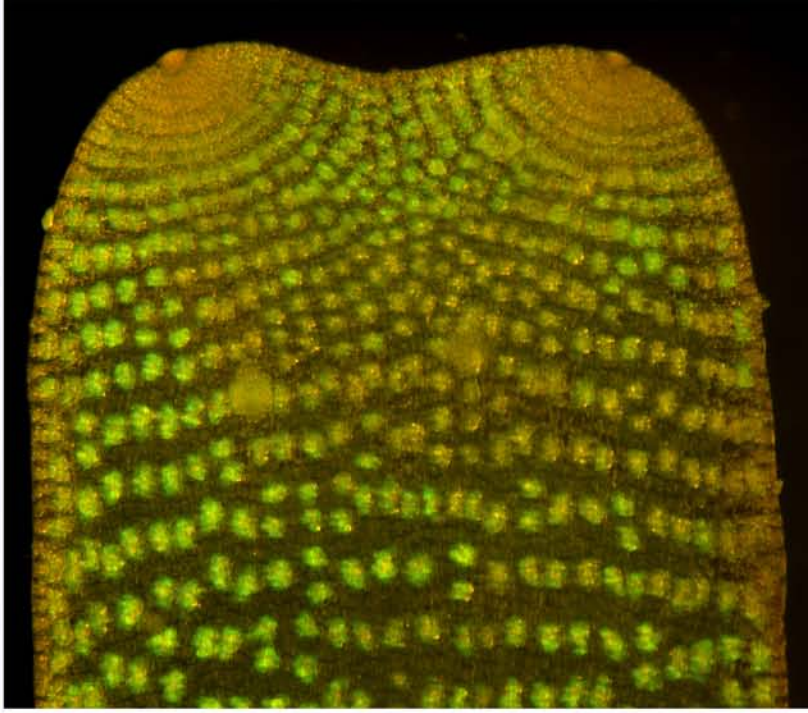
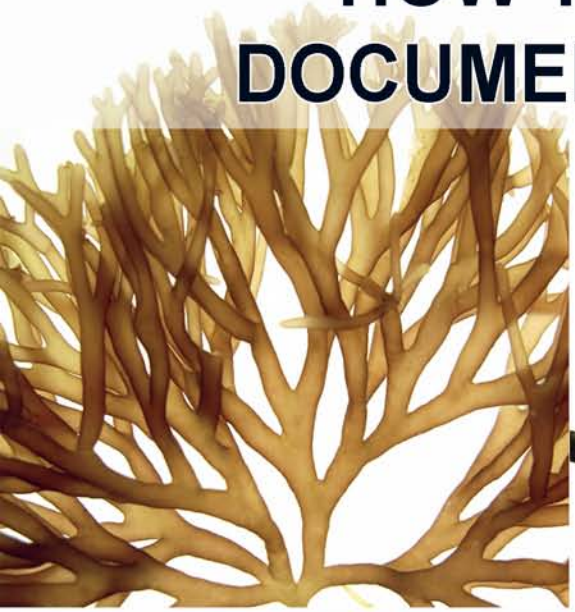
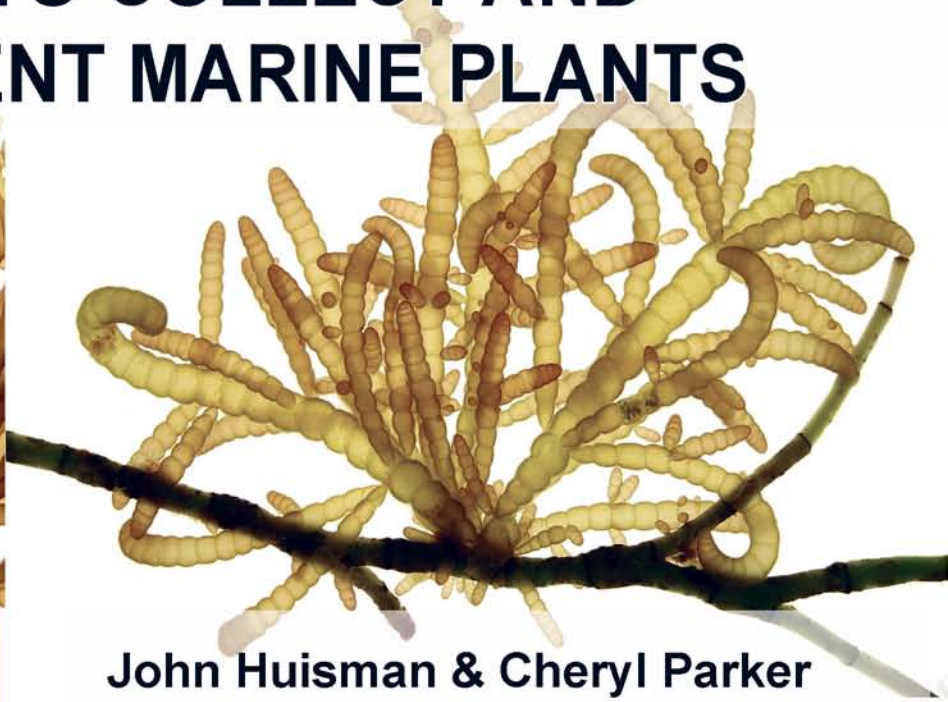


HOW TO COLLECT AND DOCUMENT MARINE PLANTS





John Huisman & Cheryl Parker

HOW TO COLLECT AND DOCUMENT MARINE PLANTS

John Huisman
Cheryl Parker

2005

Western Australian Herbarium

Natural Heritage Trust
Helping Communities Helping Australia
An Australian Government Initiative

Western Australian Herbarium
Government of Western Australia
Department of Conservation and Land Management
Conserving the nature of WA

Cover Photos: Clockwise from top left: *Chaetomorpha antennina*, *Dictyota* sp.,*Champia zostericola*, *Champia stipitata*, *Myriodesma quercifolium*, *Kraftia dichotoma*.
This Page: Diver collecting marine plants at the Houtman Abrolhos. All photos J. Huisman.

Published Thursday 15th December 2005

Department of Conservation and Land Management
Locked Bag 104 Bentley Delivery Centre Western Australia 6983

INTRODUCTION

Underpinning all biodiversity conservation, bioprospecting, environmental assessment, management strategies, etc. is the need for a sound taxonomic basis. In all cases derived scientific results are rendered meaningless unless based on accurate taxonomic information, whether it is simply expert identifications of specimens, or assessment of regional biodiversity.

The Herbarium seeks to provide a taxonomically sound framework of names for WA's flora and fungi. The capacity to reliably identify and authoritatively name species enables researchers to gather and systematize biological information about biological processes, habitats and species.

To attain a high level of support for conservation we need to increase the number of herbarium specimens that represent WA terrestrial and marine species so that we can capture and deliver details of their geographic occurrence, habitat preferences and morphological and phenological variation.

The selection, documentation and preparation of useful herbarium specimens of marine and estuarine seagrasses and macroalgae demands patience and skill. Sound field collecting methods accompanied by correct drying and labeling techniques will produce well preserved useful herbarium specimens that will add to available knowledge and can be studied by conservation scientists well into the future.

These guidelines for the special requirements for collecting and documenting macro algae and seagrasses will ensure a standardized approach to the future collection and archival of marine plant specimens as verifiable, permanent records of marine studies.

Neville Marchant
Director
Western Australian Herbarium

HOW TO COLLECT MARINE PLANTS

BEFORE YOU BEGIN

A licence is required to collect marine plants in Western Australia. Contact your local CALM office for an application form. It may also be necessary to advise the relevant authority in your collecting area of your intentions. One of the conditions of the licence is to lodge vouchers with the Western Australian Herbarium (PERTH).

SELECTING MATERIAL FOR COLLECTION

Specimens can be collected from drift, the intertidal zone or subtidally. A whole plant, or, if they are small, a number of plants can be collected. If the plant is large, collect a part of the plant that is representative of the species in that locality. If the specimen is in some way different, for example colour or height variation or different reproductive stage, this should be noted.

If collecting for a herbarium specimen, it should be a sample that represents an entire population. Specimens should be complete and fertile where possible. Specimens can to be up to 30 cm long if using a full-size mounting sheet, which measures 42 x 26 cm. A number of small plants can be collected to make a single herbarium specimen.

COLLECTING TECHNIQUES

Marine plant specimens can be collected in a variety of ways. These days, most sampling is done using SCUBA diving or snorkelling, but many excellent specimens can be collected from the intertidal zone at low tide, or in the drift (i.e., materials washed up on the beach). From a taxonomic viewpoint, drift specimens can be valuable (to this day some species are known only from examples collected from beach drift), but there are some obvious deficiencies for ecological or distributional studies. Drift specimens give you absolutely no information regarding the habitat in which the plant was living, and questionable information regarding the distribution of the species, as you have no idea where the specimen may have originated. Thus it is preferable that attached plants are collected.

When collecting, look around and note the habitat that the specimen is living in. This may not be of utmost importance when identifying, but it will certainly make your specimen more valuable to science. Whenever possible, specimens should be collected with their holdfast intact; occasionally this may be difficult and, sometimes, diligent scraping with a knife or scraper is required. In the case of crustose species, breaking off a piece of the underlying substratum is often necessary. If specimens are epiphytic (growing on other plants), collect a portion of the host plant as well, as this will provide important habitat information. Plants should be placed in plastic bags with

sufficient seawater to stop them drying out, or in calico bags and kept moist. It is generally impractical to have individual bags for each specimen, so the usual method is to include in each bag a mixed collection from one location. Never mix collections from different locations in a single bag. Also place in the bag a waterproof label with enough information to enable you to recognize the source of the collection. This can be a unique code or simply the location and date.

If you are able to, your collections should be transported to the laboratory as soon as possible for examination and curation. Most marine plants will deteriorate rapidly and if curation is not feasible within a day (or two at the most), the specimens should be preserved in a solution of 5% formalin/seawater. Be aware that formalin is regarded as carcinogenic in certain circumstances and should be handled with extreme care. Always use it where the danger of inhaling the fumes is minimal, and in the laboratory use a fume hood when dealing with specimens preserved in formalin. Wear gloves at all times. If you are some distance from home, be aware that most airlines will not allow formalin to be transported unless some extreme packaging is involved (i.e., read never!). In these situations you can freeze the specimens, but they tend to disintegrate more easily when thawed and so freezing can pose problems with delicate specimens. If preserved specimens are to be kept for some time before examination, they should be stored in dark containers to prevent loss of colour. Any light rapidly fades wet-preserved specimens.

If specimens are collected for DNA analysis, small portions of plants (approximately 2 cm long) should be dried in silica gel or preserved in ethanol (alcohol) at the highest concentration available, preferably over 90%. Freezing is also suitable, but formalin should never be used.

Special Cases

When collecting seagrasses:
Generally, identification of seagrasses can be achieved based on vegetative features, not the inconspicuous flowers. This is fortunate, as seagrasses are rarely collected in fertile condition, which occurs only at specific times of the year. Fertile specimens are generally found during the spring-summer months. Obviously, flowering plants make the better specimens, but you should not be reticent about collecting sterile plants. Do remember to collect portions of the rhizome with attached roots and leaves, which might require some digging to unearth. Also, try to collect specimens that have not been grazed.

When collecting macroalgae:
Many macroalgae undergo complex life histories that can involve three separate plants (the male gametophyte, the female gametophyte, and the sporophyte), and it is often features of the reproductive structures that are used for identification. Thus you should attempt to collect several representatives of the same species, in the hope of finding the different life-history phases. This is particularly important if you are not familiar with the

species. Reproductive specimens can often be recognized by the presence of small dots or bumps, but in many cases these are not visible in the field and will only be seen under magnification back at the laboratory.

The requirement for reproductive specimens can vary, depending on the group. Green algae are rarely collected in a fertile state and most can be identified by vegetative features, so the requirement for several specimens is not as important. Brown and red algae, however, (with some exceptions in both groups) can often only be identified with reproductive specimens. Thus collections of unfamiliar species in these groups should always include several specimens. As with seagrasses, it is important to collect the holdfast, which can be important in identification.

The Marine Environment

The marine environment can present particular problems to the collector. Harsh weather conditions and large sea swells can make collecting at best difficult, at worst life threatening. Even in ideal conditions the marine plant collector has, at most, only a few hours per day to gather specimens; subtidal collections are restricted by limited dive times, and intertidal collections by the short period when the intertidal region is exposed. Maximizing the efficiency of collection is therefore imperative. For intertidal collecting, spring tides are preferred as they give the longest and greatest exposure of the intertidal region. For subtidal collecting, efficient dive planning is important, to allow the maximum bottom time.

Whatever the case, these restrictions on collecting often make it difficult to spend time making a detailed assessment of the habitat, as the limited time is often best spent collecting additional specimens. It is therefore important that field notes are written as soon as possible following the dive, when details of the habitat are fresh in the memory. If the specimens are to be of any value as taxonomic or voucher specimens (i.e. collected as part of broader projects, for example ecological studies), several aspects should be recorded. At the very least, the location (supported by GPS co-ordinates), collector and date of collection should be noted; other desirable information includes the habitat, depth, and associated community.

LABELLING

Ideally, every collected specimen should have a tag attached with the collector's initials and a collecting number written in pencil, for example 'XYZ123', where XYZ are the collector's initials. This will enable the collector to locate the collection in their notes and link it to a collection subset such as a photograph or DNA sample. In practise, however, the marine environment mostly does not allow such a luxury and collection numbers are often not allocated until after the collections are made, usually during curation.

The following guidelines should be considered when allocating a collecting number: -

- The number should preferably be sequential and unique to each collection. The number can be part of a single series numbering system that continues year after year, or numbering can start each year, in which case the year should be included, e.g. XYZ123/05.
- To avoid confusion, use only Arabic numerals.
- Collections of very small plants of the same species, collected from the same locality at the same time, can be regarded as one collection and so can be given the same number.
- A specimen recollected from the same plant at a different time should be given a new number.
- Specimens of the same species collected at different localities should be given different numbers.

RECORDING DATA

A specimen has little scientific value unless detailed notes are recorded at the time of collection. The notes should include the collector's name, date and locality together with any information about the specimen that would not be evident from the pressed specimen. Living plants can often be a different colour (or even iridescent) compared to those that have been dried, so it is important to note these details. These notes can be recorded in the Field Data Sheet of a collecting book. Alternatively, the WA Herbarium has developed a software program to capture field data, namely *Max*.

Electronic Capture of Data

Max - A Species Database Helper for Windows 95/98/2000/XP

Max is a species-editing program for windows. It enables the collector to enter specimen data directly into the computer, to create their own database or print labels. Collecting information entered into the *Max* program can be downloaded into the WA Herbarium's specimen database, WAHerb and CALM's information delivery system *FloraBase*. *Max* also incorporates a census of WA marine plant names that is updated regularly.

Find out more about *Max* at http://science.calm.wa.gov.au/max/

WHY USE A FIELD DATA SHEET?

Using the field data sheet either in a collecting book or *Max*:

- Avoids confusion, at a later date, between specimens and corresponding field information by assigning a unique collecting number.
- Provides a logical series of prompts so important field notes can be recorded at the time of collection.
- Captures valuable biological information for inclusion in a database.
- Ensures greater consistency of recorded information by different collectors.

An example of a field data sheet is shown below.

The completion of as much as possible of a field data sheet for each collection is most important. A specimen is still useful even if we only have a precise locality, but is infinitely more useful if we know more about the habitat and the way it grows. When this label information is stored in the WA Herbarium's specimen database (WAHerb) it is linked to the names database (the Census of WA Marine Plants), a species description database and an image database. These will assist with identification and biological information. Information from all of these databases are accessed through *FloraBase*.

Above: *Stypopodium flabelliforme*, a brown alga, Busselton Jetty

CALM's information system *FloraBase* is a statewide electronic flora. *FloraBase* integrates information from a number of datasets into a single easy-to-use website. The underlying datasets relate to all known WA vascular and marine plants and includes:

- A complete and up-to-date **Census of WA Flora** with relevant literature citations.
- The **specimen database** with label details of vouchered herbarium specimens.
- A **plant description database** where every known species in WA will eventually have a description.
- Titles of **books and published papers database** on WA flora can be accessed through the botanical library database.
- **Spatial data** where collecting locations of species, derived from collecting labels, gives a map of the distribution of all known WA species.
- **Plant images** where available.

FloraBase allows researchers to communicate the results of their science to a wide range of users involved in conservation – ecologists, educators, decision makers and members of the community.

***FloraBase* is available on CALM's website: http://florabase.calm.wa.gov.au/**

Right: *Thalassodendron ciliatum*, a sea grass, Barrow Island

FloraBase: Authoritative species listings and information pages on nearly every plant taxon in the state.

Field Data Sheet

HERBARIUM PERTH- FIELD DATA SHEET FOR DOCUMENTING MARINE PLANT COLLECTIONS
(* Essential information. Other data are desirable)

Scientific name……

Common name……

Determined by: ……

Form:……

……

Height: ……..m **Width**: ……..m

Colour: red / green / brown / iridescent / other (describe) ……

Density: common / frequent / occasional / rare (circle one)

Assoc. assemblage: ……

……

……

Depth: ……m

Habitat description: ……..

……

……

Substratum: limestone reef / granitic boulder / sand / mud / epiphytic / epizoic / other (describe) ……

State: **WA** **Lat**. ……..°……..′……..″S **Long**……..°……..′……..″E

GPS / Man. (circle) Datum: WGS84 / ADG84 / GDA94

***Precise locality**:……..

……

……

***Collector**:…… **No**…… *__Date__: … /……/200…..

Voucher for:…… **Photo** Y / N **Exp. Number** …

Extra notes: (pto if necessary)

GUIDE TO COMPLETING FIELD DATA SHEET

1. Identification

The name field has two headings:

- **Scientific name**: This field can be filled in at the time of collection or soon after, however it is more usually left until a critical examination of the specimen has been carried out to determine the identification. This should be a current valid Latin name. It should also include who determined the identity of the specimen. These data are captured in the WAHerb database.
- **Field identification/common name**: This field allows the collector to put a temporary identification on the specimen. This information is captured in the 'other notes field' on the WAHerb database.

2. Description

This should include any notes on colour, shape and size of the plant and any other features that can't be seen from the pressed and dried specimen. This is particularly important for larger plants where whole specimens may not be collected. Plant description notes can include:

- **Form**: Describe the growth form/morphology of the plant.
- **Height/width**: Give an approximate measurement in centimetres or metres, as appropriate, e.g. 25cm, 1.0m
- **Colour**: The colour in marine algae can vary considerably and can deteriorate quickly when exposed to sunlight.

In this section alternative terms are given as prompts, circle one only.

Max users enter this information into the 'Plant Description' field.

3. Population Characteristics

Population density records the whole population of the species being collected at a site. If the population is small, individual plant numbers can be recorded.

If there are too many, record the approximate area covered.

In this section alternative terms are given as prompts, circle one only.

Max users enter this information into the 'Frequency' field.

4. Site and Habitat Description

This section describes the immediate area surrounding the plant collected.

- **Associated assemblage**: Describe the habitat in relation to other plants in the close vicinity. Include host plant or animals where applicable.
- Make a list of the more common species growing at the collection site.

Max users enter associated assemblage information into the 'Vegetation' field

- **Depth**: Measurement in metres e.g. 0.25m, 1.0m if the specimen is collected in the subtidal zone.
- **Habitat description**: Describe the topography of the collection site and if relevant, the position from the shore.
- **Substratum** – Several categories are given, circle one or if none are appropriate, circle 'other' and describe. If epiphytic or epizoic, note host (give name, if known) under 'associated assemblage'.

Max users enter this information into the 'Site Description' field.

5. Location

A detailed description of the collection locality is needed as well as the latitude and longitude.

- **State: WA Latitude and Longitude**: This should be recorded using a Global Positioning System (GPS). Degrees (°), minutes (') and seconds (") is preferred. Accuracy to seconds is important as 60" = 1km.
- **GPS/Man**: Indicate if a GPS unit was used or if the latitude and longitude was calculated from a map etc.
- **Datum**: GDA94 is Australia's new coordinate system and should be used in preference to any others. CALM's *FloraBase* systems encourage the use of GDA94. Older systems WGS84 or AGD84 can still be used as long as this reference datum is clearly cited. This is essential information if coordinates are provided.
- **Precise locality**: The description should enable any person to revisit the collection site. If the locality is not a well known one, the distance and direction from a better-known landmark should be given. This will often be difficult to do for offshore marine sites, so GPS coordinates are preferable.

Max users enter the full locality information in the 'Locality' field. The 'Nearest named place' field relates only to calculating the geocode and does not print out on the label.

6. Collector details

- **Collector**: Enter initial(s) first then the surname in full eg. X.Y. Zondoc.
- **Number**: The number should preferably be sequential and unique to each collection. The number can be a single series numbering system that continues year after year, or numbering can start each year, in this

case the year should be included XYZ123/03. The same number is also written on a tag attached to the specimen.

- **Date**: Use Arabic numerals for DD/MM/YYYY.

7. Voucher Specimen

Note if the specimen is a voucher for a photograph, a particular area survey, special project etc.

8. Photo

If the specimen was photographed, some identifier (e.g. exposure number(s) or file location and number if digital) should be entered into this field. Note that digital cameras record many details (including time and date) of each exposure in the EXIF data included with each image file.

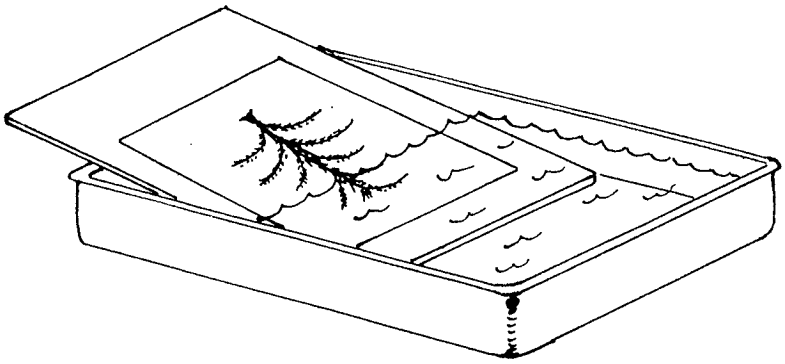
DRYING/PRESSING AND PREPARATION OF HERBARIUM SHEETS

All collections should be dealt with as soon as possible, even those preserved in formalin. The longer the specimens are kept in general collection bags, the more they will lose their colour and at least part of their value. The best way to treat all specimens is to examine them at a gross level, look for obvious taxonomic clues (colour, reproduction, structure etc.), keep a small but informative piece (e.g. a fertile branch) in liquid preservative, then press the remainder of the specimen.

Pressing

Pressing specimens is the best way to maintain a collection of marine plants. It has several advantages over keeping a wet-preserved collection: 1. For all intents and purposes, it is permanent. When properly stored (in the dark and out of reach of insects) pressed specimens never degenerate. Specimens over 300 years old can provide the same information as a specimen pressed yesterday. If kept in the dark, or mostly so, pressed specimens do not fade. If kept away from insects they are usually safe. Insects are generally more of a problem with pressed land plants and rarely attack pressed seaweeds (although seagrasses are liable to be chewed!). Specimens maintained this in way form the basis of all taxonomic study, as for each species one pressed specimen (known as the holotype) is designated as being the true representative of the species. 2. Labels, with appropriate information, can be affixed directly to the herbarium sheet, thereby removing the risk of them going astray.

The disadvantages of pressed specimens include the difficulty of examining anatomical structures using rehydrated portions of plants. This is generally only a problem with delicate specimens, some of which virtually become part of the herbarium sheet. These difficulties are of greater importance when the



Above: Equipment for pressing marine plants

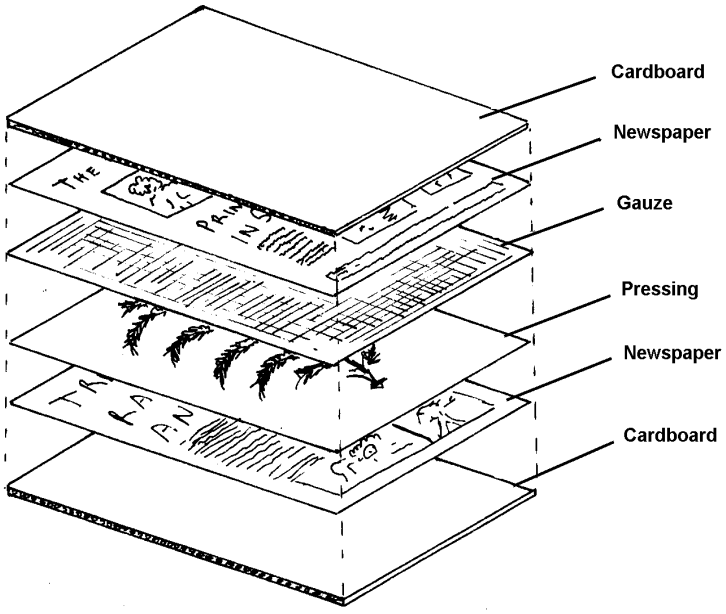
specimen is used as the basis of a publication, as in that situation the most informative view is that taken from wet-material.

Pressing can be undertaken with fresh or preserved specimens, the former being the more pleasant exercise. Pressed seaweeds can also be framed to make a decorative display, as their unusual colours and patterns can be quite attractive. Care must be taken, however, as direct sunlight will cause the colours to fade.

Marine plants are generally pressed when wet. Large photographic trays are ideal for this purpose (see figure above). Half fill them with seawater (if the plants are very delicate) or freshwater. It is best to have a piece of glass or Perspex at an angle from the edge of the tray into the water. This provides a convenient platform on which to place the paper and also allows the completed pressing to be removed without disturbing the arrangement of the plant.

Pressings should be done on a sheet of stiff paper or card (usually 42 x 26 cm.), which should be acid-free if the specimen is to form part of a scientific collection. Contact the Herbarium for further details and suppliers. Place the plant and the card in the pressing tray, making sure everything is wet. The plant can then be arranged how you would like it to appear in the final pressing; some branches might need to be trimmed but do not alter the overall pattern. For untangling delicate branches a fine paintbrush can come in handy. The card with pressing is then carefully removed, sliding it up the piece of glass. Allow to drain. If a particularly delicate specimen is being pressed, a small amount of water poured along the edges of the plant will untangle all of the very fine branches. Place the pressing on a piece of thick cardboard covered with a sheet of newspaper. Gently place a piece of gauze over the pressing, followed by another sheet of newspaper and another piece of cardboard (see figure below). Additional specimens can be placed on top in this way you can build up a series of pressings. At the end of the session place a broad, heavy object over the final piece of cardboard. An upturned stool is suitable. This will keep the specimens flat and aid the drying process. During the next week or so the newspaper should be replaced with fresh sheets on a daily basis. Once dry, which may take some time depending on

weather conditions, the plants might need to be glued in place. Most water-based glues are suitable, but only use a small amount, as you do not want to re-wet the plant you have spent some time getting dry. Another option for attaching specimens to the sheet is herbarium tape, which can be used successfully for larger specimens. Some specimens are best kept in folded sheets of paper (envelope style), which can stop them being damaged and falling apart.



Above: Materials for drying pressings

SPECIAL CASES

Mucilaginous specimens

Specimens of some algal genera, for example *Trichogloea* and *Predaea*, are extremely mucilaginous and if pressed using the described method will ‘glue’ the herbarium sheet to the gauze and probably also the newspaper. These specimens should be placed on a sheet on a flat, level surface and allowed to dry without pressing.

Crustose specimens

Many closely adherent, crustose algae are best collected along with whatever they are growing on (rock, shells, etc.), as any attempt at removal will often destroy the plant. These specimens should be left attached to the piece of substratum and air-dried, then stored in appropriately sized boxes with labels.

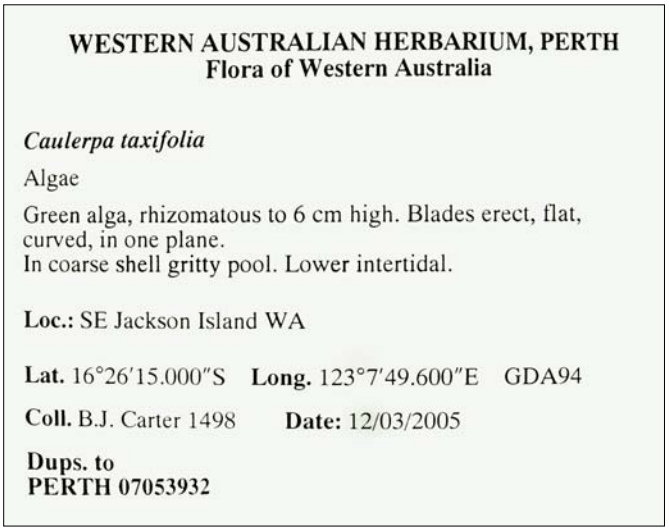
Bulky specimens

Any bulky or inflexible specimens that will not lie flat, or are likely to be damaged if pressed, should also be air-dried and stored in boxes.

If you have any queries regarding unusual specimens, or difficulties sourcing herbarium materials, contact the WA Herbarium.

Labelling

Label all pressings, even if you are only going to use them as a wall hanging. Important details to include are: The name of the plant, the date and location of collection, the name of the collector and who determined the identity of the plant. The figure below shows an example of a label for scientific use. Other information that can be valuable includes latitude/longitude and habit.


WESTERN AUSTRALIAN HERBARIUM, PERTH
Flora of Western Australia

Caulerpa taxifolia

Algae

Green alga, rhizomatous to 6 cm high. Blades erect, flat, curved, in one plane.
In coarse shell gritty pool. Lower intertidal.

Loc.: SE Jackson Island WA

Lat. 16°26′15.000″S **Long.** 123°7′49.600″E GDA94

Coll. B.J. Carter 1498 **Date:** 12/03/2005

Dups. to
PERTH 07053932

Right: WA Herbarium specimen label

Pressed marine plant specimen:
Caulerpa taxifolia

THE VALUE OF VOUCHERING

Specimens collected for marine plant studies should be pressed and deposited, together with collection information, in a recognised herbarium for future reference. When prepared properly and protected from insect damage or physical abuse, herbarium specimens can last for hundreds of years.

Why voucher specimens?

- Herbarium specimens are permanent, verifiable records of botanical diversity, biogeographical distribution, structural variation and ecology.
- Herbarium specimens serve as a clear indication of the identity of the plant upon which research is based. If there is confusion about the identity of the species recorded for a site, the voucher specimen can be checked for accuracy.
- Identifications are subject to change as marine plant classification is dynamic and species concepts often change when new evidence becomes available. Voucher specimens help cross reference changes in identification to previous research.
- Vouchering specimens of invasive species will help researchers apply a correct name for them, determine where they occur in WA and what their habitat preferences are, what weeds are important in a particular geographical area and assist in detecting new weed invasions.

FURTHER READING

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Womersley, H.B.S. (2003). *The Marine Benthic Flora of Southern Australia. Part IIID.* Australian Biological Resources Study & State Herbarium of South Australia, Adelaide.

WEB SITES

The Western Australian Seagrass Page

http://wwwscience.murdoch.edu.au/centres/others/seagrass/index.html

Algaebase

http://www.algaebase.org/

FloraBase

http://florabase.calm.wa.gov.au/