

The Seaweed Resources of kwaZulu-Natal, South Africa: The Current State of Our knowledge

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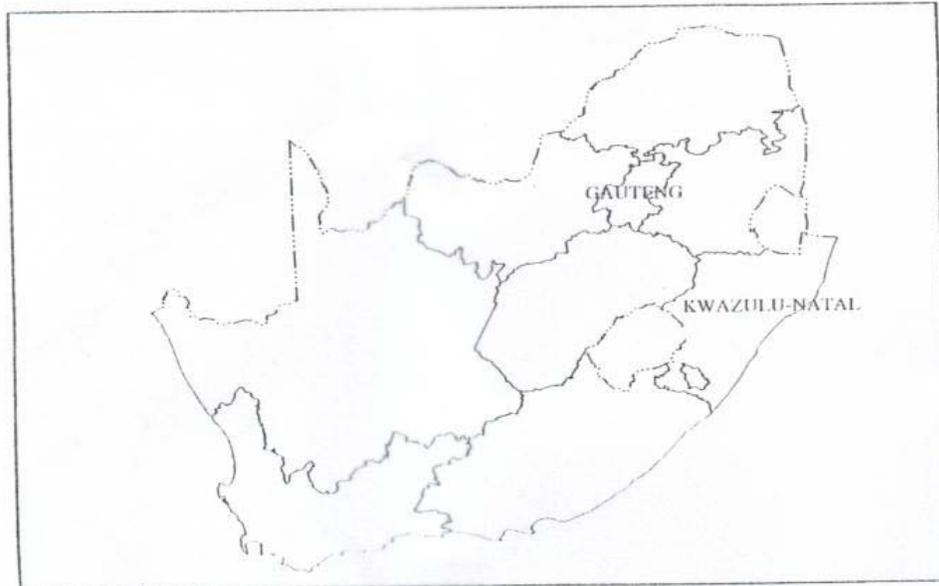
The coastline of KwaZulu-Natal, South Africa supports a substantial diversity of seaweeds which remains to a great extent unresearched with regard to both utilization and conservation. This paper discusses the seaweed flora of KwaZulu-Natal from a resource utilization perspective and identifies research needs (or seaweeds in the region. At present there is no published literature for any seaweed species of KwaZulu-Natal in terms of standing stock, or conservation status. This paper identifies the following as primary considerations when discussing the seaweed resources of any region: taxonomic composition of the flora; identification of actual and potential uses for the resource and the development of suitable stock assessment and harvesting strategies or sustainable utilization.

INTRODUCTION

Seaweeds provide economic benefit to a number of countries. Some of the applications of algae and their derivatives include colloids, use in the pharmaceutical industry, and food and feed supplements. This is achieved either through exploitation of wild stocks (Ohno & Critchley, 1993), as in the Cape Province, South Africa (Anderson *et al.*, 1989) and Chile (Avila & Seguel, 1993), cultivation of selected sea weeds (see Ohno & Critchley, 1993), as in Israel (Friedlander *et al.*, 1990), China (Tseng, 1993) and Brazil (Neto, 1987), or a combination of these approaches (Avila & Seguel, 1993). The coast of KwaZulu-Natal (hereinafter KZN; Fig. 1) possesses a diverse algal flora. There have been intensive taxonomic studies which have concentrated on specific groups of algae such as the Rhodophyta (Norris, 1992). Recently, then: have been several papers considering the biogeography of the South African seaweed flora (Farrell *et al.*, 1993; 1994). However; despite this taxonomic knowledge, which is by no means complete, the diverse algal flora of the KZN coast remains largely unresearched with regard to resource utilization and conservation.

This paper serves to highlight some of the inadequacies of the research publications involving the seaweeds of KZN and to address some of the research needs that are required from a resource utilization perspective.

Figure 1. Map of South Africa showing the position of the provinces of KwaZulu-Natal and Gauteng



Clearly, with demands on resources becoming greater and the pressure on the environment increasing, there is a need to develop sustainable management strategies for resources and to develop sound conservation strategies to ensure the existence of potential resources for future use.

SEAWEED RESOURCES: POINTS TO CONSIDER

A discussion of the seaweed resources of any region requires consideration of the following.

Composition and taxonomy of the flora

Clarification of the taxonomic status of a marine flora is necessary:

- a) if utilization of the resource is to be possible at the most efficient level, and
- b) if the most suitable management policies are to be developed which will allow for maximized utilization in a sustainable manner (Santelices & Stewart, 1985).

Furthermore, if we are to fully benefit from the use of seaweeds, we must be able to distinguish between available taxa. Neglecting taxa, or considering similar seaweeds as a single entity, may mask subtle differences in properties or composition of the seaweeds, thereby hindering diversification of uses. Indeed, accurate taxonomic identification of commercial seaweeds is necessary to convey detailed, current and reliable information on the worldwide production and utilization of seaweeds and their derivatives. As Abbott (1985) points out, "the value of any seaweed crop is enhanced by the name under which the seaweed is sold, for the kind and quality of the seaweed product is announced with its name". The taxonomic base on which the name rests furnishes the basis for proper valuation of seaweed crops (Abbott, 1988).

As mentioned previously, there have been several comprehensive studies on the marine flora of the coast of KZN (see Farrell *et al.*, 1993 for a review). It is not the intention of this article to discuss those papers; however, it is felt that a large number of seaweeds remain to be described. Additionally, debate is still active over the taxonomic status of some groups (*e.g. Gelidium* spp., Santelices, 1991).

Gaps in the taxonomic knowledge of the marine flora of KZN have meant that most research in this region has concentrated on this field of study. Consequently, ecological studies have been relatively infrequent and stock assessment and conservation studies non-existent. To our knowledge there is no published information on the seaweed stocks of KZN or proposals for their management/conservation, except for their continued conservation in the marine reserves of the Natal Parks Board.

Based on the above, we stress that any attempt to discuss the sea weeds of a region must be based on a sound taxonomic understanding so as to allow for the maximum diversification of uses possible, while at the same time using these resources to the greatest potential and overlooking none.

Identification of potential and actual uses of seaweeds

There is already a large bank of literature from a world-wide scientific base which deals with the uses to which seaweeds and their products can be put (see Jensen, 1993). Applications and uses for seaweeds are extensive, *i.e.* food, fertilizer, agar, algin, carrageenans, etc. Seaweeds play a role in industry but are also used directly by humans, *e.g.* as food and fertilizer (Glicksman, 1987; Kain & Dawes, 1987; Nisizawa *et al.*, 1987). Despite the established uses for seaweeds, new uses and applications are still being discovered (Jensen, 1993). Among these, new medicinal properties or medicinal applications of seaweeds are likely to be of importance, ranging from medicinal teas (Masuda *et al.*, 1993) to vitamin and mineral supplements (Surey-Gent & Morris, 1987). Brown algae such as kelps are known to be beneficial in the treatment of arthritis, high blood pressure, gout, goitre, hypertension and mouth ulcer, (Chapman & Chapman, 1980). Members of the Chlorophyceae have been used in the treatment of haemorrhoids (Surey-Gent & Morris, 1987), and members of the Rhodophyceae have been reported to have anti-viral properties, (Neushul, 1990). The alga *Fucus vesiculosus* has been implicated in the isolation of anti-HIV compounds (Beress *et al.*, 1993). Seaweed products are also finding application as soil-stabilizers which have a role to play in mine-spoil reclamation and land rehabilitation after mining (Critchley & Rotmann, 1992). A potassium alginate paste has been marketed as a fire-fighting aid by Kelp Products (Pty) Ltd. (Critchley & Rotmann, 1992). Often the extent to which seaweeds can be used is limited only by the confines of initiative. From an alternative aspect perhaps, new uses may not be the only approach to be followed in an attempt to more valuably employ the seaweed resources of a

region. The marketing of the products themselves may need a fresh approach, possibly focusing on the healthy, novel aspect of the product (Becker & Rotmann, 1990). Many seaweed species on the coast of KZN show unique and attractive forms which have the potential of being used as decorative components of salads and food dishes in Japan,

Stock assessment and harvesting strategies

Potentially economically important seaweeds, such as *Gelidium abbotiorum*, *Sargassum* spp., *Flypnea spicifera* and *Cracilaria aculeata* have been reported to occur on the coast of KZN. The KZN coast supports a wide range of genera which have found uses throughout the world (Table 1).

Table 1. List of selected genera of seaweeds occurring on the coast of KwaZulu-Natal and which have been used (in any form) elsewhere in the world

Chlorophyta	Phaeophyta	Rhodophyta
<i>Caulerpa</i>	<i>Dictyopteris</i>	<i>Bostrychia</i>
<i>Chaetomorpha</i>	<i>Dictyota</i>	<i>Ceramium</i>
<i>Cladophora</i>	<i>Ecklonia</i>	<i>Coralina</i>
<i>Codium</i>	<i>Padina</i>	<i>Gelidium</i>
<i>Enteromorpha</i>	<i>Sargassum</i>	<i>Gracilaria</i>
<i>Vlva</i>	<i>Turbinaria</i>	<i>Griffithsia</i>
	<i>Ectocarpus</i>	<i>Hypnea</i>
		<i>Jania</i>
		<i>Laurencia</i>
		<i>Lithothamnion</i>
		<i>Rhododymenia</i>

The list is by no means comprehensive, but it provides a good base from which to work. We have not referenced the species or cited their specific uses, as the literature on the subject is exhaustive (Simons, 1976; Seagriff, 1984).

Despite their occurrence in the area, there are no reports of economic exploitation of these or other seaweeds from KZN. This may be for a number of reasons, although the most commonly cited is the "low biomass, high diversity theory" for the seaweeds of the KZN coastline. At present, however, such a "hypothesis" remains untested. Other reasons may be a) lack of researchers in the region, b) lack of appreciation for the potential of the seaweeds of the region, or c) lack of funds to undertake the required research. The most accurate reason is probably a combination of these factors. Preliminary results of studies recently undertaken in the region would appear to indicate that there may be stocks available for small-scale harvesting by coastal communities (unpublished data). Commercial harvesting of natural populations, however, would probably not be feasible. On the other hand, the use of local natural populations as "seed-stocks" for cultivation

operations remains a possibility and warrants further investigation, bearing in mind the need for conservation of these natural populations.

Whether the sea weeds of KZN can be used as raw material for any of the above needs or applications from a qualitative view (i.e. in terms of quality of the product), or whether they can provide for new uses is unknown due to lack of research on the topic. Furthermore, it is not known whether any seaweeds are collected and/or used by the local communities, and it is suggested that this aspect should be investigated in order to evaluate the utilization of the seaweed resources in the region. Maite-Santos and Mshigeni (1992) have found sea weeds sold in the main markets in Maputo, Mozambique (to the north of KZN) for traditional medicinal uses, most frequently to cure skin diseases and heal wounds. The seaweeds most commonly used for these purposes are *Halimeda*, *Caulerpa*, *Sargassum* and *Galaxaura*, all of which are found along the coast of KZN in varying abundance. Homeopathic medicine is becoming more popular in "western" societies. The fact that many of these medicines appear to be effective and not mere placebos suggests the existence of active compounds within the algae. It is important that these compounds are investigated and isolated, as has been stressed before (Maite-Santos & Mshigeni, 1992). Closer to KZN, Williams (personal communication) has reported a single finding of seaweed (origin and type unknown) sold by local traditional healers in Johannesburg, in the province of Gauteng (Fig. 1), South Africa.

While it is likely that many KZN seaweed species have the characteristics and quality to satisfy some of the uses identified above, no studies have been undertaken to determine standing stock levels for any KZN species. As a result, no study has analysed harvesting strategies for a specific resource to allow its sustainable utilization or to provide guidelines for its successful conservation. However, some stock assessment and harvesting studies have been undertaken on the seaweed resources of the Cape provinces (e.g. Carter & Anderson, 1985; Carter & Simons, 1987; van Zyl, 1993). However, these studies have concentrated on seaweed species which do not occur in KZN but are restricted to the cooler waters of the southern and western coasts of South Africa. Therefore, it remains to be determined if the approaches outlined in these studies apply to the flora of KZN.

Current legislation regarding harvesting of sea weeds in KZN

Act 58 of 1978, section 38, regarding utilization of intertidal resources on the coast of KZN states:

Subject to the provisions of section 38 of the Act, no person shall on any day collect for his own use or remove from the sea-shore more than 1 kg shells, 50 kg shellgrit or more than 10 kg aquatic plants, unless he is a holder of a permit which may be issued by the director-general (Anonymous, 1992).

One can only wonder as to how the figure of 10 kg of seaweed per person per day was determined. This amount potentially poses a considerable threat to the continued survival of many of the smaller seaweed populations (even if commercial harvesting is restricted), and ultimately the necessity for new legislation to guarantee the continued existence of many seaweed species in the KZN area may be foreseen.

RECOMMENDATIONS

From what has been discussed above there is a clear approach to be followed : when examining the seaweed resources of KZN. This approach should include taxonomic clarification, identification of applications and ecological studies to provide the scientific basis for the development of management principles, sustainable utilization and conservation. The specific order in which these topics are addressed is not crucial, but until each has been completed any resource study is deficient. Once the main area of research has been completed, further research can be planned, particularly into the fields of cultivation, physiology and genetics of the target species.

Of course all these ideas must be tempered with a realization of the present political and social situation in South Africa. Whenever possible (but not solely) research should be geared to provide for the needs of communities. We believe that seaweed resources, either through utilization of natural stocks, or through cultivation, have the potential of contributing in some way to the satisfaction of the needs of local people. Furthermore, we believe this view should not be restricted to South Africa but should extend to many African coastal communities. Southern Africa has high rates of unemployment and increasing urbanization of a largely unskilled labour force. Seaweed cultivation has the potential to provide a labour-intensive form of employment and reasonable income to coastal dwellers. Such benefits have already been observed in countries such as Tanzania and the Philippines (Mshigeni, 1992; Llana, 1993).

CONCLUSIONS

CONCLUSION In summary, the deficiencies in research outlined above have resulted in a poor understanding of the ecology of the seaweeds along the KZN coast, especially with regard to population structure and function and more importantly with regard to conservation status of the seaweed species. Furthermore, we want to emphasize that the seaweeds of the KZN coast which remain to be investigated may contain unrecognized potential, a situation that should not be overlooked.

Finally, it is believed that controlled exploitation of natural resources, in combination with appropriate mariculture technologies, would be able to provide sustainable economic stimulation to impoverished coastal communities in southern Africa.

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