Baía dos Tigres - The dynamic of the process

Cleide Borges da Costa[1], Cidália Fonte[2], Cármen Van-Dúnem Santos[3] & Amândio Teixeira-Pinto[4]

[1] Centro de Estudos e Pesquisas Tundavala, Instituto Superior Politécnico Tundavala, Angola

[2] Departamento de Matemática, Universidade de Coimbra, Coimbra, Portugal

[3] Universidade do Namibe, Reitoria da Universidade do Namibe, Angola

[4] Instituto Superior Politécnico de Tecnologias e Ciências, Centro de Investigação de Engenharias e Geociências, Angola

Correspondence: Cleide Borges da Costa, Centro de Estudos e Pesquisas Tundavala, Instituto Superior Politécnico Tundavala, Angola. E-mail: cleidedanila@gmail.com

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Abstract

Baía dos Tigres is a well-known sandbank in Angola, referred to since the 15th century when the Portuguese navigators passed there in 1488, on the voyage that allowed them to round the Cape of Good Hope, in southern Africa. It is a phenomenon of a sedimentary nature and therefore it is linked to the availability of solid flow carried by the drift current coming from the South. However, several changes in its condition have been recorded over the centuries. It has shifted from being a sandbank (restinga) and an island, this latter occurring when the isthmus that connects it to the mainland broke, becoming a restinga again when it reestablisheb itself. In March 1962, a huge storm at sea destroyed the fragile structure connecting the land to the coast and since then, precisely 60 years ago, Baía dos Tigres became an island, being separated from the coast in a way that seemed definitive. The observation and analysis of the satellite images used in this work seem to suggest that a setback is beginning to appear, since *Baía dos Tigres* may be starting to reconnect to the mainland. If this occurs, there is the possibility for Angola to have again a true fish hatchery where countless varieties of fishes and molluscs find unique conditions for spawning. Those partially closed conditions, with waters sufficiently oxygenated to generate excellent biological environment for spawning, are of great importance for the future of fish industry in the country. If those conditions are restored, the zone will be protected from the direct action of storms and the speed of currents, covering an area of more than 250 km^2. This article makes an up-date of the situation, based on the analysis of satellite images currently available.

Keywords: restinga, tiger bay, spawning, fishing.

Baía dos Tigres – A dinâmica de um processo

Resumo

A Baía dos Tigres é uma restinga bem conhecida em Angola, mencionada desde o século XV quando os navegadores portugueses passaram por lá em 1488, na viagem que lhes permitiu contornar o Cabo da Boa Esperança, no sul da África. Trata-se de um fenômeno de natureza sedimentar e, portanto, está ligado à disponibilidade de fluxo sólido transportado pela corrente de deriva que vem do sul. No entanto, várias mudanças em suas condições foram registradas ao longo dos séculos. Ela já foi uma restinga e uma ilha, sendo esta última ocorrida quando o istmo que a conectava ao continente se rompeu, tornando-se novamente uma restinga quando se restabeleceu. Em março de 1962, uma enorme tempestade no mar destruiu a estrutura frágil que ligava a terra à costa e, desde então, precisamente há 60 anos, a Baía dos Tigres tornou-se uma ilha, separada da costa de maneira aparentemente definitiva. A observação e análise das imagens de satélite usadas neste trabalho parecem sugerir que um retrocesso está começando a aparecer, pois a Baía dos Tigres pode estar começando a se reconectar ao continente. Se isso ocorrer, há a possibilidade de Angola ter novamente um verdadeiro berçário de peixes onde inúmeras variedades de peixes e moluscos encontram condições únicas para desova. Essas condições parcialmente fechadas, com águas suficientemente oxigenadas para gerar um excelente ambiente biológico para desova, são de grande importância para o futuro da indústria pesqueira no país. Se essas

condições forem restauradas, a zona estará protegida da ação direta das tempestades e da velocidade das correntes, cobrindo uma área de mais de 250 km^2. Este artigo faz uma atualização da situação, com base na análise das imagens de satélite atualmente disponíveis.

Palavras-chave: restinga, baía dos tigres, desova, pesca.

1. Introduction

Restingas are phenomena of a sedimentary nature that occur along the Angolan coast being umbilically linked to it by an isthmus (Giresse et al., 1984). The sandbanks are formed as a result of the action of the drift current within the South-North direction, current that is generated by the storm waves of farer high seas (Guilcher, 1954) that reach the African continent with an oblique orientation (as a result of the force of Coriolis) and transport a high volume of sediments eroded along the coast and the sea bed (Ribas et al., 2013).

When these sediments find a coastal accident where they can anchor, a process of deposition of a large part of that solid volume, usually sand, is taking place, which thus stretches along a direction parallel to the current, naturally marking the path of the contour line where the speed of the water slows down and there the sand is easily deposited.

The best known examples in Angola are the Restinga do Mussulo, the "Island" of Luanda (definitively a restinga due to human intervention), Restinga do Lobito, under which one of the busiest ports in Angola was built and the *Ilha* (*Baía*) *dos Tigres*, to which this work refers, which is known for having great importance in fishing in Angola, Africa.

Other coastal accidents of less clear definition all along the Angolan Coast occur at the mouths of some rivers (Longa-Nhia, Queve, Cubal, Catumbela or Coporolo). In these cases, the entry of river waters into the sea generates an obstacle of sufficient impact to generate deposits of marine sediment being carried alongside the coast besides those brought by the watercourses themselves. The process may assume different characteristics in times of river flooding, since there can be a substantial change in the points where the river waters exit to the sea and sand is finally deposited. These processes materialize into extensive variable sandbanks, a few tens of meters wide, separated from the shoreline by water corridors, which are generally shallow but persist despite everything (Zenkovich, 1967).

The small fishing town of Tômbua (formerly *Porto Alexandre*), in (Figue 1), is protected by a very well-defined and persistent sandbank with a length of more than 5 km although about half of it being little more than 60 m wide.

Figure 1. Tombwa's restinga. Source: Authors, 2023.

The first known reference to Baía dos Tigres is designated as *Manga das Areias* by Duarte Pacheco Pereira, in 1505 (Pereira, 1505). Over time several different designations have been adopted as the marine accident changed from peninsula to island and vice-versa, according to several brakes and recovers of the isthmus, naturally within the strong dynamics of the process.

The designation "*Mangas*" in Portuguese, suggests a peninsula, and the accident has the same designation when it appears on the 1623 World Map by António Sanches[11], although it was already an island in 1675 and 1754. Figure 2 shows this area in the 1754 map of Jacques Bellin.

Figure 2. Baía dos Tigres on the 1754 map of Jacques Bellin[22].

Captain-Lieutenant Pedro Alexandrino da Cunha, later Governor-General of Angola, referred to it as a peninsula in 1839, although it was an island again in an 1846 map (Mendelsohn, 2018). However, in the Map of Angola of 1862, coordinated by Sá da Bandeira and Costa Leal, it is a peninsula once again, being then carefully surveyed and designed.

The processes are therefore alternated, according to the dynamic that is associated at each moment with the phenomenon. Even being a cyclical phenomenon, it does not have to be regular. Several decades may elapse without any alternation and it can pass by the two manifestations of the process (island and peninsula) in a short lapse of time.

It is known that Baía dos Tigres was inhabited since 1860 by a group of fishermen families from the Algarve, Portugal. According to the 1862 map at that time it formed a long bay which considerably favored the spawning of multiple species of fish, given the calm nature of the waters, protected from the direct action of marine storms. Thus, there were conditions to attract resident fishermen, despite the arid and unhealthy conditions of that remote and isolated area.

The village of S. Martinho dos Tigres, today a ghost town, reached in 1974 a population of 1500 people, equipped with a school, church, post office, buildings connected to the public administration and, of course, the essential support for the fishing industry, which included, in addition to three mooring areas for small fishing vessels, three fish processing units, two canned mackerel and one of cuttlefish, besides water and fuel reservoirs. This shows the great potential interest of the zone for fishing businesses.

On March 14, 1962, a great storm caused the rupture of the isthmus. As the pipeline that brought water from the mainland and the communication road with the coast passed through the isthmus, both infrastructures were affected and interrupted.

In a very interesting, complete and practically unique study (Guilcher et al., 1976), the authors considered the

[1] Planisphere by António Sanches, 1623, British Library, London.

[2] Carte Réduite des Costes Occidentales d’Afrique, Jacques Nicolas Bellin, Paris, MDCCLIV

phenomenon of the sandbank formation to be irreversible, given the distance of several kilometers at that time (11 years after the “break”, once the field work of the study took place in 1973) between the island and the main land. This view was seamed realistic at the time, but considering the past history of the sandbank, it was probably quite pessimistic.

Since then, the dynamic process has evolved to reinforce the condition of an island, which has decreased in length, moving away more than 7 kilometers from the isthmus that once connected it to the land. However, the analysis of the satellite images described in this study suggests that changes are under way and there may be signs of a future reversal. This is the main scope of this work, which includes a description of the characteristics of the study area and its dynamic, the available data, methodologies and a discussion of the obtained results.

2. Characteristics of the study area

2.1 Importance as a fishing zone

Atlantic fishing has always been one of the pillars of Angola's economy, which benefits from a generous coastline with more than 1600 km. Some notable points along this coast may be identified, such as Benguela (Baía Farta), Moçâmedes, Tômbua and Porto Amboim. If these regions still retain part of the strength in terms of fisheries, Baía dos Tigres lost most of its importance, due to the break that occurred in the isthmus, 60 years ago.

In fact, mainly due to the action of the wind, dominant from South-Southwest (SSW), but without sea currents, the airy waters were, before the breaking, the ideal place for the spawning of most of the species that populate the Angolan coast, the grouper, the jewfish, the croaker, the merma, the mackerel or the well-known pungo. After the isthmus rupture, the calm sea bay, protected from the direct action of the sea storms, became an area for the passage of the current that comes from the south with sufficient speed to disturb the spawning that became only residual. Since then, the coastal accident has barely distinguished itself in terms of fishing from other areas along the coast.

The fishing activity provides thousands of jobs in dozens of activities, which contribute directly to the creation of wealth. It would be of greatest interest to recognize the conditions that exist locally, recording in detail the characteristics that currently prevail (temperature, salinity, nutrient level, available species, spawning levels, etc.), in order to have a basis for comparison with what may become again the main "maternity nursery" of fishing in Angola. However, this is not the objective of current work, which intends to provide an overview of the situation in which the process finds itself.

2.2 Coastal Dynamics

The specific dynamic of this process depends obviously of the existence of the drift current that is generated in the South-North direction when the storm waves from the farer South Atlantic (latitudes 40 to 60°S) reach the African coast with a very oblique direction (Jessen, 1951; Guilcher, 1954).

As the result of the obliquity of the storm waves, there are two components - (1) a direct impact acting perpendicularly to the coast, being responsible for the erosion and - (2) the generation of a drift current South to North, parallel to the coast, which transports the eroded sediments. The erosion necessarily depends on the hardness of the shoreline, which can be rocky and difficult to erode or soft like sand and very easy to demolish.

Some authors (Ribas et al., 2013) used a morphodynamic model to test the hypothesis that these sand waves could emerge as free morphodynamic instabilities of the coastline due to the obliquity in the wave incidence. They presented a formulation and methodology, based on knowledge of the DASC (which is equal to sediment load divided by water depth), which has been successfully used to understand the characteristics of these features *(ibidem)*.

Whatever is the case, it is essential to realize the existence of areas along the south African coast where erosion is the dominant process, thus providing the solid flow that is carried northward, being that flow somehow variable as it depends on the greater or lesser resistance of coastal formations to erosion. This process is punctually reinforced by the solid flux brought by rivers and watercourses that flow into the sea. Other areas, where the speed of the drift current decreases, offer conditions for deposits under the form of sandbanks. That is, far from the center of storms, in lower latitudes, sand deposits are the main issue.

In the study area, the coastline at the south of Baía dos Tigres is mainly covered with sands from the Namib Desert, for more than 1000 km (Figure 3), therefore granting the amount of sediments necessary for the northward formations.

Figure 3. Image showing the characteristics of the Namibia coastline.

When the sea currents encounter coastal regions of greater resistance, often cliffs, the solid flow decreases. In consequence, the *restinga* region, further ahead (North), without enough feeding, may start to be dragged by the current, eventually breaking the isthmus that connects the peninsula to the mainland.

It should be noted that, in general, the sandbanks themselves are the result of a balance between the deposited sands and those that erosion carries away. If, for any reason, the deposition slows down, then the balance can become negative and erosion can lead to the rupture of the isthmus, which is almost always the weakest area, the one that connects to the mainland[3]. Nevertheless, this is not the only process that may explain the rupture of an isthmus. Being delicate and fragile structures, they can be broken by the action of storm waves, as it was the case of Baía dos Tigres[44] in March 1962, as widely documented at the time.

2.3 Geological conditions

Sequences of shoreface-connected sand ridges are examples in Angola of larger-scale aspects that occur along the coastline shelf. They consist of several elongated sandbanks of a few kilometers, oriented at an angle with respect to the shoreline, and separated an approximately constant alongshore distance (Dyer; Huntley, 1999). It is of great importance to understand the reason for this dynamic process involving sediments, marine currents and fluvial actions[55], and to realize whether it is a long-term phenomenon or a short-term process with no geological significance in temporal terms.

The coast, to the south of Baía dos Tigres, presents itself in the form of extensive sand fields (Figure 3), where the dunes, essentially aeolian in nature, can be found just a few meters away or even in contact with the sea. The morphology does not change after passing to the south of the mouth of the Cunene River (Foz do Cunene), remaining sandy hundreds of kilometers along the Skeleton Coast (Kaoko Belt) and further south, extending over a large part of the development of the Namib Desert. There, the main characteristic formations of deserts, the dunes, are always present. Being close to the sea, they are continuously beaten by the waves, permanently feeding the coastline with sediments (Figure 4, B) referring to the Skeleton Coast), south of Foz do Cunene, and (Figure 4, B) where, below the red line (Lat. 27° 05' S), coming to South, the rock is already uncovered without a sandy cover.

[3] This has to do with the process of changes in the water velocity, which allows for more or less sediments to be deposited as the water speed slows down or goes up.

[4] Henceforward we will call it that, to refer to the area, regardless of whether it is currently an island or has already formed a bay

[5] Sand that is eroded directly from the seabed is not disregarded, as it is included in the same type of process, as most of it is coming necessarily from coastal erosion

Therefore, along the so-called Kaoko Belt, there is an extensive cover of sand close to the sea, which is regularly eroded by it and dragged to the North. On the other hand, below the Damara Sequence, the basement rocks of felsic and mafic nature from the Neoproterozoic rift phase are already without any sandy cover, making the erosive process more difficult and therefore slower (Nascimento, 2012). The magnitude and persistence of the Namib Desert (supposed to be the oldest in Earth) seems to grant the permanence of the process, naturally submitted to a very particular dynamic whatsoever, with some permanent characteristics.

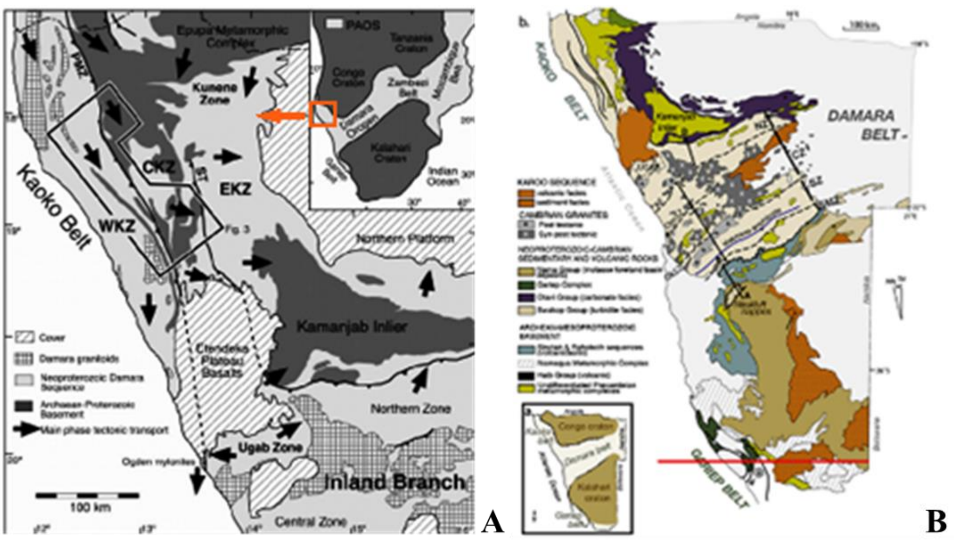

Figure 4. Geology of the Kaoko Belt (detail) (A) and (B) Geology of Damaraland (general). Source: Goscombe et al. (2003).

The sands of the Namib Desert, mainly very fine in size, somehow replace the volumes that the sea drags, but apparently the replacement is not done completely, which means there is no total compensation of what the sea removes. For this reason, there are other areas already uncovered, whose evolution is actually not determined and needs further investigation.

Some authors shown by analysis based on high-resolution bulk-petrography and heavy-mineral data on beach and dune sands, integrated with detrital-zircon geochronology and chemical analyses of pyroxene, garnet and staurolite, that sand derived from the Orange River in the far South of Namibia, is carried by powerful and persistent longshore currents as far as southern Angola, 1750 km north of its mouth (Garzanti et al., 2014). This expands the zone that can feed deposits in Baía dos Tigres and supports the idea that it is a persistent and long-term phenomenon.

In any case, having in mind the volume available along a considerable development of the coast, there is more than enough feeding material (sand) in the next millennia to prevent the process from any interruption. Figure 5 clearly shows the extensive area of sandy formations in the Namib Desert, which indefinitely may feed the coastal transport that will be deposited further north (Baía dos Tigres is the red spot indicated by the arrow).

Figure 5. Sand formations in the Namib Desert. Source: Authors, 2023.

3. Material and Methods

To be able to identify the evolution of Baía dos Tigres over the last decades, a detailed analysis was made of the changes observed in satellite images available for about 45 years. One of the main goals was to identify any tendency that may indicate the likelihood that in a more or less near future the connection between the present island to the mainland may be reestablished. The development of the study was carried out according to a sequential program, which is indicated (Figure 6) in order to obtain as much information as possible from the available images.

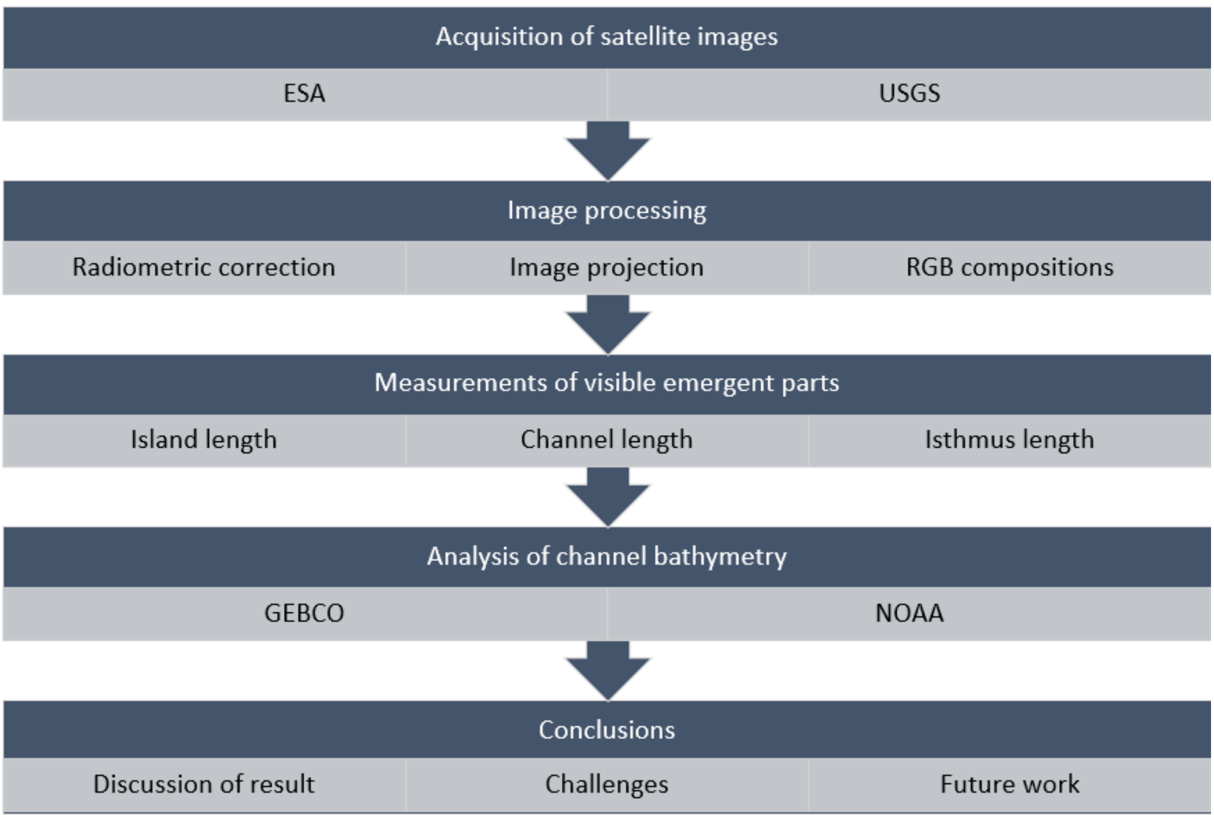

Figure 6. Structure of the work performed. Source: Authors, 2023.

In a first phase, images of several Landsat satellite missions were obtained from the European Space Agency (ESA) and United States Geological Survey (USGS) sites. Seven images were selected for this analysis. The image from 1978 was considered as the oldest one available.

The images of years 1986, 1996 and 2006 (10 years apart) were also considered and also the images of 2019, 2020 and 2021, as these are the last three years. These images were used to carry out measurement studies of the part emerged. All images were designed for the EPSG:32633 - WGS 84 / UTM zone 33N reference system and radiometric corrections were made.

As a first approximation a comparison was necessary between the dimensions of the island and the distance to the isthmus that was connected to land, to identify its variation over the years and if a reverse tendency could be observed. So that, the images were classified at the pixel level, which distinctly marks the "earth" and "water" areas; this way it is possible with great approximation to identify where the separation between the two media is registered (Figure 7).

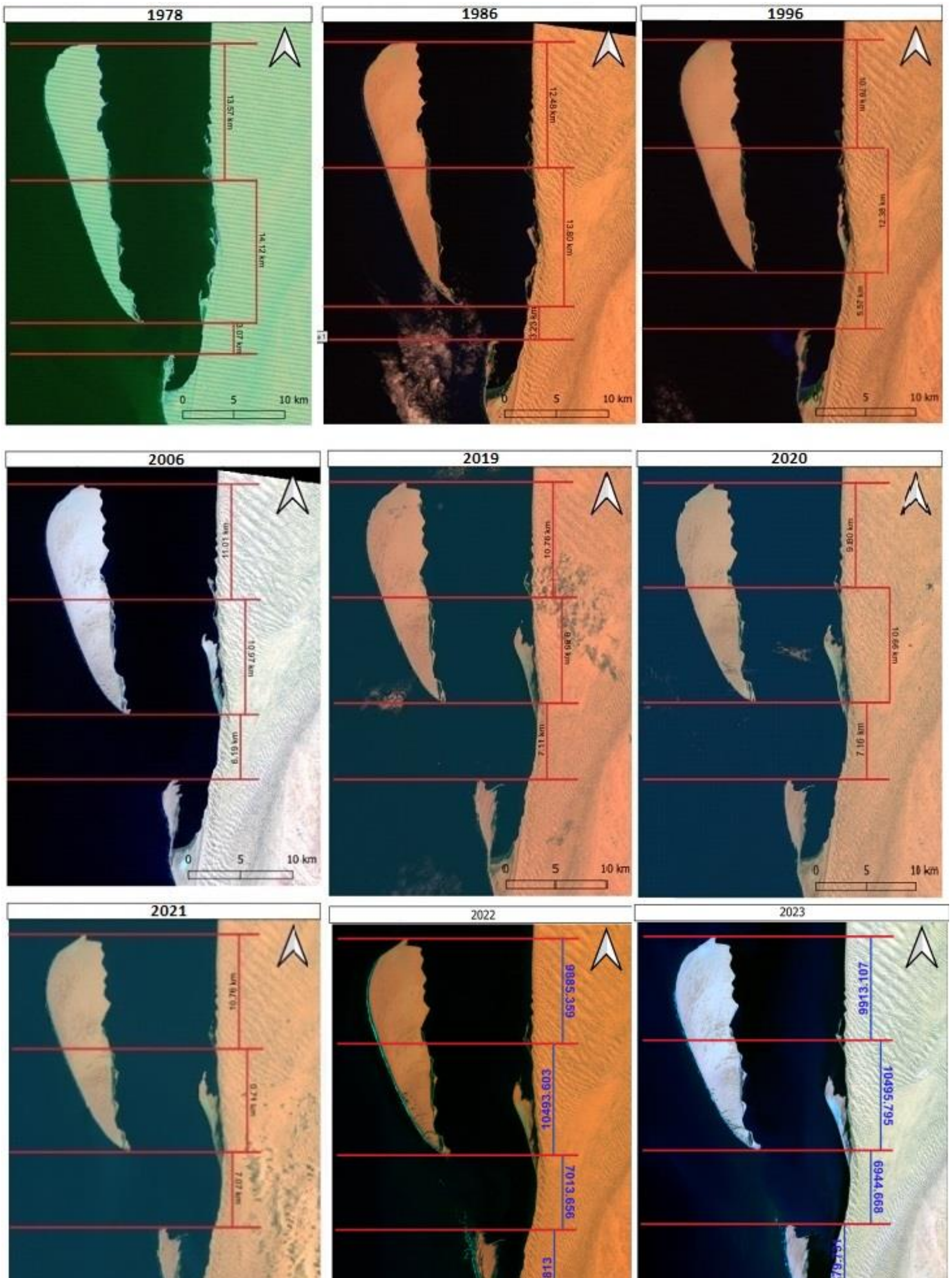

Figure 7. Island and isthmus of Baía dos Tigres. Source: Authors, 2023.

Since the images show a considerable development of the isthmus, which evolves from South to North, we also carried out measurements of this element always from the same point in the South, to understand how it has evolved (Figure 8). It is worthy to mention that both images in (Figure 8) are at similar scales, so that a visual comparison of the length of the isthmus can be made.

Method – Several parallel lines were drawn by the last pixel classified as "earth" in the satellite images, in the north and south of the present island, and in the north of the isthmus (red horizontal lines on Figure 8, A and B), being the distances between the pertinent lines measured over the years with accuracy.

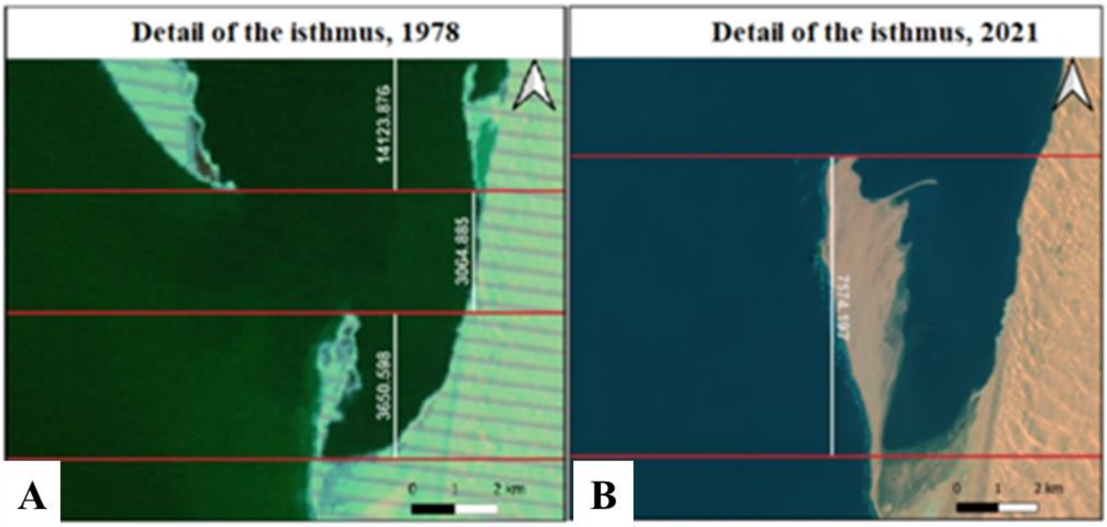

Figure 8. Detail of the isthmus of Baía dos Tigres in the years 1978 (**A**), and (**B**) 2021 (at similar scales). Source: Authors, 2023.

The results are presented in (Table 1). As can be seen in Table 1, the lengths of the island, the channel and the isthmus for the years under analysis, between 1978 and 2020, have registered important evolutions. The island itself significantly decreased in length, losing a little more than 7200 meters, while in 2021 experienced a trend of inversion (the values in question refer only to the part that emerges between the red lines in the images of Figure 8), in 2022 a new reduction and again an increase in 2023. The canal follows the same evolution, meanwhile the isthmus is always growing as it could be expected.

It seems with the available data that there is a reversal trend whose consistency is still unknown. But the evolution of the isthmus is remarkable, always growing and with a considerable "leap" in 2022. In any case these results must be viewed with great caution as they may indicate over time advances and retreats that are possible, depending on sea conditions, but we need to point out the consistency among all measurements (island-canal-isthmus).

Moreover, the study of the available images, as a whole, allows us to perceive that below the water level, a deposit of apparently increasing dimensions is being formed, which seems to suggest that the eventual connection to land will not be made by direct growth South-North of the emerged part, but from bottom to top, with the successive decrease in water depths. Therefore, this was one orientation that was quickly adopted in the work that is, trying to understand the bathymetry evolution, taking advantage of the information available from the satellites dedicated to it.

In the meantime, it will be advisable to carry out an assessment of the factors that are of decisive importance in the development of the marine phenomenon, imposing from the outset the analysis in situ of the coastal geological formations to the south of Baía dos Tigres, in order to determine their greater or lesser erodibility, since there is no quantitative information on the solid flows carried by the currents, and it is not possible for us, in the available circumstances, to proceed with any process of direct and adequate measurement of these values

Table 1. Lengths of the island, channel and isthmus of Baía dos Tigres for the dates under analysis.

Year	Length of Island (meters)	Lenghth of Channel (meters)	Length of isthmus (meters)
1978	27693	3064	3650
1986	26287	3231	4966
1996	23132	5574	5927
2006	21976	6194	6721
2019	20615	7107	7395
2020	20455	7162	7502
2021	20468	7067	7574
2022	20378	7013	7813
2023	20408	6945	7880

Source: Authors, 2023.

4. Discussion

During the well-known 2004 Indian Ocean tsunami, which caused a huge human tragedy, it was possible, using available satellites, properly equipped with high precision sensors, to understand that the seismic wave generated in the process reached a height of the order of 80 cm in high sea. The satellites involved in this study were Jason-1, TOPEX/Poseidon, Envisat and Geosat, with indications that the bathymetric accuracy was less than 5 cm (Satake, 2007) in a context of spatial resolution of 15 min. -arch (~27 km), (Ibid).

The precision referred to, is for the specific case of Baía dos Tigres, excellent, since in the analysis of the evolution of the ongoing process it is much more than sufficient and better than one might expect. In fact, the deposition process is surely not always cumulative in the full sense of the term and there are certainly small changes depending on the tides and the height of the swell. In any case, the balance will be positive (additive) even with small occasional decreases, not being worth mentioning a bathymetry variation that is less than 50 cm.

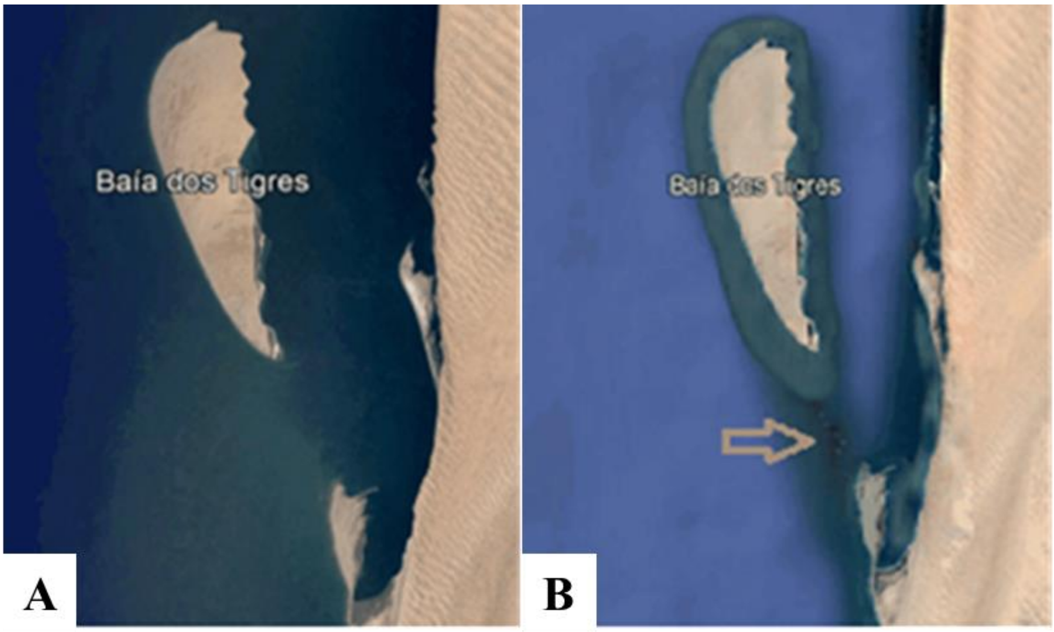

Figure 10. Landsat 8 multispectral image 2020 (**A**) and (**B**) Landsat 8 multispectral image 2021. Source: Authos, 2023.

Images covering the larger period of 1978 to 2023 from the Landsat 3 (1978 image), Landsat 5 (1986, 1996 and 2006 images), and Landsat 8 (2019 to 2023 images) missions, show with no doubt that the distance separating the island from the mainland has continued to increase since the beginning of the period (1984), currently standing below the water level at just over 7200 m (Table 1). However, the most recent images (Figure 10, A and B) seem to show the formation of extensive sediment deposits under water distributed between the isthmus and the island. Unfortunately, the historical data (in satellite records) is limited in time, and we only had access to bathymetry values in the period 2019-2023, which however has the importance of referring to the present situation and the way it has evolved in recent times.

Figure 10 (A) refers to the year 2020, where the greenish area relating to the sand deposit can be clearly seen, while (Figure 10 (B)) refers to the year 2021, in an image without water, that is, in which the immersed part is shown. The isthmus is advancing to the North, in a direction roughly NNW, towards the island, and it can be seen (arrow in Figure 10 (B)), that there is a deposit of sand in the critical zone. There seems to be a ridge there, which has necessarily been growing from the bottom up.

Figure 11 shows an image resulting from the classification of bathymetric data for the area under study for the year 2021 available at GEBCO (General Bathymetric Chart of the Oceans), in which a color gradient is indicated accompanied by the respective legend.

It must be noted that the data available free of charge at GEBCO result from the contribution of volunteers and are accompanied by a document in which the institution recognizes the data made available. In the case of Baía dos Tigres, GEBCO cannot guarantee the accuracy of the data provided, probably due to lack of collaboration of volunteers, but it allows us to have a superficial perception, or a first approximation of the sand deposition processes that may be taking place at the bottom of the sea in the area.

According to Figure 11 the area surrounding the isthmus has elevations between -5 and 0, while in the zone of advance to the North the elevations are between -10 and -5, until in the main passage channel (medium blue) the elevations will be between -15 and -10. The channel itself will currently be around 800 m wide, in practical terms. These data are a raw indication that some sedimentation process is taking place in the canal area that should be confirmed in situ, by relevant surveying, which for the moment was not been made.

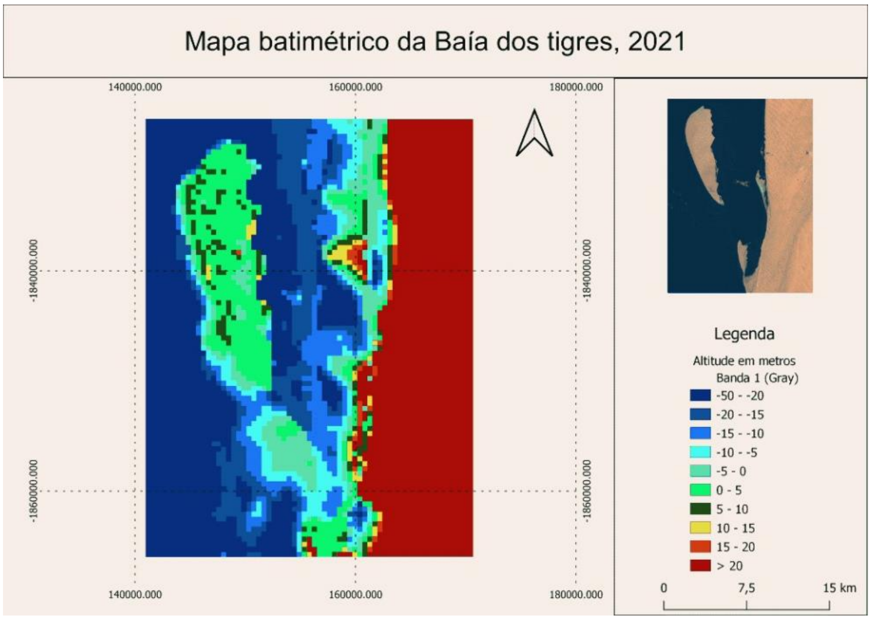

Figure 11. Bathymetric map of Baía dos Tigres in 2021. Source: Authors, 2023.

Meanwhile, in order to validate this information, data provided by NOAA (National Oceanic and Atmospheric Administration) were also taken into account. This agency has the mission to study, monitor and protect natural resources. Although it is a dense and credible data source, there are no images available for the area under study.

Despite this, NOAA provides an interactive map with altimetric data for the entire planet (https://www.ncei.noaa.gov/maps/bathymetry/), probably derived from mathematical models (Figure 12).

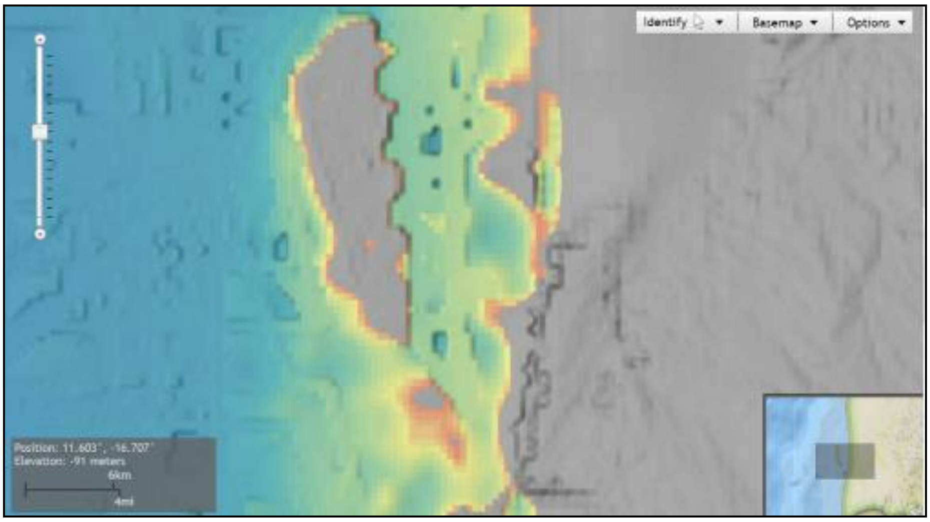

Figure 12. Altimetric data for Baía dos Tigres available on the NOAA website. Source: Authors, 2023.

Based on this map, it can be seen that the elevations are similar to the heights found in GEBCO. Three points were randomly chosen along the channel (marked with a blue 'x' in Figure 13) and the altitudes of the points are -20m, -5m, +1m. It is important to note that these data need further validation.

Figure 13. Dimensions between the island and the isthmus (points indicated with X in blue). Source: Authors, 2023.

It looks very interesting the fact that part of the channel is already emerging from the water, at least in certain parts of the year.

Comparing with the values obtained in 2023, exactly for the same points, we can notice a reasonable difference, even a certain inversion, since there is erosion where there was deposit and vice versa. We found the values +2m, -12m and -9m for the same points mentioned above. In the authors' opinion, the profile of the channel bottom is changing depending on the intensity of the storms in the South Atlantic (and therefore the intensity of the drift current) and the sediment deposit is made on one side close to the isthmus, or in the other situation it is made on the opposite side, in the south of the island. Figure 14 shows the change in patterns, which can be considered linked to stronger (1) or weaker storms (2).

It is worth mentioning here the fact that the variation of height due to the tides does not affect the readings because, according to the usual procedures, the elevations are referred to the Hydrographic Zero, being therefore absolute values and not dependent on the position of the level of the water.

In this way, and in summary, with the information that was possible to collect (information shared by the available sources, although subject to its categorical validation), it is possible that a process of deposition of sands in the submerged part between the isthmus and the island is continuously on, changing in height here and there, but with a tendency of coming up, with greater incidence in the isthmus, whose evolution from South to North has not stopped growing.

The process, whose evolution in quantitative terms it is not possible to estimate by now, could lead in the coming years to the eventual closing of the channel between the island and the mainland (isthmus) and, therefore, making its local monitoring decisive, with measurements and forms of evaluation that confirm (or not) this trend.

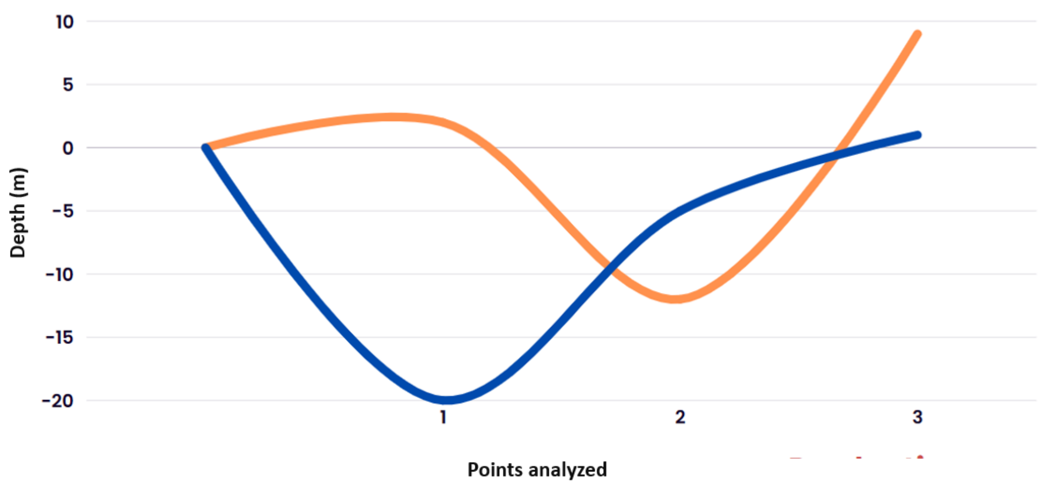

Figure 14. Variation in bathymetry at the analyzed points. Source: Authors, 2023.

5. Conclusions

The importance for the fishing sector in Angola of Baía dos Tigres, a coastal accident of the sandbank type, known since the 15th century by Portuguese navigators, is indisputable, justifying the presence of a fishing community between 1860 and 1974, which settled there despite being an inhospitable and very isolated area.

The connection to the coast was destroyed by a storm in 1962, more than sixty years before the date on which this work is being carried out. That accident somehow affected the fish richness along the coast, as millions of fishes spawned there, which, being dragged by the current, are no longer able to reach the adult stage.

Based on satellite images, which are available for free, it was possible to track how the process evolved over time, noting a significant increase of distance from the coast to the island then formed. However, some consistent indications have recently emerged that point to a possible reversal of the process, with the increment of deposits of sediments in the area between the isthmus and the island, which, in the authors' opinion, justifies an *in situ* investigation to confirm and monitor the way in which the phenomenon is being processed. If the canal closes it can be a considerable gain for the country's fisheries and economy.

6. Authors' Contributions

Cleide Barbosa da Costa: all work related to obtaining and processing satellite images, including interpretation and extraction of values within the possibilities allowed by available technology. *Cidália Fonte*: all work related to obtaining and processing satellite images, including interpretation and extraction of values within the possibilities allowed by available technology. *Cármen Van Dúnem*: framing Baía dos Tigres within the context of fisheries in Angola, focusing on prospects for improving spawning conditions to significantly increase fish and mollusk populations in that area. Following the development of a research project, Professor *Cármen* was involved in defining the processes and techniques to be used in implementing two ocean buoys for data collection (a topic not covered in the article). *Amândio Teixeira Pinto*: coordination of the article, overall framing of the theme, geomorphological approach to the marine accident, and interpretation of the possible evolution of the process in terms of present and future dynamics.

7. Conflicts of Interest

No conflicts of interest.

8. Ethics Approval

Not applicable.

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