - 6.5 μm wide; 3.0 - 9.5 μm long; barrel-shaped. Heterocysts: 4.5 - 7.5 μm long; oval to spherical. Sheath: indistinct. Spores: not noted.

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 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) 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.
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.
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 diffuent. 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:

- 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 Malabar: MW101, ME 102, ME103, ME107
- Anse Cédres: 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:

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).
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).
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).
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.
**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 intertwined 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; constricted 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).
Oscillatoria limosa Agardh

A) Trichomes: 12.3 - 16.8 \(\mu m\) wide; many intertwined to form a dark blue-green to olive-green expanded mat.

Cells: 2.0 - 4.3 \(\mu m\) 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 \(\mu m\) wide, mostly 13.0 - 16.0 \(\mu m\) wide.

Cells: 2.0 - 5.0 \(\mu m\) long.

C) Seven populations studied:

Ile Picard: W4, W7, W9, W122, 0619 + 0991

Takamaka: T3, T103

D) Recorded only from Ile Picard and the Takamaka region of Grande Terre, occasionally very abundant. Forming large sheets over damp mud.

E) 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.
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.
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 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.
A) Trichomes: 0.8 - 1.3 µm wide; single or a few intertwined, yellow-green to light blue-green. Cells: 1.0 - 3.9 µm long; not constricted at the cross-walls, cross-walls indistinct.

B) Geitler (1932) gave the size ranges as - trichomes: 1.0 - 1.5 µm wide; cross-walls indistinct.

C) Four populations studied:
   Ile Picard: W6, W118
   Cinq Cases: CC9
   Takamaka: TI

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).
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:
- Île 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).
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.
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 \( \mu \text{m} \); single or a few together. Cells: average length 5.5 \( \mu \text{m} \); 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 \( \mu \text{m} \) wide, mostly 3.0 - 4.0 \( \mu \text{m} \) wide. Cells: 3.5 - 8.0 \( \mu \text{m} \); quadratic or up to twice as long as broad, mostly 6.0 \( \mu \text{m} \) 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 jasorvensis* 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 koeltzii
015592 Oscillatoria koelzii 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 ± 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.
A) Trichomes: 6.0 - 7.2 \( \mu m \) wide, attenuate towards the apex, single or many intertwined to form a thin, dark-blue-green, expanded sheet. Cells: 3.5 - 8.5 \( \mu m \) long, end-cell up to 14.5 \( \mu m \) 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 \( \mu m \) wide; slightly attenuate towards the apex, many intertwined in free-swimming bundles. Cells: 3.0 - 7.0 \( \mu m \) long, gas vacuolate, end-cell up to 12.0 \( \mu m \) 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.
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:
Ile Picard: W1, W9, W119, 0600 + 0900
Ile Malabar: MW101, MW104, ME103, ME111
Anse Cedres: 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:
- Île Malabar: ME108
- Anse Cèdres: 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, Île 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, diffusent.

B) Geitler (1932) gave the size ranges as - trichomes: 1.5 - 2.0 μm wide. Cells: up to twice as long as broad; + constricted at the cross-walls, end-cell rounded. Sheath very thin.

C) 23 populations studied:
   Île 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., Gloeothecce sp.

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, diffuent.

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 diffuent.

C) Four populations studied:
   Île Picard: W4, W115
   Île Malabar: 3143 + 1186
   Anse Cèdres: 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 ± 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 Île 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.
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, ± 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:
   Île 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 - 2.0 \( \mu \)m wide; attenuate towards the apex, many intertwined to form an expanded, mucilaginous sheet. Cells: 1.3 - 2.0 \( \mu \)m wide; distinctly constricted at the cross-walls, end-cell rounded or conical, without calyptra. Sheath: indistinct, almost colourless, diffuent.

B) Geitler (1932) gave the size ranges as - trichomes: 1.2 - 3.0 \( \mu \)m wide; attenuate towards the apex. Cells: 1.2 - 3.0 \( \mu \)m long; distinctly constricted at the cross-walls, end-cell conical, without calyptra, sheath diffuent.

C) 43 populations studied:


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, widespread 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.

C) 35 populations studied:

Ile Malabar: MW1, MW101, MW104, ME102
Anse Cèdres: 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 μm, 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.


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:
Île 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, Île Picard.
015815 Plectonema tomasianum 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:
   Ile 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. ≤ 4 μm

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 Malabar: MW1, MW101, MW103, MW104, ME101, ME102, MW103, ME104, ME107, ME108, ME111, 1394 + 1233, 3143 + 1186
Anse Côdres: 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
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 Plectrocapsa sp. $> 4 \leq 8 \mu m$

A) See also 015931 Plectrocapsa sp. $\leq 4 \mu m$.

C) 68 populations studied:


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. $> 8 \leq 16 \, \mu m$

A) See also 015931 *Pleurocapsa* sp. $\leq 4 \, \mu m$

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. $> 16 \, \mu m$

A) See also 015931 *Pleurocapsa* sp. $\leq 4 \, \mu m$

C) One population studied:
   
   Anse Cedres: AC112

D) Recorded only on one occasion, among other algae in a filamentous sheet on rock.
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.
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:
   Ile Picard: W1, W4, W120
   Anse Cédres: 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:
   Île Picard: W3, W4  

D) Recorded only from Île 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 ≤ 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 ≤ 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 ≤ 16 µm sheaths having parallel layers

A) Probably the same species described under 016752

*Scytonema* sp., > 8 ≤ 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., $\geq 16 \, \mu m$ sheaths having parallel layers

A) Probably the same species described under 016752

Scytonema sp., $\geq 8 \leq 12 \, \mu m$ sheaths having parallel layers.

C) One population studied:

Ile Picard: 0610 + 1140, 0618 + 0991

D) From algal felts overlying rock, soil and on the trunks of Cocos nucifera.
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, Curacao (Koster, 1963); littoral zone, Oahu, Pacific (Khan, 1969).
016933 *Spirulina gigantea* Schmidle $> 2 \leq 4 \ \mu m$

A) Trichomes: 3.0 - 3.3 \mu m wide. Spirals: average width 10.0 \mu m; distance between spirals 2.5 \mu m; cross-walls indistinct.

B) Geitler (1932) gave the size ranges as - trichomes: 3.0 - 4.0 \mu m wide. Spirals: 11.0 - 16.0 \mu m 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.
Synechococcus cedrorum Sauvageau $>2 \leq 4 \mu$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 $S. \ pavelkii$ 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:

Ile 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 $> 4 \leq 6 \, \mu m$

A) Cells: 5.0 - 6.0 $\mu m$ wide; average length 7.8 $\mu m$; light blue-green.

B) There is no suitable binomial which would cover this 'species' number size range category.

C) Two populations studied:

- Ile Picard: W107
- Takamaka: T125

D) Recorded on only two occasions from widely separated pools. From films overlying mud.
017454 Synechococcus brunneolus Rabenhorst \( > 6 \leq 8 \) µm

A) Cells: average width 6.5 µm; average length 8.5 µm; single or two together, dark olive-green.

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 the previous number, 017453 Synechococcus \( > 4 \leq 6 \) µm. As the upper size range for this species is given as 11.0 µm, this 'species' number and size range exclude that part of the cell range 8.1 - 11.0 µm. Cells in this range would be included under 017455 Synechococcus aeruginosus \( > 8 \leq 16 \) µm.

B) Geitler (1932) gave the size ranges as - cells: 5.0 - 11.0 µm 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 aeruginosus* Nägeli > 8 ≤ 16 \(\mu m\)

A) Cells: 8.5 - 15.5 \(\mu m\) wide; 10.0 - 12.0 \(\mu m\) 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 \(\mu m\), this 'species' number and size range exclude that part of the cells range 7.0 - 8.0 \(\mu m\). Cells in this range would be coded under the previous number 017454 *Synechococcus brunneolus* > 6 ≤ 8 \(\mu m\).

B) Geitler (1932) gave the size ranges as - cells: 7.0 - 16.0 \(\mu m\) 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:

- Île Picard: W1, W6, W103, W111, W115
- Île 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 euryphyes* G. Beck sp. >16 ≤ 32 μm.

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

*Synechococcus euryphyes* G. Beck.

B) Starmach (1966) gave the size range as - cells: 19.0 - 42.0 μm wide.

C) Two populations studied:

- Île 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 byssoida* (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 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 byssoida* (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.
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 \( \mu \text{m} \); intertwined to form a blue-green to blue-grey powdery sheet. Cells: average length 10.0 \( \mu \text{m} \), quadratic to longer than broad; barrel-shaped to cylindrical, slightly constricted at the cross-walls. Heterocysts: average width, 5.0 \( \mu \text{m} \); average length 15.0 \( \mu \text{m} \). Branches: average width 5.0 \( \mu \text{m} \); average length 8.0 \( \mu \text{m} \); 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 \( \mu \text{m} \).

B) Desikachary (1959) gave the size ranges as - filaments: 8.0 - 12.0 \( \mu \text{m} \) wide. Cells: quadratic to slightly longer than broad; not constricted at the cross-walls. Heterocysts: 5.5 - 6.0 \( \mu \text{m} \) wide; 10.5 - 22.0 \( \mu \text{m} \) long; oblong-cylindrical. Branches: 4.0 - 6.0 \( \mu \text{m} \) wide. 'Pseudohormocysts': 8.5 - 9.0 \( \mu \text{m} \) wide.

C) Three populations studied:

Ile Picard: W1, 0590 + 0920

D) Recorded only from Ile 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 kernerii Hansgirg > 4 \leq 6 \mu m

A) Cells: 4.2 - 6.0 \mu m wide, up to 7.1 \mu m 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 \mu m wide, up to 10.0 \mu m 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.
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.
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, paramylum 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.
Euglena gracilis Klebs

A) Cells: 5.0 - 12.0 \( \mu m \) wide; 35.0 - 40.0 \( \mu m \) 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 (19/3) gave the size ranges as - cells: 6.0 - 22.5 \( \mu m \) wide; 37.0 - 45.0 \( \mu m \) long.

C) 42 populations studied:
   - Île Malabar: MW1, MW103, MW104, ME102, ME103, ME104, ME108
   - Anse Cédres: 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.

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 Malabar: MW104, ME102, ME104, ME107, ME108, ME111
- Anse Cedres: 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 floes, the plankton and occasionally in the aufwuchs of larger plant growths.
030207 *Euglena oxyuris* Schmarda 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 Cèdres: 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 posteriorally 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:

* 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 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.
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., \( \leq 8 \) \( \mu \)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., \( > 8 \leq 16 \) \( \mu \)m blue green.

C) One population studied:

\[ \text{Île Picard: W110} \]

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., \(\leq 8\) 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., \( \leq 8 \, \text{\mu m} \) 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 \( \leq 16 \, \text{\mu m} \) brown and 049955 Cryptophyta > 16 \( \mu m \) 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 ≤ 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:

A) Île Picard: W115
Cinq Cases: CC9, CC17, CC109

D) Widespread, rare, never very abundant. From films overlying mud and the plankton
049956 Cryptophyta sp., >16 μm long, brown

A) Cells recorded under this 'species' number and size range category were very similar to those described under 049954 Cryptophyta sp., ≤8 μm 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. ≤ 8 μm 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 ≤ 16 μm long, green and 049959 Cryptophyta sp., >16 μm long, green.

C) One population studied:
   Takamaka: 3300 + 0300

D) Recorded on only one occasion, planktonic.
049958 Cryptophyta sp., >8 ≤ 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.
Cryptophyta sp., >16 μm long green
049959 Cryptophyta sp., > 16 μm long, green

A) Cells recorded under this 'species' number and size category were very similar to those described under 049957 Cryptophyta ≤ 8 μm and are probably the same species.

C) Three populations studied

Ile Malabar: ME104
Anse Cedres: AC103
Takamaka: T1

D) Widespread, rare, never very abundant. From films overlying mud and the plankton.
Pyrrophyta sp., (A.D.) A

10 µm

Pyrrophyta sp., (A.D.) B

10 µm
059969 Pyrrophyta sp., (A.D.), A

A) Cells: average width 9.0 \( \mu \text{m} \); average length 12.0 \( \mu \text{m} \); 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:

\[ \text{Ile Picard: W6, W104} \]

D) Recorded only from \text{Ile 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 μm, 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 Cedres: 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.

Akanthochloris sp.
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:

A. 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.
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 Cèdres: 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 Malabar: ME108

Anse Cèdres: 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 Cedres: 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 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.
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 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.

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 Cèdres: 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.
A) Cells: average width 7.0 μm, 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:

Ile Malabar: ME109

D) Recorded only on one occasion, forming an almost unialgal growth in water storage tank (oil-drum).

122169 Spirogyra mirabilis (Hass.) Kutzing (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. Parthenosporas: 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.

122401 **Staurastrum alternans** Brebisson

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.

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 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

10 µm
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 Cèdres: 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.
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.


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.
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:
- Ile Picard: W1, W4, W5, W7, W9, W110, W117
- Ile 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.
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.

Ankistrodesmus longissimus (Lemmermann) Wille

A) Cells: average width 2.5 \( \mu m \); average length 30.0 \( \mu m \), 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 \( \mu m \) wide; up to 225.0 \( \mu m \) long.

C) One population studied:
- Île Picard: W2

D) Recorded only once. From films over bottom mud, among floating filaments and the plankton.
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 Malabar: MW103, ME103, ME108
   Anse Cedres: 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.

Ankistrodesmus mucosus

10 μm
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:

- Île Picard: W2
- Anse Cèdres: AC3

D) Recorded only twice from two widely separated pools. From films over bottom mud and the plankton.
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:
   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
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:
   Île Picard: W5

D) Recorded on only one occasion, attached to a dead twig at the bottom of a pool.
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.
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.
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:
   Ile 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.
**Coelastrum microporum Nageli**

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.

E) Philipose (1967) listed many records from, rock pools, tanks, ditches and ponds in Burma, Ceylon and India. He described its distribution as ubiquitous.
A) Cells: 4.0 - 8.0 \( \mu \text{m} \) wide, 8.0 - 12.0 \( \mu \text{m} \) 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 \( \mu \text{m} \) wide; 9.0 - 25.0 \( \mu \text{m} \) long.

C) Eleven populations studied:
   - Île Malabar: MW101
   - Anse Cèdres: AC3
   - Cinq Cases: CC3, CC5, CC104
   - Takamaka: T1, T103, T108, T118, T122, T124

D) Not recorded for Île 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:
   Ile 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) Korishikov (1953) gave the average diameter as 20.0 μm

C) Thirteen populations studied:
   - 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.
Oocystia crassa
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

10 μm
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.

E) 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 μm
143109 *Pediastrum tetras* (Ehrenberg) Ralfs

A) Colony: circular without intercellular spaces. Cells: average width 7.0 \( \mu \text{m} \); 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 \( \mu \text{m} \) 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
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 ellipsoidal, 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 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

10 μm
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 Malabar: ME103, ME108

Anse Cèdres: 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


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.
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 Cèdres: 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.
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 Cedres: 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.


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
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
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.

E) Philipose (1967) described its distribution as Europe, India, Java, and North America.
**144703 *Sorastrum spinulosum* Någeli**

A) Cells: average width 12.0 μm; average length 14.0μm; reniform or cuniform, with two relatively short spines at the apex of each angle, up to 32 cells within almost colourless, diffuent mucilage.

B) Korshikov (1953) gave the size ranges as - cells:

12.0μm - 18.0 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.
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:

Ile 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.

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

10µm
154455 *Stichococcus bacillaris* Nageli + cylindrical > 2 μm

A) Filaments: composed of 4 - 16 cells. Cells: average width 3.2 μm; average length 5.5 μm; chloroplast; a single parietal plate; without pyrenoid.

B) Ramanathan (1964) gave the size ranges as - cells:
   2.0 - 3.8 μm 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 \( \mu \text{m} \); average length 24.0 \( \mu \text{m} \). Sporangia: 18.0 - 30.0 \( \mu \text{m} \) diameter.

B) Prescott (1962) gave the size ranges as - cells: 14.0 - 35.0 \( \mu \text{m} \) wide; 24.0 - 50.0 \( \mu \text{m} \) long. Sporangia: 20.0 - 48.0 \( \mu \text{m} \) in diameter.

C) Nine populations studied:

- Île Picard: W1, 0600 + 0900, 0621 + 0997
- Cinq Cases: CC2, 3841 + 0623
- Takamaka: T1, 3300 + 0300, 3345 + 0551
- Île Esprit: 1000 + 0600

D) Widespread, occasionally very abundant. Forming bright pink, orange or green expanded sheets over rock and wood.
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:

Ile Picard: W1, W4, W107, W110
Ile 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.
456

160752 Oedogonium sp., $>8 \leq 12 \mu m$

A) See also 160751 Oedogonium sp., $\leq 8 \mu m$

B) 25 populations studied:

Ile Picard: W1, W4, W6, W7, W103, W104, W110, W111, W112, W113

Ile Malabar: MW1, MW103, MW104

Anse Cedres: 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., $>12 \leq 16 \mu m$

A) See also 160751 *Oedogonium* sp., $\leq 8 \mu m$

C) 17 populations studied:

- 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., $>16 \leq 20 \mu m$

A) See also 160751 *Oedogonium* sp., $< 8 \mu m$

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., $> 20 \leq 24 \mu m$

A) See also 160751 Oedogonium sp., $\leq 8 \mu m$

C) One population studied:
   Takamaka: T2

D) Recorded only on one occasion, planktonic.
Pithophora oedogonia
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:
   Île Picard: W4, W7, W9, W102, W104, W111
   Île 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.

Table 4.3  Computer number categories used as 'dumping grounds' for material for which insufficient taxonomic data were available.

<table>
<thead>
<tr>
<th>Number</th>
<th>Species</th>
<th>Size 1 (μm)</th>
<th>Size 2 (μm)</th>
<th>Size 3 (μm)</th>
<th>Size 4 (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>010250</td>
<td>Anabaena sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>010550</td>
<td>Aphanocapsa sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>010650</td>
<td>Aphanothece sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>010950</td>
<td>Calothrix sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>012249</td>
<td>Entophysalis not above</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>013650</td>
<td>Hyella sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>014231</td>
<td>Lyngbya not above</td>
<td>≤1</td>
<td>≥2</td>
<td>≥4</td>
<td>≥6</td>
</tr>
<tr>
<td>014232</td>
<td>Lyngbya not above</td>
<td>≥1</td>
<td>≤2</td>
<td>≤4</td>
<td></td>
</tr>
<tr>
<td>014233</td>
<td>Lyngbya not above</td>
<td>≥2</td>
<td>≤4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>014234</td>
<td>Lyngbya not above</td>
<td>≥4</td>
<td>≤6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015250</td>
<td>Nostoc sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015531</td>
<td>Oscillatoria not above</td>
<td>≥1</td>
<td>≤2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015532</td>
<td>Oscillatoria not above</td>
<td>≥2</td>
<td>≤4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015535</td>
<td>Oscillatoria not above</td>
<td>≥8</td>
<td>≤12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015538</td>
<td>Oscillatoria not above</td>
<td>≥32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015550</td>
<td>Oscillatoria sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015551</td>
<td>Oscillatoria sp.,</td>
<td>≥1</td>
<td>≤2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015552</td>
<td>Oscillatoria sp.,</td>
<td>≥2</td>
<td>≤4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015553</td>
<td>Oscillatoria sp.,</td>
<td>≥4</td>
<td>≤6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015555</td>
<td>Oscillatoria sp.,</td>
<td>≥8</td>
<td>≤12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015558</td>
<td>Oscillatoria sp.,</td>
<td>≥32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015731</td>
<td>Phormidium not above</td>
<td>≥1</td>
<td>≤2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015732</td>
<td>Phormidium not above</td>
<td>≥2</td>
<td>≤4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015736</td>
<td>Phormidium not above</td>
<td>≥1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015750</td>
<td>Phormidium sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015751</td>
<td>Phormidium sp.,</td>
<td>≥1</td>
<td>≤2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>015849</td>
<td>Plectonema not above</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015850</td>
<td>Plectonema sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>015950</td>
<td>Pleurocapsa sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Spirulina not above $\leq 1 \mu m$

Spirulina sp., $>1 \leq 2 \mu m$

Tolypothrix sp.

Westiellopsis sp.

Euglena sp.

Euglena sp., $>32 \mu m$ long

Pyrrophyta, genus not known sp.

Centrales sp., $\leq 8 \mu m$ diameter

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

Chlamydomonas sp.

Chlorella sp.

Chlorococcales, genus not known, sp.

Chlorococcales sp., $>8 \leq 16 \mu m$ narrowest diameter

Gongrosira sp.

Hormidium not above

Hormidium sp.

Ulotrichales + Chaetophorales, genus not known, sp.

Ulotrichales + Chaetophorales sp., Chaetophorales, no upright filaments, $\leq 8 \mu m$

Ulotrichales + Chaetophorales sp., Chaetophorales, no upright filaments, $\leq 8 \mu m$
D) Ecological notes on distribution, abundance, and habitat.


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)

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Present Survey</th>
<th>% Total</th>
<th>Data of Whitton (1971)</th>
<th>% Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>total species</td>
<td>292</td>
<td></td>
<td>149</td>
<td></td>
</tr>
<tr>
<td>Myxophyta</td>
<td>188</td>
<td>64%</td>
<td>90</td>
<td>60%</td>
</tr>
<tr>
<td>heterocystous Myxophyta</td>
<td>28</td>
<td>9%</td>
<td>--</td>
<td>not assessed</td>
</tr>
<tr>
<td>Rhodophyta</td>
<td>1</td>
<td>0.4%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Euglenophyta</td>
<td>11</td>
<td>4%</td>
<td>5</td>
<td>3%</td>
</tr>
<tr>
<td>Cryptophyta</td>
<td>8</td>
<td>2.7%</td>
<td>1</td>
<td>0.7%</td>
</tr>
<tr>
<td>Pyrrophyta</td>
<td>3</td>
<td>1%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Xanthophyta</td>
<td>2</td>
<td>0.7%</td>
<td>1</td>
<td>0.7%</td>
</tr>
<tr>
<td>Bacillariophyta</td>
<td>8</td>
<td>2.7%</td>
<td>14</td>
<td>9%</td>
</tr>
<tr>
<td>Conjugatophyta</td>
<td>12</td>
<td>4%</td>
<td>9</td>
<td>6%</td>
</tr>
<tr>
<td>Chlorophyta</td>
<td>58</td>
<td>20%</td>
<td>37</td>
<td>25%</td>
</tr>
<tr>
<td>Charophyta</td>
<td>1</td>
<td>0.4%</td>
<td>1</td>
<td>0.7%</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Environmental category</th>
<th>Computer query</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Terrestrial</strong></td>
<td></td>
</tr>
<tr>
<td>limestone rock</td>
<td>PNOS = Ø SUB = 3</td>
</tr>
<tr>
<td>limestone soil and</td>
<td>PNOS = Ø &amp; SUB = 17 OR PNOS = Ø &amp; SUB = 18</td>
</tr>
<tr>
<td>humic soil</td>
<td></td>
</tr>
<tr>
<td>sand</td>
<td>PNOS = Ø &amp; SUB = 19</td>
</tr>
<tr>
<td>live bark or other plant</td>
<td>PNOS = Ø &amp; SUB = 20 OR PNOS = Ø &amp; SUB = 21</td>
</tr>
<tr>
<td>other</td>
<td>PNOS = Ø &amp; SUB ≠ 3 &amp; SUB ≠ 17 &amp; SUB ≠ 18 &amp; SUB ≠ 19 &amp; SUB ≠ 20 &amp; SUB ≠ 21</td>
</tr>
<tr>
<td><strong>Aquatic</strong></td>
<td></td>
</tr>
<tr>
<td>limestone rock</td>
<td>PNOS ≥ 1 &amp; SUB = 3</td>
</tr>
<tr>
<td>dead plant or other plant</td>
<td>PNOS ≥ 1 &amp; SUB = 16 OR PNOS ≥ 1 &amp; SUB = 21</td>
</tr>
<tr>
<td>limestone soil</td>
<td>PNOS ≥ 1 &amp; SUB = 17</td>
</tr>
<tr>
<td>humic soil</td>
<td>PNOS ≥ 1 &amp; SUB = 18</td>
</tr>
<tr>
<td>plankton</td>
<td>PNOS ≥ 1 &amp; PHY &gt; 14 &amp; PHY ≤ 43</td>
</tr>
<tr>
<td>aufwuchs</td>
<td>PNOS ≥ 1 &amp; PHY &gt; 43</td>
</tr>
<tr>
<td>other</td>
<td>PNOS ≥ 1 &amp; PHY &lt; 15 &amp; SUB ≠ 3 &amp; SUB ≠ 16 &amp; SUB ≠ 17 &amp; SUB ≠ 18 &amp; SUB ≠ 21</td>
</tr>
</tbody>
</table>
Table 4.6  Summary of numbers of species recorded for major taxa from 521 1 cm$^2$ samples (2.383). For the purposes of the present study each 'species' number is regarded as a separate species.
<table>
<thead>
<tr>
<th></th>
<th>TERRESTRIAL (92 samples)</th>
<th>AQUATIC (429 samples)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>limestone</td>
<td>limestone &amp; sand</td>
</tr>
<tr>
<td>Number of samples</td>
<td>53</td>
<td>9</td>
</tr>
<tr>
<td>01 Myxophyta</td>
<td>63</td>
<td>20</td>
</tr>
<tr>
<td>02 Rhodophyta</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>03 Euglenophyta</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>04 Cryptophyta</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>05 Pyrrophyta</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>06 Xanthophyta</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>09,10 Bacillariophyta</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12 Conjugatophyta</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13,14,15,16 Chlorophyta</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>17 Charophyta</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>21 Lichens</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>22 Liverworts</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>23 Mosses</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>26 Dicotyledons</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>31 Colourless prokaryotes</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>32 Colourless eukaryotes</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

410
4.7 Total records for major taxa recorded for 521 $1\,\text{cm}^2$ samples (2.383).
<table>
<thead>
<tr>
<th></th>
<th>TERRESTRIAL</th>
<th></th>
<th>AQUATIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(92 samples)</td>
<td>(429 samples)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>lime-stone</td>
<td>lime-stone &amp; sand</td>
<td>live bark &amp; other plant sub-strata</td>
</tr>
</tbody>
</table>
| Number of samples | 53 9 20 6 4 | 164 37 71 22 68 | 22 45 01 Myxophyta 333 60 141 1102 246 448 176 282 205 328 02 Rhodophyta 1 03 Euglenophyta 04 Cryptophyta 1 05 Pyrrophyta 06 Xanthophyta 2 5 1 15 7 1 2 12 1 2 9 09,10, Bacillariophyta 5 1 10 8 47 8 25 19 13 12 Conjugatophyta 17 21 54 12 28 20 52 37 13,14,15,16, Chlorophyta 13 1 3 8 11 234 117 301 76 242 152 182 17 Charophyta 21 Lichens 2 1 3 22 Liverworts 23 Mosses 26 Dicotyledons 31 Colourless prokaryotes 3 3 2 1 2 22 16 92 8 31 22 15 32 Colourless eukaryotes 25 1 7 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>
<thead>
<tr>
<th></th>
<th>TERRESTRIAL</th>
<th>AQUATIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(92 samples)</td>
<td>(429 samples)</td>
</tr>
<tr>
<td></td>
<td>lime-stone</td>
<td>lime-stone &amp; humic soil</td>
</tr>
<tr>
<td></td>
<td>sand</td>
<td>live bark &amp; other plant sub-strata</td>
</tr>
<tr>
<td>Total samples</td>
<td>53</td>
<td>9</td>
</tr>
<tr>
<td>Total species</td>
<td>74</td>
<td>25</td>
</tr>
<tr>
<td>Total phototrophs</td>
<td>70</td>
<td>22</td>
</tr>
<tr>
<td>Total algae</td>
<td>69</td>
<td>21</td>
</tr>
<tr>
<td>Total eukaryotic algae</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Total blue-green algae</td>
<td>63</td>
<td>20</td>
</tr>
<tr>
<td>Total heterocystous blue-greens</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Total heterotrophs</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Lichens</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Liverworts (Riccia)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mosses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dicotyledons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Blue-greens of total species</td>
<td>85%</td>
<td>77%</td>
</tr>
<tr>
<td>% Blue-greens of total algae</td>
<td>91%</td>
<td>91%</td>
</tr>
<tr>
<td>% heterocystous blue-greens of total species</td>
<td>8%</td>
<td>15%</td>
</tr>
<tr>
<td>% heterocystous blue-greens of blue greens</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>% heterocystous blue-greens of total algae</td>
<td>9%</td>
<td>18%</td>
</tr>
<tr>
<td>% heterotrophs of total species</td>
<td>5%</td>
<td>12%</td>
</tr>
</tbody>
</table>
Table 4.9  Total records for major biological groups from 521 1 cm$^2$ samples (2.383).
Table 4.9

<table>
<thead>
<tr>
<th></th>
<th>TERRESTRIAL (92 samples)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>AQUATIC (429 samples)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>limestone</td>
<td>lime-</td>
<td>live</td>
<td>other</td>
<td>lime-</td>
<td>dead</td>
<td>humic</td>
<td>limestone</td>
</tr>
<tr>
<td></td>
<td>stone</td>
<td>stone &amp; humic soil</td>
<td>bark &amp; other</td>
<td>plant substrates</td>
<td>stone</td>
<td>plant</td>
<td>soil</td>
<td>stone</td>
</tr>
<tr>
<td>Total samples</td>
<td>53</td>
<td>9</td>
<td>20</td>
<td>6</td>
<td>4</td>
<td>164</td>
<td>37</td>
<td>71</td>
</tr>
<tr>
<td>Total records</td>
<td>377</td>
<td>67</td>
<td>158</td>
<td>57</td>
<td>44</td>
<td>1475</td>
<td>493</td>
<td>1119</td>
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<tr>
<td>Total phototrophs</td>
<td>349</td>
<td>63</td>
<td>150</td>
<td>51</td>
<td>38</td>
<td>1380</td>
<td>446</td>
<td>989</td>
</tr>
<tr>
<td>Total algae</td>
<td>347</td>
<td>61</td>
<td>149</td>
<td>50</td>
<td>37</td>
<td>1376</td>
<td>446</td>
<td>989</td>
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<td>Total blue-green algae records</td>
<td>333</td>
<td>60</td>
<td>141</td>
<td>42</td>
<td>25</td>
<td>1102</td>
<td>246</td>
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<tr>
<td>Total non-heterocystous blue-greens</td>
<td>269</td>
<td>47</td>
<td>124</td>
<td>34</td>
<td>22</td>
<td>966</td>
<td>216</td>
<td>413</td>
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<tr>
<td>Total heterocystous blue-greens</td>
<td>64</td>
<td>13</td>
<td>17</td>
<td>8</td>
<td>3</td>
<td>136</td>
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<td>35</td>
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<tr>
<td>Total eukaryotic algae</td>
<td>12</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>13</td>
<td>274</td>
<td>200</td>
<td>542</td>
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<tr>
<td>Total heterotrophs</td>
<td>28</td>
<td>4</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>95</td>
<td>47</td>
<td>129</td>
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<tr>
<td>Total lichens</td>
<td>2</td>
<td></td>
<td>1</td>
<td>3</td>
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<tr>
<td>Total liverworts (Riccia)</td>
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<tr>
<td>Total mosses</td>
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<td></td>
<td>1</td>
<td>1</td>
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</tr>
</tbody>
</table>

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 photoautrophs 95% 95% 94% 82% 68% 80% 55% 45% 62% 43% 45% 52%
% blue-greens of all algae 96% 98% 95% 84% 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 73% 64% 64% 11% 12% 65% 10% 12% 5% 9% 8% 6%
Table 4.10  Summary of data from Tables 4.6 - 4.9

<table>
<thead>
<tr>
<th></th>
<th>terrestrial</th>
<th></th>
<th>aquatic</th>
<th></th>
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<td></td>
<td>max</td>
<td>mean</td>
<td>min</td>
<td>max</td>
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<tr>
<td>number of algae recorded from any one habitat</td>
<td>69 (limestone)</td>
<td>38.2</td>
<td>21 (soil)</td>
<td>164 (limestone)</td>
</tr>
<tr>
<td>percentage of blue-green algae of total algae</td>
<td>92% (sand) (91% limestone and soil)</td>
<td>86.8% 75% (other)</td>
<td>71% (limestone)</td>
<td>60% 55% (dead plant, other plant, plankton)</td>
</tr>
<tr>
<td>algal records per sample</td>
<td>9.5 (other)</td>
<td>7.9</td>
<td>6.5 (limestone)</td>
<td>20.6 (Aufwuchs)</td>
</tr>
<tr>
<td>percentage records of blue-green algae of total algae</td>
<td>98% (soil)</td>
<td>88.2% 86% (other)</td>
<td>80% (limestone)</td>
<td>54.6% 43% (plankton)</td>
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</table>
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 byssoides*, 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 byssoida*: 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 C$_2$H$_4$ μg chl a$^{-1}$ min$^{-1}$ (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 C$_2$H$_4$ 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 byssoida (x = 0.00180 nM C$_2$H$_4$ 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
<table>
<thead>
<tr>
<th>Species</th>
<th>Morphology of colonies</th>
<th>Dark time (h)</th>
<th>Incubation period (h)</th>
<th>Environmental conditions</th>
<th>Mean temperature (°C)</th>
<th>µg chl a cm(^{-2}) m(^{-2})</th>
<th>nm (\text{C}_2\text{H}_4) min(^{-1})</th>
<th>nm (\text{C}_2\text{H}_4) µg chl a (^{-1}) min(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nostoc commune</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>12.12.72</td>
<td>1000</td>
<td>1</td>
<td>open platin: full light</td>
<td>A 28.0</td>
<td>0.3651</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>12.12.72</td>
<td>1000</td>
<td>1</td>
<td>coconut grove, ground</td>
<td>A 28.3</td>
<td>0.0567</td>
<td>0.067</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>28.3.73</td>
<td>0930</td>
<td>2</td>
<td>over Pimbrisistyla</td>
<td>A 33.8</td>
<td>0.0043</td>
<td>0.0092</td>
</tr>
<tr>
<td><strong>Nostoc commune var. flagelliforme</strong></td>
<td>A</td>
<td>14.12.72</td>
<td>1000</td>
<td>1</td>
<td>over Pimbrisistyla</td>
<td>A 33.8</td>
<td>0.0043</td>
<td>0.0092</td>
</tr>
<tr>
<td><strong>N. commune/Phormidium</strong></td>
<td>B</td>
<td>1.6.73</td>
<td>1020</td>
<td>2</td>
<td>over Pimbrisistyla</td>
<td>A 30.5 30.5 61.3 21.45 2.879 0.4900 0.0470 0.0115 0.0080 0.0023</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>N. sphaericum</strong></td>
<td>D</td>
<td>2.6.73</td>
<td>1100</td>
<td>2</td>
<td>open platin: full light</td>
<td>D 35.8 35.4 33.6 281 67.52 9.993 1.011 0.0356 0.0047 0.0036 0.0016</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tolyphothrix byssoidae</strong></td>
<td>F</td>
<td>29.4.73</td>
<td>1000</td>
<td>2</td>
<td>from pool, incubated by Aldabra lab.</td>
<td>W 29.6 30.0 30.0 50.4 6.38 1.638 0.0605 0.0325 0.0132 0.0012 0.0010</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tolyphothrix byssoidae</strong></td>
<td>A</td>
<td>28.3.73</td>
<td>1030</td>
<td>2</td>
<td>open platin: full light</td>
<td>A 34.8</td>
<td>0.00130 0.00160 0.00010 0.0000010</td>
<td>0.00010</td>
</tr>
<tr>
<td><strong>Tolyphothrix byssoidae</strong></td>
<td>B</td>
<td>1.6.73</td>
<td>1000</td>
<td>2</td>
<td>open platin: 100% cloud</td>
<td>A 36.0 36.0 36.0 383 55.13 1.409 0.9072 0.00368 0.00133 0.00237 0.00220</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tolyphothrix byssoidae</strong></td>
<td>C</td>
<td>1.6.73</td>
<td>1000</td>
<td>1</td>
<td>open platin: 100% cloud</td>
<td>A 77.4 29.2 0.0379 0.0185 0.00049 0.00049 0.00024 0.00012</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
commune (Fig. 5.1A) of 0.170 nM C$_2$H$_4$ μg chl a$^{-1}$ 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$_2$H$_4$ production during the second day of 2 - 3 day assays (Fig. 5.3). The behaviour with respect to C$_2$H$_4$ 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$_2$H$_4$ production was shorter for 'type' N. commune than for the other colonies. The rates during the linear phases of C$_2$H$_4$ 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 $32^\circ$, 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)

<table>
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<th>type</th>
<th>rate</th>
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<tr>
<td><em>Nostoc commune</em> (Aldabra)</td>
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<tr>
<td><em>Nostoc</em> - <em>Phormidium</em></td>
<td>0.0143</td>
</tr>
<tr>
<td><em>N. sphaericum</em></td>
<td>0.0744</td>
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</tbody>
</table>
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 5211 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.  

Taylor (1950) used the synonym for this species Hassallia byssoida.  

Computer numbers have not been included as the species were not recorded using the Durham recording system (2.383).
<table>
<thead>
<tr>
<th>Species</th>
<th>Bikini Atoll</th>
<th>Raroia Atoll</th>
<th>Heron Island</th>
<th>Aldabra Atoll</th>
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<td>Calothrix parietina</td>
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<td></td>
<td>(present survey)</td>
<td>+</td>
</tr>
<tr>
<td>Coccolithus aeruginosus</td>
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<td></td>
<td>(present survey)</td>
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</tr>
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<td>Gloeocapsa alpicola</td>
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<td></td>
<td>+</td>
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<tr>
<td>G. turgida</td>
<td>+</td>
<td></td>
<td></td>
<td>**</td>
</tr>
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<td>Entophysalis granulosa</td>
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<td>Fischeraella ambigua</td>
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<td>Gomphosphaeria sponina</td>
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<td>Hapalosiphon pumilus</td>
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<td>*</td>
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<td>Microcoleus acutissimus</td>
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<td>*</td>
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<td>M. chthonoplastes</td>
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<td>+</td>
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<tr>
<td>Nostoc commune</td>
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<td>Oscillatoria subuliformis</td>
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<td>Phormidium autumnale</td>
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<td>*</td>
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<td>P. retzii</td>
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<td>P. tenue</td>
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<td>P. papyraceum</td>
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<td>Porphyrasiphon fuscus</td>
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<td>S. lacustris</td>
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<td>S. ocellatum</td>
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<td>+</td>
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<td>Symploci klimeni</td>
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<td>S. muscorum</td>
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</tr>
<tr>
<td>Tolypothrix byssoidea</td>
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</tbody>
</table>
record of *Symploca* a genus so far not recorded for Aldabra. Preliminary studies of the terrestrial and freshwater 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 byssoides* 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

<table>
<thead>
<tr>
<th></th>
<th>Astove Is.</th>
<th>Danger Is.</th>
<th>Eagle Is.</th>
<th>Egmont</th>
<th>Farquhar</th>
<th>St Pierre</th>
<th>Aldabra</th>
</tr>
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<tr>
<td>010551 Aphanocapsa</td>
<td>&gt; 1 ≤ 2 µm</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>+</td>
</tr>
<tr>
<td>010552 A. montana</td>
<td>&gt; 2 ≤ 4 µm</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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</tr>
<tr>
<td>010553 A. grevillei</td>
<td>&gt; 4 ≤ 6 µm</td>
<td>+</td>
<td></td>
<td>+</td>
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</tr>
<tr>
<td>010602 Aphanotheca pallida</td>
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<td>010652 A. microspora</td>
<td>&gt; 2 ≤ 4 µm</td>
<td></td>
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<tr>
<td>010650 Aphanotheca sp.</td>
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<td>+</td>
<td></td>
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<td>+</td>
</tr>
<tr>
<td>010902 Calothrix braunii</td>
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<td></td>
<td>+</td>
<td>+</td>
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<td>+</td>
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<td>+</td>
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<td>010911 C. parietina</td>
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<td>+</td>
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<td>+</td>
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<td>+</td>
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<tr>
<td>011558 Chroococcus minutus</td>
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<td>+</td>
<td>+</td>
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<tr>
<td></td>
<td>non-lamellate sheath</td>
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</tr>
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<td>011554 C. turgidus</td>
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<tr>
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<td>lamellate sheath</td>
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</tr>
<tr>
<td>011560 C. turicensis</td>
<td>&gt; 8 ≤ 16 µm,</td>
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<tr>
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<td>non-lamellate sheath</td>
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<tr>
<td>011561 C. spelaeus</td>
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<td>+</td>
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<td>+</td>
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<td>+</td>
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<tr>
<td>ID</td>
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<td>Danger Is.</td>
<td>Eagle Is.</td>
<td>Egmont</td>
<td>Farquhar</td>
<td>St Pierre</td>
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<td>Gloeocapsa dermobroa $&gt; 2 \leq 4 \mu m$,</td>
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<tr>
<td></td>
<td>sheath yellow-brown</td>
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<td>G. kutzingiana $&gt; 4 \leq 6 \mu m$,</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>sheath orange/red/violet</td>
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<tr>
<td>012667</td>
<td>G. sanguinea $&gt; 6 \leq 8 \mu m$,</td>
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<tr>
<td></td>
<td>sheath orange/red/violet</td>
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<td>G. magma $&gt; 8 \mu m$, sheath orange/red/violet</td>
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<td>Danger Is.</td>
<td>Eagle Is.</td>
<td>Egmont</td>
<td>Farquhar</td>
<td>St Pierre</td>
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<td>015931</td>
<td><em>Pleurocapsa sp.  ( \leq 4 \mu m )</em></td>
<td>+</td>
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<td>+</td>
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<td>+</td>
</tr>
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<td><em>Schizothrix sp.  ( \leq 1 \mu m )</em></td>
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<tr>
<td>016650</td>
<td><em>Schizothrix sp. (c. 4.5 \mu m wide)</em></td>
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<td>016931</td>
<td><em>Spirulina subtilissima</em> ( \leq 1 \mu m )*</td>
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<tr>
<td>017203</td>
<td><em>Stigonema hormoides</em></td>
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<td><em>Synechococcus elongatus</em> ( \leq 2 \mu m )*</td>
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<td>017455</td>
<td><em>S. aeruginosus</em> ( 8 \leq 16 \mu m )*</td>
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<td></td>
<td>Astove Is.</td>
<td>Danger Is.</td>
<td>Eagle Is.</td>
<td>Egmont</td>
<td>Farquhar</td>
<td>St Pierre</td>
<td>Aldabra</td>
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<td>062050</td>
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<td>120250</td>
<td>Closterium sp.</td>
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<td>+</td>
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<td>122150</td>
<td>Spirogyra sp.</td>
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<td>+</td>
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<tr>
<td></td>
<td>palmelloid green alga</td>
<td>(c. 13 μm diameter)</td>
<td></td>
<td></td>
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<tr>
<td>160752</td>
<td>Oedogonium sp. &gt; 8 &lt; 12 μm</td>
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<tr>
<td>160801</td>
<td>Pithophora oedogonia</td>
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<td>101904</td>
<td>Nitschia palea</td>
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<tr>
<td>101950</td>
<td>Nitzschia sp.</td>
<td>+</td>
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</table>
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; Ström, 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.

<table>
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<th></th>
<th>terrestrial</th>
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<th>aquatic</th>
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<tbody>
<tr>
<td></td>
<td>max.</td>
<td>mean</td>
<td>min.</td>
</tr>
<tr>
<td>total species</td>
<td>69</td>
<td>38</td>
<td>21</td>
</tr>
<tr>
<td>percentage of blue-green algal species of total algal species</td>
<td>92%</td>
<td>86.8%</td>
<td>75%</td>
</tr>
<tr>
<td>mean number of algal records per sample</td>
<td>9.5</td>
<td>7.9</td>
<td>6.5</td>
</tr>
</tbody>
</table>
was only recorded from Île 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 Ström (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 CO₂, 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

<table>
<thead>
<tr>
<th>terrestrial</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>limestone</td>
<td>soil</td>
<td>sand</td>
<td>live bark</td>
<td>other</td>
<td>limestone</td>
<td>dead plant</td>
<td>humic</td>
<td>limestone</td>
<td>plankton</td>
<td>aufwuchs</td>
</tr>
<tr>
<td>% blue-green algae</td>
<td>91%</td>
<td>91%</td>
<td>92%</td>
<td>85%</td>
<td>75%</td>
<td>-71%</td>
<td>55%</td>
<td>56%</td>
<td>64%</td>
<td>55%</td>
</tr>
<tr>
<td>of total algae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| aquatic              |               |               |               |               |               |               |               |               |               |               |
| limestone            |               |               |               |               |               |               |               |               |               |               |
| dead plant           |               |               |               |               |               |               |               |               |               |               |
| humic                |               |               |               |               |               |               |               |               |               |               |
| limestone            |               |               |               |               |               |               |               |               |               |               |
| plankton             |               |               |               |               |               |               |               |               |               |               |
| aufwuchs             |               |               |               |               |               |               |               |               |               |               |
| other                |               |               |               |               |               |               |               |               |               |               |
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 (Golubic, 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 Île 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)

<table>
<thead>
<tr>
<th>Area recorded (island code, Fig. 2.2 in brackets)</th>
<th>number of species</th>
<th>percentage of total Aldabran species (Table 4.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Île Picard (W)</td>
<td>28</td>
<td>10%</td>
</tr>
<tr>
<td>Île Malabar (MW + ME)</td>
<td>2</td>
<td>0.7%</td>
</tr>
<tr>
<td>Anse Cèdres (AC)</td>
<td>6</td>
<td>2.0%</td>
</tr>
<tr>
<td>Cinq Cases (CC)</td>
<td>27</td>
<td>9.0%</td>
</tr>
<tr>
<td>Takamaka (T)</td>
<td>10</td>
<td>3.5%</td>
</tr>
<tr>
<td>Grande Terre, Central (SC)</td>
<td>2</td>
<td>0.7%</td>
</tr>
<tr>
<td>Grande Terre, Eastern (= Anse Cèdres, Cinq Cases, Takamaka)</td>
<td>53</td>
<td>18.0%</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>species</th>
<th>terrestrial</th>
<th>aquatic</th>
<th>terrestrial and aquatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>010215 <em>Anabaena variabilis</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>010269 <em>Anabaena</em> sp. (A.D.) *A</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>010301 <em>Anabaenopsis arnoldii</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>011811 <em>Cylindrospermum muscicola</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>012667 <em>Gloeocapsa sanguinea</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>012668 <em>G. magma</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>012802 <em>Gloeotrichia ghosei</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>014707 <em>Michrochaete tenera</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>015201 <em>Nostoc carneum</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>015213 <em>N. sphaericum</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>015218 <em>N. piscinale</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>017801 <em>Westiellopsis prolifica</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>030201 <em>Euglena acus</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>030202 <em>E. gracilis</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>030205 <em>E. spirogyra</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>030206 <em>E. minuta</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>030207 <em>E. oxyuris</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>030469 <em>Lepocinclis sphagnophila</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>030502 <em>Phacus orbicularis</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>030601 <em>Trachelomonos hispida</em> var. <em>coronata</em></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>030602 <em>T. volvocina</em></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>
Table 6.6 (contd)

<table>
<thead>
<tr>
<th>species</th>
<th>terrestrial</th>
<th>aquatic</th>
<th>terrestrial and aquatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>120369 Cosmarium subcostatum var. minor</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>152801 Gongrosira debaryana</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>154603 Trentepohlia iolithus</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160751 Oedogonium sp., ( \leq 8 , \mu m )</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160752 Oedogonium sp., ( &gt; 8 \leq 12 , \mu m )</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160753 Oedogonium sp., ( &gt; 12 \leq 16 , \mu m )</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160754 Oedogonium sp., ( &gt; 16 \leq 20 , \mu m )</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160755 Oedogonium sp., ( &gt; 20 \leq 24 , \mu m )</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160801 Pithophora oedogonia</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>170106 Chara zeylanica var. diaphana</td>
<td>+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 Île 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 byssoida formed 'abundant crusts' in depressions. On Aldabra these crusts when wet took the form of 'felts' forming in depressions. When T. byssoida 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 Île 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. Chroothecia 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 nM C₂H₄ μg 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

<table>
<thead>
<tr>
<th>Additive</th>
<th>$\bar{x}$</th>
<th>S.D.</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>No additive</td>
<td>0.0325</td>
<td>0.0114</td>
<td>4</td>
</tr>
<tr>
<td>+0.5 mg l$^{-1}$ 'Radiant'</td>
<td>0.0408</td>
<td>0.0201</td>
<td>4</td>
</tr>
<tr>
<td>+0.5 mg l$^{-1}$ 'Teepol'</td>
<td>0.0463</td>
<td>0.0066</td>
<td>4</td>
</tr>
<tr>
<td>+0.5 mg l$^{-1}$ toilet soap</td>
<td>0.0805</td>
<td>0.0070</td>
<td>4</td>
</tr>
</tbody>
</table>
1977) and McKenzie (1971) suggested that the area near freshwater 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 byssoida,
<table>
<thead>
<tr>
<th>algae</th>
<th>reference</th>
<th>location</th>
<th>experiment</th>
<th>quoted rate</th>
<th>rate, converted to standard format</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Nostoc commune</em></td>
<td>this paper</td>
<td>Aldabra</td>
<td>terrestrial: afternoon peak</td>
<td>0.171 nM C$_2$H$_4$ µg chl a$^{-1}$ min$^{-1}$</td>
<td>0.016</td>
</tr>
<tr>
<td><em>Nostoc</em> (various)</td>
<td>=</td>
<td>=</td>
<td>terrestrial: morning assays (mean)</td>
<td>0.0388</td>
<td>0.0036</td>
</tr>
<tr>
<td><em>Nostoc</em></td>
<td>Mague &amp; Holm-Hansen, Eniwetok 1975</td>
<td>10°N 162°E</td>
<td>marine: range</td>
<td>2.83-5.00 nM C$_2$H$_4$ mg N$^{-1}$ min$^{-1}$</td>
<td>0.0016 - 0.0028</td>
</tr>
<tr>
<td><em>Nostoc</em></td>
<td>Bunt et al., 1970</td>
<td>off Florida c.26°N 80°W</td>
<td>laboratory culture assayed in sea</td>
<td>11.5 nM C$_2$H$_4$ mg protein$^{-1}$ h$^{-1}$</td>
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<td><em>Nostoc</em></td>
<td>Horne, 1975</td>
<td>California</td>
<td>39°N 123°W stream (site 3), clear-day: mid morning</td>
<td>≈ 1.6 nM C$_2$H$_4$ mg d.wt.$^{-1}$ h$^{-1}$</td>
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<td><em>N. commune</em></td>
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<td>Signy Is.</td>
<td>60°S 45°W phytoplankton</td>
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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 Komárek (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.
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 byssoida, 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 NH$_4^-$ - N are the result of animal activity around pools.

The nitrogen fixing potential of *Tolypothrix byssoides* 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 byssoides*, the most widespread and abundant species, is low compared to those of the *Nostoc* spp.
APPENDIX

AI Meteorological

Data obtained from the Royal Society Synoptic observation station on Ile 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

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### Table A1.2: Highest maximum temperatures in each month at Adabra

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*1. 4 days record only*
Table A1.3  Mean maximum monthly temperatures at Aldabra

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\(^1\) 4 days of record only: disregarded in mean
Table A1.4  Mean minimum monthly temperatures at Aldabra

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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 Aldabra

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**Table A1.6 Aldebra: Monthly rainfall (mm)**

- **Jan**: January
- **Feb**: February
- **Mar**: March
- **Apr**: April
- **May**: May
- **Jun**: June
- **Jul**: July
- **Aug**: August
- **Sep**: September
- **Oct**: October
- **Nov**: November
- **Dec**: December
- **Yr**: Year

- **n**: Number of observations
- **mean**: Mean rainfall
Table A2.1 Additional environmental data on pools.

<table>
<thead>
<tr>
<th>No.</th>
<th>bottom of pool</th>
<th>approx. max. surface (m²)</th>
<th>max. depth of water recorded (m)</th>
<th>degree of permanence 72/73 wet season</th>
<th>animal activity in relation to size of pool</th>
<th>no. of times water sampled</th>
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<td>crab</td>
<td>tortoise</td>
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<td>W1</td>
<td>detrital mud</td>
<td>3.5 x 1.5</td>
<td>0.72</td>
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<td>++</td>
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<td>W2</td>
<td>detrital mud</td>
<td>2.0 x 0.5</td>
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<td>permanent</td>
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<td>2.0 x 2.0</td>
<td>0.075</td>
<td>very transient</td>
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<td>calcareous mud</td>
<td>2.9 x 1.2</td>
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<td>+++</td>
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<td>W5</td>
<td>Casuarina needles</td>
<td>2.4 x 1.3</td>
<td>0.91</td>
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<td>+</td>
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<td>Casuarina needles</td>
<td>1.5 x 1.0</td>
<td>0.19</td>
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<td>+</td>
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<td>Casuarina needles</td>
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<td>20 x 15</td>
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<td>+++</td>
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<td>+</td>
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<td>+</td>
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