

RESEARCH

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## Exploring local perceptions around the value of marine biodiversity: the case of kelp in the Western Cape, South Africa

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### ABSTRACT

Kelp are large seaweeds that provide a variety of contributions to humans and the environment. In South Africa, kelp forests are expanding as a consequence of climate change. Considering this expansion, assessing local perceptions and values around kelp's contributions may assist with the implementation of inclusive management strategies. The lack of consideration of non-market and non-use values is a gap in kelp valuation studies, with kelp ecosystems and their use rarely valued outside of classical economic valuation frameworks. This study sought to fill this research gap, intending to assess local perceptions about varied value dimensions associated with kelp using a pluralistic valuation approach. Drawing from a sample population of Recreational Users and/or Coastal Community Members, Environmental Managers and Conservationists, and Kelp and/or Abalone Industry, the study investigated perceptions of value towards kelp in the Western Cape region of South Africa. Results indicate that the perceived value of kelp extends far beyond its economic value as a harvested resource. Rather, individuals highly value kelp's ecological and social contributions, and have strong relational values towards kelp, recognizing its role in enhancing their quality of life and well-being. While most individuals did not display significant negative perceptions around kelp, some individuals in the Kelp and/or Abalone Industry indicated frustrations with kelp management strategies and kelp concession permit allocation processes. These findings highlight the need to incorporate local perceptions in integrated marine resource management solutions that recognize the plurality of values not only around kelp in the Western Cape but marine biodiversity at large.

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## 1. Introduction

Marine biodiversity enables many ecological, economic and social benefits but is vulnerable to climate change and is increasingly under threat (IPCC 2019). One example is kelp – large seaweeds that belong to the Order Laminariales and provide a variety of contributions to humans and the environment. The distribution and abundance of kelp is transforming under climate change (Bolton and Blamey 2017), affecting habitats for various species of invertebrates, fish, and marine mammals, carbon sequestration and shoreline protection (Steneck et al., 2002). In the past 50 years, there has been a global decline of kelp abundance of ~2% per year, due to the increasing number of threats faced by kelp ecosystems worldwide (Krumhansl et al. 2016). That said, changes in kelp abundance vary across regions. In Southern Africa, kelp forests occur over ~ 1,000 km of coastline in the cool nutrient-rich waters of the Benguela Current Large Marine Ecosystem (BCLME) and are expanding due to

changing conditions (Bolton and Blamey 2017). The increase in the abundance of kelp could be attributed to the increased intensity and duration of the south-easterly wind, which causes the upwelling of cool, nutrient-rich water (Bolton and Blamey 2017; Abrahams et al. 2021). The expansion of kelp in South Africa has significant management implications and brings both opportunities and threats. In different parts of the world, kelp has been used as a superfood, a biodegradable replacement for single-use plastics, livestock feed that reduces methane emissions and more (Millin 2019; Price 2020; Roque et al. 2021). These uses have not yet been mainstreamed in South Africa. As kelp continues to increase in abundance across the coastline of South Africa, it is worth looking into these opportunities and considering how they can be leveraged sustainably and equitably, to improve the livelihoods of small-scale fishers without over-exploiting the resource nor threatening the livelihoods of those who already depend on it.

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Understanding and assessing local perceptions of the value of kelp and associated ecosystems is essential for managing the use of the resource. Perception studies about marine ecosystems and biodiversity are valuable for many reasons, including their ability to inform policy and management decisions (Tonin and Lucaroni 2017). Perceptions can also be used to improve the social impact of conservation initiatives (Bennett 2016), and the extent to which local people view such initiatives as equitable or fair (e.g. Weeratunge et al. 2014). Additionally, perception studies can convey insights about the ecological impacts of a conservation initiative such as changes in species abundance, diversity and ecosystem function as well as harvest productivity. Past studies that have dealt with local stakeholders' (including local fishers') perceptions of marine resource and ecosystem governance, show that fishers' perceptions are a useful indicator to temporally and spatially track changes in marine resources (Leleu et al. 2012). In this way, perception studies are also useful in determining the value and importance of marine biodiversity for users. The relevance of perception studies in marine resource management is starting to gain recognition, with some researchers advocating for the use of locally-trained 'Perception Experts', whose role is to recognize and communicate actor perceptions in the decision-making process (Beyerl et al. 2016). As such, insights from perception studies can be utilized to continuously monitor, evaluate, and improve conservation decision-making and co-management processes.

While various studies have been conducted to understand the perceptions of marine biodiversity in South Africa, none have considered how the value of kelp is perceived locally. Rather, the few valuations that exist adopt an economic standpoint, following a monistic approach that does not incorporate the plurality of value dimensions, or place these within the context of local users. For instance, Blamey and Bolton (2018) undertook an economic valuation of kelp forests in South Africa, estimating their value to be US\$434 million, US\$144 million of which was attributed to indirect ecosystem services such as nutrient cycling, carbon fixation, and coastal protection. However, this study did not consider facets of non-use and non-market value such as the intrinsic, bequest, and cultural value of kelp. Elsewhere in the world, the value of kelp has rarely been considered outside of the economic valuation framework (Vásquez et al. 2014). While economic valuations are useful, they do not reflect the true composite value of kelp forests and all the contributions these ecosystems provide.

A critical gap in kelp valuation studies is thus the lack of consideration of plural value dimensions. This study aims to fill this research gap, with the intention

to assess local perceptions about other value dimensions and the management of kelp. A stronger recognition of the multiple values and dimensions associated with kelp is necessary to present a more encompassing picture of its contributions to people. Ultimately, the insights gleaned from this study are intended to improve kelp management objectives and frameworks in South Africa, whilst simultaneously contributing to the growing body of literature around alternative ways to understand the value/s marine biodiversity might have to a community.

## 2. Methods

### 2.1. Constructs of value pertaining to nature

Before describing the research methods, we define the concepts of perception and value to theoretically frame this work. Perceptions are 'the way an individual observes, understands, interprets, and evaluates a referent object, action, experience, individual, policy, or outcome' (Bennett 2016, p. 58). Perceptions are subjective, and are influenced by contextual factors (e.g. socioeconomics, culture, livelihoods), individual attributes (e.g. gender, race), and past experiences (Munhall 2008).

The concept of value is also subjective and can have different meanings for different people. One attempt at understanding the value dimensions of nature comes from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), that defines value as 'the **importance** of something for itself or for others, now or in the future, close by or at a distance' (IPBES 2016, p. 9). Although IPBES also recognizes other definitions of value, this study is concerned with value as importance, as defined above. As further expounded in Table 1, value itself comprises many diverse dimensions – both separate and overlapping – and a failure to acknowledge the diverse dimensions of value in terms of kelp could be detrimental to management and policy-making (Hynes et al. 2021).

### 2.2. Study area

The study area was the Western Cape province in South Africa. Here, the harvesting and use of kelp can be viewed through three lenses: recreational fishery, subsistence fishery and the commercial kelp sector.

#### 2.2.1. Recreational fishery

Recreational harvesting of kelp entails collecting kelp for private use (DAFF 2013). The recreational fishery differs from the subsistence fishery in that its primary purpose is not to feed or support the fishers and their families, but rather is focused on recreational experiences and enjoyment. In South Africa, individuals

**Table 1.** Definitions of the separate but overlapping dimensions of value. Each colour block denotes a different system of categorizing values.

Value Dimension	Definition
Held Values	These values refer to underlying situational influence, including ideals, ethics, and morals such as equality, freedom, bravery (Brown 1984; Schwartz 2006; Chan et al. 2012; Kiley et al. 2017; Gkargkavouzi et al. 2019).
Assigned Values	Assigned values refer to the relative importance humans' attribute to an entity, for example, conservation, economy, or aesthetics (Brown 1984; Schwartz 2006; Chan et al. 2012; Kiley et al. 2017; Gkargkavouzi et al. 2019).
Use Value	Use value refers to the utilitarian or material exploitation of nature and can be <i>direct</i> (e.g. food, pharmaceutical products), <i>indirect</i> (e.g. water filtration), and <i>optional values</i> (the ability to use ecosystem goods and services in the future) (Gkargkavouzi et al. 2019).
Non-Use Value	Non-use values include bequest value, which is the value of nature for future generations; and existence value, which refers to the appreciation of the existence of natural assets (Laurila-Pant et al. 2015; Kiley et al. 2017; Gkargkavouzi et al. 2019).
Economic Value	Economic value refers to the economic gains through the provision of services or resources (De Groot et al. 2002).
Socio-Cultural Value	Socio-cultural values are based on the level of mental well-being, ethical, and spiritual benefits provided by nature (De Groot et al. 2002).
Ecological Value	Ecological values relate to the contributions nature provides to support all life on Earth (De Groot et al. 2002).
Intrinsic Value	Intrinsic value refers to the inherent value of an ecosystem, independent of human utility (Chan et al. 2016; Pascual et al. 2017).
Instrumental Value	These values are anthropocentric in essence, and refer to the value that stems from the manner in which resources help to produce other things (Chan et al. 2012). Instrumental value is derivative, and can also be conditional (Sandler 2012).
Relational Value	Relational value refers to the value that is not inherent in ecosystems, but derivative of relationships and responsibilities to ecosystems (Chan et al. 2016).

wishing to collect kelp must obtain an 'Annual Recreational Fishing Permit'. According to the permit, kelp and other seaweeds fall under the category of 'Molluscs: which excludes abalone, but includes Octopus and Squid; worms and other invertebrates, and Aquatic Plants' (DAFF 2013, p. 6). While the permit allows an individual to collect up to 10 kilograms in fresh seaweed mass per day, recreational harvesting of kelp in South Africa remains low (DAFF 2013).

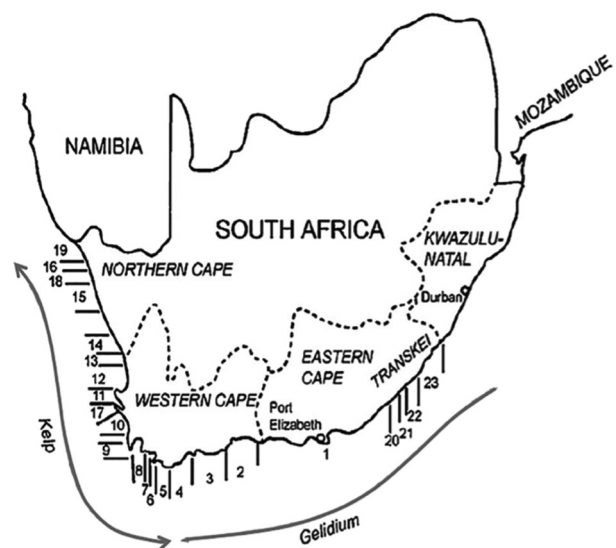
### 2.2.2. Subsistence fishery

Local and artisanal kelp foragers claim that historically, kelp was commonly used for subsistence by Indigenous coastal dwellers in South Africa (key informant, pers. comm., May, 2021). However, there is limited academic literature to quantify and/or detail the specifics of this historical use. Today, there is little to no kelp subsistence fishery in South Africa. This is due both to economic reasons and the fact that local seaweed and kelp are rarely eaten in South Africa (DAFF 2013). As such, the kelp industry is sophisticated and requires large initial investments in the form of vehicles, boats, storage space and facilities for processing. As a result, harvesting kelp in South Africa remains a commercial operation, with essentially no subsistence fishery (DAFF 2013).

### 2.2.3. Commercial kelp sector

The commercial kelp sector in the Western Cape is based on the beach-cast collection and the harvesting of kelp from kelp forests. The dominant kelp species used for commercial purposes are *Ecklonia maxima* and, to a lesser extent, *Laminaria pallida* (DAFF 2013). Currently, kelp in South Africa is managed under the Marine Living Resources Act (MLRA) of 1988, administered by the Department of Forestry,

Fisheries, and the Environment (DFFE). The South African coastline area where seaweed occurs is divided into 23 Seaweed Rights Concession Areas (SRCAs), as seen in Figure 1. Seaweed concession rights are currently allocated to harvesting and collection entities for a period of 15-years. Historically, these concession permits were only issued to large-scale commercial enterprises. As of 2016, however, DFFE also introduced a 'Small-Scale Fishing Policy' (SSFP), aimed at including small-scale fishers in the SRCA application process. These fishers were previously unable to obtain concession rights due to their inability to compete with larger commercial entities. Seaweeds were included in the group of resources to which certain small-scale fishers would be given rights (Rothman et al. 2020). As a result, in



**Figure 1.** Map of the South African coast with the 23 Seaweed rights concession areas. Areas 5–9, 11–16 and 18–19 contain kelp rights (DAFF 2013).

2017, many SRCAs were not assigned to commercial entities, but were provisionally allocated to small scale fishers under the SSFP. However, even after this policy introduction and provisional allocation, the small-scale fisheries sector has not yet been fully activated, for unknown reasons (Rothman et al. 2020). This delay has led to a pause in the harvesting of beach-cast kelp in areas provisionally allocated to small scale fishers after 2016. Ultimately, the temporary solution put in place by DFFE was to give previous rights holders (i.e. large-scale commercial entities) permission to continue harvesting in these provisionally allocated areas. As a result, the small-scale commercial harvest of kelp is virtually non-existent and small-scale fishers remain removed from the harvesting process (Rothman et al. 2020).

### 2.3. Sample population

The regions of the South African coastline where kelp forests (comprising *Ecklonia maxima* and *Laminaria pallida*) occur extend from Koppie Alleen, De Hoop, in the south of South Africa to Kleinsee, in the north of the country. Figure 1 shows this area, denoted by the arrow labelled 'Kelp'. To understand how the value of kelp was perceived, individuals who are directly or indirectly dependent on kelp across the Seaweed Rights Concession Areas within the Western Cape – specifically, Areas 5,6,7,8,9, and 11 in Figure 1 – were identified. These individuals were identified through a literature review of the local kelp 'industry' in the Western Cape, including consideration of government reports by DFFE, as well as through consultation with other researchers engaged in seaweed-related research in South Africa. Taking a cue from the 'snowball sampling' technique (Cox 2015), potential respondents were identified through recommendations from people who were considered to be local kelp 'experts'. From all those identified, 74 individuals responded to our requests to participate in this study. Thus, the sample population consisted of 74 individuals who directly or indirectly depend on kelp. The identified individuals were broadly grouped based on their relationship with and use of kelp:

#### 2.3.1. Recreational Users and/or Coastal Community Members

This group comprised individuals who were members of coastal communities and/or used kelp primarily in a recreational and/or personal capacity. They included individuals who owned property close to the coast, volunteers from coastal community 'stakeholder meetings', members of dive clubs, members of recreational angling clubs, and kelp foraging groups. In total, there were 24 individuals in this group.

#### 2.3.2. Environmental Managers and Conservationists

This group comprised academics, individuals involved with the research and conservation of biodiversity (either through the government or through non-governmental organizations) and/or the government-appointed environmental management of kelp. Occupations of individuals in this category included individuals working for CapeNature,<sup>1</sup> World Wide Fund for Nature (WWF),<sup>2</sup> South African Shark Conservancy,<sup>3</sup> and others. In total, there were 20 individuals in this group.

#### 2.3.3. Kelp and/or Abalone Industry

This group comprised individuals whose livelihoods directly depended on kelp, either as a resource or ecosystem. It consisted of workers from kelp companies, including kelp harvesters, kelp processors, kelp tumblers, beach-cast kelp collectors, skippers, and kelp company management executives. It also included small-scale fishers, abalone divers, and abalone poachers, who rely on kelp for their daily catch. In total, there were 30 individuals in this group.

### 2.4. Data collection and analysis

Data were collected in two stages: first, through the use of questionnaires distributed to the sample population, and second, through semi-structured key informant interviews.

#### 2.4.1. Questionnaires

The questionnaires were modelled on the IPBES conceptual framework, as one of the many ways to contextualize the interactions between people and nature. The IPBES conceptual framework is centred around three foci of value: Nature, Nature's Contributions to People, and Quality of Life (Pascual et al. 2017). The questionnaire was framed using IPBES' foci of value across the various value dimensions discussed in Table 1.

Participants were asked about their knowledge, attitudes and perceptions towards kelp and its contributions to people, to understand the perceived sources of kelp's value. Participants were also asked to elaborate on perceived opportunities and threats from kelp. The questionnaire was predominantly multiple-choice, and participants were able to choose more than one response from the list of provided contributions. Text boxes were provided for any additional inputs from respondents. There was also a smaller set of open-ended questions that respondents were able to answer freely to gain qualitative insights on perceived value. To gauge the presence of relational, intrinsic and bequest values of kelp, participants were also asked to rate statements on a 5-point Likert scale. Prior to answering the questions, participants were briefed about the background

and objective – to understand how the value of kelp is perceived – of the study. Characteristics relating to the individuals' socio-demographics were recorded. The questionnaire is available in Appendix I.

The quantitative data resulting from the questionnaire were used to create graphical representations of peoples' perceptions of value. Descriptive statistics were used to summarize the data, and these initial insights were used to guide the key informant interviews. Cronbach's alpha was run as a measure of internal consistency amongst relational, intrinsic and bequest values of kelp.

#### 2.4.2. Key informant semi-structured interviews

After the questionnaire was disseminated and data were analyzed, semi-structured interviews were held with a selection of key informants to qualitatively contextualize the data insights from the questionnaire results. Semi-structured interviews were selected as appropriate due to their exploratory and subjective nature.

The choice of key informants was based both on their expertise and knowledge around kelp, as well as the willingness of respondents to partake in an interview. Like the sample population, key informants were identified through literature reviews, discussions with individuals in the kelp sector, and through recommendations of identified individuals who were considered knowledgeable about kelp (Cox 2015). A total of nine semi-structured key informant interviews were conducted.

Due to the varying backgrounds, roles, and expertise of the key informants, questions were tailored for each informant, but based on common themes. Each interview thus consisted of questions based on insights from the questionnaire relevant to each key informant's field of expertise, as well as some general opening questions about their relationship with and feelings toward kelp. The interview guide for the key informant semi-structured interviews is available in Appendix II. The key informant interviews were transcribed and uploaded into NVivo – a qualitative data

analysis software – for in-depth textual analysis and the arrangement of data into different themes.

### 3. Results

#### 3.1. Socio-demographic characteristics

Table 2 details the sociodemographic characteristics of the respondents. The majority of the respondents (72%) were male. The ages of respondents ranged from 18 to 60 years old, with the median age of the respondents being 40.5 years old. Almost three-fourths of all respondents (70%) lived by the coast in coastal towns or less-formal coastal settlements, within 10 km of the coast.

#### 3.2. Instrumental values from kelp's contributions to people

Table 3 details the proportion of respondents that assigned importance to each of kelp's various contributions, illustrating its high instrumental value. Most respondents valued kelp for its ability to create and maintain a healthy marine and coastal environment (89%), and for its provision of habitats for abalone, rock lobster, and other fish or invertebrates (81%). As such, kelp's regulating contributions to people were perceived to have the most value, further evidenced by qualitative findings. One respondent articulated this value as follows:

We appreciate that kelp provides a range of ecosystem services benefits to the city (Cape Town). It is quite well researched, and that is, it provides a role in trapping sand and elevating beach profiles, which is useful to mitigate against coastal erosion. And in an urban context, that's important because we do have large sections of our coastline that are developed and there is coastal property and infrastructure public infrastructure that is fairly close to the high-water mark. (Respondent, Environmental Managers and Conservationists, May 2021)

**Table 2.** Sociodemographic characteristics of the respondents. The median is shown for certain characteristics, namely, age, years in stated occupation, breadwinners, dependants and years in residence area. Education levels (less than Grade 12, Bachelor's degree or higher), gender (male, female) and whether one lives in a coastal residence area are reported as both, a proportion of the sample population (%) and the actual number of respondents fitting each of these characteristics (n).

Sociodemographic characteristic	Sample Population (n = 74, 100%)
Median age (years)	40.5
Median number of years in stated occupation	11
Median number of breadwinners in the family	1
Median number of dependants	3
Less than Grade 12	n = 22, 31%
Bachelor's degree or higher	n = 28, 38%
Male	n = 54, 72%
Female	n = 20, 27%
Coastal Residence Area (within 10 km of coast)	n = 52, 70%
Median number of years in stated residence area	12.5

**Table 3.** Perceived aggregate value (across all actor groups) of kelp's contributions to people. Viewing this data as a whole allows for a general indication of how kelp's contributions are perceived, highlighting contributions of value that transcend the differing relationships each individual/Actor Group has with kelp.

Kelp's Contributions To People	Aggregate Perceived Value (% of respondents)
<b>Regulating contributions</b>	
It creates and maintains a healthy marine and coastal environment	89%
It regulates air and water quality and improves the climate	38%
It absorbs pollutants	39%
It can increase my safety from extreme natural events	38%
It provides a habitat for abalone, rock lobster, and other fish or invertebrates	81%
It is not important to me for any of the above contributions	0%
<b>Material contributions</b>	
It provides energy, such as fuel from dried kelp	27%
I can consume it as an alternative source of food	47%
It is a source of food and feed for domestic animals	39%
It provides important medicinal and/or genetic resources	21%
It is used in materials like paint and cosmetic products	22%
It contributes to my livelihood and/or job satisfaction	45%
It allows me to procure abalone	5%
It is not important to me for any of the above contributions	14%
<b>Non-material contributions</b>	
It is a source of learning and inspiration for me in terms of art and design	23%
It provides opportunities for recreation that give me physical/psychological satisfaction	45%
It plays a role in my social life	26%
I associate kelp with influential childhood experiences	42%
It supports my religious and/or spiritual identity and plays a role in rituals, and celebrations.	4%
It increases my enjoyment of the sea and/or coast	64%
It is not important to me for any of the above contributions	8%

Another respondent further highlighted kelp's regulating contributions and resulting impacts on abalone farming:

Kelp has also got its importance as an—I'm not going to use the right words here—an ecosystem regulator. Maybe I'm using the wrong words, but because we [abalone farm] are a flow-through operation, we rely on the water that's coming out from the sea, and that the water is of good quality. So you know, the kelp and the kelp beds then form an important part of protecting the water in front of us, and ensuring that the water is as healthy as it can possibly be. So it's got huge direct and indirect benefits to us. (Respondent, Kelp and/or Abalone Industry, June 2021)

Specific non-material and material contributions of kelp were also assigned value, albeit at a lower frequency than its regulating conditions as denoted by the broad ranges of each group of NCP. Although kelp's various contributions to people were valued at different degrees of importance, the perceptions of kelp's high instrumental value were evident through the results detailed in Table 3:

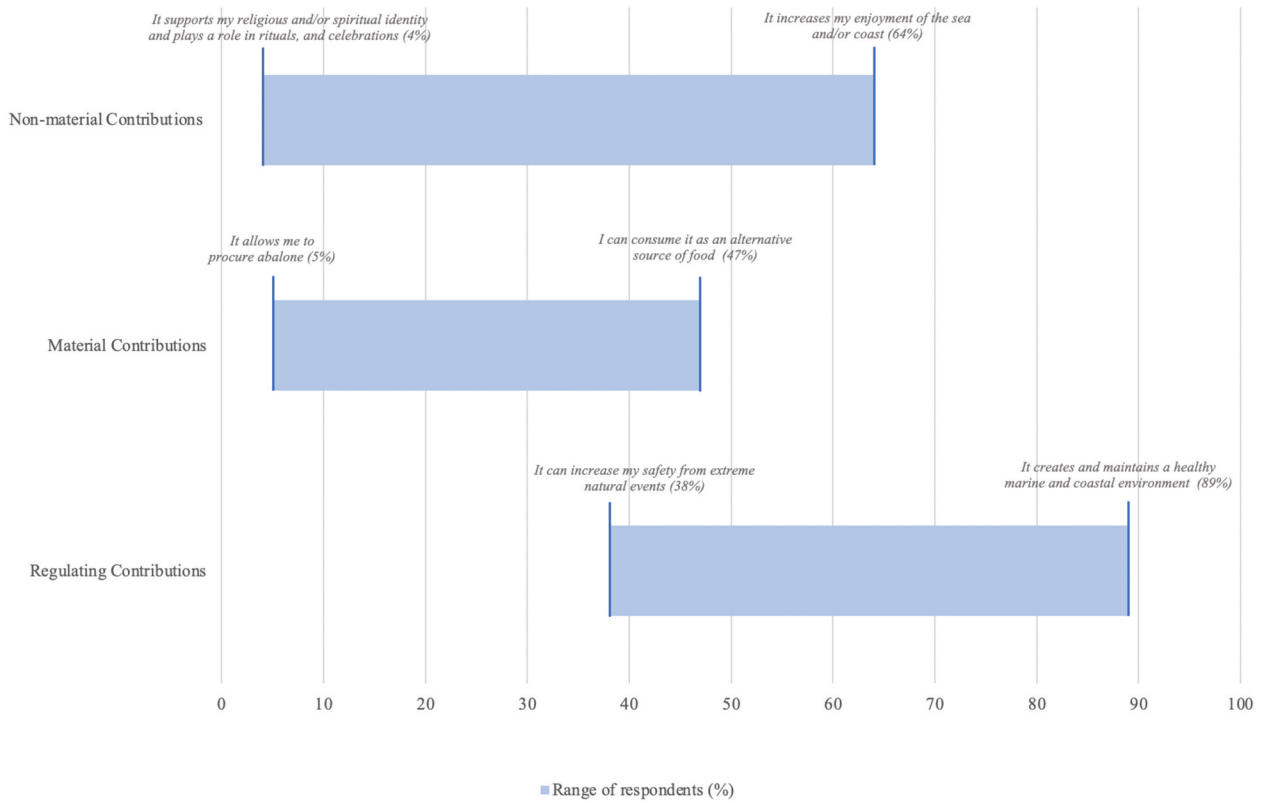
For each broad category of NCP, the range, denoting the contributions that were assigned importance at lowest and highest frequencies is shown in Figure 2. This allows for a better understanding of the perceived value of kelp's contributions. The denoted range discounts the response option 'It [kelp] is not important to me for any of the above contributions'. This response option is considered separately beyond the above typology of values, as the option does not measure kelp's contributions but rather the perceived lack of them.

### 3.3. Kelp as a focus of intrinsic and relational value

The presence of relational, intrinsic and bequest values of kelp is detailed in Table 4. These values were seen to be highly correlated, as shown by the high Cronbach's  $\alpha$  value of 0.78. The mean response was that of agreement to the statements associated with each value dimension. Table 5 further describes these findings, showing the proportion of responses in agreement (i.e. 'Agree' or 'Strongly Agree' on the Likert scale) with statements of relational, intrinsic and bequest value. The results show that respondents deemed kelp's bequest value (89%) as very important, followed by strong relational values towards kelp (88%).

This is not surprising, given that the prevalence of relational values towards kelp continues to be seen through individuals' responses to other questions in the questionnaire. Relational values were brought to light through some of the qualitative responses like 'Kelp is important and should be valued and protected as a critical and beautiful environment' or 'Kelp is important to me because conserving and caring for nature is important to me', and also through frequent indications by individuals that kelp 'plays a role in community life' and/or 'contributes to my lifestyle'.

Similarly, both quantitative and qualitative findings show that most people (80%) perceive kelp to have high intrinsic value. One recreational actor's response succinctly captures the general feeling around the intrinsic value of kelp: 'Quite simply it is one of the most important ecosystems in the world' (pers. comm., April 2021).



**Figure 2.** Range of respondents who identified value in the different broad categories of NCPs: Non-material contributions, material contributions, regulating contributions.

**Table 4.** Perceptions of non-use value for the sample population of 74 actors; SDi: strongly disagree; Di: disagree; N: neither; Ag: agree; Sag: strongly agree. All items were measured in a 5-point Likert scale; Mean of each factor is computed by averaging the items of the corresponding factor. Cronbach’s  $\alpha$  — a measure of internal consistency showing how closely related a set of items are as a group — is also shown. In this study, the high alpha value (0.785) shows that the dimensions measured are closely related.

Statements	Responses (%)						Mean
	Unanswered (0)	Sdi (1)	Di (2)	N (3)	Ag (4)	Sag (5)	
Relational value: ‘I have a moral and ethical obligation to protect kelp forests’.	1%	5%	0%	5%	24%	64%	4.36
Intrinsic value: ‘My seaside experience depends on the knowledge that kelp is flourishing’.	3%	1%	1%	15%	39%	41%	4.08
Bequest value: ‘Kelp is important to me because of its value to future generations’.	3%	3%	3%	3%	28%	61%	4.34
Cronbach’s $\alpha = 0.785$							
Mean = 4.26							

**Table 5.** Positive perceptions of kelp’s relational, intrinsic, and bequest value.

Perceptions of ‘Kelp’ as a foci of value	Aggregate % of respondents in agreement (Ag, Sag)
Relational value: ‘I have a moral and ethical obligation to protect kelp forests’.	88%
Intrinsic value: ‘My seaside experience depends on the knowledge that kelp is flourishing’.	80%
Bequest value: ‘Kelp is important to me because of its value to future generations’.	89%
<b>Range</b>	<b>80–89%</b>

### 3.4. Negative perceptions around kelp

Individuals were also asked about whether there was anything that reduced their perceived value of kelp (and if so, what the source of these negative perceptions entailed) to identify and assess key frustrations around kelp in the Western Cape. Interestingly, 54% of responses across actor groups indicated that

nothing reduced their appreciation of kelp, with 76% of responses stating that kelp created no threats. Table 6 shows these results in greater detail.

Based on these results, one can infer that most local people hold kelp in high regard and were not threatened by it. Importantly, the main reasons for a diminished appreciation of kelp were issues of

**Table 6.** Negative perceptions around kelp, further detailed by reasons for the reduction of appreciation of kelp and threats from kelp. The range discounts the options ‘None of the above reduce my appreciation of kelp’ and ‘It [kelp] does not create any threats for me’ since these statements do not measure negative perceptions towards kelp, but rather the perceived lack of them.

Negative perceptions around kelp	Aggregate Perceived Importance (% of respondents)
<b>Reasons for the reduction of appreciation of kelp</b>	
Mechanisms of control and rules of access around kelp (e.g. harvest control and regulations)	9%
Issues of power and inequality in the kelp sector	15%
Its odour and unsightly looks	14%
Its ability to take away from my recreational enjoyment of the sea/coast	14%
None of the above reduce my appreciation of kelp	54%
Other	3%
<b>Range</b>	<b>3%-15%</b>
<b>Threats from kelp</b>	
Kelp limits my recreational opportunities	5%
Kelp limits my livelihood/business	1%
Kelp negatively affects my experience of the coast and/or ocean (e.g. unsightly, smelly, etc.)	8%
Kelp scares me when I come across it while swimming	1%
Kelp does not create any threats for me	76%
Other	5%
<b>Range</b>	<b>1%-8%</b>

power and inequality in the kelp sector (15%). On further analysis, it was found that this statistic was largely a response from respondents within the Kelp and/or Abalone Industry group. Twenty-seven percent of individuals within this group indicated that issues of power and inequality in the kelp sector resulted in their reduction of appreciation of kelp. However, on further probing, Kelp and/or Abalone Industry group was reluctant to provide detail, often reverting to statements like ‘*it’s just like that*’, or ‘*it’s the honest truth*’ (April 2021). One cannot say whether this was due to a sense of trepidation because of being recorded, whether this was a result of translation problems, or a sense of uneasiness about talking about these issues. Historically, the Abalone Industry has had aspects of ‘cheap labor’ linked to coastal communities involvement (Troell et al. 2006).

Nonetheless, insights about possible power imbalances and inequality were provided by key informants:

Inequality in South Africa can be regarded as a ‘wicked problem’. Therefore, there will always be South African persons perceiving that they are treated unfairly regardless of the measures put in place to ensure that everyone is given the opportunity to participate in the seaweed rights allocation process to some degree, and the opportunity to apply for seaweed rights of which the applications are subjected to the assessment process. Hence, some would be granted the rights, and some would not. Those that are not granted the rights or did not apply for them would always regard themselves as being treated unfairly. (Environmental Manager, pers. comm., May 2021)

Issues of power and inequality pertaining to kelp management and permit allocations were regarded as the main reasons for a reduction of appreciation of kelp. While there is no denying that these dynamics need to be explored in future research, when considered in the context of the assignment of values of kelp and its contributions, most respondents felt these factors did not

reduce their perceived value of kelp. As such, the value assigned to the benefits from kelp and its contributions was seen to far outweigh any negative perceptions.

#### 4. Discussion

Our study brings attention to the complex and diverse values and local perceptions around kelp in South Africa. It reveals that kelp is perceived by users and managers to have high intrinsic and instrumental value, particularly due to its regulating ecological contributions, such as maintaining a healthy marine and coastal environment. Contributing to its high instrumental importance, kelp was valued for its material contributions, specifically in supporting livelihoods. These findings are in line with other research on marine biodiversity highlighting the overlapping prevalence of perceived instrumental, intrinsic, and relational values of aspects of nature. For instance, a study investigating perceptions of marine biodiversity conservation in the Kogelberg Biosphere Reserve in the Western Cape showed that two main themes – a ‘scientific management-based ecological approach’, and a ‘livelihoods discourse’ – emerged, illustrating the impact of variation in how values were assigned to biodiversity in the reserve (Hagan and Williams 2016). Our study also showed that 80–89% of local people recognized kelp for its intrinsic and bequest value, with 88% of people indicating a sense of stewardship through a moral and ethical obligation to protect kelp forests. Similarly, a recent study to assess the interest of recreational divers in kelp monitoring revealed all to strongly support the protection of kelp (Lucrezi 2021).

Perceptions of kelp management were a particular concern, largely a result of the country’s social, cultural, and political landscape. The largest contributor to



people's frustrations around kelp were issues of power and inequality in the seaweed sector, experienced predominantly by Kelp and/or Abalone Industry (27%). Specifically, frustrations were noticed around the lack of inclusion of small-scale fishers in the permit allocation process as well as inadequate consultation of provincial and local spheres of government in the kelp rights allocation process. The livelihoods of kelp harvesters are dependent on their employment by larger commercial entities that can obtain permits to access kelp, even in areas provisionally allocated to small-scale fishers. Sowman and Sunde (2021) affirm these concerns more broadly in the small-scale fisheries sector in South Africa, and attribute the disjuncture between the development and implementation of a new small-scale fisheries policy in South Africa to a lack of ongoing engagement and collaboration with stakeholders and the top-down manner in which concession permits are assigned. A lack of genuine consultation to enable a new small-scale fisheries sector policy – has meant that local perceptions have not been systematically integrated into planning and decision-making (Sowman and Sunde 2021). Reports at the provincial and local level also echo our findings about perceptions of kelp management, noting that planning around the advertisement and allocation of the fishing rights and concessions does not take the full life cycle of harvesting activity into account, thus causing conflict amongst kelp users, as well as environmental disturbances (Green and de Villiers 2016).

Previous studies have also expounded that the slow pace of fisheries transformation in South Africa has prioritised big business over local communities, leading to frustration among fishing communities along the coast, and a phenomenon known as 'protest fishing' (Norton 2015). Here, fishers question the authority of compliance and enforcement officials, and continue to fish beyond allocated quotas, thus using fishing as a form of protest, fuelled by a sense that catch allocations were unjust and only favoured big businesses. In turn, the implementation of the MLRA, under which kelp is governed and managed, went through a period of militarisation that justified the use of weapons by compliance officers because of the threat of violence against them. Consequently, the enforcement of the MLRA and subsequent policies have been widely criticised as 'criminalising many in the small-scale fishing sectors' (Norton 2015, p. 339). Similarly, if the opportunities from kelp are leveraged without adequate considerations of governance and access rights, South African kelp could end up disenfranchising those who are most dependent on it. Hostile outcomes such as these can be avoided through the recognition of local perceptions in marine management options.

While only 9% of individuals cited mechanisms of control and rules of access around kelp as something that reduced their appreciation of kelp, qualitative findings brought the struggle for inclusivity in kelp

management to light. Concession permits are only issued at the national level through DFFE and are not always communicated to the local and provincial spheres of government. However, while provincial and local spheres of government have no mandate in the management of the kelp, they are involved in the management of coastal areas which entails beach cleaning and the retaining or clearing of kelp from beaches. As a result, provincial and local government bodies often run into problems with kelp rights holders when monitoring the beaches because these government bodies are sometimes not made aware of newly issued concession permits and renewed conditions:

So, there's still a point of friction between the way that we manage kelp and, specifically rights holders removing kelp from our "no kelp clearing" areas. And I do believe there's still some friction there that's unresolved. The discussion surrounding that exact point is always really difficult [...]. And every now and again, the problem does crop up when we do find rights holders removing kelp from beaches where they're not meant to. And that's problematic for us because those beaches are erosion hotspots. (Environmental Manager, pers. comm., May 2021)

In this way, the absence of inclusive consultation and collaboration has resulted in the implementation of policy provisions that are ill-suited to biological and local socio-ecological contexts. Another example of this is seen in the management of recreational kelp collection, which bizarrely is governed under the category of 'Molluscs: which excludes abalone but includes Octopus and Squid; worms and other invertebrates, and Aquatic Plants' (DAFF 2013, p. 6). This policy statement is not only irrational in a framework of even the most rudimentary principles of biological classification (i.e. in no way are worms, 'other invertebrates', or aquatic plants molluscs), but it is also blind to the major biological and ecological differences between members of the Kingdom Animalia (which include molluscs, 'worms' and 'other invertebrates') and the Kingdoms that contain the aquatic plants that should be considered in deciding how these different resources from marine biodiversity must be managed. This demonstrates a lack of tailoring of policy provisions with regards to contextually relevant knowledge of kelp, or even biological facts and common sense more generally.

Considering local perceptions and the diverse dimensions of the value of marine biodiversity can assist in avoiding undesirable generalized outcomes like these. Rather, the integration of local perceptions of marine biodiversity can promote contextually relevant outcomes that are more likely to be accepted by local communities, given that they are formed around individual and community values and perceptions (Bennett and Dearden 2014; Bennett 2016; Beyerl et al. 2016; Tonin and Lucaroni 2017).

The results of this study bring attention to dynamics around kelp in South Africa that may never have surfaced without the incorporation of holistic and inclusive approaches in understanding nature. If anything, the complex values around kelp in South Africa underscore the recognition that ecological and social systems are not separate entities, but rather, are innately entwined (Sanborn and Jung 2021). This study makes the case for the acknowledgment of diverse sources of value from nature in marine resource management, looking beyond economic valuation studies alone. As evident from the literature cited above, the value/(s) of kelp forests have not been examined outside of an economic valuation approach. However, reducing the value of a nature to its monetary worth alone can disregard the multiple ways in which people relate to nature and express its importance. Our study fills this gap in South Africa through the consideration of the perceived value of kelp forests and their contributions to people through the assessment of human perceptions, and can be used as a model to elicit understandings around the diverse value dimensions of kelp forests around the globe. These findings can be used to supplement information gained from economic valuations of kelp and assist in making inclusive and relevant resource management decisions.

## 5. Conclusion

Our study shows that the instrumental value of kelp – through its ecological, economic, social, and cultural contributions – was perceived to be high amongst respondents. Kelp's most valued contribution was seen to be its ability to create and maintain a healthy marine and coastal environment, with 89% of respondents choosing this contribution as important. Kelp was also seen to have high intrinsic, bequest and relational values, with over 80% of respondents recognizing its value for future generations, as well as signifying that they felt an ethical obligation to protect kelp forests. Finally, the majority of respondents did not express significant frustrations around kelp and were not threatened by it. The importance of kelp – whether in terms of its intrinsic value, instrumental value or relational value – is thus clearly evident through our findings. Even so, our study brought to light local frustrations with the management of kelp that can reduce appreciation of this ecosystem. While considering the sample population as an aggregate did not indicate a significant presence of issues and frustrations around kelp management, delineating results by 'actor group' revealed that 27% of Kelp and/or Abalone Industry group had concerns about issues of power and inequality in the kelp sector. Crucially, frustrations around the management of kelp were mostly signified by the group

that is arguably most closely involved with kelp – Kelp and/or Abalone Industry. In this regard, further research is needed to understand perceptions around the power dynamics and governance of kelp in South Africa, as well as socio-economic causal linkages which were outside the scope of this study.

The goal of sustainable marine ecosystem and resource management relies deeply on understanding the interactions of individual worldviews and values ascribed to nature and its contributions, and the consequent assimilation of these diverse viewpoints into marine policy (Pascual et al. 2017). However, there are no studies in South Africa that consider how local people attribute importance towards kelp. Thus, our work can aid in informing constructive policymaking around kelp. Our findings can be of use to policymakers for the implementation of effective management and conservation strategies that include communities' perceptions and take social complexities into account (Hawkins et al. 2016). This is especially important given the increased abundance of kelp across the South African coastline as the climate changes, and the new opportunities that it provides (Bolton and Blamey 2017). Through the consideration of diverse and plural values around marine biodiversity, we hope that our research will be of use in the future management and governance of kelp to promote equitable, sustainable, and inclusive management and use of marine biodiversity.

## Notes

1. CapeNature is a public entity that promotes and ensures biodiversity conservation in the Western Cape. Cape Nature manages complexes made up of 113 nature reserves and wilderness areas, including six Marine Protected Areas (the latter on behalf of the national Department of Forestry, Fisheries and the Environment).
2. WWF is a independent conservation organization.
3. The South African Shark Conservancy (SASC) is an NGO based in Hermanus, Western Cape that works to promote the sustainable use and informed conservation of living marine resources.

## Author contribution

Akshata Mehta led the conception and design, the collection of data, analysis and interpretation of data and writing of the research reported here. Prof. Albertus J Smit and Prof. Rachel Wynberg contributed to the conception and design of the research and provided guidance in terms of writing, statistical analyses, and the final draft of the manuscript. Chantal Ramcharan-Kotze provided guidance in the conceptualization of this study and review of recommendations. All authors approved the submitted version of the article.

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