The Economic Value of the Ecosystem Services Provided by the UThukela MPA and Associated Coastal and Estuarine Systems

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Cover Photo: A pair of double sash butterfly fish resting in the arms of a black coral tree at 50m off Mtunzi. (Source: www.marineprotectedareas.org.za)

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The economic value of the ecosystem services provided by the uThukela MPA and associated coastal and estuarine systems

Deliverable #5: Economic valuation document

Prepared for WildTrust
by Conservation Strategy Fund

Marcello Hernández-Blanco, Mark Gerrard, Felipe Gandra, Wadzanai Mafunga
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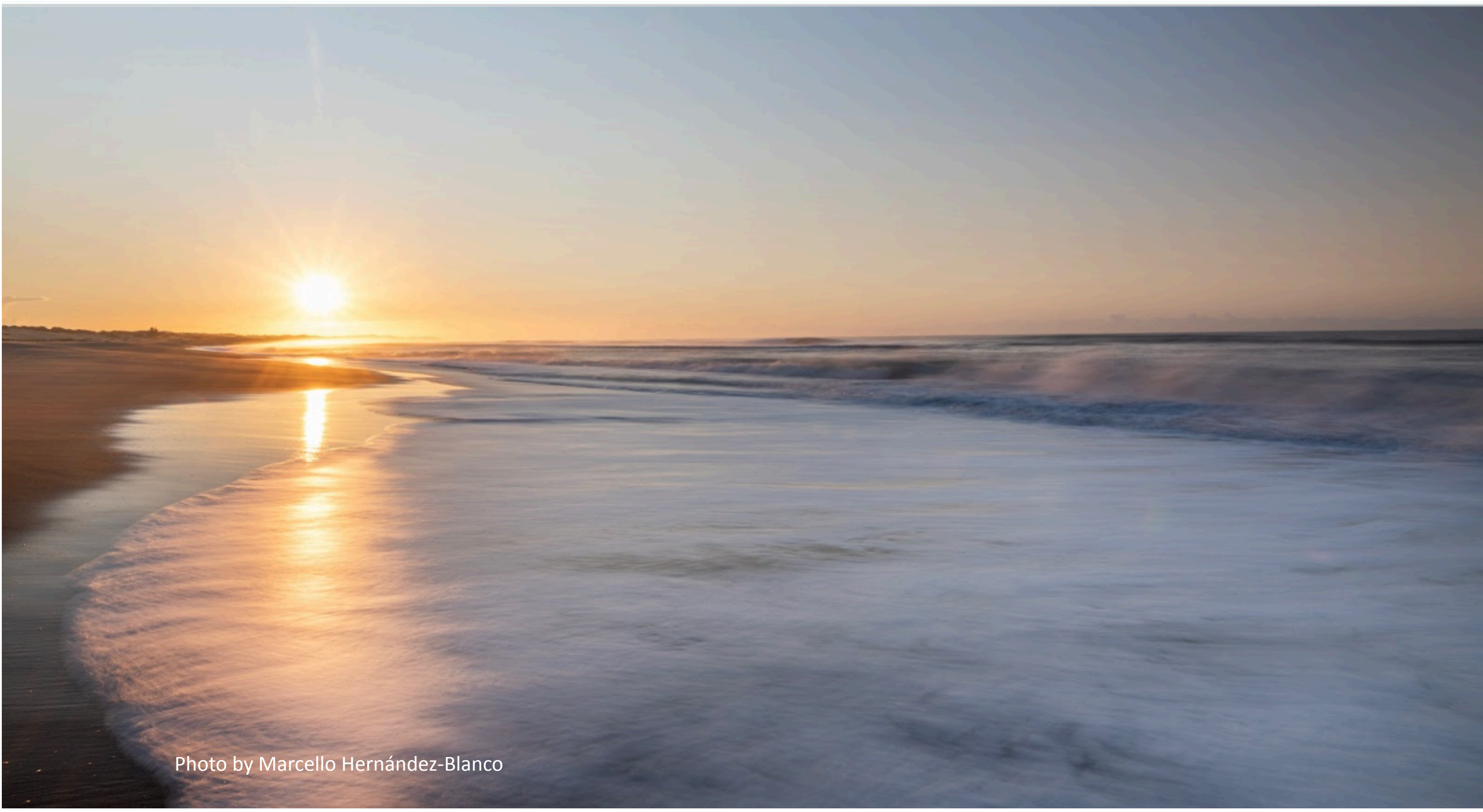

Photo by Marcello Hernández-Blanco

Table of contents

Executive summary

This report provides a baseline economic valuation of ecosystem services associated with the uThukela Marine Protected Area (MPA) and adjacent coastal and estuarine ecosystems in KwaZulu-Natal, South Africa. The valuation is intended to support government decision-making (planning, budgeting, compliance, and management prioritization) and to inform sustainable financing pathways for long-term protection and restoration. Values are presented in Int$ (2025) for the coastal ecosystem, fisheries and tourism valuations. For coastal ecosystems, Net Present Value (NPV) is estimated over a 100-year horizon at a 2.5% discount rate.

The analysis combines site-specific valuation of human uses within and around the MPA (recreational fishing, small-scale/subsistence fishing, marine tourism, and commercial fisheries based on available monitoring and secondary data) with an expert-modified value transfer assessment for key coastal ecosystems adjacent to the MPA. For coastal ecosystems, per-hectare per-year values were extracted from the Ecosystem Services Valuation Database (ESVD), applied to mapped ecosystem extents, and then refined through an expert and stakeholder validation process to better reflect local service delivery and beneficiary context.

Aggregating across ecosystem services and mapped extents, the original (unfiltered) ESVD-based valuation for the six coastal ecosystems adjacent to the uThukela MPA is 28,564,858 Int$ (2025) per year, corresponding to an NPV of 1,048,876,729 Int$ (2025). Estuaries contribute the largest share of annual value, followed by coastal forests and swamp forests. After expert spatial filtering and validation, the expert-modified valuation is 16,683,164 Int$ (2025) per year, with an NPV of 610,839,128 Int$ (2025). Under the expert-modified results, the largest contributions come from estuaries at 8,491,068 Int$ (2025)/year (NPV 310,892,860 Int$), coastal forests at 4,979,054 Int$ (2025)/year (NPV 182,303,625 Int$), and foredunes at 1,412,168 Int$ (2025)/year (NPV 51,705,277 Int$). Overall, regulating services dominate the estimated value, reinforcing the economic importance of maintaining estuarine condition, coastal vegetation integrity, and dune stability as part of the broader land–sea system that supports the MPA.

For fisheries and tourism, the report indicates that recreational angling generates material economic activity through travel behavior and related expenditures. Travel-cost estimates suggest average annual travel expenditures for recreational anglers accessing launch sites within the MPA in the order of approximately 1–2 million Int$ (2025)/year, underscoring the MPA's role in sustaining recreation-linked economic activity. For small-scale and subsistence fisheries, focus group discussions and monitoring data confirm strong livelihood and cultural reliance on marine resources, but quantified results of ~22,272 Int$ (2025)/year based on available monitoring windows should be interpreted as conservative lower-bound estimates due to limited temporal coverage and data constraints. Marine tourism activity is comparatively limited in the available datasets; charter fishing is the most consistently documented segment, with estimated annual revenues in the range of approximately 30,932–53,026 Int$ (2025)/year. For commercial fisheries, the mean annual economic value of recorded activity within the uThukela MPA is estimated at 84,032 Int$ (2025)/year, with value concentrated among a limited set of species and areas.

The valuation provides an evidence base to justify sustained investment in enforcement, monitoring, and habitat condition as public goods; to strengthen marine spatial planning by highlighting where benefits concentrate and where degradation could cause disproportionate losses; and to orient management toward measurable outcomes such as estuary health, vegetation cover, dune stability, and fish abundance proxies. The magnitude and composition of benefit flows—particularly those linked to coastal protection, hydrological regulation, and ecosystem condition—also strengthen the case for diversified funding aligned with resilience and nature-based coastal protection finance, user-linked mechanisms where appropriate with transparent reinvestment into management, and performance-based models that link funding to ecological indicators and management outcomes. These values represent the economic importance of ecosystem services rather than directly monetizable revenues, and care is required to avoid double counting across benefit categories and to interpret results in light of data limitations. The report should be treated as a baseline for decision support and financing design, to be strengthened through improved time-series monitoring, broader coverage of fishing activities, and additional local empirical valuation where feasible.

A decision-use summary translating valuation insights into policy and financing actions is provided in Table 18 (Conclusion section).

1. Introduction

Over the past few years, the economic valuation of ecosystem services (ES) has gained significant traction, driven by the need to recognize the multiple benefits we obtain from nature in order to make better policy and business decisions. While some argue that valuing intangible environmental goods, particularly those without formal markets is complex or even impossible (Morse-Jones et al., 2011), others, like Constanza et al. (1997), assert that such valuation is not optional but essential.

ES valuation enhances societal recognition of natural capital's worth, thereby preventing overexploitation, ensuring equitable distribution, and facilitating efficient resource allocation (Liu et al., 2010). Although ES valuation encompasses both monetary and non-monetary approaches, this study focuses on a monetary valuation of the ecosystem services provided by the uThukela Marine Protected Area (MPA). This approach enables direct comparison of natural capital with human and physical capital, facilitating clearer assessment of trade-offs and policy impacts. It also allows for analysis of how costs and benefits are distributed across stakeholders, a critical consideration for equitable decision-making.

The WildTrust, through its WildOceans Programme, in collaboration with Ezemvelo KZN Wildlife and the Ocean Risk and Resilience Action Alliance (ORRAA), commissioned this economic valuation for the uThukela MPA. This initiative aims to integrate ecosystem services into planning and decision-making processes, ensuring their continued provision for local communities and the global society. Additionally, the study informs the development of financial instruments to support conservation and restoration strategies, securing the long-term sustainability of these critical marine ecosystems.

MPAs are established worldwide to safeguard ecosystem functions, preserve biodiversity, and sustain the flow of ecosystem services (Leenhardt et al., 2015). South Africa has a total of 42 MPAs, 41 within its mainland ocean territory and one expansive MPA, the Prince Edward Islands MPA, designated in 2013 within the Southern Ocean territory. Among these, the uThukela MPA stands as one of the 20 MPAs officially proclaimed in 2019 (uThukela MPA management plan, 2020). MPAs provide a wide range of ecosystem services, including food provisioning through fisheries, climate regulation, recreation and tourism opportunities, spiritual values and coastal protection facilitated by seagrass beds and mangrove forests, among many others (Leenhardt et al., 2015).

MPAs serve as vital management instruments that balance conservation with sustainable use through carefully designed zoning systems. These typically include both multi-use areas and strictly protected no-take zones where all extractive and non-extractive activities are prohibited. The uThukela MPA is no exception with its distinct inshore and offshore zones each with specific regulations governing permissible activities. The following section briefly describes these zone-specific restrictions, along with an overview of the MPA and coastal strip's key biophysical characteristics and ecological features.

This study aims to quantify the economic value of the benefits provided by the uThukela MPA, as well as those from key coastal ecosystems adjacent to the MPA, offering deeper insight into both their ecological importance and financial contribution. The economic valuation detailed in this document is intended to inform (i) sustainable financing products and (ii) government authorities on the importance and value of protecting these areas.

2. Methods

2.1 Study area

The uThukela MPA is located in the KwaZulu-Natal province on the subtropical east coast of South Africa. It includes the uThukela Estuary, the adjacent shoreline, and parts of the offshore waters within the KZN Bight. The protected coastline covers approximately 80 km, with the total area of the uThukela MPA spanning about 4,094 km² and incorporating the substrata, seabed, subsoil and water column within defined boundaries. Its boundaries stretch from 4 km north of the uMlalazi Estuary (near Port Durnford) southward to 400 meters beyond the Seteni Estuary (see Figure 1). Extending 37 km offshore in the north and 50 km offshore in the south, the MPA reaches depths of 500 meters (uThukela management plan, 2020).

The MPA is divided into various zones, each governed by its own set of regulations. It has two inshore and three offshore controlled zones, two inshore and one offshore restricted zone, a controlled pelagic fishing zone and a controlled offshore commercial fishing zone. No extractive resource use is permitted in the restricted zones and vessels must not anchor (except emergencies), fishing gear must be stowed and a boat cannot stop for more than 3 minutes. The controlled zones allow for extractive resource use, e.g. spearfishing, harvesting of invertebrates or netting provided one has a permit. Boat-based night fishing is generally prohibited except in the commercial controlled zone with a special permit (uThukela management plan, 2020).

In the uThukela MPA, different forms of fishing take place in the estuary including subsistence fishing for food security. Recreational, small-scale, and subsistence line fishing is allowed in the inshore and offshore controlled zones of the MPA, with fishing for specified pelagic species permitted only in the controlled pelagic line fish zone. The shoreline and offshore waters between Richards Bay and Durban are heavily utilized by recreational line fishers, alongside a smaller number of small-scale fishers (uThukela management plan, 2020). Commercial line fishers with limited rights operate along the KwaZulu-Natal coastline, targeting demersal species such as sparids, sciaenids, and serranids. Line fishing is permitted within the controlled zones of the uThukela MPA, including offshore controlled and commercial zones. Spearfishing is practiced by a small group between Richards Bay and uMvoti, although underwater visibility is often poor due to sediment from rivers. Spearfishing is allowed in the inshore and offshore controlled zones and the offshore controlled pelagic zone, but only for specified species. There has also been a problem with illegal subsistence gillnetting and seine-netting driven by crime syndicates selling poached fish (uThukela management plan, 2020).

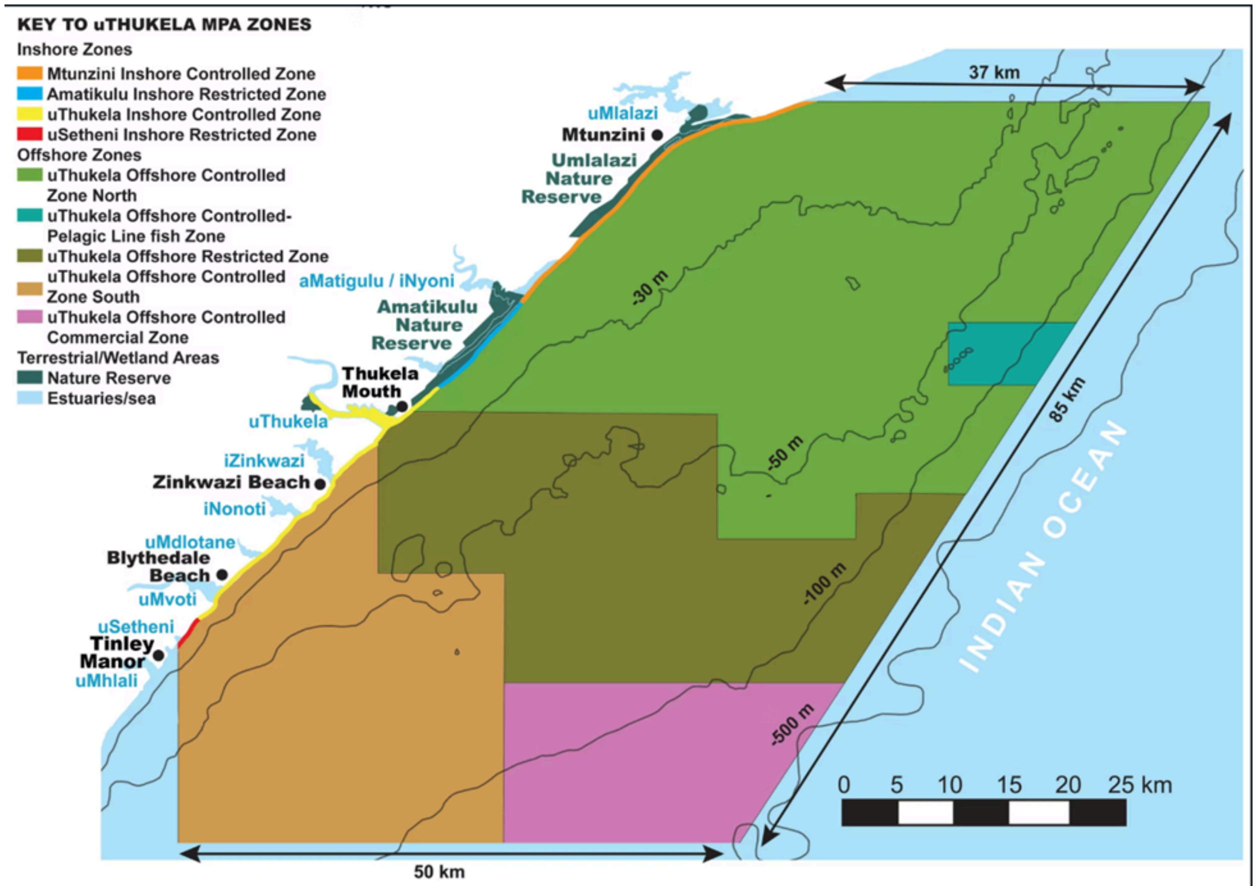

Figure 1. Study area, including coastal ecosystems adjacent to the MPA.

The KwaZulu-Natal province has over 23 communities presently involved in subsistence and artisanal fishing. As of 2014, an estimated 2 500 people from these communities participated in five types of fisheries. These include estuarine fish traps (Kosi Bay), marine and estuarine rod and line fishing (shore fishing), marine rocky and sandy shore invertebrate harvesting (mainly brown mussels), estuarine sand and mud prawn harvesting (bait harvesting); and traditional spear fishing (handheld spears used only in Kosi Bay) (Mann et al., 2014). Prior to 2014, fishing rights in South Africa were exclusively granted to the commercial sector, effectively excluding local fishing communities. By 2024, however, 172 small-scale fishing cooperatives had received 15-year fishing rights, with KwaZulu-Natal fishers securing their rights in 2019 (DFFE, 2024). This marks significant progress in the small-scale fisheries sector, which now operates under stricter legal frameworks, formal registration processes, and cooperative structures. A small-scale fishing permit authorizes cooperatives to legally harvest fish for subsistence and food security, while also allowing the commercial trade of select species to support livelihoods (DFFE, 2024). Within the uThukela MPA, five cooperatives are active, two of which work with WildTrust (Personal communication, 2025). These have been subdivided into committees including both co-op and non co-op members who hold own-consumption permits, authorizing them to harvest fish strictly for personal use, prohibiting any form of sale. WildTrust monitors recently began working with these committees to gather fishing data.

KwaZulu-Natal coastline has different types of commercial fisheries comprising pelagic long-lining, industrial trawling, beach seine-netting, oyster gathering and estuarine bait collecting. While these activities operate on a relatively small scale, they hold significant importance at the provincial level. They generate employment and economic benefits for participants while supplying seafood to the public and local hospitality industry (Fennessy et al., 2014). Commercial line fishers are permitted to operate in the offshore and commercial controlled zones of the uThukela MPA. A shallow water crustacean trawl fishery operated on the Thukela bank from the 1990s through to 2012. This ceased due to poor recruitment of juvenile prawns from the estuary to the Thukela Bank which was blocked for many years. In addition, the declaration of the MPA in 2019 led to inaccessibility of the fishery as the area was largely within the iSimangaliso and uThukela MPAs (DFFE (Department of Forestry, Fisheries and the Environment 2023; Personal communication, 2025).

Identification of the various fishing activities in the uThukela MPA guided data collection and selection of economic valuation methods for each of the activities.

2.2. Fisheries

We used a mixed methods approach combining both primary and secondary data for the valuation of these ES. Focus group discussions with subsistence fishers, a survey for ski-boat recreational fishers for one of the ski-boat clubs within the MPA and a workshop with key stakeholders to validate the spatial extent of the ES were all carried out. This integrated primary data with existing secondary data from various literature sources and databases including the Boat Launch Monitoring System (BLMS) and the National Marine Linefish System (NMLS). All price data were based on current market rates provided by local sources. To ensure consistency across the time series, these prices were adjusted for inflation to reflect their 2025 equivalent value in US$.

Recreational fisheries

This study applies two economic valuation techniques to estimate the willingness to pay (WTP) of recreational fishers to access and visit the uThukela MPA. The first approach estimates WTP based on the value derived from the purchase of recreational permits, directly capturing the monetary commitment fishers make to access the MPA. The second approach evaluates WTP by calculating the travel costs incurred by fishers visiting the area, serving as a proxy for the value they place on the recreational experience associated with the uThukela MPA.

Approach 1: Value from recreational permits

Recreational permits are issued by the Department of Forestry, Fisheries and the Environment (DFFE) and allow for recreational fishing for personal consumption, with no permission to sell or trade the catch. Permits are often endorsed for specific types of fishing, such as angling, spearfishing, or cast-netting. The data required for this analysis was collected through the following steps.

Step 1: Description of original dataset and data compilation of the total number of recreational anglers

The number of recreational anglers visiting the uThukela MPA was drawn from the NLMS database (see Appendix 7). Recreational NLMS data is produced by the Oceanographic Research Institute (ORI) and through consultations with one of ORI's representatives we accessed data for the years 2015 to 2025 (excluding 2020 as this data was unavailable). This data encompasses four fishing sectors in the recreational angling component: marine shore angling (also known as rock & surf angling), estuarine angling (shore- & boat-based), marine boat-based angling (ski-boats, inflatables, paddleskis, jetskis, etc.) and spearfishing (shore- & boat-based). The data was organized in Excel by year, number of anglers, and type of fishing gear used.

Step 2: Recreational angling permit prices

Based on information from the DFFE website, the recreational angling permit costs R76.00 and the spearfishing permit R94.00, both inclusive of a R7 application fee (DFFE, 2015). For vessel-based activities, a permit priced at R94.00 is required and must be paid by the skipper. It is worth noting that while a vessel permit fee of R94.00 is required from the skipper, the number of anglers who actually paid this fee is unclear. As a result, this analysis uniformly applies the R76.00 permit price to all anglers and reserves the R94.00 rate exclusively for spearfishing activities.

Step 3: Calculating the value of the total WTP of recreational fishers visiting uThukela MPA

The following formula was used to estimate the WTP of recreational anglers to access the MPA:

$$Total\ value\ =\ Price\ of\ recreation\ angling\ permit \times total\ number\ of\ anglers$$

To ensure a more accurate estimate of the total value of permits purchased by recreational anglers, a Repeat Visit Adjustment Factor (RVAD) was applied to account for multiple visits by the same individuals. We applied three scenarios to reflect varying assumptions about repeat visitation: a conservative estimate of 5 visits per angler, a mid-range scenario of 17 visits, and a high-end estimate of 30 visits. These figures were informed by an online ski-boat visitor frequency survey conducted among fishers in Zinkwazi. These scenarios enabled a more precise estimation of the total number of anglers visiting the MPA per year and enhanced the overall accuracy of the valuation results.

Approach 2: The travel cost method

The second approach used the travel cost method to estimate recreational fishers' willingness to pay for visiting the MPA. For this analysis we used the BLMS and travel cost data. In the following sections we detail the steps undertaken.

Step 1: BLMS data compilation

The BLMS database is developed through a multi-stakeholder collaboration involving the Department of Economic Development, Tourism and Environmental Affairs (EDTEA), ORI, boat launch site licence holders and their designated operators, along with launch site users. The database provides detailed marine launch statistics and related information on fishing activities (see Appendix 4). Data accessed was for the years 2008 to 2023 (excluding the years 2009 and 2012 as these were unavailable in the data set). Launch data for the following sites was available within the uThukela MPA: Amatikulu, Tugela Mouth, Umlalazi/Mtunzini, Zinkwazi, Blythedale/Umvoti formed the basis of the analysis.

Step 2: Data sorting

We aggregated the annual private fishing launches across these areas. Given our primary focus on recreational fishers, the analysis specifically concentrated on private fishing records from the chosen launch sites. The data was structured to reflect the average number of people per vessel per launch site. This allowed us to calculate the estimated number of people visiting the launch site per year.

Step 3: Compilation of travel cost data

For this study we excluded the opportunity cost of time as the BLMS data indicated that the majority of recreational visits were during weekends and holidays. Due to time limitations, it was not possible to survey all recreational fishers to gather relevant travel cost data. Our analysis is based on Potts et al. (2021) who assessed the total annual spending and annual average spend per fisher by South African recreational fishers per fishing excursion.

The study by Potts et al. (2021) examined spending behavior at two levels: short-term expenditures on fishing excursions and day trips, and annual costs associated with maintaining fishing activities, such as boat upkeep and storage fees. To ensure a comprehensive reflection of spending patterns, the analysis considered 17 distinct expenditure categories related to fishing excursions (see Appendix 8).

To contextualize the national cost data for the uThukela MPA, an online survey was conducted with recreational fishers from the Zinkwazi ski-boat club. This club was selected due to an existing relationship with its management, who supported the distribution of the questionnaire. The survey, developed using Google Forms, was structured around 15 expenditure categories identified in the study by Potts et al. (2021), gifts and competitions were excluded. A shareable link was generated and disseminated to club members with the assistance of the club's management.

Step 4: Comparison of online survey and the national survey cost data

In compiling the costs from the online surveys, a few outliers were identified that exhibited substantial deviation from both the central tendency of the sample and the benchmark values from the Potts et al (2021)'s study. Outlier detection was guided by the interquartile range (IQR) method, which flagged values falling well beyond the upper quartile threshold. Given the small sample size (12 respondents) and the potential for these outliers to disproportionately influence mean estimates and comparative interpretations, they were excluded from the final analysis.

The online survey results were compared against national-level travel cost estimates reported by Potts et al. (2021) to determine the most appropriate travel cost estimate for recreational fishers visiting the uThukela MPA. The inflation-adjusted national average from the 2021 survey was R9,585 and site-specific average travel cost using data collected from Zinkwazi ski-boat club members was R12,529.

The MPA figure is approximately 30.7% higher than the national benchmark, suggesting potentially higher travel costs for this user group. However, since the MPA survey had a limited sample size (n = 12), which constrains its statistical reliability and generalizability, we selected the national average as the primary cost estimate. The MPA-specific figure was retained for sensitivity analysis to reflect localized variation in travel behavior and support scenario testing.

The final step involved calculating the cost of visiting the MPA, based on the assumption that each launch represents a single recreational trip. The total number of launches (from inflatables, jet-ski and ski-boats) per launch site were extracted from the BLMS data for each of the years. This was used to calculate the costs of visiting the MPA using the formula:

$$Total\ costs\ =\ Tl\ \times APV \times AST$$

Where:
Tl is the total number of launches/trips
APV is the average number of persons on vessel and,
AST is the average spend per trip

Subsistence fisheries

To gather insights on communities adjacent to the MPA, we conducted an interview with a WildTrust representative overseeing subsistence fisheries within the MPA and two focus group discussions with the Nqutshini (Amatikulu Mouth) and Nyembe (eSikhaleni) local fishers. This provided valuable insights into the local dynamics of the fishery and helped establish a contextual basis for the valuation exercise. We used the market valuation approach for quantifying the economic value of subsistence fisheries for uThukela MPA. This approach calculates the value of fisheries production based on observed catch volumes and prevailing market prices. The structure of the FGDs is in Appendix 7**.**

Catch and price data were obtained from WildTrust's small-scale fisheries (SSF) monitoring programme, which collects data over 12 days each month. For this analysis, data were available from June to October for Nqutshini and from June to September for Nyembe. The catch records were organized by species type and monthly catch counts, then aggregated to determine the total number of each species caught per month per area.

Price information was gathered through interviews with local fishers, facilitated by WildTrust SSF monitors. Two pricing systems were identified: in Nqutshini, fishers estimate prices visually, ranging from ZAR 30 to ZAR 500 depending on fish size; in Nyembe, fish are sold at a flat rate of ZAR 50 per kilogram, regardless of species. Due to the lack of weight data and the subjective nature of visual pricing, we adopted the Nyembe price-by-weight approach for consistency and comparability.

To estimate fish weights, we consulted ORI fish fact sheets and the ORI Fish App, which provide species-specific minimum and maximum weight data. The minimum weight corresponds to the legal catch size limit, while the maximum reflects the species' potential growth. In cases where certain species had no catch size limit we used the maturity size as the minimum weight. Recognizing that maximum-sized catches are uncommon, we introduced a third scenario using average weight, calculated as the midpoint between minimum and maximum values, to better reflect typical catch sizes. The minimum weight was the conservative scenario and the maximum was the optimum scenario.

To estimate the economic value of subsistence fish catches, we applied the following formula:

$$Total\ value\ of\ fish\ caught\ = Ns \times Ws\ \times P$$

Where Ns is the number of individuals caught per species

Ws is the minimum, average or maximum weight per species and,

P is the price of fish per kg

Commercial fisheries

We estimated the economic value of commercial fisheries within the uThukela MPA using a market-based valuation approach. This approach calculates the value of fisheries production based on observed catch volumes and prevailing market prices and is widely applied in rapid assessments and applied conservation finance studies. Due to time limitations, the analysis focused on estimating gross economic value (landed value) rather than net economic benefits.

Data used
The valuation drew on available fisheries monitoring data from DFFE for the years 2015 to 2024, including:
Fish species caught
Total catch weight (kilograms)
Catch data were aggregated by species, over the study period to estimate total landings associated with the fishery. We focused on areas within the MPA: Amatikulu Mouth, Matigulu Bluff, Tugela River, Zinkwasi, Port Dunford and Nonoti River.

Price assumptions
Economic value was estimated using ex-vessel prices/landing prices, representing the price fishers receive at the point of first sale before any value is added. Prices were supplied by ORI staff via personal communication, categorized according to species' scientific families (Sparidae, Sciaenidae, Serranidae, and game fish). While we acknowledge that South Africa is a net exporter of both fish and fish products (Dunlop and Mann, 2013), assessment of the value of exports is beyond the scope of this project.

Valuation calculation

The gross economic value of the commercial fishery was calculated by multiplying the weight of fish caught by the corresponding market price:
The annual use value will be calculated using the formula:

$$Annual\ use\ value\ =\ \sum(\ Catch\ weight\ \times\ Price\ per\ kg)$$

This provides an estimate of the total landed value of fish harvested each year during the assessment period.

Scope and data limitations
Due to time and data availability constraints, it was not possible to collect detailed information on fishing costs, such as fuel, labour, gear maintenance, vessel costs, and licensing fees. As a result, the valuation does not estimate net income, profitability, or economic surplus. The results therefore reflect gross production value, not the net economic benefits accruing to fishers or the broader economy.

2.3 Tourism

We focused on three categories of charter based marine activities: charter fishing, charter pleasure cruises, and charter scuba diving across all launch sites within the MPA, namely Amatikulu, Tugela Mouth, Umlalazi/Mtunzini, Blythedale/Umvoti, and Zinkwazi. Tourism related price and activity data were informed by a combination of BLMS records and insights from local tour operators. The data was compiled and aggregated to determine the total number of launches per site for the period 2008 to 2023, excluding 2009 and 2012 due to missing records.

We then used price estimates from tour operators:
- Charter fishing trips: People rent the whole boat from owners who have officially registered them as charter fishing vessels. Hiring costs differ depending on the charter models.
- Charter pleasure cruises: This activity involves participants embarking on a chartered vessel operated by licensed tour operators for the purpose of a cruise or sightseeing excursion . Boats carry 5 to 8 people with costs varying depending on the tour operator.
- Charter scuba diving: This includes transporting divers to the diving spots and provision of a cylinder. Divers use their own personal gear and boats carry 4 to 10 people.

All price data were based on current market rates provided by local sources. To ensure consistency across the time series, these prices were adjusted for inflation to reflect their 2025 equivalent value.

The following formulas were used to estimate the annual economic value of each activity:
- Charter fishing value = Number of launches per year × minimum/maximum charter boat hire price (conservative scenario-minimum , optimum scenario- maximum charter boat price)
- Charter pleasure value = Number of launches per year × minimum/maximum number of passengers per launch × maximum/minimum price per person (conservative scenario-minimum

passengers, minimum price person, optimum scenario- maximum passengers, maximum price per person)

- Charter scuba value = Number of launches per year × minimum/maximum number of divers per launch × price per person (conservative scenario-minimum divers/launch , optimum scenario-maximum divers/launch)

2.4 Expert modified value transfer for coastal ecosystems

Due to time and budget constraints, it is often not possible to conduct original/primary studies to economically value ecosystem services (Wilson & Hoehn, 2006; Plummer, 2009), which has led to an increased use of secondary data for this purpose through valuation techniques such as value transfer. Value transfer consists of "applying estimates of economic values from one location to a similar place in another location" (Plummer, 2009). The site where the primary data are collected and processed is called the study site, and the site to which this information (i.e., ecosystem service values) will be applied is called the policy site (because the values are combined and used for policy decisions such as land-use change or the establishment of financial mechanisms) (Plummer, 2009). Transfer can be spatial (across different sites, national or international) or temporal (where the study site and the policy site are at different points in time) (Stale Navrud & Olvar Bergland, 2004), or both.

This study followed an expert-modified value transfer approach implemented in two phases. In Phase 1, per-hectare per-year ecosystem service values (Int$/ha/year) were extracted from the ESVD/TEEB literature for services relevant to the uThukela context, these values were then transferred to the policy site by applying them to mapped ecosystem extents. In Phase 2, the transferred values and mapped service areas were validated and refined through stakeholder engagement and participatory mapping to identify key beneficiaries and the spatial location of demand, and to adjust service delivery areas and resulting value estimates accordingly. This is preferable to just transferring a single point estimate because a median value from several studies will produce a more accurate result (either because there are many appropriate studies to draw on or because there are no appropriate studies, thus partially canceling out trends in individual studies). Economic values from literature studies were extracted from the Ecosystem Service Valuation Database (ESVD) (Brander et al., 2024), a freely available tool with over 6,700 estimates from more than 950 studies distributed across all biomes, ecosystem services, and geographic regions. The ESVD is the largest existing repository of ecosystem service values and is therefore a key source of information.

Specifically, the value transfer consisted of 7 steps (Figure 2).

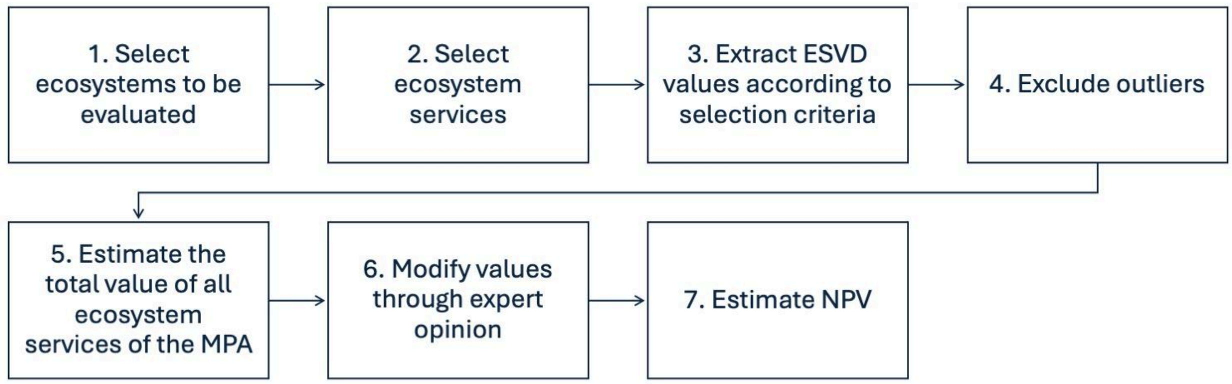

Figure 2. Methodological process for the valuation of ecosystem services.

Step 1. Ecosystem selection

The initial spatial data provided for this study consisted of maps of the terrestrial and coastal ecosystems in the EFZs, and a 2 to 10 km stretch of coastal extent adjacent to the MPA, provided by WildTrust (Appendix 1). For the purposes of this valuation, the policy site is defined as the proclaimed uThukela MPA marine area (including the uThukela Estuary and the inshore/offshore waters within the MPA boundary), while the coastal ecosystem value-transfer component additionally evaluates the mapped terrestrial/coastal ecosystems in the EFZs within the 2–10 km coastal strip adjacent to the MPA (outside the MPA boundary) to capture connected systems associated with the MPA. With this information, as well as inputs from technical experts, we prioritized six ecosystems to value, due to their area and likelihood of economic data availability:

1. Coastal forests
2. Foredunes
3. Lotic freshwater (rivers)
4. Lotic saline influence (estuaries)
5. Reeds and sedges
6. Swamp forests

Using the attribute table of the shapefile provided by WT, we calculated the initial area of each ecosystem in the area of study.

It was essential to ensure that the estimates extracted from the ESVD database corresponded to the ecosystem categories used in the project. To interpret and align these classifications, the spatial data (shapefiles) and accompanying metadata provided by Wildtrust were utilized, along with detailed ecosystem descriptions and publications shared by colleagues from Wildtrust and the South African Association for Marine Biological Research (SAAMBR). On the ESVD side, the Biomes and Ecosystems classification metadata from ESVD 2.0 was applied, which builds on the FAO Global Ecological Zoning framework (2015) and the IUCN Global Ecosystem Typology (2020) (see Annex 2 for details).

These sources facilitated the identification of the closest correspondences between the ecosystems represented in the ESVD and those occurring within the project area. Table 1 presents the resulting equivalency between the local project ecosystems and their corresponding (or most closely aligned) ecosystem categories in the ESVD.

Table 1. Project ecosystems and equivalent ESVD classifications

Project Ecosystem	ESVD Ecosystem Classification
Coastal forest	Subtropical humid forest
Foredunes	Coastal dunes
Lotic freshwater (rivers)	Permanent lowland rivers
	Seasonal lowland rivers
	Large lowland rivers
Estuaries	Riverine estuaries and bays
Reeds and sedges	Coastal salt marshes and reedbeds
Swamp forest	Marshes and swamps

2. Ecosystem service selection

Due to the scarcity of directly applicable studies to the uThukela MPA, we could not carry out a comprehensive systematic review of South African MPA valuation studies. Based on a series of work sessions with Wildtrust, as well as key documents related to the MPA (e.g., the "Management Plan for the uThukela Marine Protected Area", produced by Ezemvelo KZN Wildlife), we selected a set of ecosystem services for each coastal ecosystem (Table 2). Literature offered context, but stakeholder input proved far more valuable in ensuring ecosystem services reflected local realities. Expert guidance enabled us to efficiently identify the most relevant ecosystem services without duplicating existing work.

Table 2. List of ecosystem services contemplated by the first valuation

Project ecosystems	Ecosystem service
Coastal forest	Climate regulation
	Erosion prevention
	Existence, bequest values
	Food
	Maintenance of soil fertility
	Ornamental resources
	Raw materials
Foredunes	Moderation of extreme events
	Opportunities for recreation and tourism

Lotic freshwater (rivers)	Erosion prevention
	Food
	Opportunities for recreation and tourism
	Raw materials
	Water
Lotic saline influence (estuaries)	Climate regulation
	Food
	Medicinal resources
	Moderation of extreme events
	Opportunities for recreation and tourism
	Raw materials
	Water
Reeds & sedges	Food
	Opportunities for recreation and tourism
	Raw materials
Swamp forest	Food
	Maintenance of soil fertility
	Medicinal resources
	Opportunities for recreation and tourism
	Raw materials
	Regulation of water flows
	Waste treatment
	Water

3. Extracting ESVD values according to selection criteria

Using R version: 4.5.0 (2025-04-11 ucrt), we prepared data from the ESVD to produce a single expanded dataset, with one row per unique value–attribute combination. During this step, unnecessary variables and rows were also removed (e.g., blanks), columns were renamed, and any values not standardized to international dollars were excluded. The entire database was also deflated from 2020 to 2025[1] international dollars using the World Bank GDP deflator (annual % growth) series. Non-positive or missing values were also removed.

[1] Values are expressed in constant 2025 international dollars using the World Bank's GDP deflator (annual % growth, series NY.GDP.DEFL.KD.ZG). As the latest available deflator data (December 2025 update) extends only to December 2024, the 2025 price level reflects cumulative inflation up to December 2024 (i.e., early-2025 price levels). Future updates should revise these estimates as new GDP deflator data become available.

For the selection of economic values themselves, specific selection criteria were applied to minimize potential errors in the value transfer:

- Duplicate entries or overlapping ES values
    - In the ESVD, individual values are often linked to multiple ecosystem services, which compromises analytical precision due to non-excludability. Such entries were not considered except if, upon further inspection of the source (study), it was established that the value clearly pertained to a single ecosystem service. Even in those cases, the values were only employed if none other were available.
- Geographic filters:
    - For estuaries (i.e., lotic saline influence ecosystems), reeds & sedges, and swamp forests, only studies from Africa were used, since sufficient data were available. In contrast, for coastal forests and foredunes—where African data were scarce—studies from ecologically similar regions in the Global South were included.
    - For rivers (i.e., lotic freshwater ecosystems), even after applying the filter for Africa, there was a large supply of valid entries (n = 137), so a second geographic filter was applied to exclude studies from countries located more than 3,000 km from the uThukela MPA (e.g., Nigeria, Kenya, and Uganda).
- Existing beneficiaries and applicability:
    - Based on the MPA management plan, values for ES not utilized in the area, or those without a clear beneficiary, were excluded. While some limited extractive uses (e.g., gathering, small-scale fishing, or cane cultivation) are documented, others such as grazing are not. Services considered incompatible with the uThukela coastal strip were removed, to the best extent possible.
    - When the information from the database was insufficient to determine eligibility, a more thorough analysis of the study was conducted.

4. Excluding outliers

To ensure the robustness of the ecosystem service valuation, outliers were identified and excluded using a two-stage process. First, all monetary values ($Int 2023/ha/yr) were transformed to their natural logarithms to reduce right skewness and stabilize the variance in the dataset. This was done before the filtration mentioned above, in order to preserve the quantity of data and therefore the accuracy of outlier identification (more variability, higher accuracy – even though some of the estimates would be dropped later). Using a loop operation in R, rows corresponding to each value were then partitioned into separate groups according to ecosystem service type (e.g., 1_Air_Quality, 2_Climate_Regulation, etc). Within those distinct data frames, the interquartile range (IQR) method was applied to the transformed values: outliers were considered those below the lower bound ($Q1 - 1.5 * IQR$) or above the upper bound ($Q3 + 1.5 * IQR$). The values outside of this range were excluded from ensuing statistical calculations, as a means of consistently and transparently identifying extreme values without distorting the central distribution of the data.

5. Estimating the total value of ecosystem services

After applying the selection criteria and outlier exclusion operations described above, the data was merged again to produce a single expanded database, listing multiple values from various studies for each ecosystem service in each ecosystem, on a per-hectare per-year basis. Summary statistics were then computed, including the sample size, minimum, maximum, and median values for each service and each ecosystem. After incorporating the areas from the spatial data analysis, the next step was to multiply the median value for each ecosystem service by the ecosystem area, to obtain a total value per year.

6. Modifying values through expert opinion

6.1. Ecosystem Provision Area Adjustment

During a stakeholder validation workshop conducted in July 2025, detailed maps for each ecosystem were used in a participatory mapping exercise, where local experts and stakeholders identified the three most important ecosystem services, both in terms of magnitude and spatial distribution, per ecosystem and marked key locations where their provision was significant. These areas were classified as low, medium, or high for a given ecosystem service, which made possible an adjustment of the initial ecosystem areas to reflect where ES benefits were actually demanded.

To achieve that goal, the annotated maps were scanned, digitized, and georeferenced using control points with spline transformations to handle irregular distortions. All resulting polygons were merged into a single layer per ecosystem (even though they overlapped), with attributes for ES type and the magnitude of its provision, in order to adjust for the new areas . These layers were then intersected with the original ecosystem maps, which fragmented polygons by ES demand area and magnitude of provision. For each resulting polygon, the new areas were calculated and a weighting system was applied (0.33 for low, 0.67 for medium, and 1 for high provision) to account for the provision magnitude of the chosen ecosystem services in those areas. Those weights were multiplied by the median values calculated with the ESVD. For the ecosystem services not adjusted by the participatory mapping, the entire ecosystem area was assumed to provide a “medium” level of provision, since that level of detail is unknown. This choice reflects a conservative preference to approximate the true level of provision for these services.

Furthermore, notes from the workshop made by the participants were scanned and transcribed, and later used to adjust the values from the literature used for the benefit-transfer (i.e., to adjust the median values from the ESVD). Some studies were revisited and the selection criteria changed in order to match the kinds of activities in uThukela's coastal area. That process narrowed down the amount of estimates used to compute the median values for these well-recognized ES. That process increases the accuracy of the values, but also increases the risk that an inaccurate estimate is chosen, which means it should be taken with caution.

7. Estimating Net Present Value (NPV)

The Net Present Value (NPV) represents the total current worth of the ecosystem service benefits expected to be generated over time, expressed in today's monetary terms. For this project, NPV was estimated by discounting the annual ecosystem service flow values—derived from benefit-transfer estimates for each ecosystem and service—over a 100-year period using a 2.5% real discount rate. This approach captures the long-term economic significance of ecosystem services while accounting for the time value of money, ensuring that future benefits are valued less than immediate ones in a consistent and comparable way.

3. Results and discussion

Interpretation and aggregation note.
The valuation results presented in this section reflect different economic concepts and should be interpreted and used separately. Recreational fisheries estimates use willingness-to-pay (WTP) proxies, including permit-based values and travel-cost-based estimates (travel expenditures as a proxy for the value placed on access/experience).

Marine tourism estimates (e.g., charter fishing) are reported as gross annual revenues under alternative assumptions, and are not directly comparable to WTP measures.

Coastal ecosystem values are benefit-transfer estimates reported as per-hectare, per-year ecosystem service flows and are also summarized as Net Present Values (NPV) over time.

Because the coastal ecosystem valuation includes cultural services such as "opportunities for recreation and tourism," readers should avoid summing across fisheries/tourism and coastal ecosystem totals without a consistent accounting framework to prevent double counting and mixing incompatible metrics.

For decision-making, authorities should use each component to inform targeted management and financing choices (e.g., which activities and ecosystems drive value, and where interventions protect the largest benefit flows), rather than treating the study as producing one single additive "total economic value" across all sections.

3.1 Recreational fisheries

Based on recreational fishery catch data from the National Marine Linefish System (NLMS) for the assessed period, the estimated total WTP of recreational fishers accessing the uThukela MPA ranges between 173 to 1,151 Int$ (2025)/yr (for 30 and 5 visits/permit/yr respectively). Figure 3 shows values of recreational fishing permits for anglers visiting the uThukela MPA from 2015 to 2025 (excluding 2020), and adjusted to account for repeat visits through three repeat visit adjustment factors (RVAD): 0.2, 0.06, and 0.03, reflecting 5, 17, and 30 visits per permit per year, respectively. The data reveal fluctuating permit revenues over the decade, with notable peaks in 2015 and 2022.

The exclusion of the year 2020 and a drop in 2021 is likely due to COVID-19 disruptions. The final years (2023–2025) show a tapering off in permit value. The variability observed in the dataset is partly due to gaps in the underlying data sources. The estimates are based on competitive shore-based angling catch data and inspection records, both of which were incomplete or unavailable for certain years. Specifically, no competitions were held in the area in 2024, and the competition catch data for 2025 were incomplete. In addition, inspection records were not provided for the period between 2017 and 2022, contributing to uncertainty in the annual estimates (see Table 3).

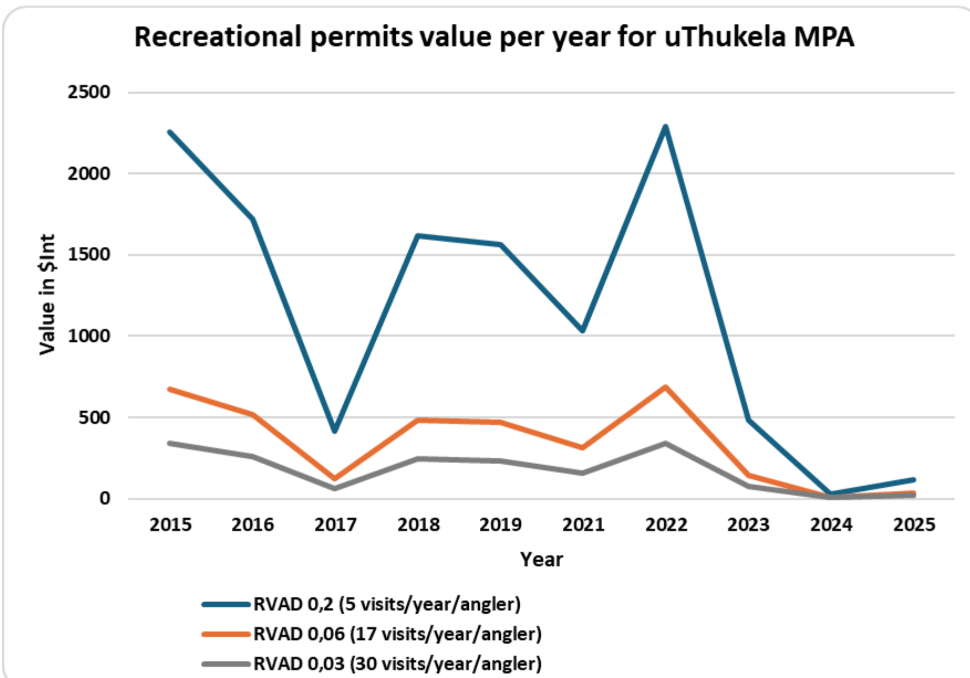

Figure 3: Recreational permit values/ year for anglers visiting the uThukela MPA for the years 2015 to 2025

Table 3: Reported total number of fish by year from competitive shore based angling catch data and inspection records (ORI Data report, 2025)

Year	Competition catch	Inspection	Total
2015	2248	919	3167
2016	733	187	920
2017	92		92
2018	771		771
2019	631		631
2021	574		574
2022	796		796
2023	125	13	138
2024		48	48
2025		62	62
Total	5970	1229	7199

To complement these findings, the average yearly travel costs incurred by recreational anglers visiting launch sites within the MPA were estimated at values of 1 to 2 million Int$ (2025)/yr (values reflect annual values from the national-level travel cost estimates and MPA-specific respectively) . Across the 14-year observation period the total recreational anglers travel costs are estimated at 22 million Int$ using MPA-specific values (see Figure 4). The line graph in Figure 4 demonstrates a sustained upward trend in tourist expenditure over time. This cumulative value serves as a meaningful indicator of long-term economic contribution, reflecting consistent demand for local services and experiences. Beyond direct spending, such costs generate multiplier effects, where initial tourist expenditures circulate through the local economy, supporting jobs, stimulating investment, and encouraging infrastructure development. Figure 4 below illustrates how these values fluctuated across the years analyzed for the MPA-specific scenario.

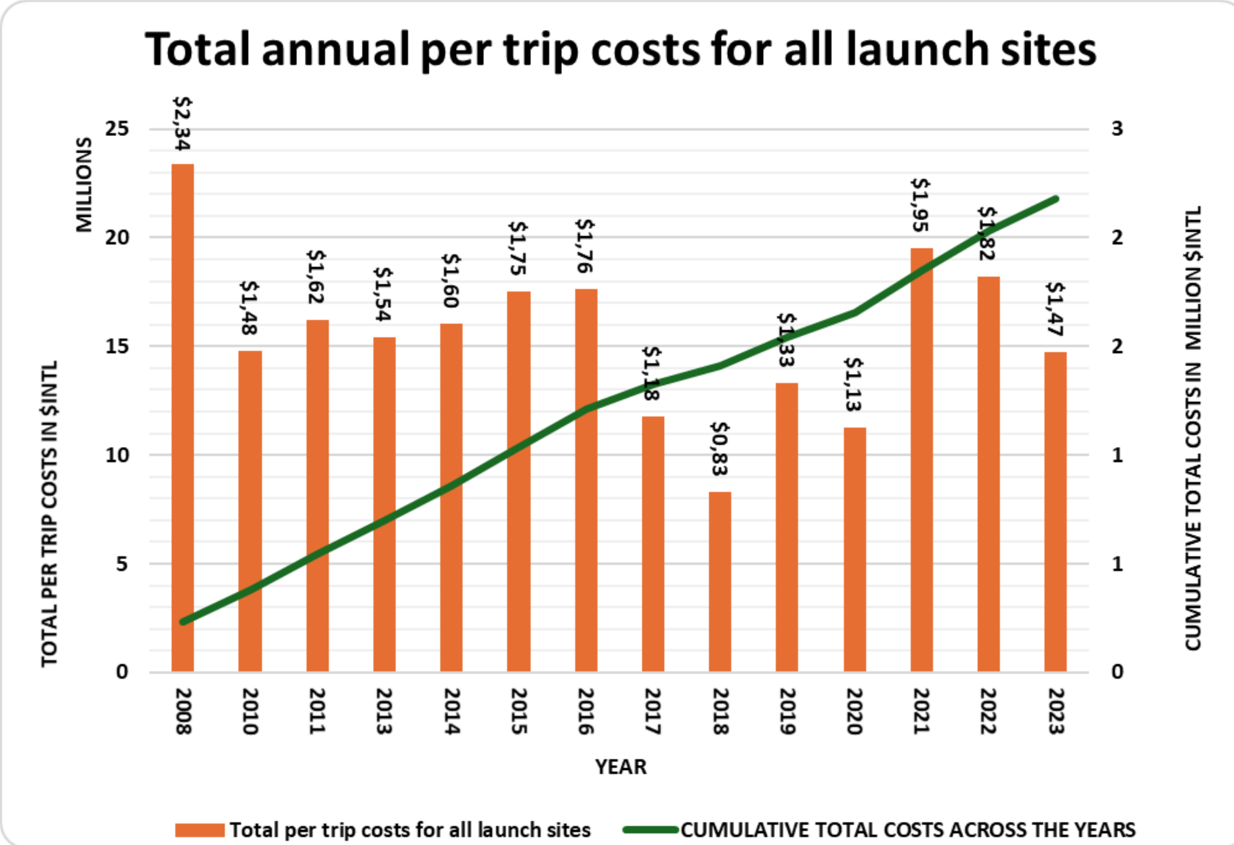

Figure 4: Total annual per trip travel costs for all launch sites within the uThukela MPA for the MPA specific value

The travel costs over the observed years highlight the substantial economic footprint of recreational fishing in the MPA. For MPA managers, these findings justify investment in infrastructure, monitoring, and enforcement to support sustainable use and enhance visitor experience. Tourism operators can leverage this insight to tailor services, while policy makers may view the results as evidence of recreational fisheries' contribution to the blue economy. This supports the case for inclusive marine spatial planning and innovative financing mechanisms.

3.2 Subsistence fisheries

3.2.1 Focus Group Discussions (FGDs) with co-operatives in Nqutshini and Port Durnford

Engagements with the Amatikulu Mouth (Dokodweni, Amatikulu Mouth areas) and Sikhaleni Port Dunford, Esikhaleni, Nozalela areas) fishing co-operatives revealed deep cultural, economic, and ecological ties between coastal communities and the ocean. Fishers rely heavily on marine resources for food security, income, and traditional practices, often fishing in groups with basic gear and selling their catch collectively to support their households. Many began fishing at a young age, viewing the ocean as central to their identity and survival.

However, both co-operatives face significant challenges, including restrictive catch limits, limited access to deep-sea fishing equipment, and declining fish abundance due to pollution and overfishing. Despite these constraints, demand for fish remains high, and fishers seize every opportunity to harvest species such as grunter, shad, rock salmon, bream, mussels, and lobsters. These insights underscore the need for inclusive, community-informed marine management that balances ecological sustainability with local livelihoods.

Four key themes were identified from the FGD results.

Co-operative profile and activity focuses on the operational and demographic details of the fishing groups. Members hail from multiple communities including Port Durnford, Dodokweni, Esikhaleni, Nozalela, and Gobandlovu. Fishers spend full days on the water from 8 a.m. to 4 p.m. Collective selling of catch is common, with earnings primarily used to support household food needs.

Livelihood and community highlights the central role of fishing in the fishers' lives and the broader community. Fishing is a foundational livelihood for most participants, many of whom began fishing at a young age. Two local fishermen particularly mentioned this:

> *"Fishing has sustained me all my life. My father taught me how to fish, and now I have taught my son, it is our inheritance."*
>
> *"I started fishing at a very young age, and through fishing proceeds, I have been able to send my children to school."*

Fishing supports not only co-op members but also unaffiliated individuals who rely on the same ecosystem. The seasonal availability of species and the predominance of coastal fishing (90% of activity) shape daily routines and income patterns.

Value and sustainability captures the fishers' perspective on the intrinsic and practical value of the ocean. Fishers recognize the ocean's practical and ecological value, noting that fish breeding in the estuary is limited and that species availability is seasonal. Despite using simple gear, they demonstrate adaptive strategies, fishing when weather permits and targeting species like shad, rock salmon, bream, mussels, and lobsters. Their practices reflect an understanding of local marine dynamics and a commitment to maximizing sustainable use within their means.

Challenges and constraints groups the immediate threats and operational limitations faced by both co-operatives. Catch restrictions emerged as the most pressing challenge, limiting fishers' ability to harvest enough to meet household needs. Environmental limitations, such as poor estuarine breeding conditions compound these challenges. These constraints reduce income potential and increase vulnerability among fishing households.

3.2.2 Small-scale fisheries analysis for Nqutshini and Nyembe areas

Nqutshini

Between June and October, Nqutshini local fishers recorded catches of 13 species. The flathead grey mullet, river bream, and spotted grunter accounted for the highest average by mass, with mullet reaching up to a total value of 1,570 Int$ (2025)/5 months (Table 4). The average value per month over the 5 month period is 748 Int$/month. An average of 36 fishers were active in the area each month, with peak activity recorded in September, when the number of fishers recorded reached 58.

Table 4: Total number of species and values in Int$ (2025) for fish caught over 5 months by Nqutshini local fishers

Type of species	**Total number of individuals per species for 5 months**	**Minimum value in Int$**	**Average value in Int$**	**Maximum value in Int$**
Flat head grey mullet	119	376.44	1,569.53	2,762.62
River bream	131	125.48	670.98	1,216.48
Spotted grunter	61	169.94	925.83	1,681.66
Bigeye king fish	5	29.19	145.15	261.17
Grey grunter	3	0.87	4.82	8.71
Cave bass	1	1.74	9.29	16.83
Natal stumpnose	12	8.36	138.25	268.14
Blacktail	7	4.29	29.54	54.85
Silver sillago	3	0.17	3.13	6.09
Kite fish	7	1.86	5.17	8.53
Bronze bream	12	26.81	107.43	188.04
Stone bream	13	14.34	56.24	98.08
Sole fish	1	0.64	2.50	4.35

Nyembe

Between June and September, Nyembe local fishers recorded catches of seven fish species, with notable variation in both numbers and value. Dusky kob contributed the highest average value of 3,393 Int$/4 months) (Table 5). Although it was not the most frequently caught species during the four-month period, its potential to grow up to 80 kg contributes significantly to its high market value. Shad and large spot mpompano were the most commonly caught species, with a total catch of 40 and 38 respectively, contributing moderate average values of 619 and 152 Int$ (2025)/4 months). Other species such as yellow bellied rockcod, river bream, and spotted grunter were caught in smaller numbers but still added value. The monthly average value for the 4 month period is 1,108 Int$ (2025)/month). An average of 13 fishers were active in the area each month, with peak activity recorded in June, when the number of fishers recorded reached 25.

Table 5: Total number of species and values in Int$(2025) for fish caught over 4 months by Nyembe local fishers

Type of species	Total number of individuals per species for 4 months	Minimum value in Int$ (2025)	Average value in Int$ (2025)	Maximum value in Int$ (2025)
Large spot pompano	38	27.57	151.63	275.68
Dusky kob	29	54.70	3,393.57	6,732.44
Shad	40	41.79	618.69	1,195.59
River bream	4	3.83	20.49	37.14
Rockcod	5	55.72	227.37	399.01
Blacktail	1	0.61	4.22	7.84
Spotted grunter	1	2.79	15.18	27.57

Annually, both areas have a contribution of ~22,272 Int$ (2025)/year. While these results provide an important foundation for understanding the value that fisheries contribute to small-scale fishers within the uThukela MPA coastal areas, the dataset used remains very limited. The collection period only covered a maximum of five months, preventing robust accounting for fish seasonality. Workshop discussions indicated that certain species, such as mullet, are present throughout the year, with peak abundance typically occurring from June to August. In contrast, other species like shad and rockcod exhibit clear seasonal patterns, but these could not be incorporated into the analysis due to the limited data available. Moreover, the data did not include records of other important invertebrates such as oysters, mussels, crabs, sand prawns and sea lice, which were acknowledged as present in the ecosystem but not captured in the dataset.

The total number of fishers relying on these coastal resources is significantly underrepresented, leading to an underestimation of the true value of these fisheries. Lastly, the fish prices applied did not differentiate by species, further undervaluing the benefits fishers provide to their communities. To better support small-scale fishers, we recommend improvements in data collection protocols, including systematic recording of clearly identified species names and capture weights. Tools such as the ORI Fish app, which translates fish length to weight, could facilitate more accurate and detailed data, strengthening economic valuations and building a stronger case for supporting and investing in sustainable small-scale fisheries.

3.3 Tourism

Charter scuba analysis results

Scuba diving activity within the MPA is relatively limited, with a small number of launches recorded over the years. The highest number of launches occurred in 2013, with 36 recorded at Umlalazi (Figure 5 and Table 6). Other sites: Zinkwazi, Amatikulu, Tugela Mouth, and Blythedale/Umvoti recorded minimal or no activity over the 2008–2023 period. Based on the valuation scenarios applied, the estimated minimum annual value of charter scuba activities (in the years where launches are recorded) ranges from a conservative (minimum of 4 people per boat) 55 Int$ (2025)/yr to an upper estimate (maximum of 10 people per boat) of 6,491 Int$ (2025)/yr). This results in an annual average economic value of ~3,273 Int$ (2025)/yr. Overall, the data indicates limited demand or possible operational constraints affecting scuba diving across the launch sites. However, since the establishment of the MPA in 2019, one needs a permit to operate a scuba diving business within the MPA. At the moment only Dive Zinkwazi has this permit.

Discussions with the Zinkwazi management revealed that poor underwater visibility has limited scuba diving activity within the MPA, particularly at sites like Tugela Mouth where heavy inland rainfall causes river runoff that clouds the ocean water. This runoff reduces water clarity, making conditions unsuitable for diving and discouraging both operators and tourists. As a result, scuba tourism in these areas is highly variable year on year with few recorded launches and minimal economic contribution.

Table 6: Charter scuba analysis results showing number of launches and total annual revenue per year under two scenarios

Year	Total launches/ year across all launch sites	Total annual value with 4 people per vessel in Int$ (2025) (conservative scenario)	Total annual value with 10 people per vessel in Int$ (2025) (optimum scenario)
2008	1	55	138
2010	3	184	461
2011	2	129	323
2013	36	2,596	6,491
2014	2	153	383
2015	0	0	0
2016	24	2,044	5,110
2017	0	0	0
2018	0	0	0
2019	1	98	244
2020	0	0	0
2021	0	0	0
2022	0	0	0
2023	3	358	895

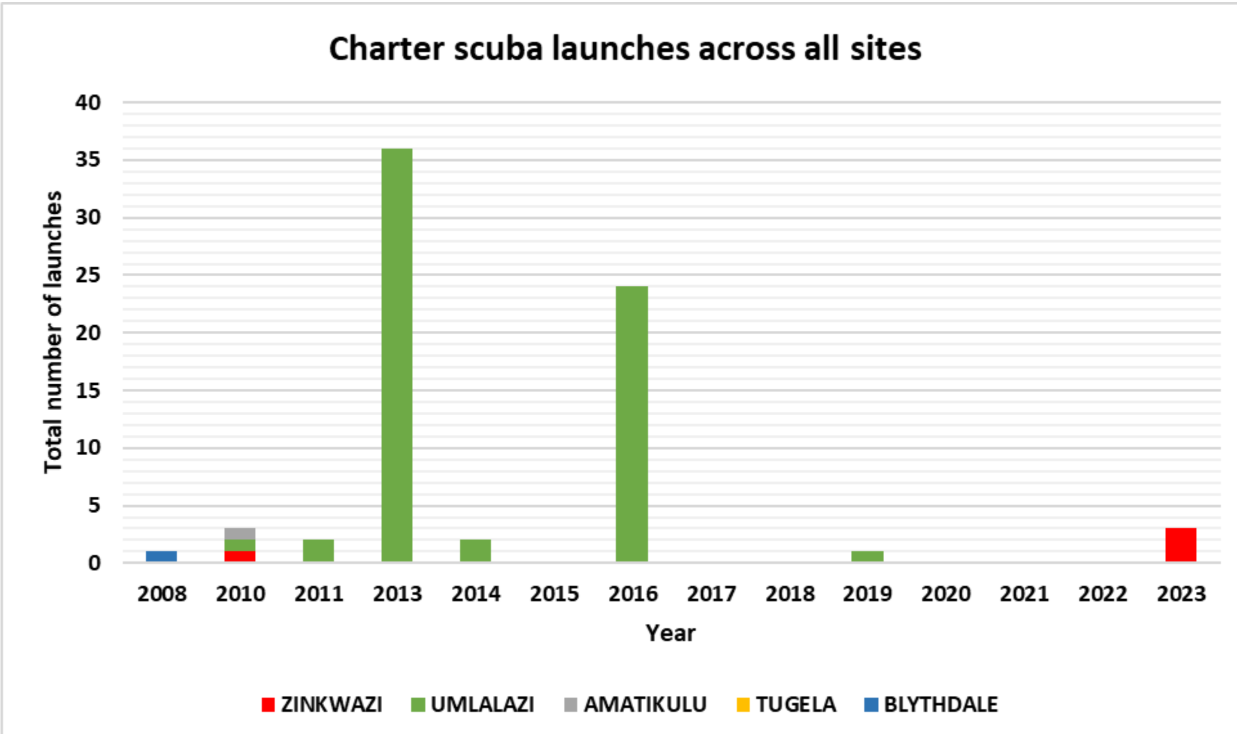

Figure 5 Distribution of charter scuba launches across the launch sites

Charter pleasure analysis results

Charter pleasure activity within the MPA has been sporadic and limited over the 2008–2023 period, with Zinkwazi emerging as the most active site in recent years (Figure 6). After minimal launches in earlier years, Zinkwazi recorded a notable increase to 14 launches in 2023, suggesting renewed interest or improved operational capacity. Umlalazi/Mtunzini and Blythedale/Umvoti showed brief activity in the early years, while Amatikulu and Tugela Mouth recorded no launches at all. The overall trend reflects low and inconsistent demand for ocean touring across most sites, with long periods of inactivity indicating operational or environmental constraints. In the years that launches were recorded, the total annual minimum value ranges from a conservative 90 Int$ (2025)/yr to an upper optimum estimate of 6,680 Int$ (2025)/yr, see Table 7. This results in an annual average economic value of ~ 3,385 Int$ (2025)/yr.

Table 7: Charter pleasure analysis results showing number of launches and total annual revenue per year under two scenarios

Year	Total launches/ year across all launch sites	Total annual revenue in Int$ (2025) at minimum price and 5 people per boat (conservative scenario)	Total annual revenue in Int$ (2025) at maximum price and 8 people per boat (optimum scenario)
2008	5	346	1,106
2010	8	615	1,967
2011	3	242	775
2013	1	90	288
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	1	122	390
2020	1	126	403
2021	0	0	0
2022	1	141	451
2023	14	2,088	6,680

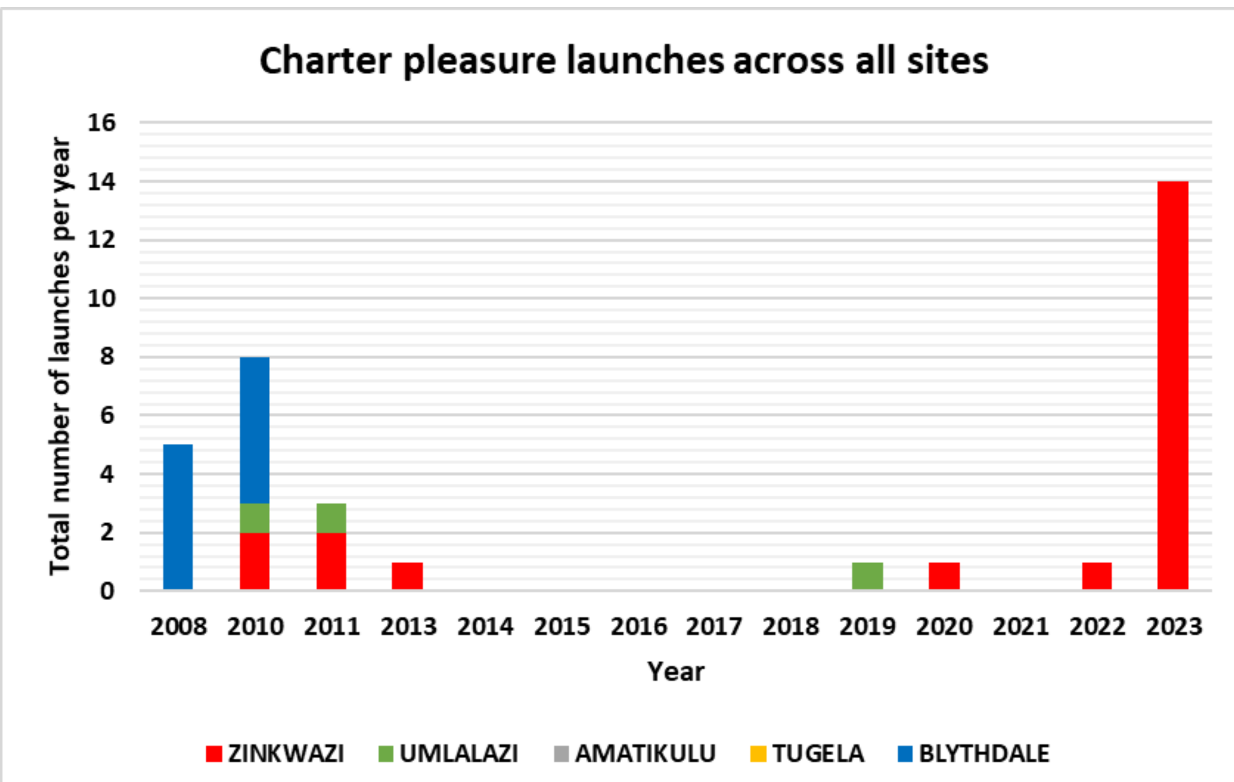

Figure 6: Distribution of charter pleasure launches across all launch sites

Charter fishing results analysis

Charter fishing is the most consistently active marine tourism activity across the MPA, with regular launches recorded from 2008 to 2023 (Table 8). Tugela Mouth and Zinkwazi were the most active sites, with Tugela peaking at 138 launches in 2011 and Zinkwazi showing renewed growth in 2023 (Figure 7). Blythedale/Umvoti also contributed significantly in earlier years, while Umlalazi/Mtunzini maintained moderate activity. In contrast, Amatikulu recorded minimal use, with no launches after 2011. Overall, the data reflects sustained demand and operational capacity for fishing charters, distinguishing it from the more unpredictable trends seen in scuba and charter pleasure tourism. Hiring costs are between ZAR3,500 and ZAR6,000 depending on the charter models. The total annual value from charter fishing ranges from a conservative minimum value of 1,111 Int$ (2025) to a maximum of 53,026 Int$ (2025) /yr. This results in a total average economic value of ~27,068.50 Int$ (2025)/yr.

Table 8: Charter fishing results analysis showing number of launches and total annual revenue per year under two scenarios

Year	Total launches/ year across all launch sites	Total annual revenue at minimum boat hire price in Int$ (2025) (conservative scenario)	Total annual revenue at maximum boat hire price in Int$ (2025) (optimum scenario)
2008	248	21,824	37,412
2010	226	22,097	37,881
2011	301	30,932	53,026
2013	165	18,932	32,454
2014	88	10,711	18,362
2015	60	7,638	13,095
2016	49	6,639	11,381
2017	46	6,554	11,235
2018	21	3,134	5,373
2019	37	5,744	9,847
2020	66	10,589	18,152
2021	83	13,912	23,849
2022	62	1,111	19,045
2023	116	22,013	37,736

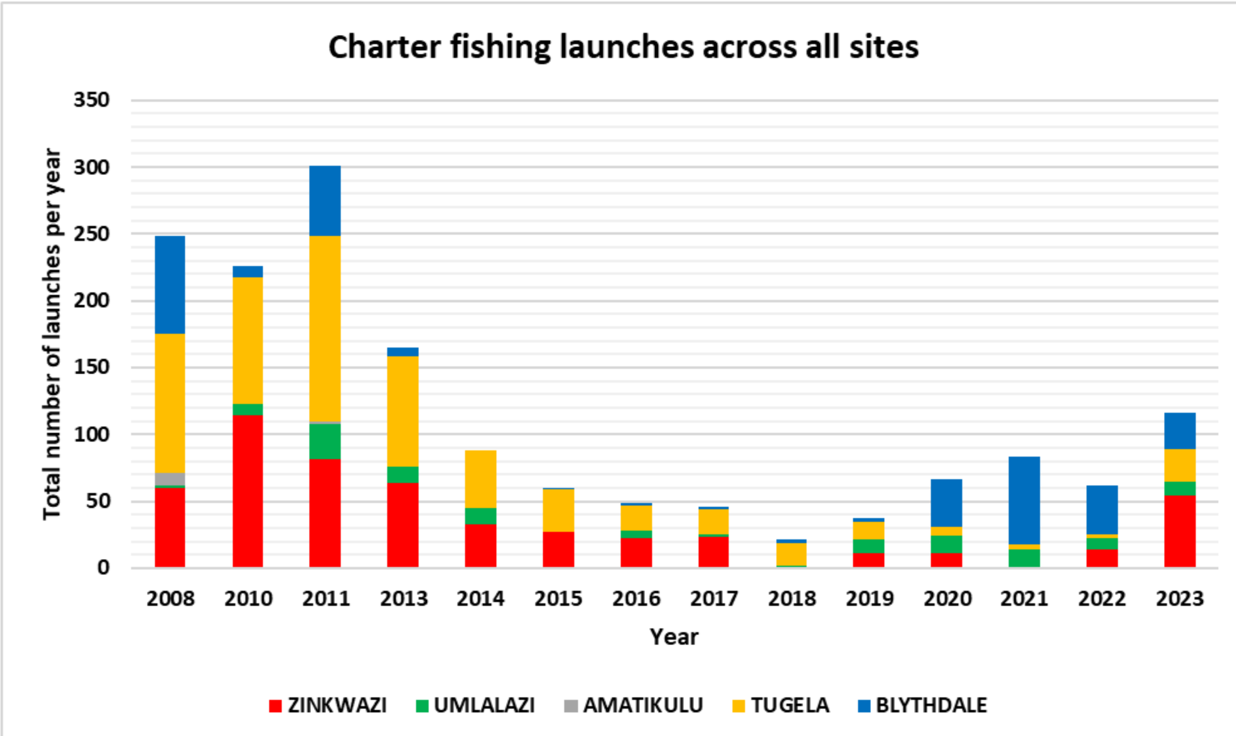

Figure 7: Distribution of charter fishing launches across all launch sites

Summary of tourism results

The tourism component contributes a total economic value of ~33,762.50 Int$ (2025)/yr with notable variation across activities.

- Charter fishing ($27,068.50/yr) accounts for approximately 80% of total tourism value, making it the dominant revenue-generating activity.
- Charter pleasure trips/safaris ($3,385/yr) and scuba diving ($3,273/yr) contribute comparatively smaller but still meaningful shares (around 10% each).

Tourism value is highly concentrated. Charter fishing dominates tourism revenue in the MPA, making the sector heavily reliant on extractive recreational use. While this generates substantial income, it also creates risk, as tourism earnings depend directly on healthy fish stocks, intact reefs, and overall ecosystem condition. Any ecological decline would translate into economic losses. At the same time, the relatively low contribution of scuba diving and pleasure safaris highlights untapped potential. Expanding non-extractive tourism could diversify revenue streams while reducing pressure on marine resources.

3.4 Commercial fisheries

The mean annual economic value of commercial fisheries within the uThukela MPA is estimated at 84,032 Int$ (2025)/yr. Across the 51 species recorded over the 17-year period, the most significant contributors to overall value are Slinger (26.2%), Santer (17.1%), Geelbek (10.6%), Kob (10.0%), Squaretail kob (8.0%), and Rockcods and seabass (7.0%). Spatially, the Zinkwazi area accounts for the highest cumulative catch weight, translating into the greatest economic value, followed by the Tugela River (Table 9). In contrast, Matigulu Bluff shows the lowest contribution. It is important to note that harvesting did not occur in all years at all sites, reflecting interannual variability in fishing activity, access, or resource availability.

Table 9: The distribution of fish harvested by mass and annual mean economic value for the areas within the MPA from 2008 to 2024

Area	**Total sum weight of fish harvested in kg (2008 to 2024)**	**Estimated mean annual economic value Int$ (2025)**
Zinkwasi	128,395	28,760
Tugela river	92,265	20,667
Amatikulu Mouth	80,146	17,952
Blythedale beach	36,184	8,105
Port Dunford	22,619	5,067
Nonoti river	10,704	2,398
Matigulu Bluff	4,841	1,084

Species contribution by area and ecological implications

Table 10 reveals that *Sparidae* and *Sciaenidae* species (slinger, santer, kob, and geelbek) consistently drive the economic value of catches across the uThukela MPA. Spatial variation is evident, with Zinkwazi and Tugela River emerging as the most productive areas, while Matigulu Bluff contributes the least. This pattern highlights the importance of prioritizing conservation efforts for dominant sparid stocks, as their protection is vital to sustaining both biodiversity and economic returns. At the same time, the variability in harvests over the years, including periods with no recorded catches, demonstrates the need for adaptive and precautionary management strategies to ensure long-term sustainability of the fishery and resilience of the ecosystem. Refer to Appendix 10 for graphs showing the distribution of fish species across the 6 areas over the observed period

Table 10: Area contributions, key species, and conservation Implications

Area	**Top two species (by weight and value)**	**Contribution and interpretation**	**Conservation implications**
Zinkwazi	Slinger, Squaretail kob	Highest overall catch weight and economic value. These two species dominate the fishery, reflecting strong dependence on sparid linefish.	Protecting slinger and kob stocks here is critical. Overfishing could destabilize both ecological balance and local livelihoods.

Tugela river	Kob, Slinger	Second highest contribution. Kob and slinger consistently drive value, showing this area’s importance as a linefish hotspot.	Conservation measures should prioritize sustainable harvest of kob and slinger, ensuring long-term productivity.
Blythedale beach	Geelbek, Santer	Geelbek and santer are the leading contributors, with moderate overall value.	Management should focus on maintaining healthy stocks of these sparids, as they underpin local catches.
Amatikulu Mouth	Santer, Slinger	Large contributions from sparid species, reflecting reliance on reef-associated linefish.	Protecting reef habitats is essential to sustain these species and prevent declines.
Matigulu Bluff	Geelbek, Slinger	Lowest overall contribution. Limited diversity and smaller catches recorded.	Even though contribution is low, protection ensures resilience and prevents local depletion.
Nonoti river	Santer, Catface rockcod	Moderate contribution, with sparids and rockcods leading.	Rockcods are vulnerable to overfishing; targeted protection is needed alongside sparid management.
Port Dunford	Slinger, Santer	Catch dominated by sparids, with smaller contributions from emperor and rockcods.	Conservation should balance sparid protection with monitoring of less abundant reef species.

The commercial fishery valuation provides a pragmatic and transparent estimate of the economic importance of commercial fisheries associated with the uThukela MPA under current data constraints. It offers a useful baseline for donors and decision-makers, while clearly identifying areas where additional data collection would strengthen future analyses. Considering that costs are not deducted, the reported values should be considered an upper-bound estimate of economic benefit.

3.5 Economic value of coastal ecosystems

The total areas for each coastal ecosystem included in the benefit-transfer valuation can be seen in Table 11, which collectively amount to 5,301.47 hectares of land. This represents 38.5% of the total coastal area where WildTrust is currently working on their restoration efforts, with coastal forests, swamp forests and estuaries being the largest mapped ecosystems included in the analysis.

Table 11. Valued ecosystems in the coastal area adjacent to the MPA

Project Ecosystem	Area (ha)	Percentage of coastal area (%)
Coastal forest	2733.77	19.85
Foredunes	360.08	2.61
Lotic freshwater (rivers)	257.85	1.87
Lotic saline influence (estuaries)	583.78	4.24
Reeds & sedges	293.74	2.13
Swamp forest	1072.26	7.79
Total	5301.48	38.49

Table 12 shows the summary results for the values extracted from the ESVD, after the interquartile range calculation and ensuing outlier exclusion process. Not that many outliers were present in the database for the areas of interest. The estimates from the database revealed considerable variability across ecosystem services and ecosystem types (Column 6 of Table 12), which is a reflection of both their characteristics and structural limitations of the database itself. Regulating services exhibited the highest median monetary values, with climate regulation and erosion prevention in coastal forests reaching about 444 Int$/ha/yr and 1,990 Int$/ha/yr, respectively. Similarly, foredunes displayed high values for moderation of extreme events (≈3,145 Int$/ha/yr), reflecting this ecosystem's critical role in coastal protection. Estuarine ecosystems (lotic saline influence) showed particularly elevated estimates for climate regulation (≈18,929 Int$/ha/yr), revealing a high carbon sequestration capacity. It is important to note that the valuation estimates for climate regulation differ fundamentally from those of other services, as their economic value reflects global benefits—namely, the avoided damages associated with climate change—rather than localized gains. In this sense, the beneficiaries are society as a whole, not the immediate communities surrounding the uThukela coastal area.

In contrast, local provisioning services such as food and raw materials demonstrated high variability, spanning several orders of magnitude depending on ecosystem type, with median values ranging from less than 1 Int$/ha/yr in swamp forests to 2,424 Int$/ha/yr in reeds and sedges. Cultural services such as recreation, existence, and ornamental resources are generally clustered in the tens to hundreds Int$/ha/yr range, demonstrating their non-market and non-extractive nature. This distribution may illustrate the imbalance between well-studied regulating services and the limited evidence base for cultural or less tangible benefits in the ESVD, a common feature in global ecosystem valuation datasets.

Multiplying the areas from Table 11 and the median per hectare monetary values found in the ESVD (column 6 below), we get column 7 in Table 12, which shows the annual value per ecosystem service and ecosystem in the project area. The largest contributions came from climate regulation in estuaries (≈ 11.05 million Int$/yr), due to its high median value, and erosion prevention in coastal forests (≈ 5.44 million Int$/yr), primarily due to size but also a relatively high median estimate. Those are followed by water provision in swamp forests (≈ 3.59 million Int$/yr). Overall, regulating services dominated the total economic value, while provisioning services such as food and raw materials provided smaller but locally relevant benefits—especially in rivers and reeds & sedges. Cultural services like recreation and existence values made comparatively modest contributions, yet highlight the diverse non-market benefits of uThukela's coastal ecosystems.

Table 12. ESVD estimates and annual value per ecosystem service and ecosystem, after outlier exclusion

Project ecosystem	Ecosystem service	N. of estimates	Min (Int$ 2025)*	Max (Int$ 2025)*	Median (Int$ 2025)*	Annual value (Int$ 2025)
Coastal forest	Climate regulation	2	386	503	444	1,214,381
	Erosion prevention	1	1,990	1,990	1,990	5,441,510
	Existence, bequest values	3	6	149	7	18,249
	Food	2	3	68	36	97,214
	Maintenance of soil fertility	1	203	203	203	555,241
	Ornamental resources	1	14	14	14	37,217
	Raw materials	1	491	491	491	1,342,051
Foredunes	Moderation of extreme events	1	3,145	3,145	3,145	1,132,381
	Opportunities for recreation and tourism	1	777	777	777	279,788
Lotic freshwater (rivers)	Erosion prevention	1	77	77	77	19,961
	Food	3	0.1	6,958	1,140	293,924
	Opportunities for recreation and tourism	3	12	655	33	8,391
	Raw materials	8	0.1	37,617	10	2,461
	Water	2	1	1,803	902	232,558
Lotic saline influence (estuaries)	Climate regulation	1	18,929	18,929	18,929	11,050,213
	Food	9	0.1	6,958	17	9,986
	Medicinal resources	2	15	23	19	11,310
	Moderation of extreme events	2	847	1,010	929	542,279
	Opportunities for recreation and tourism	3	9	3,210	30	17,516
	Raw materials	10	0.02	271	23	13,551

	Water	1	1,803	1,803	1,803	1,052,351
Reeds & sedges	Food	2	17	4,831	2,424	712,058
	Opportunities for recreation and tourism	1	671	671	671	197,189
	Raw materials	3	0.02	5,839	9	2,673
Swamp forest	Food	5	0.1	37	0.3	299
	Maintenance of soil fertility	1	607	607	607	650,803
	Medicinal resources	1	0.3	0.3	0.3	297
	Opportunities for recreation and tourism	2	0.01	0.4	0.2	225
	Raw materials	5	0.1	116	0.2	183
	Regulation of water flows	1	1	1	1	732
	Waste treatment	1	39	39	39	41,737
	Water	2	138	6,551	3,344	3,586,133

*Unit: values reported per hectare, per year

After aggregating across ecosystem services, we reach the total annual value for the six coastal ecosystems adjacent to the uThukela MPA. These ecosystems amount to approximately 28.6 million Int$ 2023 in value per year, corresponding to a Net Present Value (NPV) of about 1.05 billion Int$ 2025 over a 100-year horizon at a 2.5% discount rate (Table 13). Estuaries contributed the largest share of total value (≈ 44% of annual flow), followed by coastal forests (≈ 30%) and swamp forests (≈ 15%). These three systems together accounted for almost 90% of the total economic value, highlighting the importance of habitats linked to hydrological and coastal regulation and their dependence on the uThukela MPA. Foredunes also contributed substantially (≈ 5%), mainly due to their high per-hectare regulating service values, despite having a smaller spatial extent. As mentioned before, the dominance of coastal forests and swamp forests is primarily due to size and their regulating service values, especially global climate regulation. While embedded in the estimation of damages caused by climate change globally, this value also reflects a structural bias in the ESVD database, which gives greater emphasis to global rather than local ecosystem dynamics.

Table 13. Total summary per ecosystem

Project ecosystems	**Ecosystem services**	**Area (ha)**	**Percentage (%)**	**Total annual value (Int$ 2025)**	**Net Present Value (Int$ 2025)**
Coastal forest	7	2,734	20	8,705,862	318,757,355
Foredunes	2	360	3	1,412,168	51,705,277
Lotic freshwater (rivers)	5	258	2	557,295	20,404,852
Lotic saline influence (estuaries)	7	584	4	12,697,206	464,896,834
Reeds & sedges	3	294	2	911,919	33,389,088

Swamp forest	8	1,072	8	4,280,408	156,723,325
Total (coastal ecosystems)		5,301	38	28,564,858	1,045,876,729

*Note: Net Present Value was estimated at a 2.5% discount rate with a time horizon of 100 years

Table 14 presents the expert-modified (EM) statistics, with adjustments to the area, weights and monetary values of ecosystem services prioritized during the participatory workshop. As described in the Methods section, this process began with a selection of 2-3 ecosystem services per ecosystem and a spatial refinement of their provisioning areas, resulting in 16 new individual maps depicting low, medium and high provision for each ecosystem service. These maps can be found in Appendix A.

In addition, the ESVD values for those ecosystem services were filtered during the workshop according to local practices and activities, consolidating evidence around verified beneficiary uses, which led to narrower, context-specific ranges compared to the preliminary results in Table 12. Although they display smaller sample sizes, reflecting this refined selection process, the resulting medians are more representative of the actual economic relevance of each service in the uThukela coastal strip, providing a stronger empirical link between ESVD data and observed ecosystem use patterns. For ecosystem services not selected by local experts during the workshop, median values were uniformly reduced by one-third to represent a "medium" level of provision. Given that even the highest-ranked services were observed to occur only in specific areas rather than uniformly across each ecosystem, it is reasonable to assume that a similar spatial pattern applies to the remaining, unverified services. This adjustment therefore helps correct for potential overestimation in the unadjusted values by accounting for the spatial variability of ecosystem service provision.

Based on these changes, expert-modified (EM) annual values were then computed by multiplying the refined per-hectare values with the new provision areas, which can be seen under Column 10 of Table 14.

Table 14. Expert-modified statistics, per ecosystem service and ecosystem

Project ecosystems	Ecosystem service	N. of estimates	Min (Int$ 2025)	Max (Int$ 2025)	Median (Int$ 2025)	Level of provision	Weighted median (Int$ 2025)	EM area (ha)	Annual value (Int$ 2025)
Coastal forest	Climate regulation	2	386	503	444	Medium	296	2,734	809,579
	Erosion prevention	1	1,990	1,990	1,990	Medium	1,327	2,734	3,627,637
	Existence, bequest values	3	6	149	7	Medium	4	2,734	12,166
	Food	2	3	68	36	Medium	24	6	142
	Maintenance of soil fertility	1	203	203	203	Medium	135	2,734	370,157
	Ornamental resources	1	14	14	14	Medium	9	10	93
	Raw materials	2	78	491	285	High	285	553	157,438
	Raw materials	2	78	491	285	Medium	190	10	1,843
Foredunes	Moderation of extreme events	1	3,145	3,145	3,145	High	3,145	360	1,134,653
	Opportunities for recreation and tourism	1	777	777	777	High	777	360	280,349
Lotic freshwater (rivers)	Erosion prevention	1	77	77	77	Medium	52	258	13,307
	Food	2	0	6,958	3,479	High	3,479	196	681,080
	Food	2	0	6,958	3,479	Medium	2,319	9	20,804
	Opportunities for recreation and tourism	3	12	655	33	Medium	22	258	5,594
	Raw materials	5	2	37,617	10	High	10	199	2,023
	Water	2	1	1,803	902	High	902	204	183,694
	Water	2	1	1,803	902	Low	301	22	6,582
	Water	2	1	1,803	902	Medium	601	5	2,865
Lotic saline influence (estuaries)	Climate regulation	1	18,929	18,929	18,929	Medium	12,619	584	7,366,735
	Food	5	17	6,958	88	High	88	411	36,358
	Food	5	17	6,958	88	Low	29	7	204
	Food	5	17	6,958	88	Medium	59	61	3,589

	Medicinal resources	2	15	23	19	Medium	13	584	7,540
	Moderation of extreme events	2	847	1,010	929	Medium	619	584	361,516
	Opportunities for recreation and tourism	3	9	3,210	30	High	30	420	12,610
	Opportunities for recreation and tourism	3	9	3,210	30	Low	10	23	235
	Raw materials	5	0.02	61	14	High	14	37	524
	Raw materials	5	0.02	61	14	Low	5	24	115
	Raw materials	5	0.02	61	14	Medium	9	9	82
	Water	1	1,803	1,803	1,803	Medium	1,202	584	701,560
Reeds & sedges	Opportunities for recreation and tourism	1	671	671	671	High	671	76	50,704
	Opportunities for recreation and tourism	1	671	671	671	Medium	448	22	9,772
	Raw materials	1	9	9	9	High	9	46	417
Swamp forest	Food	3	0.1	37	1	High	1	297	209
	Maintenance of soil fertility	1	607	607	607	Medium	405	1,072	433,864
	Medicinal resources	1	0.3	0.3	0.3	Medium	0.2	1,072	198
	Opportunities for recreation and tourism	1	0.4	0.4	0.4	High	0.4	128	52
	Opportunities for recreation and tourism	1	0.4	0.4	0.4	Medium	0.3	164	45
	Raw materials	5	0.1	116	0.2	Medium	0.1	1,072	122
	Regulation of water flows	1	1	1	1	Medium	0.5	1,072	488
	Waste treatment	1	39	39	39	Medium	26	1,072	27,824
	Water	2	138	6,551	3,344	High	3,344	77	258,212
	Water	2	138	6,551	3,344	Medium	2,230	46	103,018

A comparison of ecosystem service values before and after the participatory mapping exercise is presented in Table 15, revealing substantial adjustments in total annual values following expert input. In several cases, expert-modified estimates are markedly lower than the original ESVD-based values, reflecting a more spatially constrained and context-specific understanding of service provision.

For instance, water provision shows pronounced downward revisions in both swamp forests and lotic saline influence (estuaries). In swamp forests, the estimated annual value declined from approximately 3.59 million Int$ (2025) to 0.36 million Int$, while in estuaries it decreased from about 1.05 million Int$ to 0.70 million Int$. These changes reflect expert assessments that water-related benefits are concentrated in specific sub-areas rather than delivered uniformly across the full ecosystem extent. Regulating services also exhibit systematic but moderate downward adjustments, with the annual value of climate regulation in estuaries declining from roughly 11.05 million Int$ to 7.37 million Int$ and erosion prevention in coastal forests decreasing from about 5.44 million Int$ to 3.63 million Int$.

Large proportional reductions are also observed for provisioning services where expert mapping substantially constrained the spatial extent of use. For example, raw materials in coastal forests declined from roughly 1.34 million Int$ to 0.16 million Int$, and food provision across several ecosystems was sharply reduced where local experts did not confirm active or significant use. These shifts are driven primarily by reductions in service area rather than changes in per-hectare values.

By contrast, ecosystem services more directly linked to observable human use—such as recreation and tourism—remain broadly consistent in magnitude after expert modification. For example, values for recreation in foredunes and reeds & sedges remain within the same order of magnitude (approximately 0.2–0.3 million Int$ annually), suggesting stronger empirical alignment between global valuation evidence and local use patterns for these services.

Overall, the expert-modified results tend to reduce or stabilize annual ecosystem service values relative to the original estimates, effectively tempering globally derived unit values to better reflect the scale, spatial distribution, and actual intensity of service provision in the uThukela coastal system. The resulting estimates provide a more realistic and policy-relevant representation of benefit distribution across the landscape, highlighting ecosystem services most closely tied to local livelihoods, risk regulation, and ecological functioning.

Table 15. Comparison between expert-modified and original valuation

		Expert-modified (EM) valuation		**Original valuation**	
Project ecosystems	**Ecosystem service**	**Area (ha)**	**Annual value (Int$ 2025)**	**Area (ha)**	**Annual value (Int$ 2025)**
Coastal forest	Climate regulation	2,734	809,579	2,734	1,214,381
	Erosion prevention	2,734	3,627,637	2,734	5,441,510
	Existence, bequest values	2,734	12,166	2,734	18,249
	Food	6	142	2,734	97,214

	Maintenance of soil fertility	2,734	370,157	2,734	555,241
	Ornamental resources	10	93	2,734	37,217
	Raw materials	563	159,281	2,734	1,342,051
Foredunes	Moderation of extreme events	360	1,132,381	360	1,132,381
	Opportunities for recreation and tourism	360	279,788	360	279,788
Lotic freshwater (rivers)	Erosion prevention	258	13,307	258	19,961
	Food	205	701,884	258	293,924
	Opportunities for recreation and tourism	258	5,594	258	8,391
	Raw materials	199	2,023	258	2,461
	Water	230	193,140	258	232,558
Lotic saline influence (estuaries)	Climate regulation	584	7,366,735	584	11,050,213
	Food	479	40,151	584	9,986
	Medicinal resources	584	7,540	584	11,310
	Moderation of extreme events	584	361,516	584	542,279
	Opportunities for recreation and tourism	444	12,845	584	17,516
	Raw materials	70	721	584	13,551
	Water	584	701,560	584	1,052,351
Reeds & sedges	Food	NA	NA	294	712,058
	Opportunities for recreation and tourism	97	60,476	294	197,189
	Raw materials	46	417	294	2,673
Swamp forest	Food	297	209	1,072	299
	Maintenance of soil fertility	1,072	433,864	1,072	650,803
	Medicinal resources	1,072	198	1,072	297
	Opportunities for recreation and tourism	292	97	1,072	225
	Raw materials	1,072	122	1,072	183
	Regulation of water flows	1,072	488	1,072	732
	Waste treatment	1,072	27,824	1,072	41,737
	Water	123	361,230	1,072	3,586,133

Table 16 aggregates the expert-modified results across ecosystems, reporting both total annual economic values and corresponding Net Present Values (NPV) over a 100-year horizon using a 2.5 percent discount rate. As in the original valuation, lotic saline influence (estuaries) contributes the largest share of total value under the expert-modified valuation, accounting for approximately 51 percent of the total annual value, followed by coastal forests at roughly 30 percent. Foredunes emerge as the third most important ecosystem (about 8–9 percent), reflecting the relatively high and well-verified contribution of coastal protection and recreation services, while swamp forests also represent a meaningful share (approximately 5 percent) of total value.

Table 16. Total summary comparison for expert-modified (EM) and original valuation

	Expert-modified (EM) valuation			**Original valuation**		
Project ecosystems	**Ecosystem services**	**Total annual value (Int$ 2025)**	**Net Present Value (Int$ 2025)**	**Ecosystem services**	**Total annual value (Int$ 2025)**	**Net Present Value (Int$ 2025)**
Coastal forest	7	4,979,054	182,303,625	7	8,705,862	318,757,355
Foredunes	2	1,412,168	51,705,277	2	1,412,168	51,705,277
Lotic freshwater (rivers)	5	915,948	33,536,617	5	557,295	20,404,852
Lotic saline influence (estuaries)	7	8,491,068	310,892,860	7	12,697,206	464,896,834
Reeds & sedges	2	60,893	2,229,540	3	911,919	33,389,088
Swamp forest	8	824,032	30,171,209	8	4,280,408	156,723,325
Total		16,683,164	610,839,128	0	28,564,858	1,045,876,729

*Note: Net Present Value was estimated at a 2.5% discount rate with a time horizon of 100 years

Overall, the expert-modified valuation yields a total annual ecosystem service value of 16.7 million Int$ (2025), corresponding to an NPV of approximately 611 million Int$ (2025). This represents a substantial reduction relative to the original valuation, which estimated 28.6 million Int$ annually and an NPV of about 1.05 billion Int$. This comparison can be better visualized in Figure 8 and highlight the effect of expert-led spatial filtering and adjustments to service provision levels. While these refinements reduce aggregate values, they provide a more robust and policy-relevant representation of the economic importance of uThukela's coastal ecosystems by anchoring valuation results in services that are spatially constrained, locally relevant, and empirically supported by expert knowledge and observed use patterns.

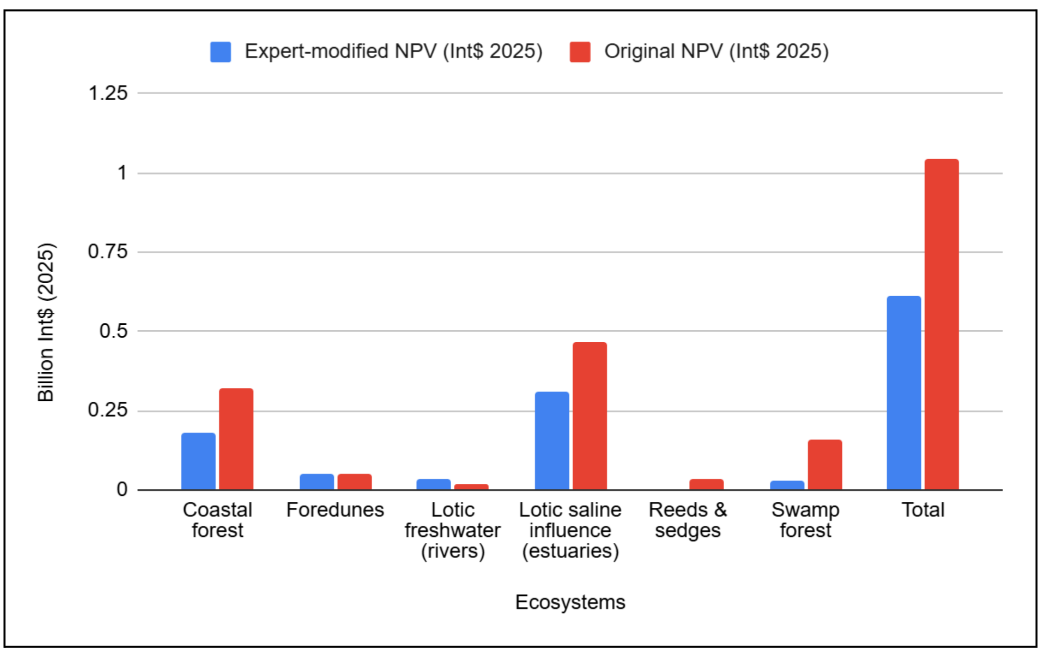

Figure 8: Net Present Value comparison between expert-modified (EM) and original valuation

3.6 Beneficiaries and demand hotspots

During the July 2025 stakeholder validation workshop, detailed ecosystem maps were used in a participatory mapping exercise to confirm the most important ecosystem services (by magnitude and spatial distribution) and to identify the locations where service provision and associated benefits are most significant. Mapped areas were classified as low, medium, or high for each prioritized ecosystem service, and these spatial outputs were used to constrain the valuation to the areas where ecosystem service benefits are most plausibly demanded, thereby producing the expert-modified estimates reported in this section.

Table 17 translates the mapping outputs into a decision-oriented view of who benefits and where demand concentrates, consistent with the TOR requirement to locate beneficiaries (demand) through participatory mapping.

Table 17: The primary beneficiaries of those ecosystems mapped during the stakeholder workshop including the area where demand is greatest.

Ecosystem service (as valued)	**Primary beneficiaries (who benefits)**	**Where demand is concentrated (extraction areas)**
Climate regulation (coastal forests and estuaries)	Global beneficiaries; national/provincial public interest; climate-risk stakeholders	Does not apply - beneficiaries and demand are local, regional and global
Erosion prevention / coastal protection (coastal forests and rivers)	Coastal communities; municipal/provincial infrastructure owners; tourism assets	Medium demand is assumed across entire mapped ecosystem areas
Moderation of extreme events (foredunes and estuaries)	Vulnerable coastal communities; disaster-risk management authorities	Figure 4 (Appendix 2); otherwise, medium demand is assumed across entire mapped ecosystem area
Water provision / water-related benefits (rivers, estuaries and swamp forests)	Local communities; municipalities; downstream users	Figures 8 and 16 (Appendix 2); otherwise, medium demand is assumed across entire mapped ecosystem areas
Waste treatment (swamp forests)	Downstream communities; municipalities; fisheries users	Medium demand is assumed across entire mapped ecosystem area

Regulation of water flows (swamp forests)	Downstream communities; municipal services; flood-risk stakeholders	Medium demand is assumed across entire mapped ecosystem area
Food / provisioning (coastal forests, rivers, estuaries, swamp forests)	Subsistence/small-scale resource users; local households	Figures 1, 6 and 9 (Appendix 2); otherwise, medium demand is assumed across entire mapped ecosystem areas
Raw materials / provisioning (coastal forests, rivers, estuaries, reeds & sedges and swamp forests)	Local communities and resource users; small-scale livelihood activities	Figures 3, 7, 10 and 12 (Appendix 2); otherwise, medium demand is assumed across entire mapped ecosystem area
Ornamental resources / provisioning (coastal forests)	Local communities and resource users; small-scale livelihood activities	Figure 2 (Appendix 2)
Opportunities for recreation and tourism (foredunes, rivers, estuaries, reeds & sedges and swamp forests)	Recreational users; tourism operators; local businesses	Figures 5, 11, 13 and 15 (Appendix 2); otherwise, medium demand is assumed across entire mapped ecosystem areas
Existence / bequest values (coastal forests)	Broader public; conservation stakeholders; future generations	Non-spatial / diffuse; non-localized, available data only for coastal forests

3.7 Use of valuation results for government decision-making and sustainable finance

This valuation is designed to be decision-usable, meaning the results can be translated into practical choices about management priorities, budgeting, and the structuring of sustainable finance mechanisms. The expert-modified coastal ecosystem valuation (16.6 million Int$ per year; NPV 607.4 million Int$) provides a conservative, policy-relevant estimate of benefit flows associated with maintaining ecosystem condition, with estuaries and coastal forests representing the largest components of value. These estimates should be interpreted as the economic importance of ecosystem service benefits (not direct revenues), and used to support decisions on where public investment and blended finance can most credibly protect benefit flows that are at risk.

For government authorities, the results support three immediate applications. First, they provide an economic justification for core public expenditures (enforcement, monitoring, estuary management, and habitat integrity), especially where regulating services dominate value and where degradation would generate disproportionate losses. Second, the spatial identification of high-value ecosystem services and ecosystem "hotspots" can be used to prioritize marine spatial planning, compliance focus, and restoration sequencing, including targeting interventions in estuarine areas and coastal vegetation systems that underpin the largest estimated benefits. Third, the valuation offers a results-oriented foundation for management: because several high-value services can be linked to measurable ecological indicators (e.g., estuary condition, vegetation cover, dune stability, fish abundance proxies, and compliance performance), authorities can define management targets and track whether interventions are protecting the underlying natural capital that produces the benefits.

For sustainable finance users (donors, development banks, philanthropic foundations, and private-sector partners), the valuation helps identify what can be financed, who benefits, and what outcomes can be measured. The results point to a pipeline of financeable interventions that protect the highest-value benefit flows (e.g., estuary health and functionality, dune and coastal vegetation stabilization, and enforcement/monitoring capacity where pressures concentrate). The valuation can also guide beneficiary-linked and user-linked mechanisms by clarifying which user groups and beneficiary segments are associated with different services (e.g., recreational and subsistence fisheries, tourism operators, and downstream beneficiaries of regulating services), and by framing transparent reinvestment logic (how revenues or grant capital would be allocated to sustain the ecosystem conditions that generate benefits). Finally, the valuation supports performance-based financing approaches by identifying ecological attributes that can serve as measurable triggers for funding (pay-for-results, outcome-based tranching, or donor performance agreements), provided that indicators and baselines are defined and monitored consistently.

To operationalize this use case, the next step is to pair these valuation results with (i) an explicit management and financing gap assessment (what it costs to manage and restore priority areas which has been carried out as part of the WildOceans uThukela EbA project), (ii) a shortlist of priority interventions linked to the highest-value ecosystem services and hotspots, including the justification for the continued allocation of public funds for the MPA management, (iii) an agreed monitoring framework for performance indicators, and (iv), where relevant, an institutional vehicle or governance arrangement capable of receiving, managing, and transparently disbursing funds (e.g., a conservation trust fund or similar fund with multi-stakeholder oversight). This connects the valuation directly to budget decisions, investable interventions, and credible financing structures that can sustain the uThukela MPA system over the long term.

4. Conclusion

This economic valuation offers a foundation for rethinking how conservation in the region is financed and governed. Our results highlight a broad set of services that carry tangible and intangible benefits for local communities, fishers, tourism operators, and national and global society, among other beneficiaries. Translating these insights into practice will require linking the valuation to concrete financing pathways and institutional structures capable of sustaining the MPA over the long term.

One of the clearest messages emerging from the valuation is that the ecosystem services of the MPA are diverse, spatially differentiated, and closely tied to both ecological processes and human activities. This creates a strong case for financial instruments that recognize and capture the value generated by healthy estuaries, coastal forests, river systems, dunes, and the marine zone. Several categories of financial mechanisms align with these findings. For example, climate-linked mechanisms, such as blue carbon projects, nature-based coastal protection finance, and resilience-focused blended finance, are particularly relevant given the regulating services identified across multiple coastal ecosystems.

Implications for sustainable financing products and government decision-making

In parallel, the valuation highlights the economic significance of recreational and subsistence fisheries, both of which depend on ecosystem condition. This opens space for revenue-generation models that retain a share of the economic activity associated with resource use. For example, in the case of recreational users, this could involve enhanced permit systems, conservation levies, or voluntary contributions administered transparently and reinvested locally. For small-scale fishers, the valuation points toward financial mechanisms tied to co-management initiatives such as micro-grants for improving fishing practices, livelihood diversification funds, or reward-based systems that link sustainable use to direct financial support. In any case, the main goal is to use this approach not as a restriction but as a source of stability and long-term opportunity to enhance and make resilient the income for local communities.

The valuation also supports the development of performance-based financial models. Because many of the ecosystem services documented in the study can be linked to measurable ecological indicators (e.g., estuary health, forest cover, dune stability, or fish abundance), there is potential to structure financial flows around ecological performance. This could take the form of pay-for-results schemes, certification-linked financing, or agreements with donors or investors in which funding is tied to the maintenance or improvement of specific ecosystem attributes.

An additional implication of the valuation is the opportunity to integrate natural capital considerations into marine spatial planning and local development processes. The identification of ecosystem service “hotspots” and areas of overlapping benefits provides a roadmap for prioritizing restoration, enforcement, and monitoring. When linked with funding mechanisms, this spatial information can guide strategic investment: for example, directing resilience finance to estuarine areas, funding dune stabilization efforts where erosion control is most critical, or supporting community-led restoration in high-value river corridors.

Our results offer a clear narrative that can be used to engage donors, development banks, philanthropic foundations, government agencies, and private-sector partners. Through the communication of not just what benefits the MPA provides, but how these benefits connect to financeable outcomes, the uThukela MPA is better positioned to secure the types of long-term, diversified funding that modern marine conservation requires.

To make the “authorities + finance products” application operational, Table 18 summarizes how the valuation results can be translated into specific policy decisions, financing mechanisms, and accountable actors—consistent with the TOR requirement that this document inform both sustainable financing products and government authorities.

Table 18. Decision-use summary: how valuation insights translate into policy and financing actions

Valuation insight	**Policy implication (what authorities can do)**	**Finance mechanism linkage (what it enables)**	**Responsible actor (lead / convene)**
Expert-modified (EM) valuation provides policy-relevant annual + NPV estimates (Table 17; Figure 8) that are anchored in spatially constrained, locally relevant services.	Use EM results as the core economic justification for multi-year MPA management budgets and to defend prioritization versus competing expenditures.	Underpins investment cases for resilience/climate finance and blended finance by translating ecosystem condition into financeable benefit flows.	Provincial authorities + MPA managers + conservation partners (incl. municipal/provincial stakeholders as part of the MPA governance arrangement).
Value concentration by ecosystem (notably estuaries, coastal forests, dunes) shows where benefit flows are most material.	Make spatial prioritization decisions: target restoration, protection, and compliance activities where the largest benefit flows are at risk.	Enables targeted “use-of-proceeds” design (e.g., earmarking funds to estuary restoration or dune stabilization).	MPA management + municipalities + conservation organisations (joint prioritization).
Regulating services across multiple coastal ecosystems support climate-linked mechanisms (as stated in the report).	Integrate natural capital into climate adaptation planning and coastal risk reduction policy (NbS screening; adaptation investment pipeline).	Blue carbon projects; nature-based coastal protection finance; resilience-focused blended finance (as highlighted in the Conclusion).	Conservation partners + provincial authorities + investors/donors(pipeline development).

Valuation insight	**Policy implication (what authorities can do)**	**Finance mechanism linkage (what it enables)**	**Responsible actor (lead / convene)**
Recreational fisheries show material WTP via permits + travel cost proxy (incl. 1–2 million Int$/yr travel costs).	Strengthen/adjust access management and compliance (permits; monitoring at launch sites), framing it as protecting a measurable recreational benefit stream.	Enhanced permit systems; conservation levies and launch fees; voluntary contributions earmarked to local reinvestment (as proposed in Conclusion).	DFFE (permits) + MPA managers + municipal stakeholders (implementation + earmarking design), working with angling/skiboat clubs.
Subsistence/ small-scale fisheries link ecosystem condition to food security + livelihoods (FGDs and analysis).	Make co-management and livelihood safeguards explicit in MPA management decisions to reduce conflict and improve compliance legitimacy.	Micro-grants and finance; livelihood diversification funds; reward-based systems tied to sustainable use (as proposed in Conclusion).	Small-scale fishing cooperatives (or other similar collective entity) + conservation orgs + municipal/provincial stakeholders (program delivery + targeting).
Tourism activity (e.g., charter fishing) shows measurable revenue streams (Table 8; results narrative).	Use tourism activity evidence to prioritize site-level management (launch sites, enforcement, user engagement) where tourism is sustained. Align with regional tourism development planning strategies.	Supports user-linked revenue capture options (levies/fees/voluntary contributions) that recycle tourism value into MPA funding.	Tourism operators + MPA managers + municipal or tourism sector stakeholders (fee design + administration).

Valuation insight	**Policy implication (what authorities can do)**	**Finance mechanism linkage (what it enables)**	**Responsible actor (lead / convene)**
Report identifies potential for performance-based finance tied to measurable ecological indicators (estuary health, dune stability, fish abundance, etc.).	Define a small set of operational indicators and targets (monitoring plan) that can trigger disbursements and justify enforcement prioritization.	Pay-for-results; certification-linked financing; donor/investor agreements tied to outcomes (as stated).	MPA managers + conservation partners + donors/investors(indicator design + verification).
Viability of mechanisms depends on a dedicated fund/vehicle and stakeholder-inclusive governance (trust fund / blue resilience fund; Common Asset Trust (CAT) framing).	Establish an agreed institutional home for revenues and investments (rules, representation, accountability) to prevent fragmentation and build legitimacy.	Conservation trust fund as the continuity mechanism to manage diverse revenue streams and reinvest locally, ensuring independence, confidence and transparency.	WildTrust + provincial authorities + municipal stakeholders + cooperatives + tourism reps (governance design and convening).

To make any of these mechanisms viable, institutional arrangements must be structured to manage funds effectively and equitably. A dedicated vehicle, such as a conservation trust fund or a blue resilience fund, would create the continuity needed to manage revenues and investments over time. The design of such a fund should reflect the diverse users and beneficiaries of the MPA. Including small-scale fishing cooperatives, municipal stakeholders, provincial authorities, conservation organizations, and tourism representatives would anchor decision-making in the realities of the landscape. The participatory mapping exercise conducted during this study has already shown that local knowledge is essential for identifying the areas where benefits are produced and where pressures are most acute. That same principle applies to governance: local actors must have a seat at the table for financial mechanisms to be credible, fair, and effective.

The framework proposed by Hernández-Blanco et al. (2024) offers a clear institutional lens for thinking about one of the possibilities of how the uThukela MPA could enhance its governance and finance scheme to protect and restore its ecosystem services. They argue that many marine and coastal ecosystems function as open-access or weakly governed blue commons, and that conventional property rights and market mechanisms are not always well suited to stewarding them. This framework proposes Common Asset Trusts (CATs), defined as a collection of agreements, institutions, and funds that sustainably manages ecosystems (assets) for their benefits (i.e., for delivery of ecosystem services). This institutional arrangement emphasizes cooperative rule-making, polycentric governance, and a shared overarching goal of ecological health and human well-being. We believe these principles align closely with the institutional needs of the uThukela MPA. For example, a conservation or resilience fund for the area could be designed as a localized expression of the CAT model: a fiduciary entity mandated to safeguard ecosystem services, governed collectively by the stakeholders who rely on them, and capable of capturing and reinvesting revenue streams to secure the long-term sustainability of the MPA.

For government authorities, these results can be used immediately to (i) justify and defend multi-year allocations for core MPA management costs by referencing the expert-modified annual and NPV estimates (see Table 17 and Figure 8), (ii) integrate the mapped ecosystem service patterns into marine spatial planning and coastal development screening using the expert-modified service provision maps (Appendix 2), and (iii) prioritize enforcement and monitoring attention in the ecosystems driving the largest benefit flows (notably estuaries, coastal forests, and dunes) where pressures and benefits most strongly overlap.

5. References

Brander, L. M., De Groot, R., Schägner, J. P., Guisado-Goñi, V., Van't Hoff, V., Solomonides, S., McVittie, A., Eppink, F., Sposato, M., & Do, L. (2024). Economic values for ecosystem services: A global synthesis and way forward. Ecosystem Services, 66, 101606.

Costanza, R., d'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., ... & Van Den Belt, M. (1997). The value of the world's ecosystem services and natural capital. Nature, 387(6630), 253-260.

Department of Forestry, Fisheries and the Environment (DFFE). 2015.
https://www.gov.za/sites/default/files/gcis_documents/fisheries-tariffs-2015_0.pdf

DFFE (Department of Forestry, Fisheries and the Environment). 2023. Status of the South African marine fishery resources 2023. Cape Town: DFFE

DFFE. 2024. SA's big five of the deep. Building South Africa's sustainable fisheries. Environment quarterly, March 2024.

Draft management plan for uThukela Marine Protected Area. July 2020. Ezemvelo KZN Wildlife.

Dunlop, S. W., & Mann, B. Q. (2013). An assessment of participation, catch and effort in the offshore boat-based linefishery in KwaZulu-Natal, South Africa. African Journal of Marine Science, 35(1), 79-97.

Hernández-Blanco, Marcello, Robert Costanza, Tundi Agardy, Joshua Farley, Elizabeth Fulton, Ida Kubiszewski, and Rifaee Rasheed. "Common Asset Trusts for blue commons stewardship." *Marine Policy* 159 (2024): 105957.

Leenhardt, P., Low, N., Pascal, N., Micheli, F., & Claudet, J. (2015). The role of marine protected areas in providing ecosystem services. In Aquatic functional biodiversity (pp. 211-239). Academic Press.

Liu, S., Costanza, R., Farber, S., & Troy, A. (2010). Valuing ecosystem services: theory, practice, and the need for a transdisciplinary synthesis. Annals of the New York Academy of Sciences, 1185(1), 54-78.

Mann, B., Rhodes, G. and Kyle, S. 2014. Artisanal and Subsistence Fishing. (eds). Ugu Lwethu – Our Coast. A profile of coastal KwaZulu-Natal. KwaZulu-Natal Department of Agriculture and Environmental Affairs and the Oceanographic Research Institute, Cedara, 110-112.

Morse-Jones, S., Luisetti, T., Turner, R. K., & Fisher, B. (2011). Ecosystem valuation: some principles and a partial application. Environmetrics, 22(5), 675-685.

Plummer, M. L. (2009). Assessing benefit transfer for the valuation of ecosystem services. Frontiers in Ecology and the Environment, 7(1), 38–45.

Potts, W. M., Saayman, M., Saayman, A., Mann, B. Q., Van der Merwe, P., Britz, P., & Bova, C. S. (2022). Understanding the economic activity generated by recreational fishing in South Africa provides insights on the role of recreational fisheries for social development. Fisheries Management and Ecology, 29(1), 29-43.

Stale Navrud, & Olvar Bergland. (2004). Value transfer and environmental policy. The International Yearbook of Environmental and Resource Economics 2004/2005, 189.

United Nations. 2021. System of Environmental Economic Accounting.
https://seea.un.org/ecosystem-accounting [Accessed 26 August 2025]

Wilson, M. A., & Hoehn, J. P. (2006). Valuing environmental goods and services using benefit transfer: the state-of-the art and science. Ecological Economics, 60(2), 335–342.

Appendix 1: List of ecosystems in the coastal area adjacent to the MPA

Ecosystem	Area (ha)
Bare	169.24
Coastal forest	2,733.77
Consolidated sediment	11.91
Cultivated	2,043.75
Foredunes	360.08
Formal cultivation	1,906.59
Formal mixed	107.76
Formal residential	149.38
Herbaceous	340.24
Industrial	69.65
Informal cultivation	22.99
Informal residential	355.63
Infrastructure	99.19
Invasive alien plants	52.33
Invasive aquatic macrophytes	0.07
Lentic surfacewater	5.30
Lentic vegetated	890.43
Lotic freshwater	257.85
Lotic saline influence	583.78
Mangroves	55.67
Mixed	1,161.56
Open spaces	174.68
Reeds & sedges	293.74
Riparian	287.40
Salt marshes	45.90
Swamp forest	1,072.26

Unconsolidated sediment	505.88
Water structures	12.12
(blank)	0.62
Total	**13,769.80**

Appendix 2: Expert-modified maps of ecosystem service provision

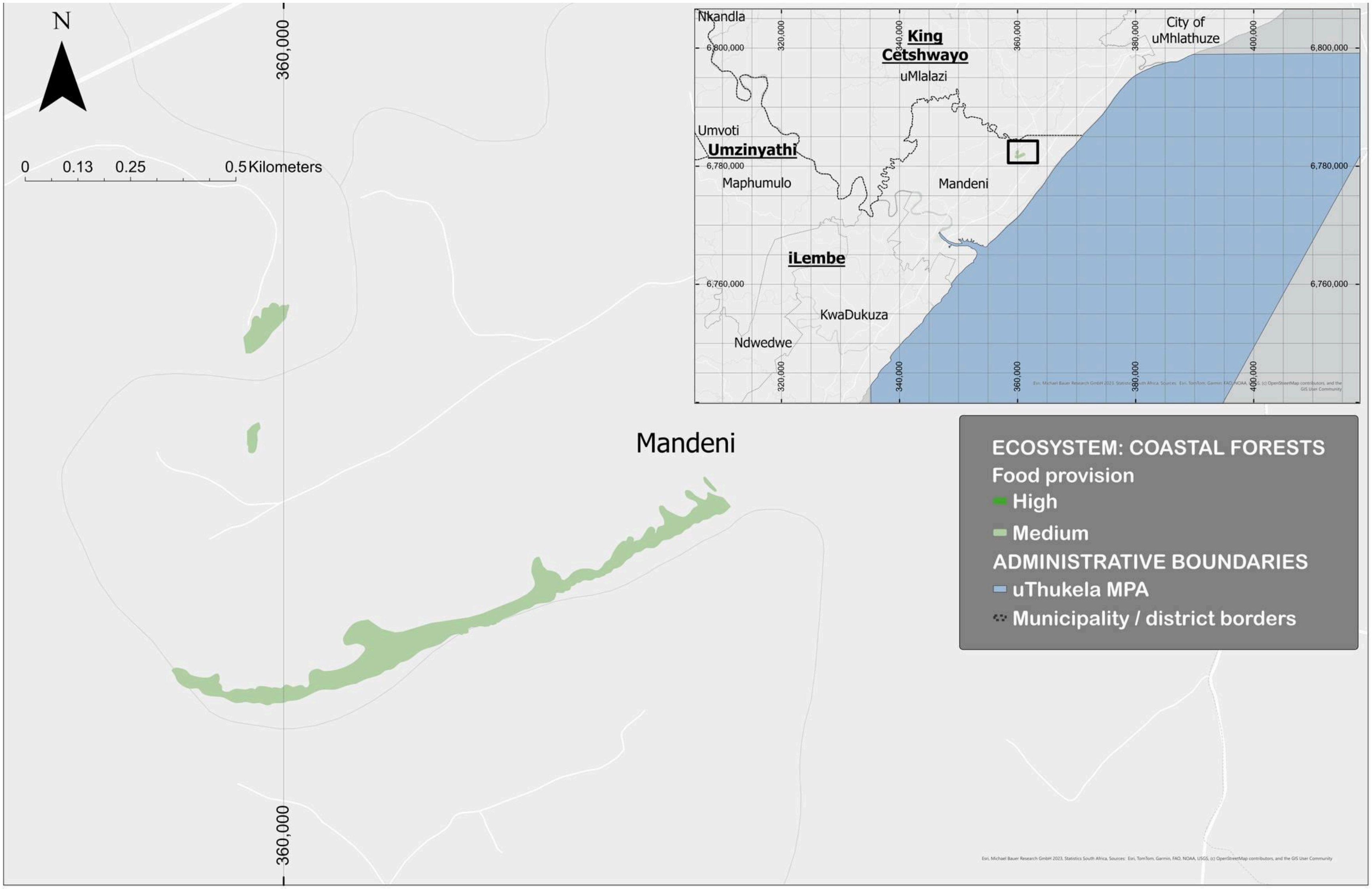

Figure 1. Coastal Forest: Food

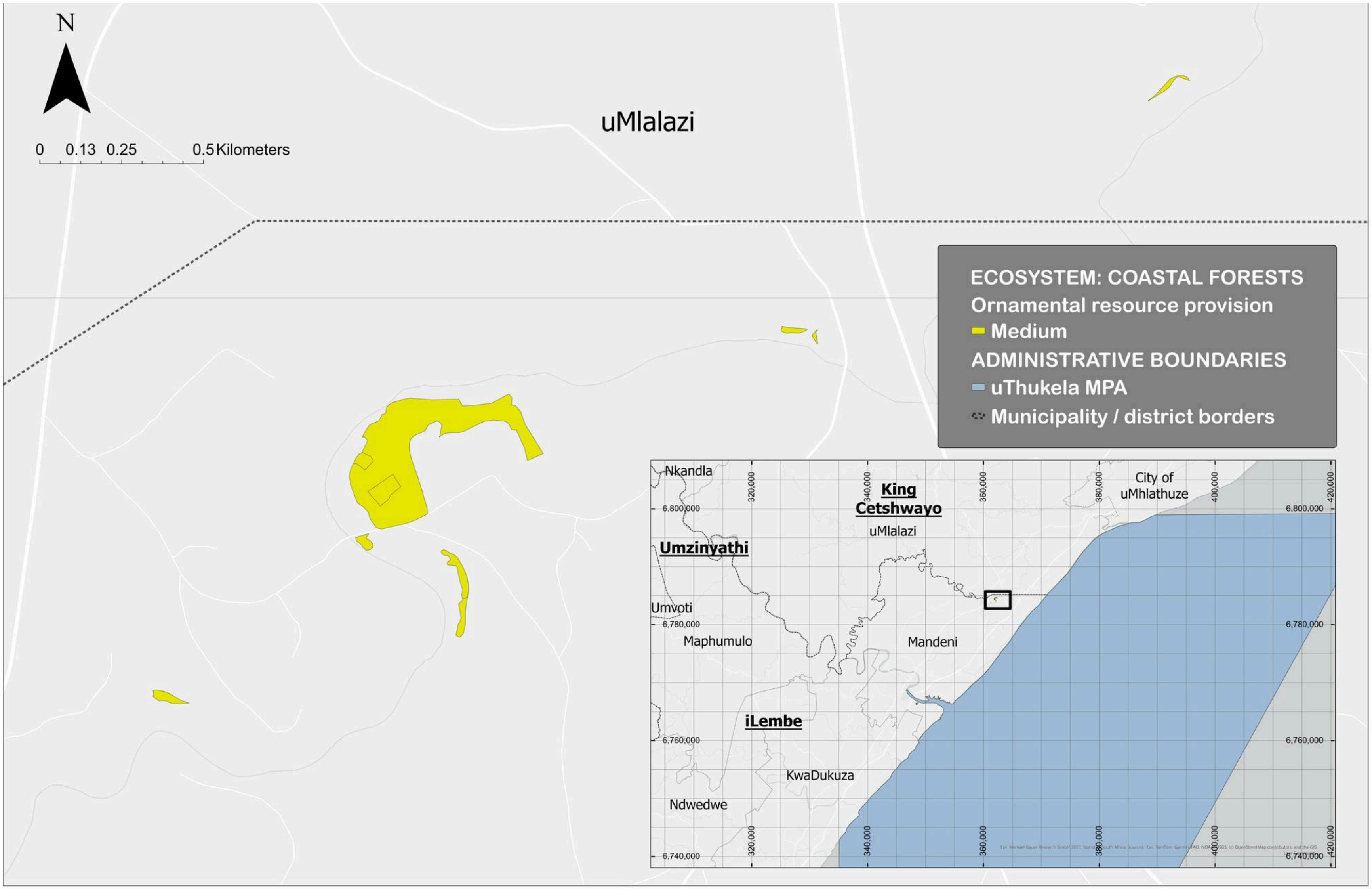

Figure 2. Coastal Forest: Ornamental Resources

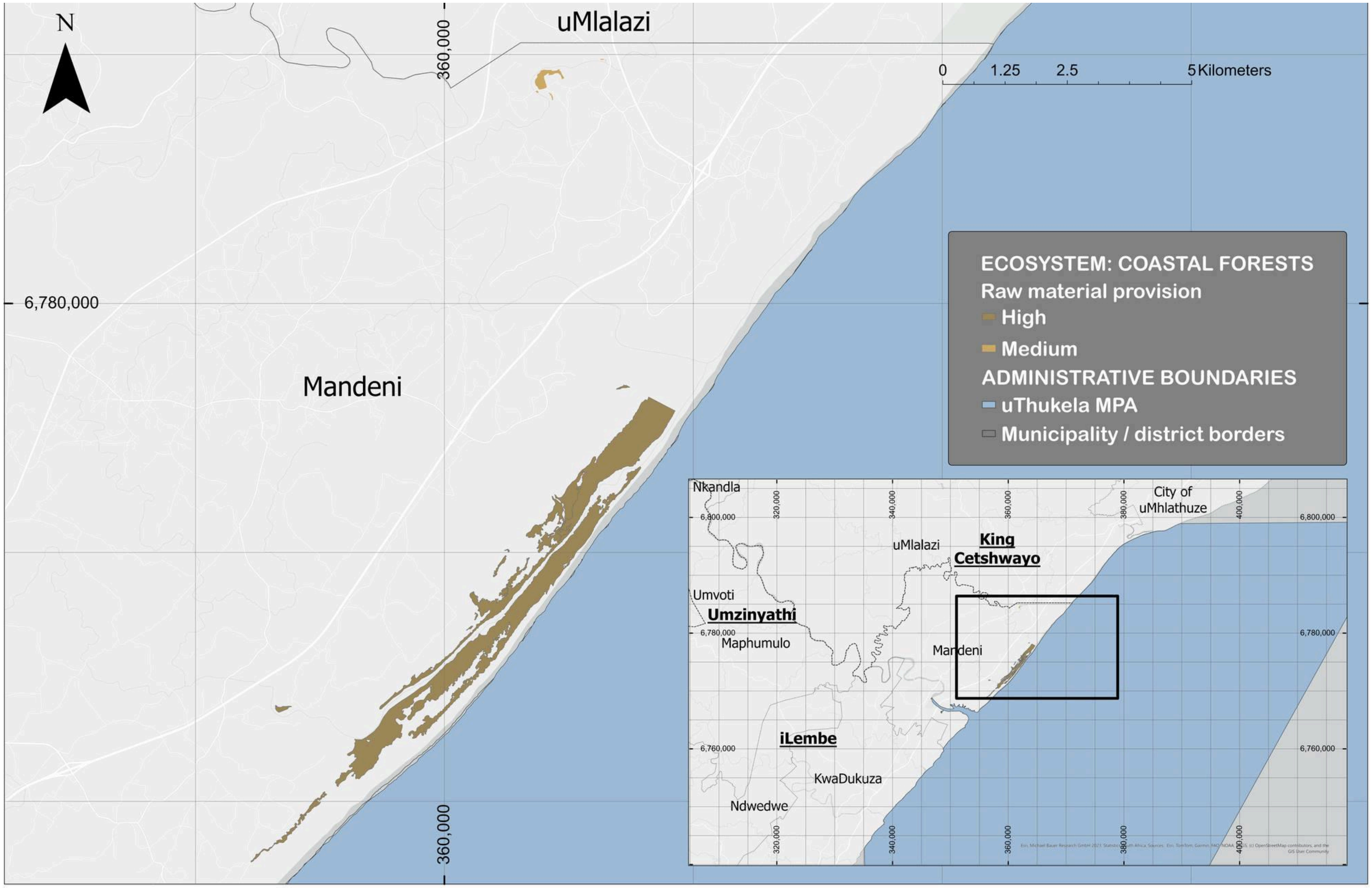

Figure 3. Coastal Forest: Raw Materials

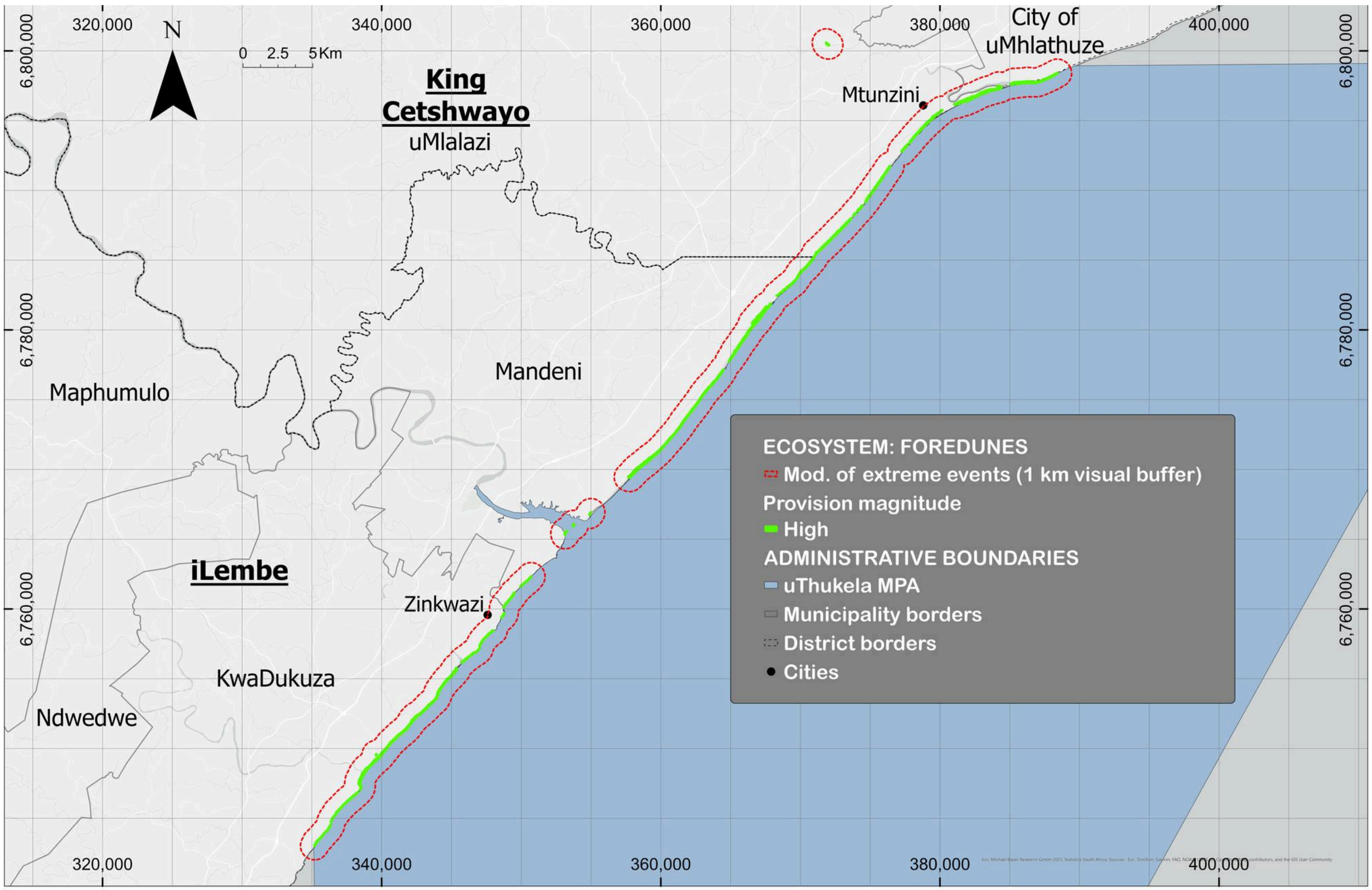

Figure 4. Foredunes: Moderation of Extreme Events

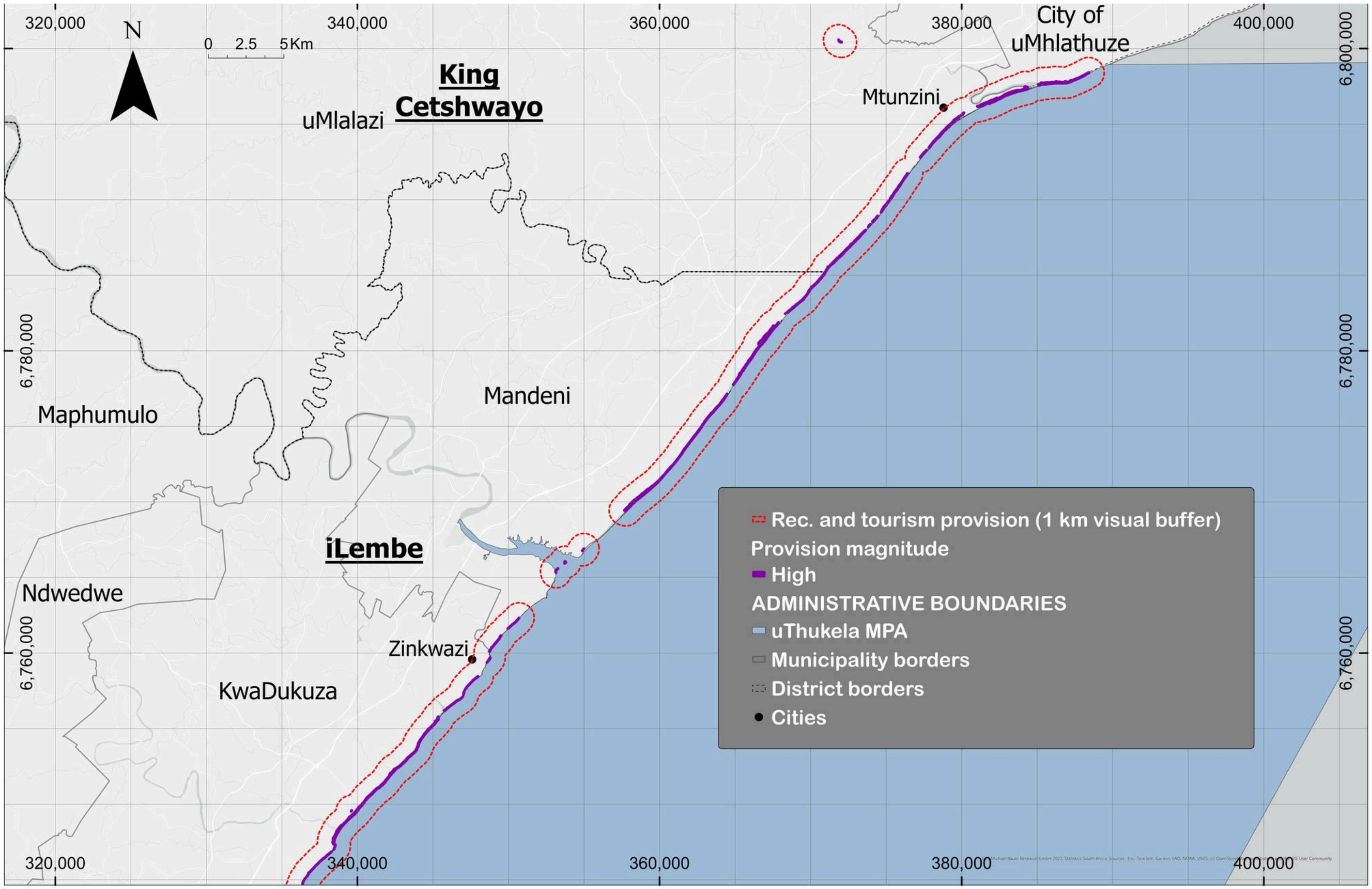

Figure 5. Foredunes: Opportunities for Recreation and Tourism

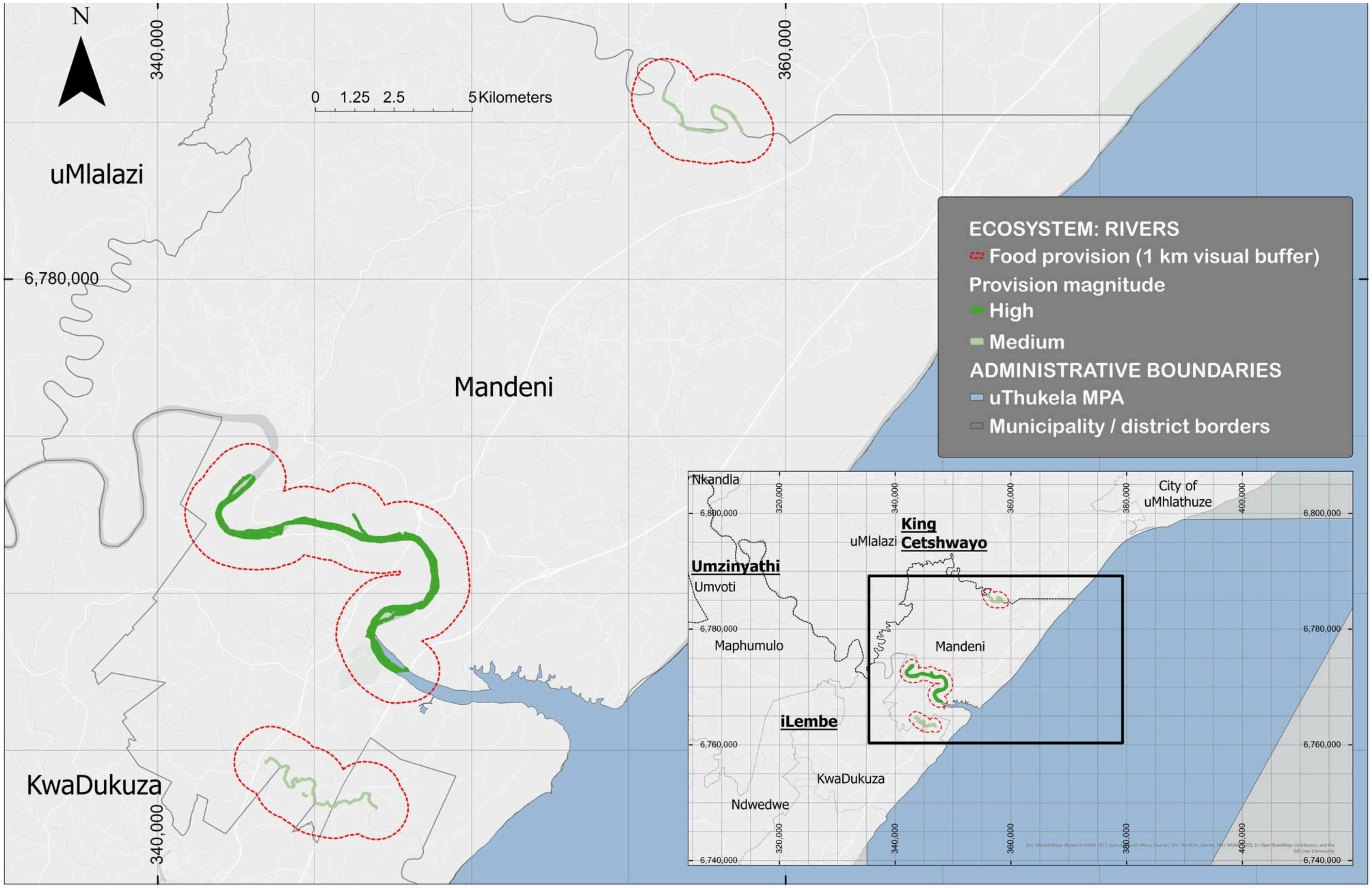

Figure 6. Lotic freshwater (Rivers): Food

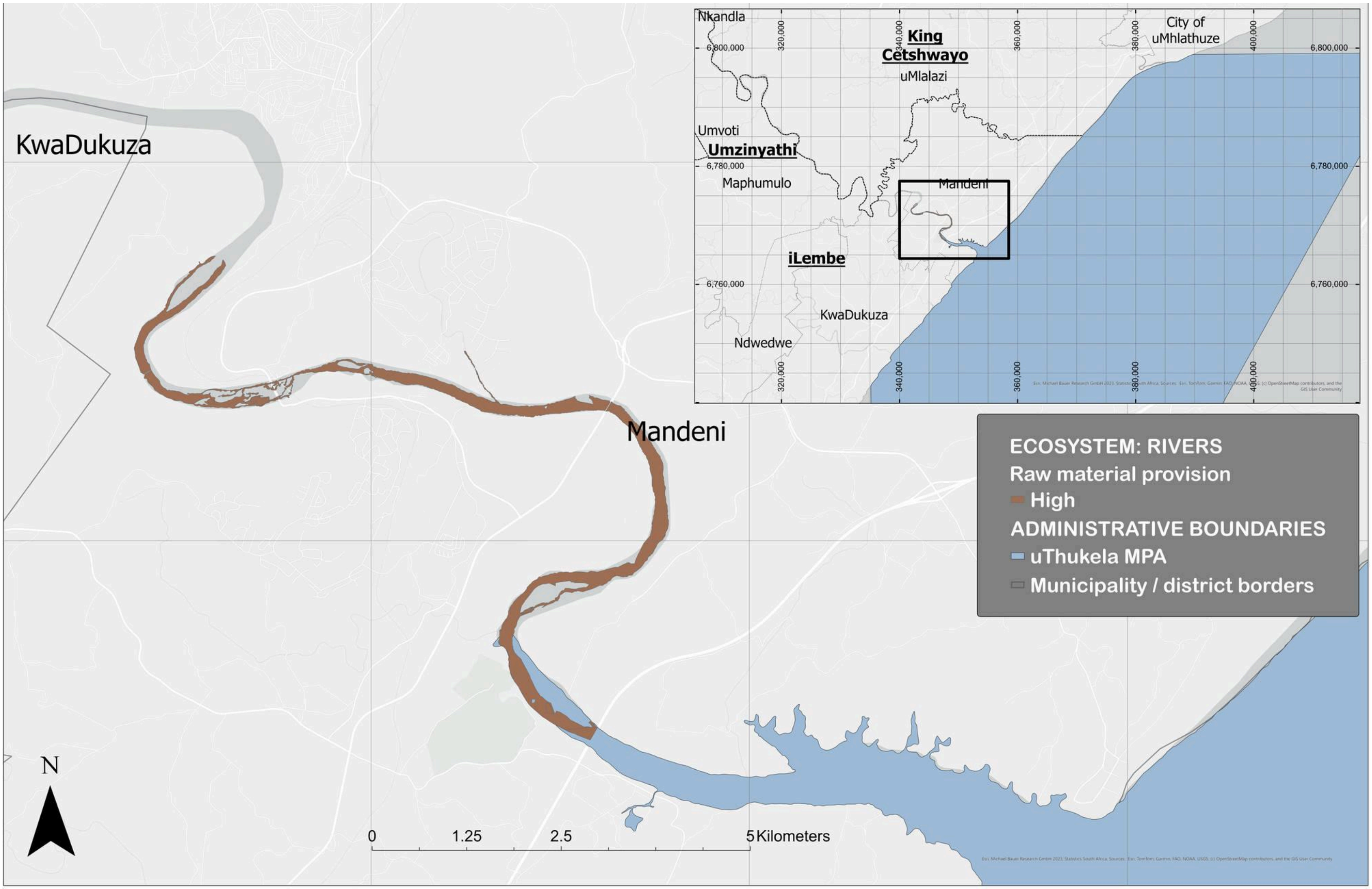

Figure 7. Lotic freshwater (Rivers): Raw Materials

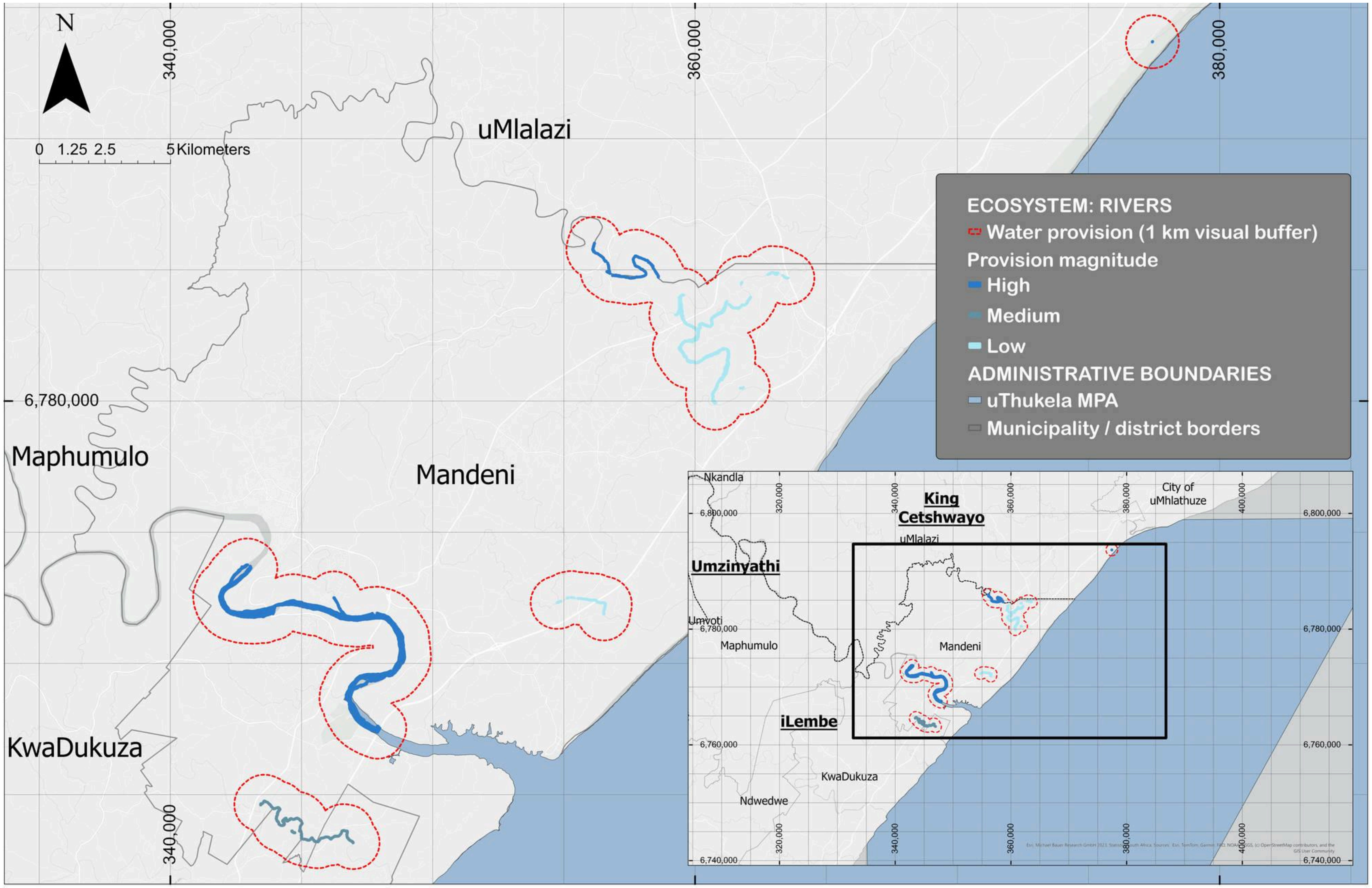

Figure 8. Lotic freshwater (Rivers): Water

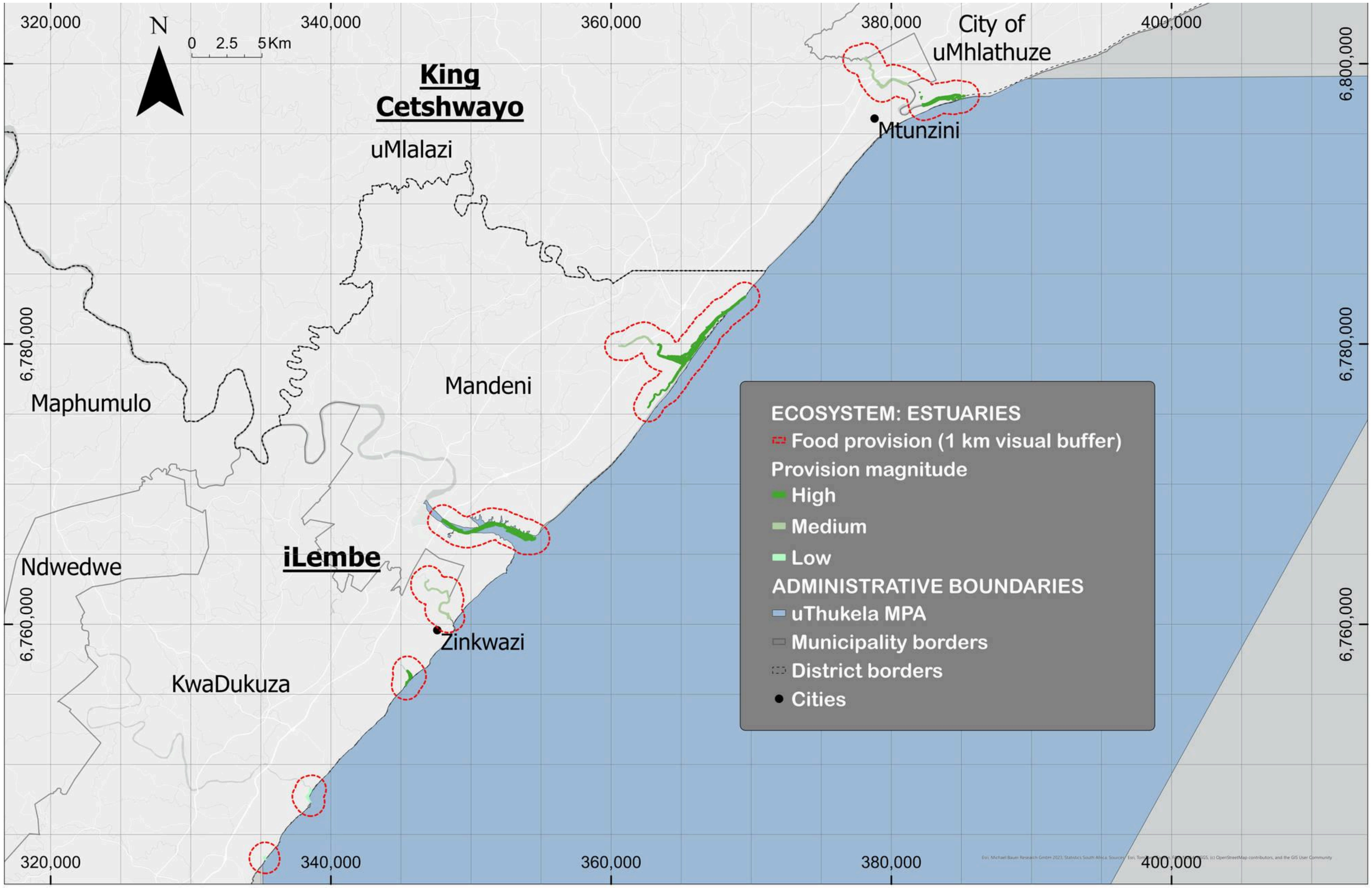

Figure 9. Lotic Saline Influence (Estuaries): Food

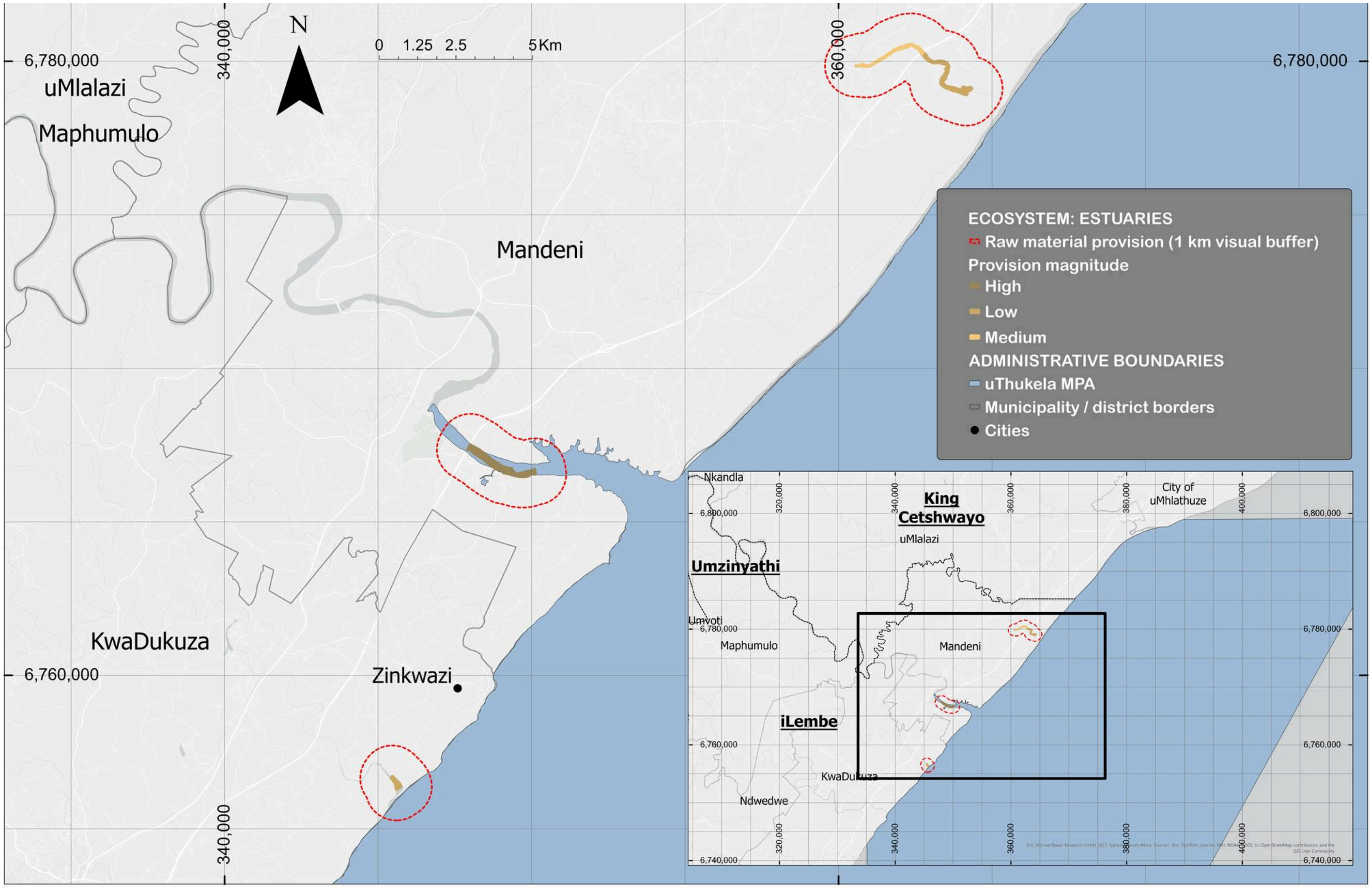

Figure 10. Lotic Saline Influence (Estuaries): Raw Materials

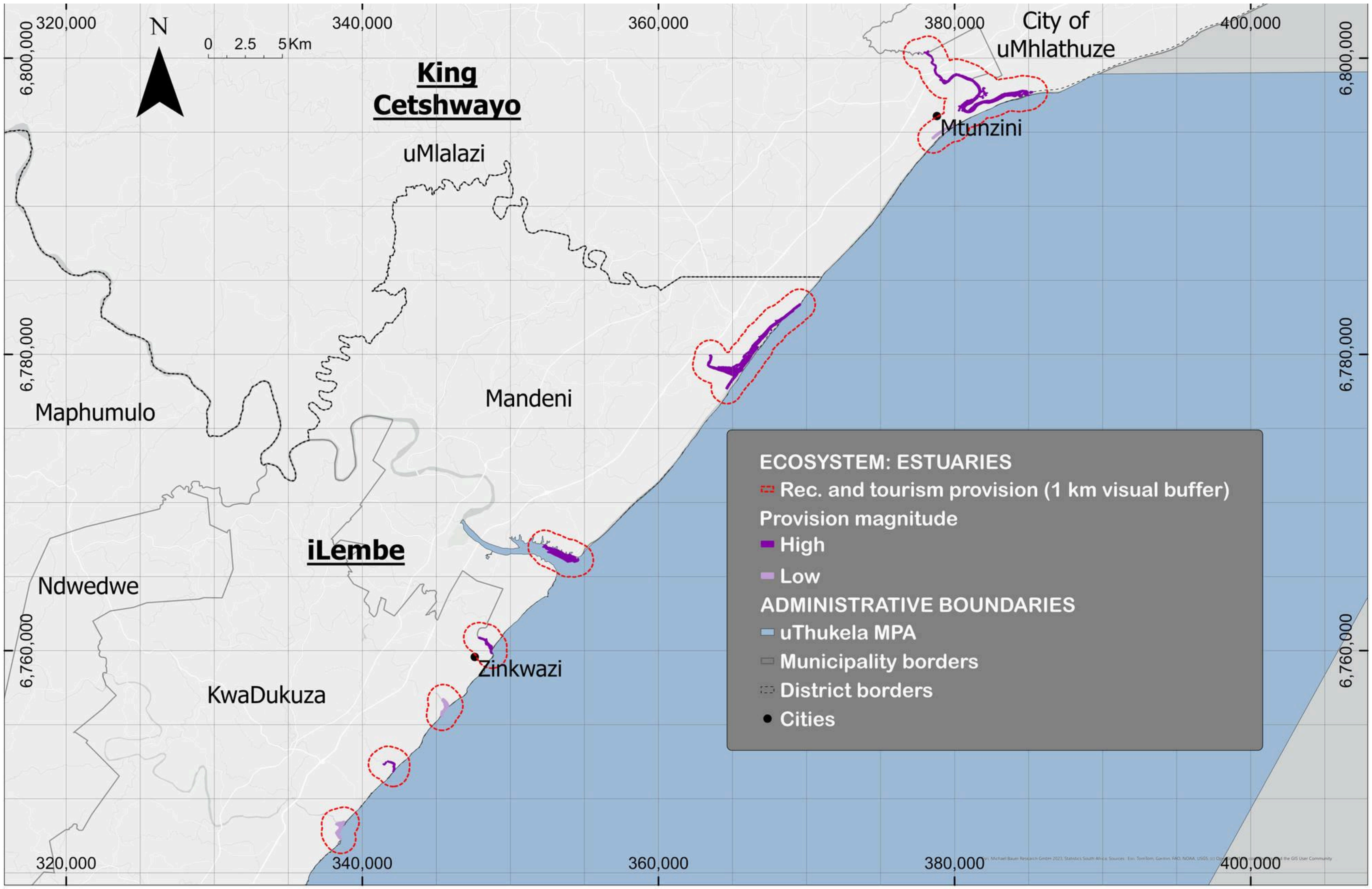

Figure 11. Lotic Saline Influence (Estuaries): Opportunities for Recreation and Tourism

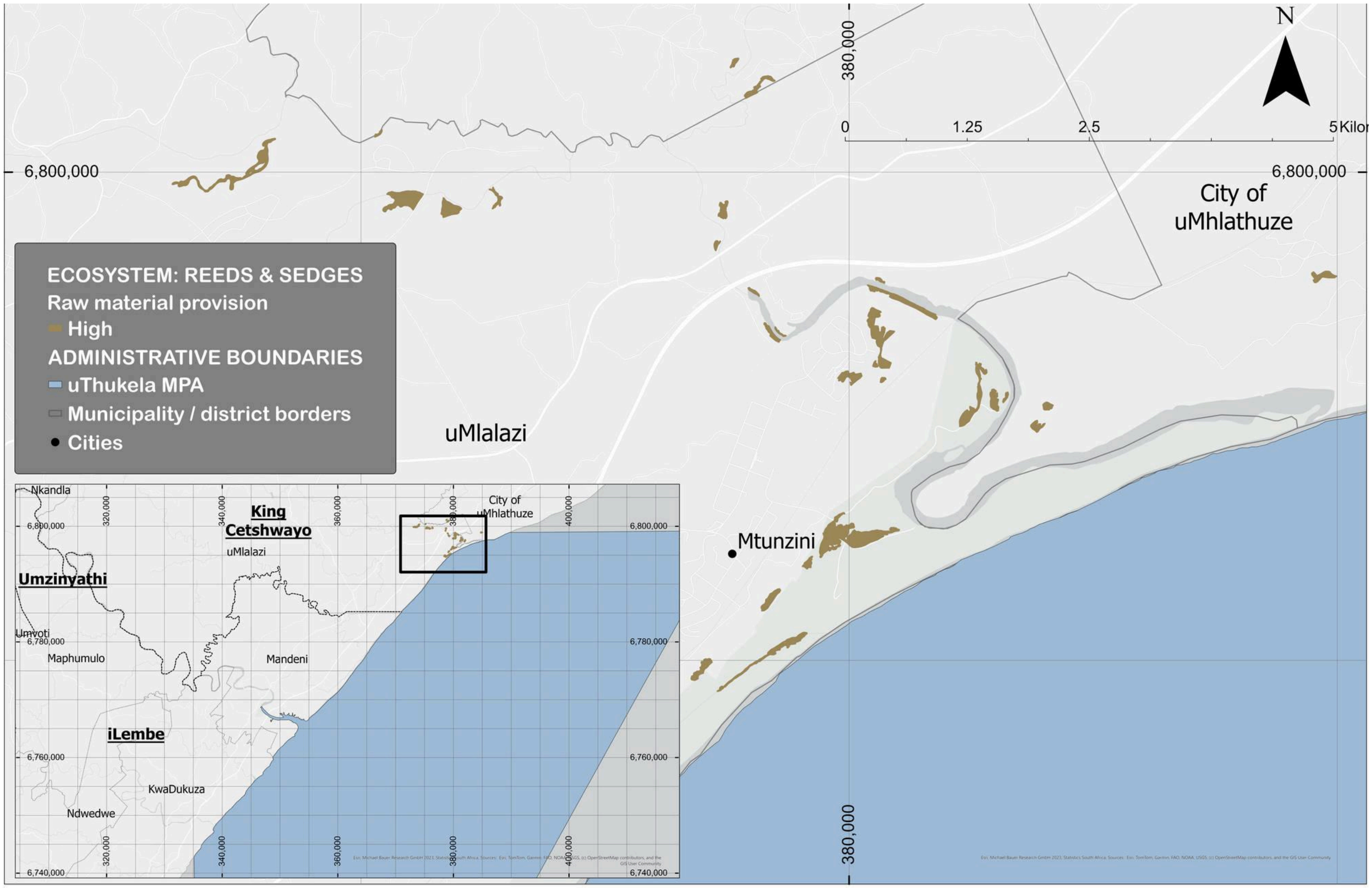

Figure 12. Reeds and Sedges: Raw Materials

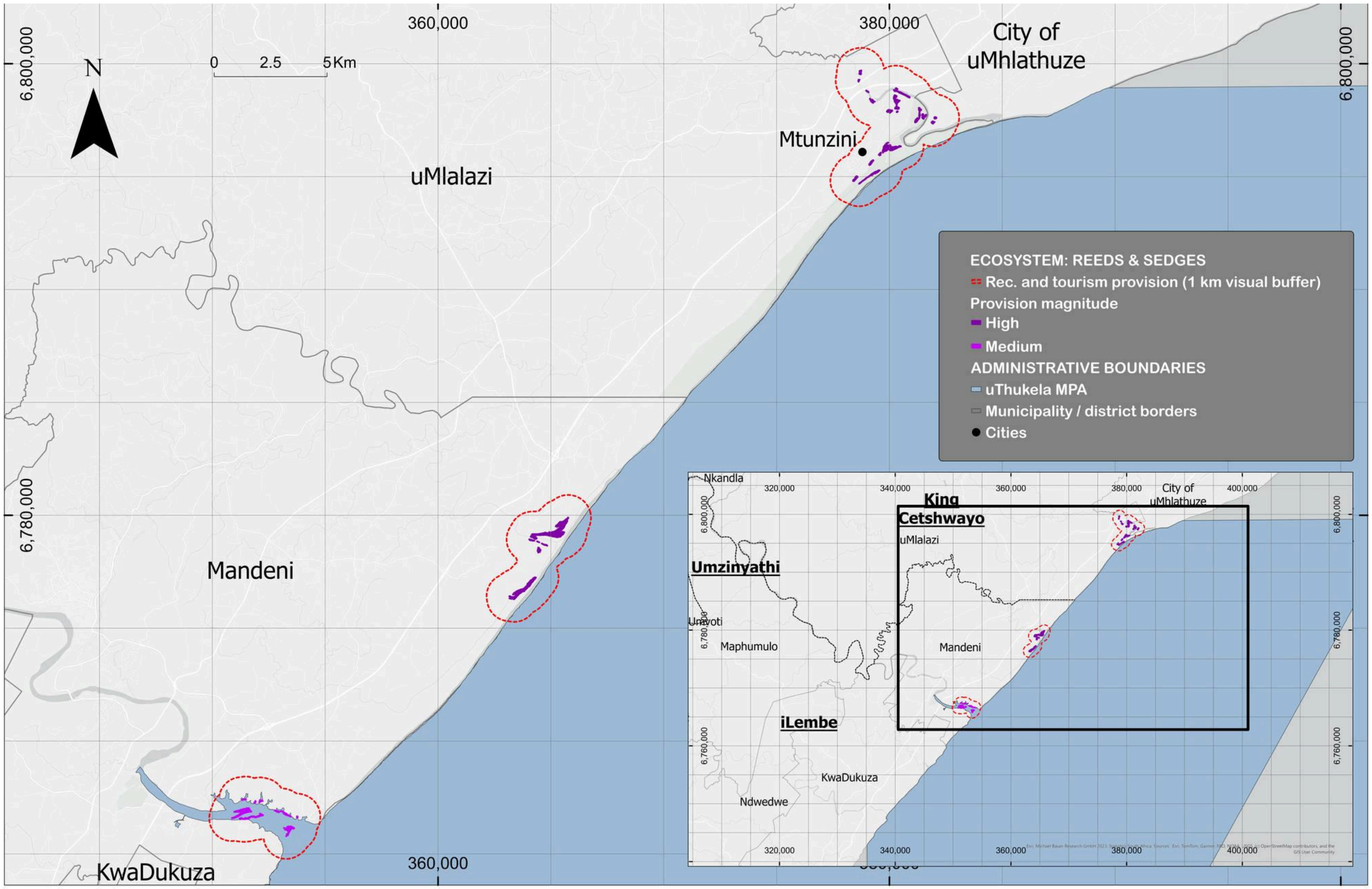

Figure 13. Reeds and Sedges: Opportunities for Recreation and Tourism

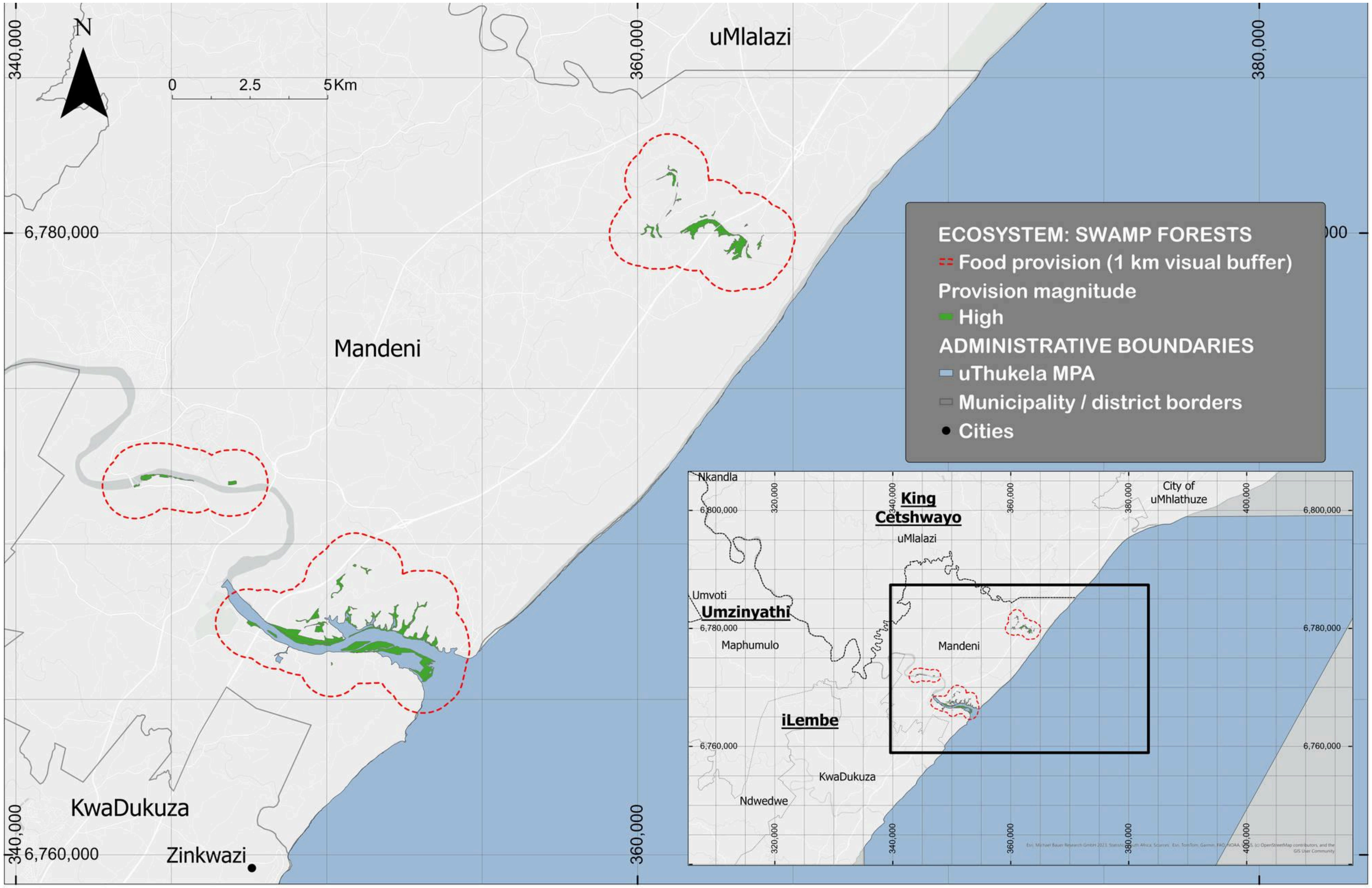

Figure 14. Swamp Forest: Food

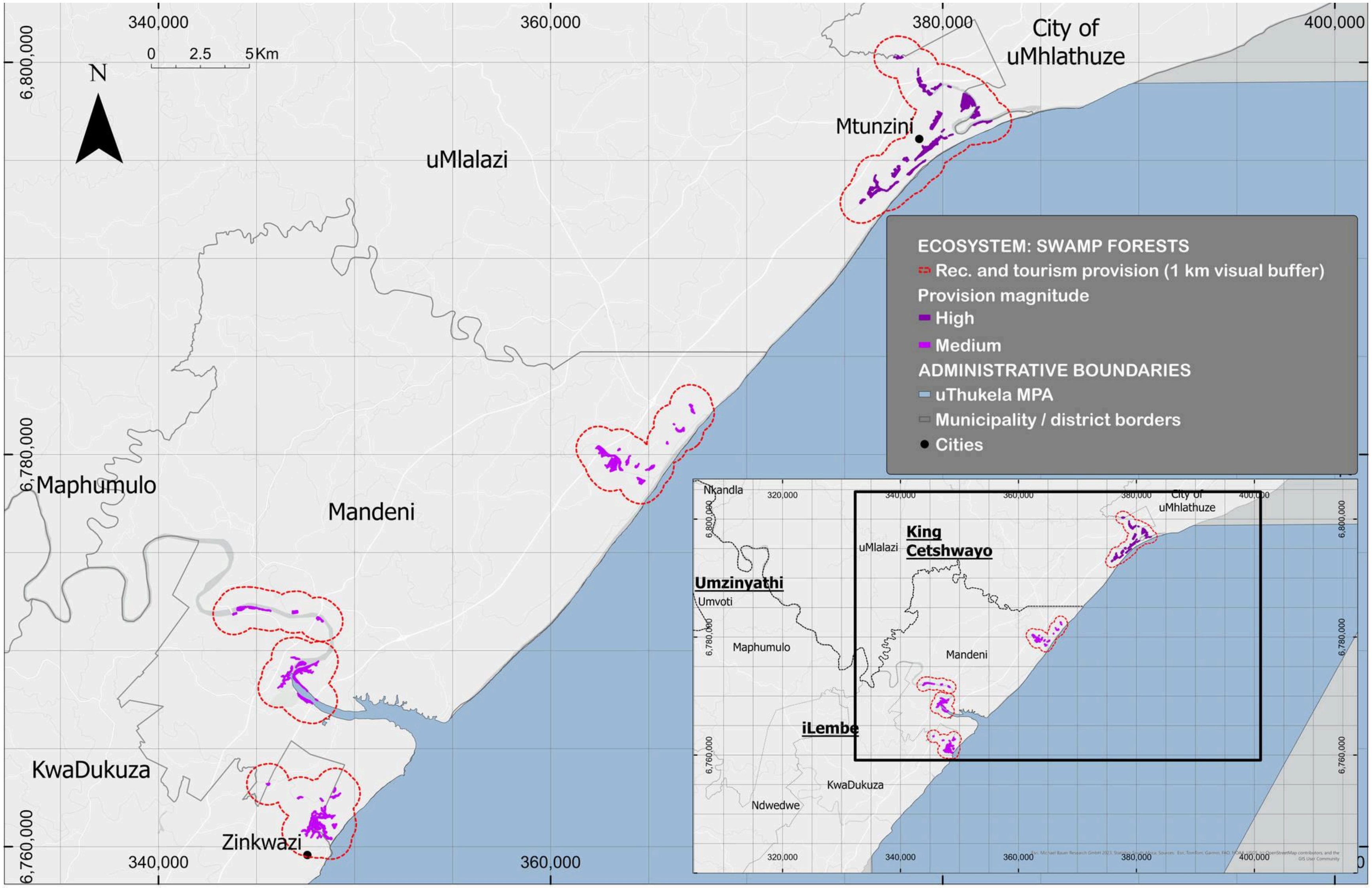

Figure 15. Swamp Forest: Opportunities for Recreation and Tourism

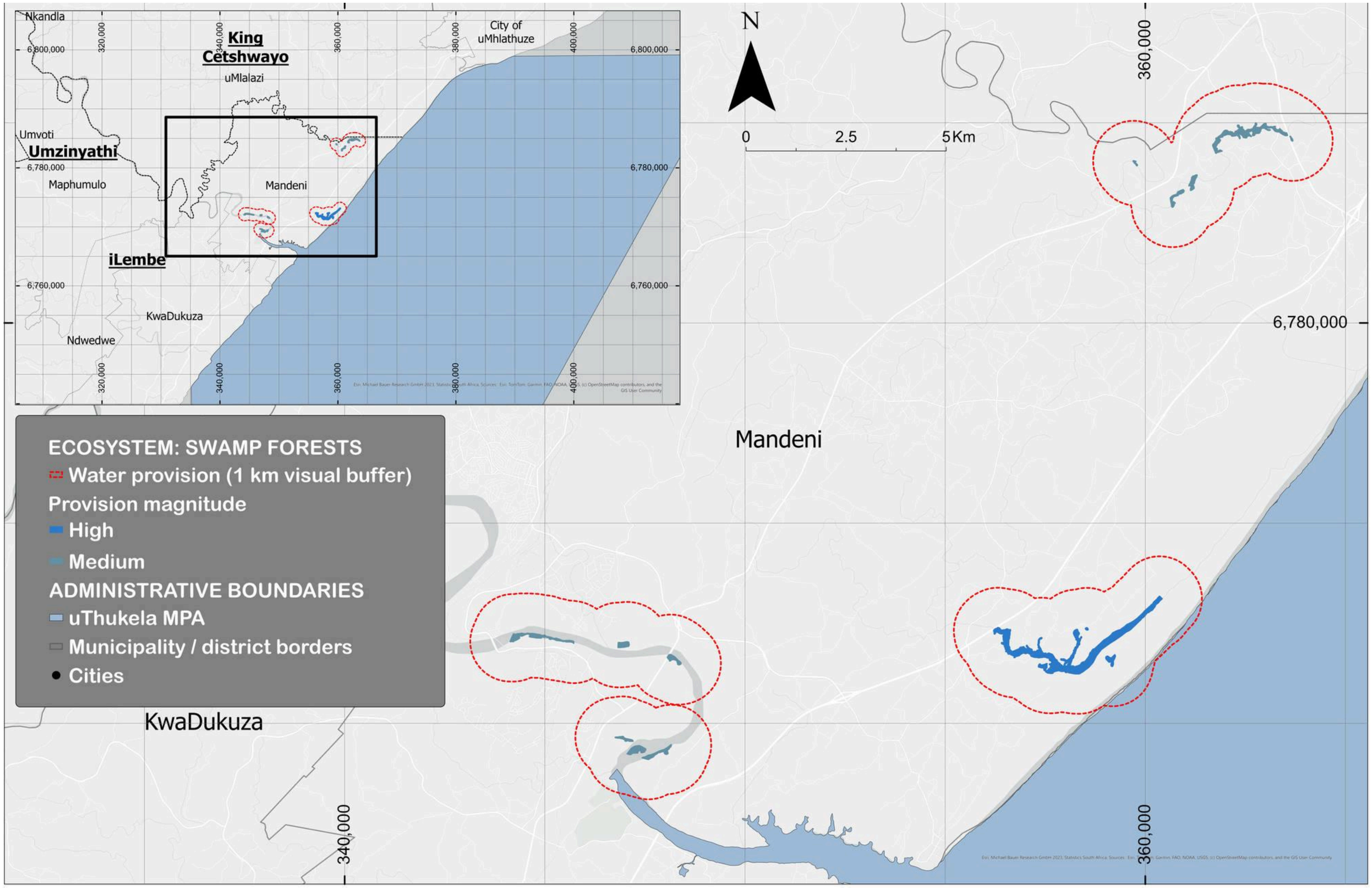

Figure 16. Swamp Forest: Water

Appendix 3: Participatory mapping workshop agenda

uThukela Marine Protected Area (MPA) Ecosystem Services Participatory Mapping Valuation Workshop

Date: 25 July 2025
Time: 08:30 – 16:15
Location: Mtunzini Country Club in uMlalazi, KwaZulu-Natal, South Africa

Purpose

This full-day workshop uses participatory mapping to spatially refine benefit transfer estimates of ecosystem service values for the uThukela MPA. The expert modification is based on identifying the real areas where ecosystem services are provided, allowing for more precise application of transferred values.

Goal

Refine ecosystem service valuation by spatially identifying service-relevant areas through participatory mapping.

Participants

- Marine ecologists and conservationists
- Local fishers or fisher associations
- Tourism operators (e.g., diving/snorkeling)
- Local government or MPA authorities
- Cultural heritage or community leaders
- Environmental economists and facilitators

Specifics:

- Ezemvelo KZN Wildlife (5)
- DFFE/EDTEA (3)

- WildTrust (7)
- Traditional authorities (4)
- Tourism entities/associations (3)
- Skiboat club representation (Tinley Manor, Mtunzini etc.) (4)
- Local fishers co-op (3)
- Other NGOs (SAAMBRA, ORI) (4)
- CSF (3)

Total: 36

Agenda

08:30–09:00 | Arrival & registration
- Coffee/tea and informal introductions
- Distribute agenda, maps, and workshop materials

09:00–09:30 | Welcome & workshop framing (30 mins)

- Welcome and Introductions
- Introduce the valuation project and goals
- Purpose of the workshop
- Explain benefit transfer method and why expert spatial input matters (clarify that we are refining values spatially, not economically)

09:30–10:15 | Session 1 – Natural capital overview and results (45 mins)

- Present ecological zones, preliminary benefit transfer results
- Share cultural and local-use insights
- Set up the participatory mapping activity

10:15–10:30 | Tea Break (15 mins - take a working tea and straight to Session 2)

10:30–13:30 | Session 2 – Participatory mapping: spatial value refinement (3 hours)

- Groups map actual areas where services are provided (e.g., fishing zones, recreational areas, spiritual sites)
- Annotate intensity of use, seasonal variations, threats, and changes
- Use color codes or stickers to indicate high/medium/low priority
- Document justifications and notable observations

13h30 - 14h30 - Lunch (1 hour)

14:30–15:15 | Session 3 – Plenary discussion & map sharing (45 mins)

- Each group presents their mapped outputs
- Discuss key differences from assumed areas
- Highlight critical insights or constraints
- Reach agreement on area delineations

15:15–15:45 | Session 4 – From maps to values (30 mins)

- Explain how these mapped areas will be used to refine valuation (e.g., adjusting ha used in $/ha/year)
- Clarify any assumptions and next steps
- Note any qualitative insights on under-/over-valuation

15:45–16:15 | Session 5 – Wrap-up (30 mins)

- Summarize results and next steps
- Collect feedback forms or post-it reflections
- Thank participants and provide contact info for draft sharing

Appendix 4: Validation workshop agenda

uThukela Marine Protected Area (MPA) Ecosystem Services Valuation Validation Workshop

Date: 20th November 2025
Time: 15:00 – 17:00
Meeting Link

The goal of this workshop:
To present the findings from the Ecosystem Services Valuation analysis, and follow on from the mapping exercise conducted in July this year. Participants will have the opportunity to provide feedback, question and review the results, ensuring that the outputs are relevant for future management and planning of the uThukela MPA. In addition, the workshop will begin a process for assessing sustainable finance opportunities for the management of the MPA and associated sustainable development objectives.

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Macambini Traditional Authority | Mkhwanazi Traditional Authority

WORKSHOP PROGRAMME

ITEM AND FORMAT	LEAD
Welcome and introductions	Musa Mabasa
Overview of the uThukela Economic Valuation (background and objectives, and inclusion into the broader WT plans)	Mark Gerrard
• Methods • Methods on Fisheries	Marcello Hernández/ Wadzanai Mafunga
Results	Felipe Gandra/ Wadzanai Mafunga
Challenges and limitations	Felipe Gandra/ Wadzanai Mafunga
Discussion	
Takeaways from the obtained results	Marcello Hernández
Leading into Conservation Finance	Mark Gerrard
Closing and Vote of Thanks	Makhosi Mkhwanazi

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Appendix 5: Subsistence fisheries validation workshop agenda

Date: 5 February 2026
Time: 09:00 – 12:30
Location: The Hatchery, Amatikulu Mouth and WildTrust Hub, Port Durnford

Time	Session	Purpose	Lead / Method
10 min	Welcome & Opening	Welcome participants, explain purpose of the workshop, set expectations	Facilitator Musa – plenary
10 min	Recap of the Assessment	Brief overview of what was assessed and how the valuation was done	Facilitator Wadzi – presentation
25 min	Presentation of Key Results	Present main findings on the value of subsistence fisheries and coastal ecosystems	Facilitator Wadzi & Laylaa – presentation with visuals
30 min	Validation Discussion	Validate results with fishers' experiences; identify gaps or corrections	Facilitated discussion Musa & Wadzi / small groups
10 min	Adjustments & Consensus	Agree on which results are accurate and what needs adjustment	Facilitator Wadzi – plenary discussion
10 min	Way Forward	Explain how results will be used and outline next steps	Facilitator Mark– plenary
5 min	Closing	Final comments and appreciation	Facilitator Mark

Appendix 6: Example of the data captured in the BLMS database for the Zinkwazi launch site in 2016

ORI Unpublished Report 341

BOAT LAUNCH SITE FEEDBACK

Boat launch site:	Zinkwazi
Feedback period:	Jan – Dec 2016
Daily launch limit:	15

Launch Site Licence Holder
KwaDukuza Municipality

	No. of launches	J	F	M	A	M	J	J	A	S	O	N	D	Total
Vessel	Inflatable		1										1	2
	Jet-ski	2		1	3	3			4			2	5	20
	Paddle-craft													
	Ski-boat	67	36	50	39	97	12	41	21	33	14	37	71	518
	Unspecified	4	1	4	2	3	2	3	3			1	4	27
Purpose	Charter fishing		1		4	3		2	5		1	2	4	22
	Charter pleasure													
	Charter scuba													
	Charter whale/dol.[1]													
	Commercial fishing	1	10	17	10	14	6	1		10	7	8	8	92
	Private fishing	63	23	33	25	76	8	40	20	23	5	28	64	408
	Private pleasure		1											1
	Private scuba													
	Private spearfishing		1			1								2
	Other/ unspecified	9	2	5	5	9		1	3		1	2	5	42
	Total launches	73	38	55	44	103	14	44	28	33	14	40	81	567

1. Charter whale/dolphin viewing

General results	Launches/day[2]	3
	Launches/weekday[2]	3
	Launches/weekend day[2]	5
	% days launched	47%
	No. days limit exceeded	5
	Persons on vessel	3
	Proportion night launches	2%
	Proportion night beaching	3%
	Duration of outing (hours)	6.81
	Popular destination	R-34
		61%

2. In terms of averages

Recreational catch returns	Targeting	64% bottomfish
		32% gamefish
	Diversity	49 spp.
	Main catch composition	
	Unsp. kob	22.2%
	Slinger	13.9%
	Unsp. rockcod	13.7%
	Dorado/dolphin fish	7.5%
	Unsp. grunter	5.8%
	Catch rate (retained fish)	
	7.0 fish/outing	

Appendix 7: An extract of the original dataset from the NLMS system provided by ORI

start_datetime	end_datetime	locality	return_type	gear_type	form_number	species	num_angler	num_caught
2015/01/06 06:00	2015/01/06 11:02	3900	inspection	SKROD	698956	YFTN	1	1
2015/01/06 08:00	2015/01/06 11:00	3900	inspection	SKROD	698957	YFTN	1	1
2015/01/07 06:20	2015/01/07 09:37	3900	inspection	SKROD	698953	YFTN	1	4
2015/01/07 06:30	2015/01/07 09:28	3900	inspection	SKROD	698958	YFTN	1	1
2015/01/07 08:00	2015/01/07 10:50	3900	inspection	SKROD	698954	KMCK	1	1
2015/01/07 08:30	2015/01/07 12:08	3900	inspection	SKROD	698959	YFTN	2	1
2015/01/10 05:00	2015/01/10 13:25	3883	inspection	SKROD	699006	ELTN	3	1
2015/01/10 05:00	2015/01/10 13:25	3883	inspection	SKROD	699006	DLFS	3	3
2015/01/10 05:00	2015/01/10 14:50	3883	inspection	SKROD	699008	KSLD	3	1
2015/01/10 05:00	2015/01/10 15:10	3883	inspection	SKROD	699009	YFTN	4	1
2015/01/10 05:00	2015/01/10 14:50	3883	inspection	SKROD	699008	DSKB	3	2
2015/01/10 05:00	2015/01/10 14:50	3883	inspection	SKROD	699008	SSLD	3	2
2015/01/10 05:00	2015/01/10 15:10	3883	inspection	SKROD	699009	DLFS	4	3
2015/01/10 05:00	2015/01/10 15:10	3883	inspection	SKROD	699009	SNTR	4	3
2015/01/10 05:00	2015/01/10 15:10	3883	inspection	SKROD	699009	LYTL	4	4
2015/01/10 05:00	2015/01/10 15:10	3883	inspection	SKROD	699009	FISH	4	5
2015/01/10 05:00	2015/01/10 14:50	3883	inspection	SKROD	699008	LYTL	3	6
2015/01/10 05:00	2015/01/10 09:45	3900	inspection	SKROD	698703	YFTN	1	4
2015/01/10 05:00	2015/01/10 09:50	3900	inspection	SKROD	698704	YFTN	1	4
2015/01/10 06:00	2015/01/10 13:55	3883	inspection	SKROD	698998	BONT	3	1
2015/01/10 06:00	2015/01/10 13:55	3883	inspection	SKROD	698998	LYTL	3	13
2015/01/10 06:00	2015/01/10 13:55	3883	inspection	SKROD	698998	DLFS	3	5
2015/01/11 05:00	2015/01/11 11:00	3883	inspection	SKROD	699010	ELTN	3	2
2015/01/11 05:00	2015/01/11 11:00	3883	inspection	SKROD	699010	YFTN	3	2
2015/01/11 05:00	2015/01/11 11:00	3883	inspection	SKROD	699010	DLFS	3	9
2015/01/11 05:00	2015/01/11 13:10	3883	inspection	SKROD	699001	DLFS	4	1
2015/01/11 05:00	2015/01/11 13:10	3883	inspection	SKROD	699001	YFTN	4	1
2015/01/11 05:00	2015/01/11 11:40	3883	inspection	SKROD	699004	YFTN	2	4
2015/01/11 06:00	2015/01/11 11:30	3883	inspection	SKROD	699011	ELTN	3	1
2015/01/11 06:00	2015/01/11 11:49	3883	inspection	SKROD	699003	YFTN	2	2
2015/01/11 06:00	2015/01/11 11:30	3883	inspection	SKROD	699011	YFTN	3	2
2015/01/11 06:00	2015/01/11 10:41	3883	inspection	SKROD	699000	YFTN	2	6
2015/01/30 01:00	2015/01/30 01:00	3880	competition	SHROD	710262	MUSMUS	7	3
2015/01/31 05:00	2015/01/31 13:00	3833	competition	SHROD	709985	DMRY	8	18
2015/01/31 05:00	2015/01/31 13:00	3833	competition	SHROD	709985	CARAMB	8	1
2015/01/31 05:00	2015/01/31 12:00	3836	competition	SHROD	704925	DMRY	6	5
2015/01/31 06:00	2015/01/31 14:00	3888	competition	SHROD	709990	BNFS	5	1
2015/01/31 06:30	2015/01/31 14:30	3836	competition	SHROD	704889	DMRY	8	11
2015/01/31 09:30	2015/01/31 17:30	3824	competition	SHROD	709984	DSKB	4	1
2015/01/31 09:30	2015/01/31 17:30	3824	competition	SHROD	709983	DMRY	8	7
2015/01/31 09:30	2015/01/31 17:30	3824	competition	SHROD	709983	HNRY	8	1
2015/01/31 13:00	2015/01/31 21:00	3824	competition	SHROD	710264	DMRY	5	59
2015/01/31 13:00	2015/01/31 21:00	3824	competition	SHROD	710266	DMRY	1	5
2015/01/31 16:00	2015/01/31 23:59	3829	competition	SHROD	704909	DMRY	8	77
2015/01/31 16:00	2015/01/31 23:59	3829	competition	SHROD	704911	DMRY	5	7
2015/01/31 16:00	2015/01/31 23:59	3833	competition	SHROD	704963	DMRY	8	51
2015/01/31 16:00	2015/01/31 23:59	3833	competition	SHROD	704963	RTSH	8	1
2015/01/31 16:00	2015/01/31 23:59	3833	competition	SHROD	704963	SNSH	8	1
2015/01/31 16:00	2015/01/31 23:59	3833	competition	SHROD	704963	BURY	8	1

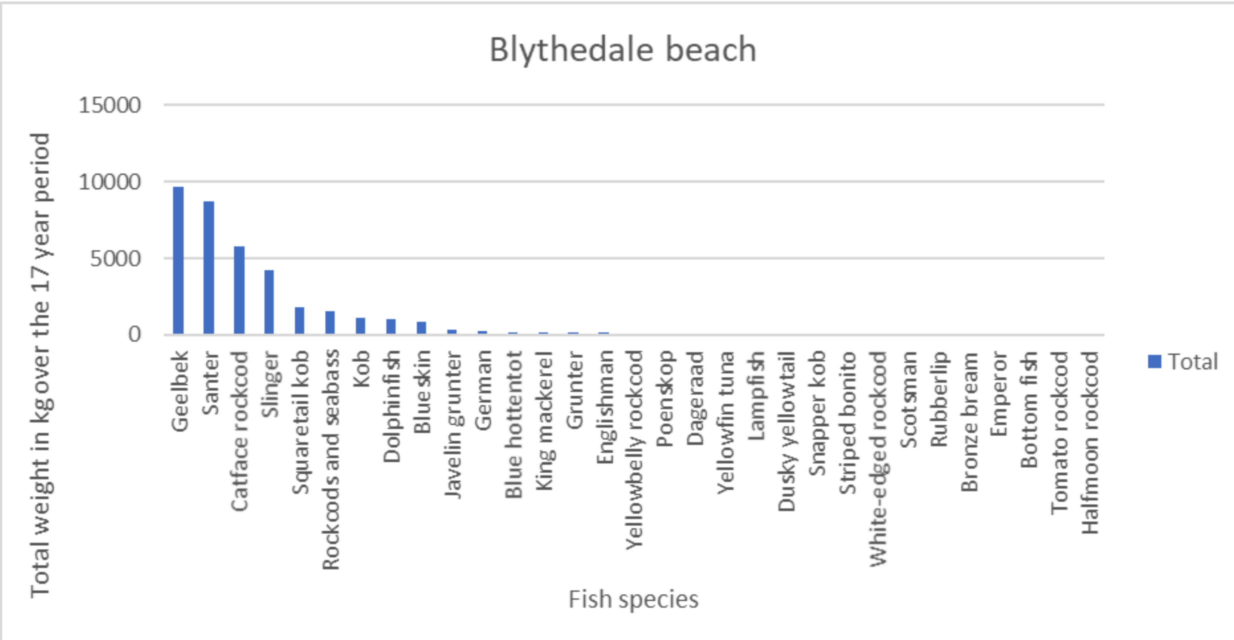
Appendix 8: The 17 distinct cost categories according to Potts et al. (2021).

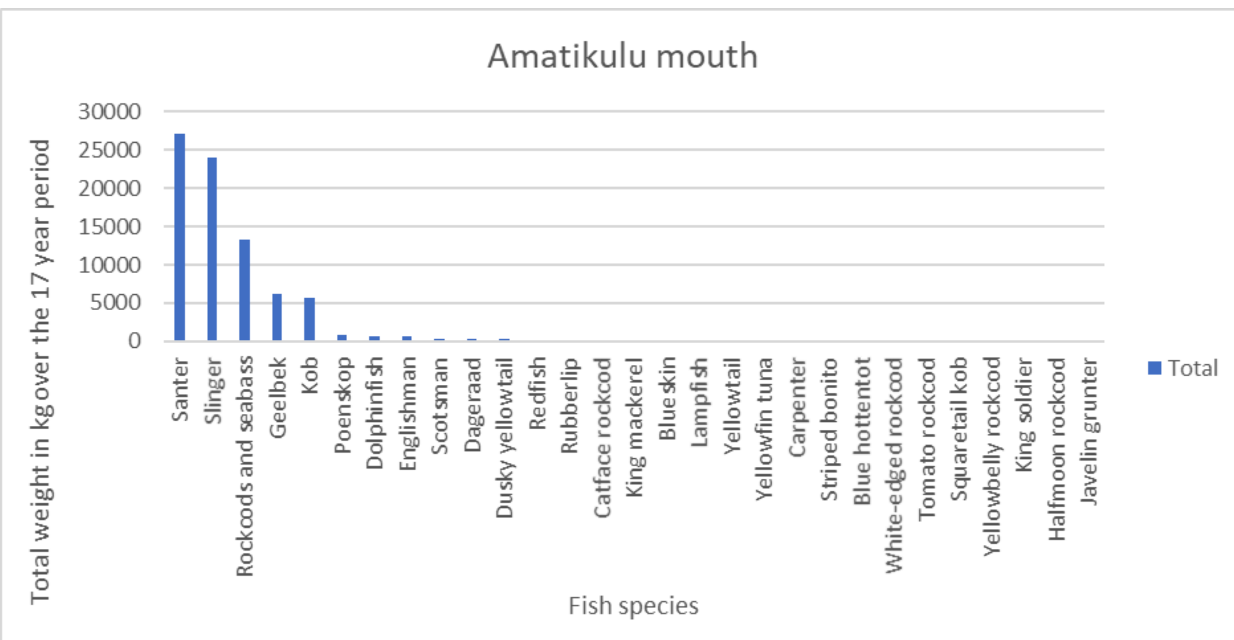
Cost description	Average spend per angler per trip in Rands (Potts et al., 2021)
Entrance fees	241.69
Accommodation	1134.42
Transport	1823.87
Food	1135.81
Alcohol and beverages	467.14
Boat fuel and oil	658.51
Terminal fishing tackle	1484.74
Commercially sourced frozen bait	543.95
Locally harvested bait	114.81
Gillies	50.55
Boat hire	44.96
Competitions	188.72
Parking	21.4
Charter or fishing guides	33.84
Fish cleaning/filleting	6.05
Gifts	104.73
Medical supplies (first aid/sunscreen)	147.17
Total	R8,202.36

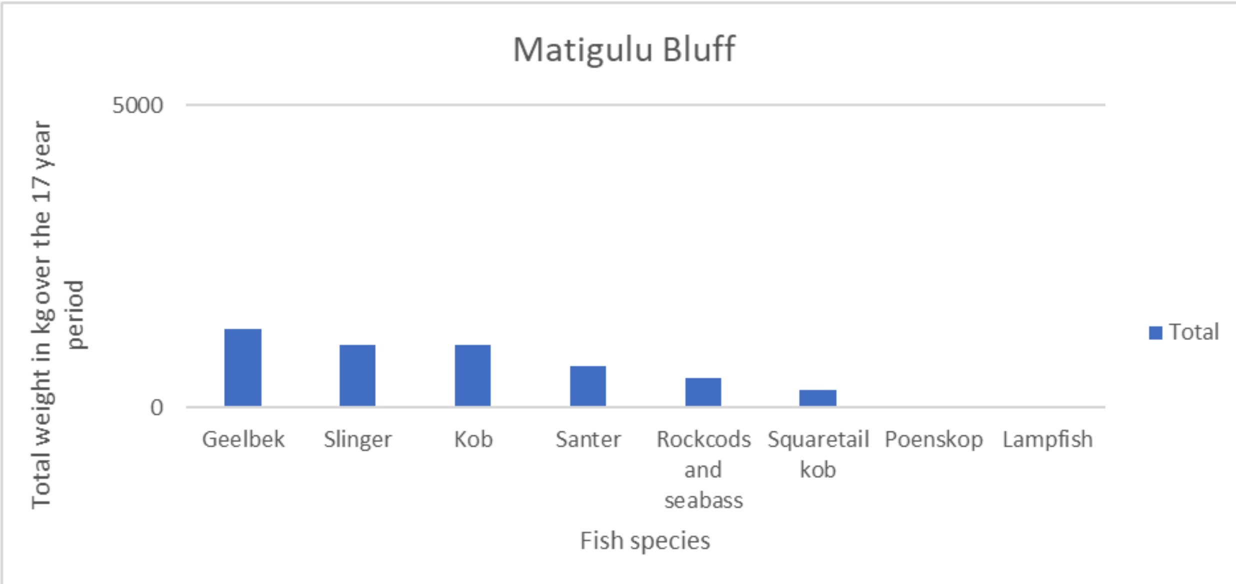
Appendix 9: Structure of the focus group discussions

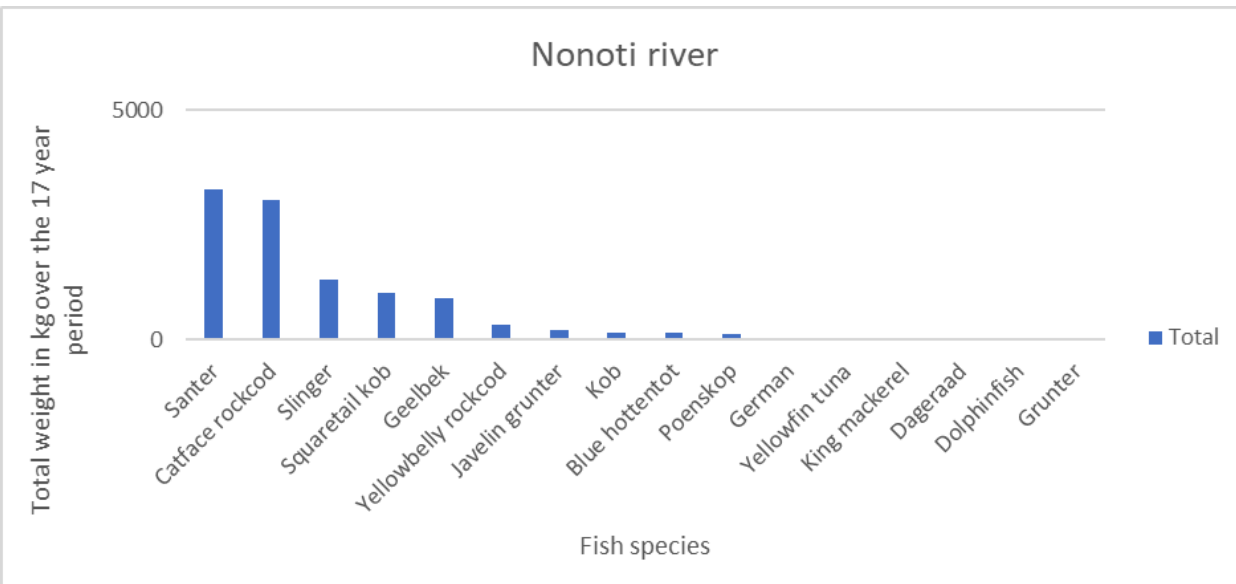
TIME	ACTIVITY
09:00- 09:10	-Introductions and background to the project -Highlight the purpose of the discussion
09:10- 9:45	Catch and effort - Understand how much can be harvested in a day or week during different times of the year -Establish whether they fish as a group or individually -Understand the type of equipment used, its price, durability, and whether it's shared among households -Establish an understanding of the species caught
	Seasonality -Understand changes in availability over the year/ years
	Selling prices -Understand what they do with their catch, whether they sell it, to whom, and at what price.
UNDERSTANDING THE CONTEXT OF THE AREA AND FISHING COMMUNITY	
9:45- 10:00	Number of households engaging in fishing - Average household size, and number of households engaging in fishing activities -Establish the role of men, women and children in the harvest and processing of the resource.

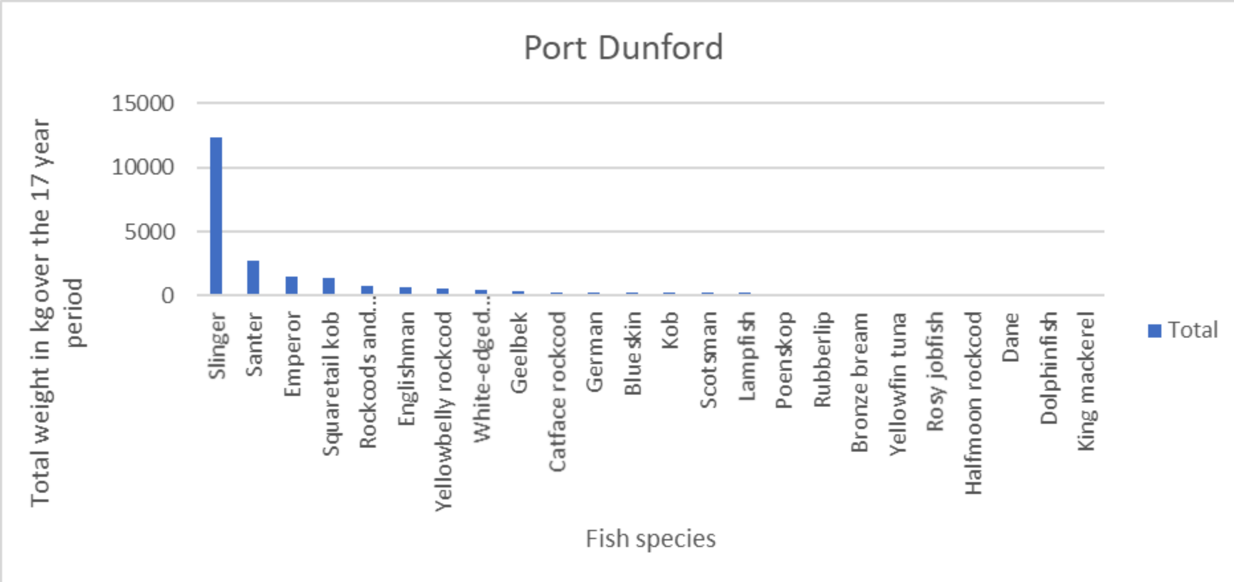
Appendix 10: Distribution of fish species across the 6 areas over the observed period



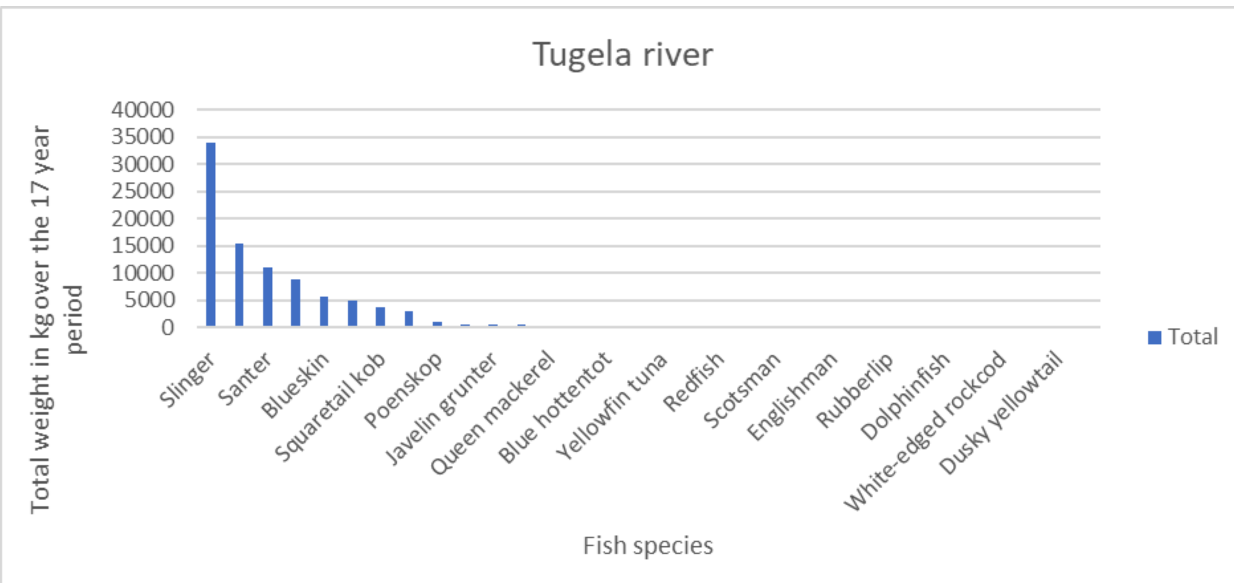



Matigulu Bluff
Total weight in kg over the 17 year period
5000
0
Geelbek
Slinger
Kob
Santer
Rockcods and seabass
Squaretail kob
Poenskop
Lampfish
Fish species
Total

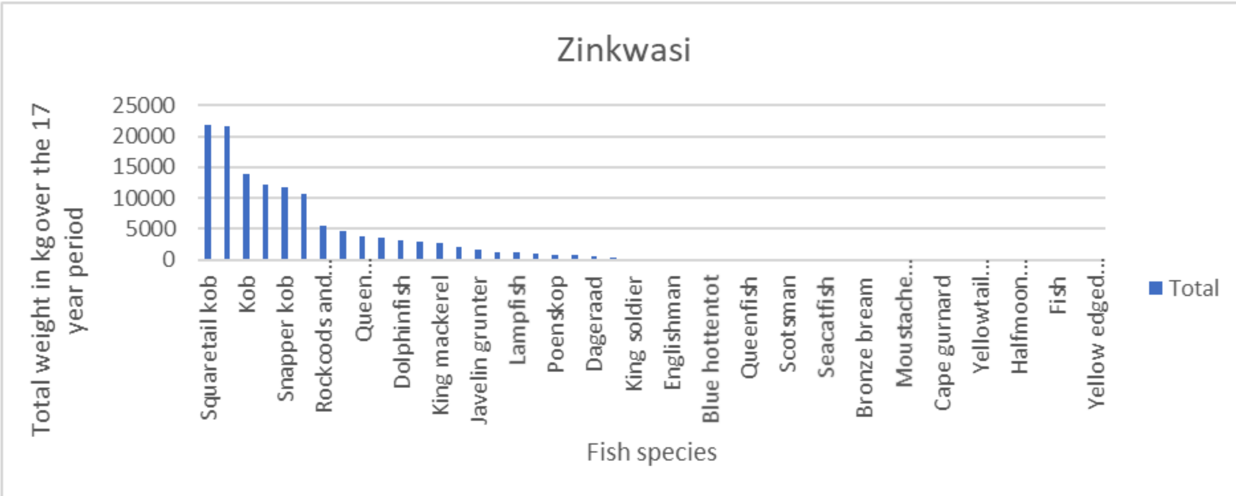

Nonoti river
Total weight in kg over the 17 year period
5000
0
Santer
Catface rockcod
Slinger
Squaretail kob
Geelbek
Yellowbelly rockcod
Javelin grunter
Kob
Blue hottentot
Poenskop
German
Yellowfin tuna
King mackerel
Dageraad
Dolphinfish
Grunter
Fish species
Total



Port Dunford
Total weight in kg over the 17 year period
15000
10000
5000
0
Slinger
Santer
Emperor
Squaretail kob
Rockcods and...
Englishman
Yellowbelly rockcod
White-edged...
Geelbek
Catface rockcod
German
Blueskin
Kob
Scotsman
Lampfish
Poenskop
Rubberlip
Bronze bream
Yellowfin tuna
Rosy jobfish
Halfmoon rockcod
Dane
Dolphinfish
King mackerel
Fish species
Total



Tugela river
Total weight in kg over the 17 year period
40000
35000
30000
25000
20000
15000
10000
5000
0
Slinger
Santer
Blueskin
Squaretail kob
Poenskop
Javelin grunter
Queen mackerel
Blue hottentot
Yellowfin tuna
Redfish
Scotsman
Englishman
Rubberlip
Dolphinfish
White-edged rockcod
Dusky yellowtail
Fish species
Total



Zinkwasi
Total weight in kg over the 17 year period
25000
20000
15000
10000
5000
0
Squaretail kob
Kob
Snapper kob
Rockcods and...
Queen...
Dolphinfish
King mackerel
Javelin grunter
Lampfish
Poenskop
Dageraad
King soldier
Englishman
Blue hottentot
Queenfish
Scotsman
Seacatfish
Bronze bream
Moustache...
Cape gurnard
Yellowtail...
Halfmoon...
Fish
Yellow edged...
Fish species
Total

The Economic Value of the Ecosystem Services Provided by the UThukela MPA and Associated Coastal and Estuarine Systems

CONSERVATION STRATEGY FUND

Conservation Strategy Fund | Technical Report | February 2026

NUMBERS**FOR**NATURE