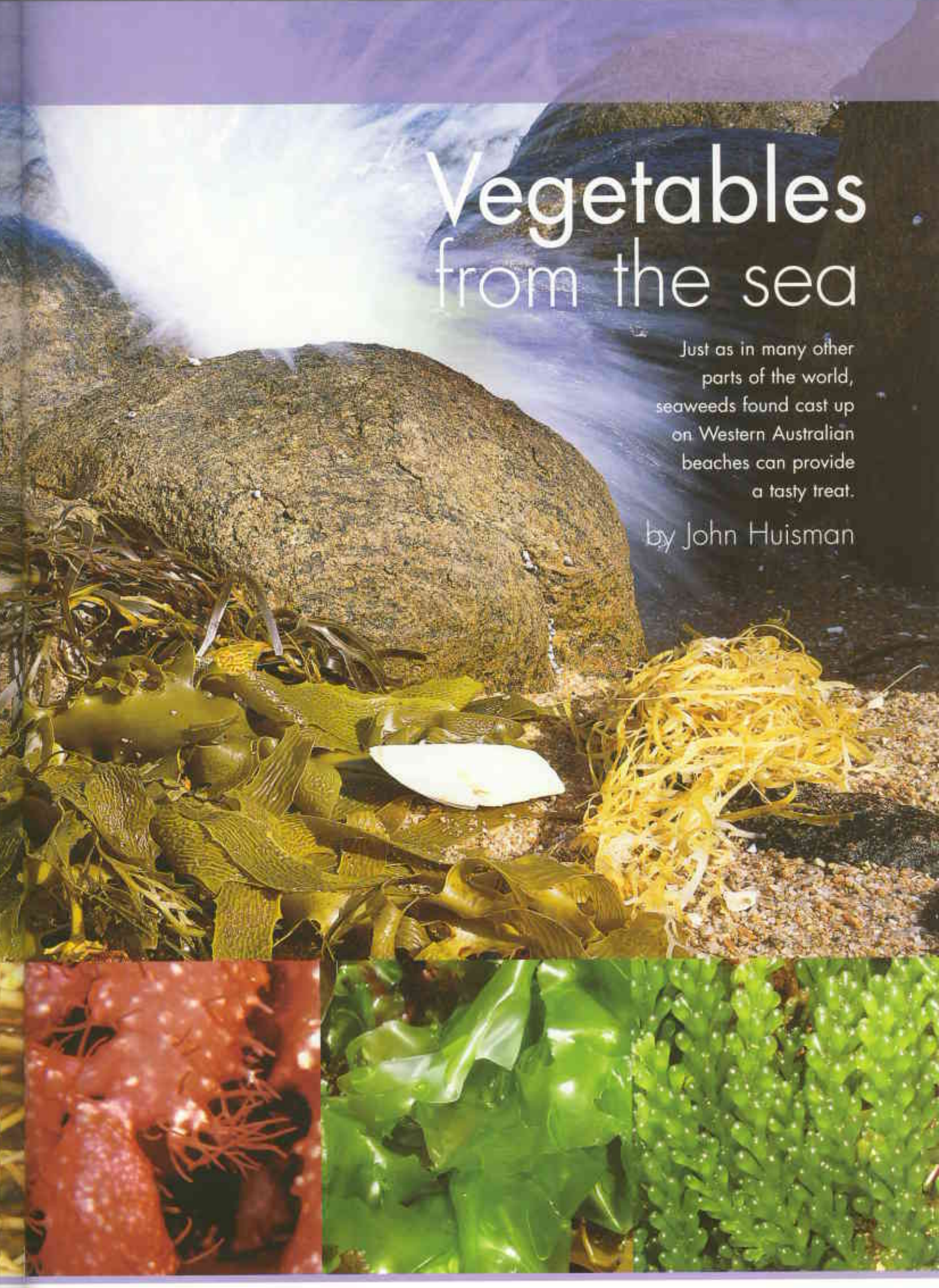
Vegetables from the sea

Just as in many other parts of the world, seaweeds found cast up on Western Australian beaches can provide a tasty treat.

by John Huisman



We often regard seaweed as something to avoid. It collects in huge smelly piles on the beach, or slithers around the ankles during a paddle in the shallows, generally making that trip to the seashore a less pleasurable experience. Sure, it is essential for the wellbeing of the coastal ecosystem, but what possible direct value might there be to people? Surprisingly to most, that value is immense and varied. Some 400 different species of seaweeds around the world are used by people for food, stock feed, medicines, fertilisers, and to provide raw materials for food processing and numerous industrial processes. And these seaweeds are valuable, generating billions of dollars each year.

Seaweeds have been a staple part of Japanese and Chinese diets since prehistoric times. As far back as 600 BC, Sze Teù wrote in China 'Some algae are a delicacy fit for the most honoured guests, even for the King himself'. Presently some 21 species are eaten in Japan, where they account for about 10 per cent of the Japanese diet. Seaweeds are also eaten in other parts of Asia, in Europe and in several places in the tropical Pacific. In the Hawaiian Islands, edible seaweeds (known as *limu*) are an important part of the local cuisine and have been for centuries.

As well as the species eaten directly, many seaweeds are used to make desserts. This is possible because the cell walls of these seaweeds produce compounds known as colloids, which can be extracted and will set at room temperature. The Western Australian jelly weed (*Betaphycus speciosum*) is one of the few examples of local seaweeds with a history of human use. In the early days of the Swan River Colony, beach cast plants of this seaweed would be collected and used to make jellies or blancmanges. Plants are cleaned and bleached in the sun, roughly chopped and then simmered in milk for about 30 minutes. Once the mixture starts to thicken it is strained to remove the seaweed (which is discarded), flavoured, and then allowed to set in the fridge or at room temperature.

Relative to other nationalities, Australians are newcomers when it comes to eating seaweeds, but our recent enthusiastic adoption of Asian cuisine is resulting in a broadening of tastes to include these marine vegetables. The thought of eating sushi rolls wrapped in seaweed would have been incomprehensible to most Australians of 50 years ago, but today these exotic foods are widely available and are even treated as a healthy alternative to fast food. By and large, however, all of the seaweeds eaten in Australia are grown overseas and imported, arriving here already processed. But with our vast coastline, we also have a great untapped natural resource,

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Main Common kelp (*Ecklonia radiata*) at Quarry Bay in the proposed Capes marine park.
Photo – Alex Bond
Insets (from left) Foxtails (*Asparagopsis*).
Photo – John Huisman
Common kelp.
Photo – Julia Phillips
Ogo (*Gracilaria*), jelly weed (*Betaphycus*), sea lettuce (*Ulva*) and sea grapes (*Caulerpa*).
Photos – John Huisman

Above left Alvarez's jelly weed (*Kappaphycus*) growing on rope in a Balinese seaweed farm.
Photo – John Huisman

Left Nori farm in Japan.
Photo – Tadao Yoshida

virtually on our doorstep. With a little encouragement and a taste for experimentation, it should be possible for Western Australian seaweeds to also find a place at the dinner table!

Only a few seaweeds have an appealing taste when eaten raw, so 'grazing' along the shoreline is unlikely to please the taste-buds. The coast of Western Australia supports more than 1000 different seaweed species, and it would be a huge undertaking to assess each one for edibility. Instead, it is worth looking at the practices in other cultures. Some 30 seaweeds are used regularly as food in other countries. Many species or closely related species used by those cultures can be found in Western Australia. This article examines just a few.

Nori

Nori (*Porphyra* species) is one of the most valuable products yielded by the oceans. In Japan, fishers have cultivated nori since the seventeenth century, by placing bamboo or brushwood poles in the ocean to increase the available surface area for plants to grow on. Annual production of nori in Japan is valued at well over US$1 billion dollars, making it one of the world's most valuable aquaculture crops. As well as being used as the familiar wrapping around sushi rolls (more accurately called *sushi maki*), nori is used to flavour a wide variety of snack foods. Nori is sold in sheets that may be toasted to give a green colour and then flaked and added to sauces, soups and broths. In the United Kingdom, *Porphyra* is known as 'laverbread' and is collected from the shore at low tide. Plants are boiled to make a spinach-like paste, which is then thinly spread on toast. In Wales, it is even added to cheese. *Porphyra* provides excellent nutrition. It has high protein content and is full of vitamins, trace elements and minerals. The vitamin C content of nori is 1.5 times that of oranges.

Nori grows during the winter months on rocks high in intertidal areas. It looks similar to sea lettuce, but is typically a purple colour. It is generally a plant of colder waters and, in Western Australia, does not occur further north than the Perth region.

Sea lettuce

Sea lettuce is the common name used for blade-like species of the green algal genus *Ulva*. Plants are thin and membranous, being only two cells thick. Sea lettuce can be used directly as a salad vegetable, or cooked and added to soups.

Top Sea lettuce (*Ulva*).

Above A fully laden kelp harvester in France. Alginates will be extracted from these plants, some of which will end up in expensive French cosmetics.
Photos – John Huisman

The wonderful world of seaweeds

Did you know?

Seaweeds form the basis of a multimillion dollar industry that produces jellies and thickening agents. The red seaweeds *Kappaphycus* and *Eucheuma* are cultivated in several tropical countries for carrageenan, a component of their cell walls that is extracted and used in a variety of foods, industrial processes, medicines and cosmetics, to thicken and stabilise liquids. Carrageenan is commonly added to toothpaste and shampoo, so you might well be using a seaweed product every day!

Seaweeds are also used in medicine. The red seaweeds *Digenea simplex* and *Chondria armata* (plus others) produce compounds such as kainic acid and domoic acid. These are toxic in large amounts but in small quantities provide an effective anti-worm treatment. In Asia, *Digenea* extracts taken orally have been used as a folk remedy to treat roundworm infestation for centuries. Several other seaweeds including foxtails produce high levels of iodine and have been used in the treatment of goiter (swelling of the thyroid). Other seaweeds are currently being investigated for anti-cancer activity.

Seaweeds can be used in gynaecology. When dilation of a narrow or closed cervix is needed before any gynaecologic procedure, a small tube of dried kelp seaweed *Laminaria* is placed in the cervix. This slowly absorbs moisture from the surrounding tissues and swells, gently opening the cervix and allowing access to the uterus and fallopian tubes. This type of dilation greatly reduces the risk of injury.

Seaweeds are the only source of agar, a complex carbohydrate that is extracted from some red seaweeds that solidifies at room temperature. Agar is used in many industrial processes and in the production of agar plates for microbiology.

Seaweeds are also a wonderful addition to the garden. As well as being excellent mulch, brown seaweeds are used commercially to produce fertiliser. These seaweed-derived fertilisers contain growth promoters and also compounds that enhance the health of plants, increasing their resistance to disease and attack by pests.

Left Foxtails (*Asparagopsis*).

Below left Ogo (*Gracilaria*).
Photos – John Huisman

Another option is to toast sea lettuce. Plants are cleaned then rubbed with a mixture of sesame oil and salt. Several sheets are then rolled together and left to stand for five minutes. The sheets are then unrolled and cooked separately in a hot pan until crisp, then cut into smaller pieces and served with rice.

Sea grapes

Some species of *Caulerpa* (*C. racemosa* and *C. lentillifera*) are eaten under the names sea grapes or green caviar. They are eaten raw and can have a pleasant crunchy texture, as the small grape-like vesicles 'pop' in the mouth. In south-east Asia, sea grapes are cultivated for human consumption. Sea grapes (*Caulerpa racemosa*) is the only species of seaweed mentioned here where some caution is advised, as it is known to contain certain compounds that could cause a reaction in people. If plants have a strong peppery flavour, they are probably best avoided (see the section 'Is it safe?').

Foxtails

Foxtails or iodine weed (*Asparagopsis taxiformis*) is regarded as the supreme *limu* of the Hawaiians, where it goes under the name *limu kohu*. It is so popular that many Hawaiian reefs have been denuded of this seaweed, and it is advisable to collect only the fluffy upper portion, leaving the basal parts to regenerate. Plants are cleaned thoroughly, soaked overnight in fresh water (an essential step to remove potentially toxic compounds) and then lightly salted. Pieces are then rolled into small balls and added to raw fish or stews. The flavour is very strong and peppery, so only a small amount is used. Strangely, this seaweed finds favour with very few people not of Hawaiian origin, and its usage is virtually restricted to the Hawaiian Islands.

Ogo

Ogo (*Gracilaria* species) can be eaten raw, but some people recommend it first be plunged into boiling water for two to three minutes. It then becomes an attractive green while retaining its crispness. Ogo is a vital component of the Hawaiian dish *poke* (pronounced po-KAY), which is essentially cubed raw fish (generally sashimi-grade tuna), combined with soy, sesame oil, toasted sesame seeds, chopped ogo and sea salt. The mix can be served immediately or refrigerated for an hour or two.

Is it safe?

The vast majority of seaweeds do not produce compounds that are harmful to people. Some species in the genus *Caulerpa*, including sea grapes, have been reported to show some human toxicity. They produce substances, such as caulerpin, caulerpicin and caulerpenyne, which appear to repel grazers and possibly stop other organisms from settling on

Above left Jelly weed (*Betaphycus*).

Above *Digenea* from tropical Australia —used elsewhere to combat roundworm for centuries.

Right Hair weed (*Lyngbya*)—one to avoid!
Photos – John Huisman

the *Caulerpa* fronds. These compounds have demonstrable impacts on animals and on human cells, but the general belief is that the levels that might be ingested are not sufficient to cause problems. In other countries, sea grapes are reported to develop a bitter taste at particular times of the year, presumably as a result of toxin accumulation, so any plants with a bitter taste should be avoided.

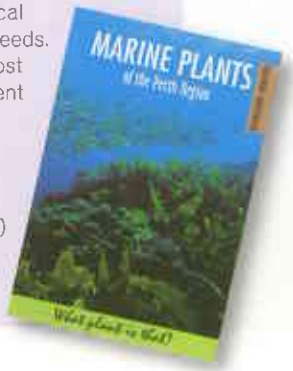
There have also been reports of *Caulerpa* causing an allergic reaction, with symptoms including dizziness, numbness at the tip of the tongue, and breathing difficulties. Whether these symptoms are the result of toxins produced by the seaweed, or something ingested coincidentally, is not known. Incidences of food poisoning from eating the red algae *Gracilaria* and *Acanthophora* have been reported in the tropical Pacific (such as in Guam, Hawaii, Japan and the Philippines). One outbreak resulted in eight deaths, but it is suspected the causative agent was not the seaweed, but associated microorganisms ingested with it. One of the compounds implicated in these deaths is known as aplysiatoxin. Aplysiatoxin was first discovered in the sea hare *Stylocheilus*, but actually originates in the blue-green alga *Lyngbya majuscula* that forms part of the sea hare's diet. In the tropics, *Lyngbya* can be a common inhabitant of reef flats and is known to cause contact dermatitis ('swimmer's itch'). There are also cases of *Lyngbya* causing the death of marine turtles in Queensland. This species grows to about 20 centimetres tall and looks very much like coarse, dark purple or black hair. It is definitely one to avoid!

Certainly, some caution is appropriate. Only eat seaweeds taken from unpolluted areas and which are themselves clean of associated epiphytes (attached plants). Never eat seaweeds growing in the proximity of *Lyngbya*. For the most part, seaweeds that taste good will not be harmful—it is perhaps redundant to say, but do not eat anything that is particularly distasteful. There is little danger of being poisoned by seaweeds that taste pleasant.

Remember, despite the implications of the name, all our seaweeds are native to WA coasts and their collection is managed by the Department of Environment and Conservation. Before gathering plants, ensure that appropriate licenses are obtained.

John Huisman is a contract seaweed specialist at the WA Herbarium and a research fellow at Murdoch University. He is an international expert on seaweeds, having studied WA's marine plants for more than 20 years and written several books on marine plants from various parts of the world.

If you enjoyed this article then look out for the new full colour pocket-sized Bush Book, *Marine plants of the Perth region*, which John has cowritten. It contains a wealth of information on our local seagrasses and seaweeds. It is available from most bookshops, Department of Environment and Conservation offices and online through NatureBase (www.naturebase.net) for a recommended retail price of $6.50.



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