THE KELP CONNECTION

Stranded kelp, although aesthetically unpleasing, supplies a reliable and rich source of food to upper shore beach inhabitants. photo: P. Tarr

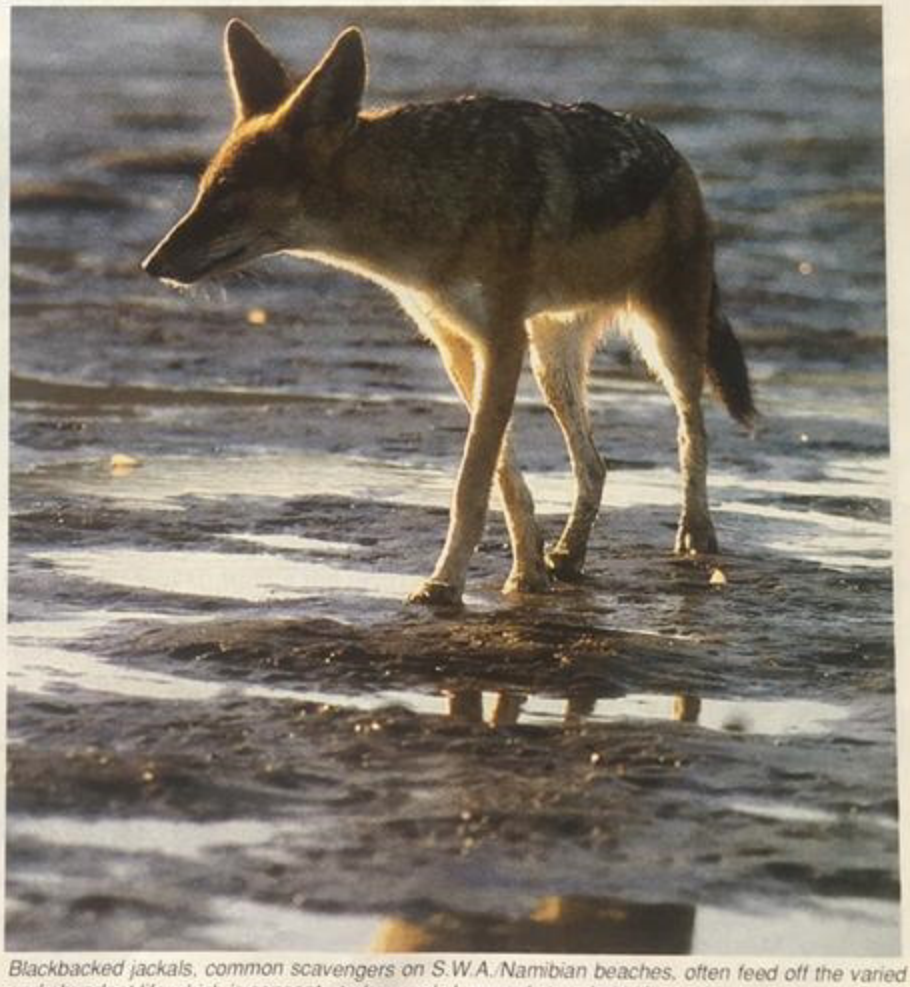
by Jacquie Tarr

Although it falls partly within the tropics, the west coast of southern Africa is washed by seas which are the coldest in all Africa. These cool waters, swept northwards from the icy sub-Antarctic by the Benguela Current, are rich in nutrients which help to create an ideal environment for the growth of giant marine algae, otherwise known as sea bamboo or kelp.

Forming underwater forests, these large algal plants occupy vast areas — sometimes extending as far as three kilometres offshore — between Cape Agulhas in the western Cape and Rocky Point on the northern Skeleton Coast of Namibia. Three major kelp species are encountered within these forests: *Ecklonia maxima* and *Laminaria pallida* which dominate the kelp beds in the south and *Laminaria schinzeii*, which is most evident along the Namibian coast.

Although viewed by many as unsightly, these kelp beds play a vital role in maintaining a food chain which sustains a variety of offshore marine creatures. These include the commercially viable and heavily exploited crayfish whose favourite prey, the black mussel, thrives in the nutrient rich, sheltered environment of the kelp forests. When kelp is uprooted, washed up and left stranded on a rocky shore, the desiccating action of the sun and wind soon leave hard, shrivelled relics of the original plants. However, clumps of kelp that are cast ashore on sandy beaches are soon covered by windblown sand and play a vital role in enriching these otherwise impoverished and seemingly barren ecosystems.

Sandy beaches are characterised by an almost total lack of *in situ* plant life. As a re-



Blackbacked jackals, common scavengers on S.W.A./Namibian beaches, often feed off the varied and abundant life which is concentrated around clumps of stranded kelp. photo: P. Tarr

Acanthoscelis ruficornis, *a large, predatory beetle frequently found beneath kelp debris.*
photo: S. Tarr

sult, their resident animal species have no local vegetable matter upon which to base their food chain. Thus, these animals are forced to rely, either directly or indirectly, on imported food material for survival. On almost all beaches the most reliable source of food comes from the sea in the form of phytoplankton particles and finely divided detritus. These tiny organic particles are not only broken down and consumed by microscopic sand-dwelling bacteria, but are also filtered from the water by a variety of larger marine animals. Moving up the beach towards the high-tide mark, the sand becomes drier, risk of desiccation increases and periodic strandings of large items of carrion provide an unreliable source of food. As a result, sandy beaches are generally sparsely populated with most of their inhabitants concentrated low down on the shore in the permanently saturated sand. However, the beaches along southern Africa's west coast, particularly those which receive a regular supply of stranded kelp, deviate considerably from this generalised pattern. Comparatively they support an abundance of animal life, the majority of species being found, not on the water-saturated lower shore, but high up on the beach along the exposed driftline.

The animals which have invaded the upper shore in order to utilise the stranded kelp are subject to extreme environmental conditions, alternating between turbulent submergence at high tide and desiccating exposure when the waters recede. Their adaptations to a semi-terrestrial/semi-marine existence make even the notorious kelp fly interesting subjects to study. These flies, the most common of which is *Fucellia capensis*, are terrestrial and in order to minimise the possibility of continual swamping by the sea, their life-cycle has become closely linked to that of the lunar tidal cycle. Soon after spring tide, the adult flies feed briefly off the mucous of freshly stranded kelp plants. Mating ensues and large numbers of eggs are laid on the decomposing kelp. These eggs hatch into tiny voracious larvae which consume the kelp at a rapid rate of 1,8 times their mass per day. Approximately 12 days later the satiated larvae pupate and over the next two weeks metamorphose into adult flies, shortly before the next spring tide deposits a fresh batch of kelp onto the upper shore. Therefore, while the larvae are feeding, the tides are in the neap stage of their cycle and their chances of being washed out to sea are minimal.

Furthermore, *Fucellia* pupae are able to float, and in this way survive occasional swamping by waves as the tides approach spring conditions. Other terrestrial insects which have been recorded on west Cape beaches in close association with stranded kelp include no less than 22 different species of beetle — nine of which have been encountered on the Namibian coast. Represented by both predatory and herbivorous forms, they colonise fresh clumps of stranded kelp in relatively low numbers, reach a peak within a few days, and thereafter remain associated with the kelp debris until it is almost dry. Of these beetles, the kelp consuming tenebrionid, *Pachyphaleria capensis*, and the large, predatory carabid, *Acanthoscelis ruficornis*, are the most conspicuous.

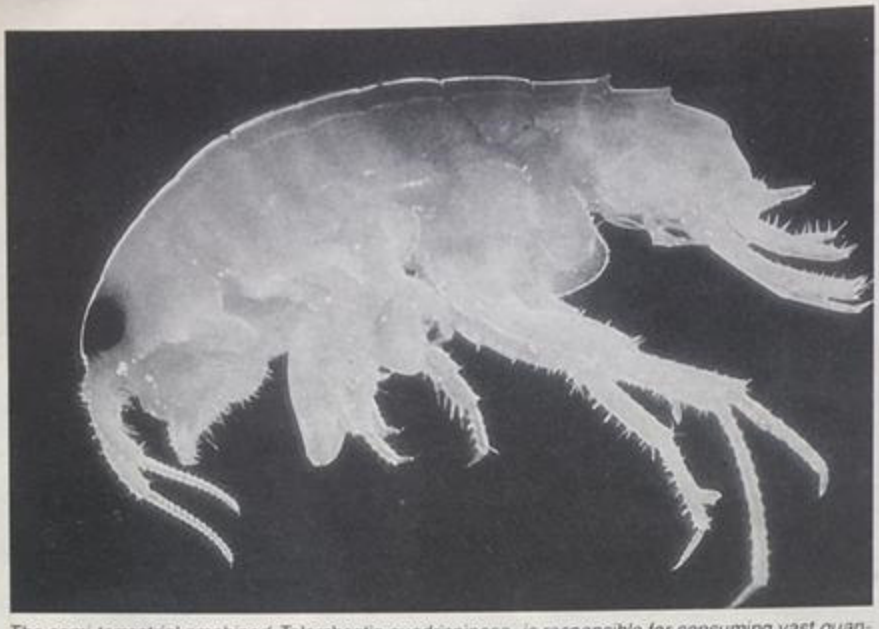
On many beaches the marine sand hopper, *Talorchestia quadrispinosa*, is the predominent consumer of kelp debris. In order to avoid desiccation these highly mobile, semi-terrestrial amphipods remain buried in the sand during the day. Emerging in vast hordes at night, they scour the beach in search of freshly stranded kelp and other dead and decaying organic matter. West coast beaches susceptible to kelp strandings are also populated by *Tylos granulatus*, another marine animal which has adopted a semi-terrestrial mode of life. During the day these giant isopods (some adult specimens reach five centimetres in length) remain on the high beach in deep burrows. They emerge nocturnally only at low tide, during which time the juveniles seek out decaying animal matter and the adults feast on rotting kelp which has been stranded for at least seven days.

Blackbacked jackals are frequently encountered on the isolated beaches of Namibia and, although these master scavengers continually scan the shore for dead fish, seal carcasses and other carrion, they often capitilise on the abundant and varied organisms that are associated with clumps of stranded kelp. For the same reason, small numbers of spiders, scorpions, sand lizards and terrestrial birds are attracted to the upper shore. European swallows occasionally frequent freshly stranded kelp to feed off the swarms of flies, while tractrac chats and Cape wagtails have been observed grubbing beneath the kelp in search of insect larvae, sand hoppers and beetles. At high tide when the waves wash over the upper shore, many of the kelp consuming organisms fall prey to feeding fish — white steenbras, in particular, are known to consume considerable numbers of the marine sand hopper.

Thus, on west coast beaches, the presence of stranded kelp attracts life to the otherwise barren upper shore, while the nutrient rich waters which wash over them have resulted in an enrichment of their overall intertidal fauna. The predominent consumers of these intertidal organisms are undoubtedly the large flocks of wading shorebirds that frequent the west coast during the summer months. Escaping the harsh Palaearctic winter, these birds spend more than half the year on our shores, recovering from their strenuous migration and building up adequate fat reserves for the return journey to their breeding grounds in the northern hemisphere.

Studies conducted in the south-western Cape and along the Namib and Skeleton coasts of S.W.A./Namibia, have shown that most waders favour mixed shores of sand and rock as feeding areas. These mixed shores constitute sandy beaches extending down to a rocky platform. Kelp, which grows along the infratidal fringe (zone which is never exposed even by the lowest tide) of the rocky substratum, is stranded along the driftline of the beach and at low tide, when both the beach and part of the rocky platform are exposed, a large variety of prey organisms are made potentially available to shorefeeding birds. On the Skeleton Coast a survey of a typical mixed shore of this type revealed that 71 per cent of the entire sandy beach fauna were dependent on decomposing kelp and that the four most abundant shore-birds observed there (whitefronted plovers, grey plovers, turnstones and sanderlings) spend at least a third of their feeding time consuming beach-dwelling organisms. During this study *Tylos*, although previously regarded as having no known predators, repeatedly fell prey to feeding birds — the larger specimens torn into pieces before being consumed.

In addition to playing an important ecological role on the west coast, kelp has enormous commercial potential and forms the basis of a lucrative industry. Belonging to the group of brown algae or "Bryophyta", all kelp is rich in alginic acid, a non-toxic, highly viscous compound that readily forms



The semi-terrestrial amphipod, Talorchestia quadrispinosa, *is responsible for consuming vast quantities of stranded kelp and falls prey to many predators including fish, beetles and shore-birds.* photo: S. Tarr

The giant isopod, Tylos granulatus, *is commonly encountered on west coast beaches susceptible to kelp strandings.* photo: S. Tarr

gels and is widely used industrially as an emulsion stabiliser. Annually, tons of dried, crushed plants are exported to overseas factories mainly in Japan, Scotland and California where the alginic acid is extracted and eventually used in the creation of a surprising variety of commercial products — from lipsticks, eyeshadows, pharmaceuticals and paint to printing ink, marshmallows, ice cream and processed cheese. Furthermore, kelp may be used agriculturally as highly effective fertilisers, plant growth stimulants and as supplements to pig feed and cattle fodder.

Controlled harvesting of kelp from the sea is unlikely to be ecologically detrimental, as the removal of large plants appears to stimulate rapid regrowth in the disturbed areas. However, the harvesting of stranded kelp should be limited to rocky shores and pebble beaches — those areas where it plays a minor ecological role. There is no doubt that the presence of stranded kelp on sandy beaches vastly influences the composition, abundance and distribution of their animal species. Denuding these areas of beached plants is clearly unwise. Ironically, the over-exploitation of crayfish (an important predator amongst the kelp forests) can result in a population explosion of sea urchins, one of their major prey species. If uncontrolled, the sea urchins can easily destroy vast beds of kelp. Thus, careful management is essential if man is to continue to utilise and conserve kelp as a valuable natural resource. ■

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J. Tarr,
P.O. Box 3338,
9000 Vineta.