1989

doesn't include Atlases (there map 100 (of 632) Brit species.) see Norton, T.A. (1985) Provisional Atlas of the Marine Algae of Britain & Ireland.

KEYS AND FLORAS FOR IDENTIFICATION OF ESTUARINE BENTHIC ALGAE

There is no specific key to estuarine algae. Most species can be identified with works for marine algae, although there are some works, in German, on the Baltic Sea which are particularly useful.

1. Seaweeds

The only complete standard work on British seaweeds is:

Newton, L., 1931. A Handbook of the British Seaweeds. London, British Museum (Natural History).

The nomenclature is out of date, the keys to genera are difficult to use, the illustrations are not always helpful and the notes may be misleading.

The nomenclatural problem can be overcome, at least partly, by correcting identifications in accordance with the most recent check-list:

South, G.R. and I.Tittley. 1986. A checklist and distributional index of the benthic marine algae of the North Atlantic Ocean. Huntsman Marine Laboratory and British Museum (Natural History), St Andrews, New Brunswick and London.

This checklist lacks the footnotes given in previous British checklists which enable one to follow the history of taxonomic changes for each entity since the time of Newton. The most recent British checklist, superseded by South and Tittley, which contains theses notes is:

Parke, M. and Dixon, P.S. 1976. Check-list of British marine algae - third revision. J. mar. biol. Ass. U.K., 56, 527-594.

For scientific acceptability all seaweed names should be cited in accordance with South and Tittley wherever possible.

The other objections to Newton can be overcome by the use of additional works. The Seaweeds of the British Isles is a series of very detailed identification works being published by the British Museum (Natural History) and the British Phycological Society to replace Newton. The parts so far published are:

Dixon, P.S. and Irvine, L.M. 1978. Seaweeds of the British Isles. vol.1 Rhodophyta. part 1. Introduction, Nemaliales, Gigartinales

Irvine, L.M. 1983. Seaweeds of the British Isles. vol 1. Rhodophyta. part 2a Cryptonemiales (sensu stricto), Palmariales, Rhodymeniales.

Fletcher, R.L. 1987. Seaweeds of the British Isles. vol 3. Fucophyceae (Phaeophyceae). part 1.

Christensen, T. 1987. Seaweeds of the British Isles. vol 4. Tribophyceae (Xanthophyceae). one genus only - Vaucheria

Further parts are in preparation to cover the remaining red and brown algae and the green algae.

Seaweeds can be identified to genus level using the following key:

Jones, W.E. 1962. A key to the genera of the British seaweeds. Field Studies, 1(4), 1-32.

Easier to use than the genus key in Newton but still requires Newton or other works to confirm identifications or to take them to species level.

Two other keys useful keys are:

Hiscock, S. 1979. A field key to the British brown seaweeds (Phaeophyta). Field Studies, 5, 1-44.

Hiscock, S. 1986. A field key to the British red seaweeds (Rhodophyta). Field Studies Council Occasional Publication no 13.

These are easier to use than Jones or Newton. Beware that the brown one really is a field key and does not contain many smaller species. The red one is more comprehensive and has excellent drawings.

There is no general field key to the green seaweeds of Britain as a whole, comparable with those of Hiscock. There is however a regional key which can be used reasonably well throughout Britain:

Clokie, J.P. and A.D. Boney. 1980. Key to green algae of the Firth of Clyde. Scottish Field Studies 1980.

Other useful works include the following:

Pankow, H. 1971. Algenflora der Ostsee. I. Benthos. (Blau-, Grün-, Braun-, und Rotalgen). Stuttgart, Gustav Fischer Verlag.

[A pity this book is in German! I have really found it to be one of the most useful works for brackish-water algae; partly because it is written specifically for a brackish sea (The Baltic) and partly because Pankow seems to have a knack of simplifying the taxonomically-difficult microscopic species without losing scientific validity].

Gams, H. 1974. Keine Kryptogamenflora Band Ib. Makroskopische Meeresalgen. Stuttgart, Gustav Fischer Verlag.

[Another German language work. This is occasionally very useful as it is very simple and specifically includes the Baltic brackish flora but beware on three counts: It also includes other European locations with subtropical species e.g. the Meditterannean, it excludes microscopic species, it is only a key - not a complete flora so results must be checked elsewhere. On the whole it is occasionally useful for a non-specialist but not recommended as a main source key].

Kornmann, P. & Sahling, P-H. 1977. Meeresalgen von Helgoland. Benthische Grün-, Braun- und Rotalgen. Hamburg, Biologische Anstalt Helgoland. Originally published as a lengthy paper in Helgolander Wissenschaftliche Meeresuntersuchungen (29, 1-289, 1977). this was reissued as a separate book and sold by the BAH at the giveaway price of only DM 10.00.

still available only about £3.00

[This does not contain keys, nor does it contain every species. Its great value is that all species named are represented by high quality photographs and/or photomicrographs rather than line drawings, so it's good for checking you've got something right when Newton's or Pankow's drawings are inadequate. Beware that Kornmann has a nasty habit of using a different set of names for species than most other European phycologists so cross-refer to Dixon & Parke's check-list

Since publication there has been production of a supplement:

Kornmann, P. and P-H. Sahling. 1983. Meeresalgen von Helgoland : Erganzung. Helgolander Wiss. Meeresunters., 36, 1-65.

Taylor, W.R. 1957. Marine Algae of the North-Eastern Coast of North America. Ann Arbor, The University of Michigan Press. 2nd edition.

[This is the definitive work for its area - their equivalent of Newton. Since our flora is similar to that of N.E. America it can be used for its illustrations, keys and descriptions many of which are superior to those of Newton. Again you must beware that it doesn't have all our species and it has some which are not present here - so cross-refer to Parke & Dixon's check-list].

South, G.R. and Cardinal, A. 1975. Contributions to the flora of marine algae of Eastern Canada. 1. Introduction, historical review and key to the genera. Naturaliste, can., 100, 605-630.

[As for Taylor, above, this key to genera covers some but not all of our species and contains some extra ones. It should only normally be used as a last resort when west European keys fail, and you must corss-refer to the check-list].

Normally you should avoid laymen's guides such as Collins Pocket Guide or the Hamlyn Guide to the Seashore. They are very misleading and incomplete. However one layman's book is very good:

Dickenson, C.I. 1963. British Seaweeds. Kew Series, London, Eyre & Spottiswoode.

It doesn't have all the microscopic species but for the macroscopic ones it is surprisingly good. Unfortunately it is now out of print but it is in many local libraries.

Normally Newton, Jones, Pankow and the check-list should be enough for your needs. If you are doing algal work seriously the following specialist works on selected groups which include species found in brackish waters may be particularly valuable.

Bliding, C. 1963. A critical survey of European taxa in Ulvales. Part I. Capsosiphon, Percursaria, Blindingia, Enteromorpha. Opera Botanica, 8(3), 1-160.

Bliding, C. 1968. A critical survey of European taxa in Ulvales. Part II. Ulva, Ulvaria, Kornmannia, Monostroma. Botaniska Notiser, 121, 535-629.

[The two Bliding papers do not contains keys but are lavishly illustrated].

Koeman, R.P.T. and C. van den Hoek 1980. The taxonomy of Ulva (Chlorophyceae) in the Netherlands. Br. phycol. J., 16, 9-53.

Koeman, R.P.T. and C. van den Hoek. The taxonomy of Enteromorpha Link, 1920, (Chlorophyceae) in the Netherlands.
I Arch. Hydrobiol. Suppl. 63, 279-330 (1982)
II Cryptogamie Algol. 3, 37-70 (1982)
III Cryptogamie Algol. 5, 21-61 (1984)

Lokhorst, G.M. and B.J. Trask. 1981. Taxonomic studies on Urospora (Acrosiphoniales, Chlorophyceae) in western Europe. Acta Bot. Neerl., 30, 353-431.

Kornmann, P. and P-H Sahling. 1974. Prasiolales (Chlorophyta) von Helgoland. Helgolander Wiss. Meeresunters., 26, 99-133.

Ramanathan, R. 1964. Ulotrichales. New Delhi, Indian Council of Agricultural Research.

[Altough primarily Indian it includes species from all over the world. This book is particularly important since we have found many apparently fresh-water Ulotrichales, not included in the marine works, living in estuaries].

Van den Hoek, C. 1963. Revision of the European Species of Cladophora. Leiden. (Reprinted 1976 by Otto Koeltz Science Publishers, Koenigstein, FRG.).

Soderstrom, J. 1963. Studies in Cladophora. Botanica gothoburgensia, 1, 1-147.
* see additional reference below.

Excellent illustrations, but not keys, of some only of the species particularly important in estuaries are to be found in:

Carter, N. 1933. A comparative study of the algal flora of two salt-marshes II. J. Ecol., 21, 128-208.

An annotated check-list of marine and estuaries algae of the Clyde, while apparently of local interest, contains a tremendous amount of algal natural-history information of the behaviour and distribution of many species. It is possible that such a list could be very useful to the partly-trained worker in assessing whether or not a problematical identification is likely to be correct. One must however be careful as behaviour of the plants may be different a long way from the Clyde e.g. the South coast. The reference is:

Clokie, J.J.P. & Boney, A.D. 1979. Check-list of marine algae of the Firth of of Clyde. Scottish Field Studies, 1979, 3-13.

2. Chrysophyta

The principal chrysophytes to be found in estuaries are

(a) mats of Vaucheria spp. (Xanthophyceae)
(b) epilithic scums and benthic sediment-dwelling diatoms (Bacillariophyceae)
(c) benthic filamentous phases in the life-histories of otherwise planktonic forms in the Haptophyceae and Chrysophyceae, found in salt-marshes or on mud.

(a) Vaucheria spp. This coenocytic filamentous plant forms distinct ruffled or velvety cushions in a wide range of habitats and can often be identified to genus level with the naked eye in the field. Species identification is very difficult. It is based on the structure and position of sexual organs and consequently cannot be done on non-reproductive specimens. The normal practice is to excise a small area, say 1 or 2 sq cm, of algal mat and to maintain it in the laboratory at about 15°C and a long day-length in a closed petri-dish without added culture medium. This appears to induce formation of sex organs. Specimens collected in the Summer are quite likely to be reproductive at the time of collection.

* Lokhorst, G.M. 1978 Taxonomic studies on the marine and brackish-water species of Ulothrix (Ulotricales, Chlorophyceae) in Western Europe. Blumea, 24, 191-299

In addition to Christensen's Tribophyceae volume in the "Seaweeds of the British Isles" other identification works are:

Kmntzen, J. 1973. Marine species of Vaucheria (Xanthophyceae) in South Norway. Norv. J. Bot., 20, 163-181.

This key is specifically on North-West European material and includes useful habitat notes. Two more general works which include species from elsewhere (hence reference to [illegible] needed to check likely identifications) are:

Blum, J.L. 1972. Vaucheriaceae. North American Flora Series II, Part 8. New York Botanical Garden.

Venkataraman, G.S. 1961. Vaucheriaceae. New Delhi, Indian Council of Agricultural Research.

A good key (but not very good illustrations) to West European species is included in Pankow (loc. cit.).

(b) Diatoms. Detailed identification of the massive range of diatoms found in benthic samples is probably beyond the capabilities of most workers - even macrophycologists! It requires detailed microscopic examination of the structure of the siliceous frustule after protoplasm has been cleared away by vigorous treatment with acids and oxidising agents. It is however possible to identify some of the commonest estuarine diatoms without clearing.

For all diatoms three works are particularly useful:

Hendey, N.I. 1964. An introductory account of smaller algae of British coastal waters. Part V. Bacillariophyceae (Diatoms). (Fishery Investigations Series IV). London, H.M.S.O.

Van Heurck, H. 1896. A treatise on the Diatomaceae. London, Wesley. Reprint, 1962 by Wheldon & Wesley and J. Cramer.

Hustedt, F. 1930. Bacillariophyta. In Die Susswasser-flora Mitteleuropas. Vol. 10. Ed. A. Pascher. Publ. Fisher Verlag, Jena. Since issued as a reprint. [a freshwater work but still useful]

In addition there is a very useful key to the diatoms commonly grouped under the name "Schizonema". These diatoms are naviculoid forms which live in colonies in mucilaginous tubes and resemble filamentous brown algae to the naked eye. The key is:

Cox, E.J. 1977. The distribution of tube-dwelling diatom species in the Severn estuary. J. mar. biol. Ass. U.K., 57, 19-27.

Diatoms are not included in Parke and Dixon's check-list and nomenclature should be revised in accordance with their own check-list:

Hendey, N.I. 1974. A revised check-list of British marine diatoms. J. mar. biol. Ass. U.K., 54, 277-300.

(c) Benthic forms of planktonic chrysophytes.
The most likely ones to be found include members of the genera Apistonema, Chrysomeris and Ruttnera.

Descriptions are to be found in Pankow (loc. cit.), Carter (loc. cit.) and a further reference to Carter:

Carter, N. 1937. New or interesting algae from brackish-water. Arch. Protistenk., 90, 1-68 & Taf. 1-8.

3. Blue-green algae

These are a major component of the epilithic and epibenthic flora of the upper reaches of estuaries. Identification is difficult because of their incredible morphological plasticity and the high level of disagreement between authors. My personal preference is not to accept the over-simplifications proposed by the application of traditional taxonomic principles by Drouet & Daily. Even if the originally recognized taxa have often been shown not to be genuine species in the "higher-plant" sense, it seems preferable to continue to use them for the time-being for two reasons; a particular morpholigical form or ecophene may indicate a particular set of environment conditions; the high level of disagreement among physologists about Drouet & Dailys' ideas makes it desirable to record data in the more complete older format.

A good key to brackish blue-greens is found in Pankow (loc. cit.).

Keys to genera of blue-greens together with keys to species within genera and, very usefully, tables showing equivalent names between Drouet & Daily's taxonomy and the traditional taxonomy are given in:

Humm, H.J. and S.R.Wicks 1980. Introduction and guide to the marine blue-green algae. Wiley.

This is probably all that is needed. It is arguable whether or not more detailed treatment is desirable from non-expert phycologists. If more detailed works are needed the following are particularly recommended:

Desikachary, T.V. 1959. Cyanophyta. New Delhi, Indian Council of Agricultural Research.

Frémy, P. 1972. Cyanophycées des Cotes d'Europe. Asher and Co. BV., Amsterdam. Reprint of original series of articles published 1929-33 in Mem. Soc. Nat. Math. Cherbourg.

Geitler, L. 1932. Cyanophyceae in Rabenhorst's Kryptogamen-Flora. Leipzig. Akademische Verlagsgesell-schafft m.b.H. Reprinted 1971, Johnson Reprint Corporation. New York and London.

You should note that Parke and Dixon's check-list is of limited value for blue-greens because it is based on Drouet & Daily's revised taxonomy.

4. Euglenophyceae

Green patches of benthic euglenoids are common on intertidal muds of some estuaries, particularly in Summer, interspersed with diatoms. The commonest ones appear to be Euglena obtusa and E. vermiformis.
A good key is:

Butcher, R.W. 1961. An introductory account of the smaller algae of British coastal waters. Part VIII Euglenophyceae. (Fishery Investigations Series IV) London, H.M.S.O.

Many of these references are out of print but second-hand or reprint copies can usually be obtained from: Koeltz Scientific Books, P.O. Box 1360, D-6240 Koenigstein, West Germany. Ask for their catalogue on Algae & Phytoplankton, issued every year or two, which contains many hundreds of algal books. They are expensive. A cheaper, though much less comprehensive British supplier is Wheldon & Wesley, Lytton Lodge, Codicote, Hitchin, SG4 8TE

MARTIN WILKINSON
6 APRIL 1989