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Degradation of *Cymodocea nodosa* (Ucria) Ascherson meadow at Las Canteras Beach (Gran Canaria, Canary Islands, Atlantic Ocean)

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PEER REVIEW

Peer reviewer

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Comments

This is valuable research work showing the relationship between sedimentary dynamics, anthropogenic inputs and reduction in seagrass populations. This information will be important in the management of these areas.
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ABSTRACT

Objective: To monitor the distribution of *Cymodocea nodosa* (Ucria) Ascherson in Las Canteras Beach (Las Palmas de Gran Canaria, Spain), comparing the status in 2005 with the distribution observed in 1985 and 1995.

Methods: Field observations by self-contained underwater breathing apparatus diving records and cartographic report.

Results: The seagrass meadow originally distributed between the beach and a bar of volcanic rocks, which sheltered it from the strong north–east winds and swells. Since 1985 a gradual reduction of its extent has been observed and more than 80% of the original canopy disappeared in twenty years time, mostly due to the anthropogenic impact and modification of the sedimentary dynamics of the beach.

Conclusions: The degradation of this seagrass meadow determinates the loss of the only meadow in the north of the island of Gran Canaria and the absence of a management plan for its conservation.

KEYWORDS

Anthropogenic impact, Conservation biology, *Cymodocea nodosa*, Distribution, Seagrasses, Sediment burial

1. Introduction

The coast and adjacent seas were, from the earliest chronicles of civilization, places where man had taken not only sustenance but also the pleasure of recreational activities. With the expansion of human activities along the coast, a rapid growth of tourism and recreational facilities developed worldwide. The Canary Islands occupy a privileged place for marine life in the North Atlantic Ocean, due to outcrops of deep water nutrients of the nearby region of Canary–Saharian Africa[1]. However, excessive use of the coast as a result of the development

of fisheries, the demographic pressure and the urban, industrial and tourist facilities, originated changes in the environmental characteristics, and assumed a pressure for marine life[2].

Cymodocea nodosa (Ucria) Ascherson (*C. nodosa*) is a seagrass species widely distributed in the Mediterranean, along the Southern Portuguese and North–Western African coasts[3]. This species is the most abundant seagrass in the Canary Islands[4]. Apart from being protected by the European legislation (Habitat Directive), the local government of the Canary Islands has adopted additional protection measures for the conservation of

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all seagrasses present in the Archipelago, including them in a Catalogue of Protected Species (Law 4/2010 of 4th June, BOC No. 112 of 9th June 2010) and recognizing their ecological value.

Seagrasses are essential components of the biological and physical structures and processes of coastal areas[4]. Their important multifunctional role in contributing to the productivity of coastal zones (directly or by supporting a rich epiphytic flora) and in providing habitat and shelter for fishes and invertebrates is worldwide known[5–7].

This ecosystem is very complex and yet very delicate. A clear example of the fragility of *C. nodosa* and its ecosystem in Canary Islands is the meadow at Las Canteras Beach (Las Palmas de Gran Canaria). The distribution of *C. nodosa* in Gran Canaria is limited to the southern half of the island because of strong north-east winds and swells that make the establishment of seagrass meadows difficult in the north[8]. The seagrass beds are found in sheltered bays from Jinamar on the east side of the island to La Aldea on the west side[8]. This distribution is due to the so-called “island mass effect”[9–11], a phenomenon which, on a large scale, is the result of the interaction between the presence of the mainland of the islands along the passage of the Canary current and the prevailing trade winds in the area, so that the land provides shelter from the strong north-eastern currents and allows the development of meadows of elongated shape along the coast of the south of Gran Canaria. The seagrass bed at Las Canteras beach is the only one located in the north of Gran Canaria[12,13].

The favourable position of the beach of Las Canteras is due to the presence of an extended reef that protects it[14], and had allowed the development of a large seagrass meadow, monitored since 1985[12,13]. The changes in the urban limits of the city of Las Palmas de Gran Canaria and the construction of numerous buildings in the isthmus, with the consequent connection of La Isleta small islet with the mainland, have produced an important alteration in the sedimentary dynamic of this area. During the 19th century, when no buildings were present in this area, aeolian transportation of sand from the beach creates a dune field connecting this beach with that one of Alcaravaneras on the other side of the isthmus[15]. The buildings have made the movement of sand from Las Canteras to Alcaravanera Beach impossible and the accumulation of sand in the north of the beach has become, since then, a problem for the conservation of the marine life in the area, particularly for the maintenance of *C. nodosa* meadows[16].

The present study aims to monitor the distribution of *C.*

nodosa in Las Canteras Beach after 10 years since the last observations made by Pavón–Salas *et al*[13].

2. Materials and methods

Canary Islands are located near the Northwest African coast, and are composed by seven islands and several islets (Figure 1). Las Canteras Beach is located on the north-eastern coast of Gran Canaria island (28°08′24.32″ N 15°26′15.43″ W, Figure 1) and sheltered from the prevailing north-eastern winds and swells by a rocky bar of volcanic origin. Detailed descriptions of the study area are reported by Martínez–Martínez *et al.*[15] and Alonso and Vilas[16]. The monitoring of the seagrass meadow at Las Canteras Beach (Figure 1) was carried out during July–August 2005 by a diver along eleven transects distributed in the stretch of North Las Canteras, the most protected area due to the presence of the largest part of the bar and of the northern headland. Two transects parallel to the coast were also traced close to the rocky bar and in the middle distance between the bar and the beach. Random observations were carried out by covering the total extent of the beach, in order to verify the possible distribution of the seagrass in areas not covered by transects. The results obtained on the distribution were compared with those reported by González and Pavon–Salas *et al*[12,13]. The depth was recorded by a log dive computer (ALADIN Pro, UWATEC). All measurements were recorded in the field without using destructive methods.

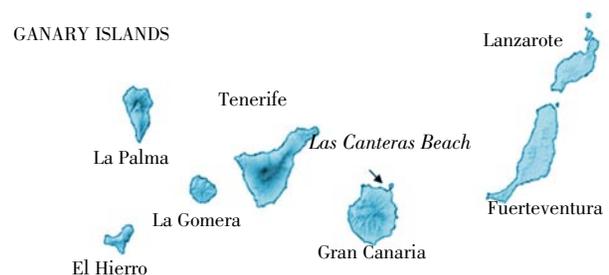


Figure 1. Map indicating Las Canteras Beach at Gran Canaria (Canary Islands, Atlantic Ocean).

3. Results

The coverage of *C. nodosa* at Las Canteras is reported in Figure 2. In the area before, to reach the rocky bar, the maximum depth was 2.7 m and the average depth was 1.4 m. The extent of the seagrass meadow in 2005 has been reduced by about 80% compared to 1985 and only few *C. nodosa* patches, less than 1 m wide, were found close to the area called “Muro Marrero” where in 1985 there was

the maximum covered area. The highest coverage was observed at North Las Canteras (two areas of 156 and 84 m²), while at the “Muro Marrero” it was reduced to a few patches not wider than 2.5 m². At the area called “La Puntilla”, the coverage area was reduced and there was an extremely low density due to the presence of a rocky bottom, which facilitated the spreading out of the green alga *Cymopolia barbata* (Linnaeus) J.V.Lamouroux. The government’s decision to reduce the amount of sand accumulated at the beach in summer 2003, by the removal of 35 000 tonnes of dry sand, gave results only for a limited period of time. In fact, in the summer of 2005 the level of sand, which has continued to increase, did not leave any sign of the operation made two years earlier.



Figure 2. Distribution of *C. nodosa* at Las Canteras Beach in 2005 (black areas).

4. Discussion

The degradation of the seagrass ecosystem at Las Canteras is a problem closely related to the sedimentary dynamics and the anthropogenic impact. A strong seasonal pattern was observed by Alonso and Vilas^[16], who found successive erosions and accretions in the layer of the sand on the beach. These authors observed an accumulation of sediments during autumn and winter and an erosive effect on the rest of the year at the most sheltered side of the beach, where *C. nodosa* grew. Martínez-Martínez *et al.* pointed out that this part of the island received most of the sand eroded from the other sectors of the beach^[15]. Although Marbá and Duarte reported a limited tolerance of *C. nodosa* to burial^[17], the deposition of sand on the beach of Las Canteras could be the cause of the limited extent and fragmented distribution of the seagrass meadow evidenced in this study. The reduced depth, the sediment deposition and the tourism pressure lead to a strong and continuing degradation of the meadow which continued from 1985, with a consequent reduction of more than 80% of its

total coverage in twenty years time. The current net loss of the environmental quality confirms the need for effective measures to reduce the causes of disturbance in order to allow the recovery of the marine ecosystem and explain the loss of genetic diversity evidenced in this meadow by Alberto *et al.*^[18]. The amendment caused by the human activities on Las Canteras Beach, has led to the degradation of the natural system, transforming it in a recreational area whose survival depends now on the periodical removal of sand, unless other heavier measures are taken, such as the utopian return to the original communication of the seawater between the two sides of the isthmus and the separation of the La Isleta small islet. Without doubt, this option seems impossible to do for two main reasons: (1) the city has evolved so much that it is unthinkable for the removal of all the buildings in this area, even considering that the local government and the municipality of Las Palmas de Gran Canaria are providing measures for the construction of buildings of lesser height; (2) the hypothetical communication of the two sides of the isthmus will put the water of the tourism area in direct contact with the port in the eastern side of Las Palmas de Gran Canaria with serious damages to the recreational business.

Since the restoration of the original conditions of the isthmus is very difficult, it seems that the maintenance of the beach (of enormous tourism value to the local economy), of the volcanic bar (of great geological value) and of the seagrass meadow (with ecological value recognized worldwide) will depend on the frequent removal of sand (at least once a year). The creation of a stable sedimentary condition in Las Canteras is a necessary and indispensable step that must precede every other recovery measure, such as collection and germination of seeds or vegetative growth for further restoration purposes. Without a drastic change in the environmental management of the beach of Las Canteras, the population *C. nodosa* will disappear in the near future in the only distribution site on the north of Gran Canaria.

Conflict of interest statement

We declare that we have no conflict of interest.

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Comments

Background

C. nodosa populations and associated ecosystem is very complex and subject to human impacts. This study outlines the effect of disturbance on this seagrass between 1985 and 2005.

Research frontiers

This work shows the reduction in *C. nodosa* populations due to human disturbance.

Related reports

Reduction in seagrass populations linked with modification of sediment dynamics and anthropogenic inputs. There are some related reports, Polifrone M (2005). Distribución, fenología y evaluación de las condiciones de habitat de *Cymodocea nodosa* (Ucria) Ascherson en las Islas Canarias orientales. Obra Social de La Caja de Canarias. Pavón-Salas N, et al. (1998) Distribution and structure of seagrass meadows in Las Canteras Beach, Las Palmas, Canary Island (Spain).

Applications

As this is a monitoring situation it may turn possible the intervention in the degraded area.

Peer review

This is valuable research work showing the relationship between sedimentary dynamics, anthropogenic inputs and reduction in seagrass populations. This information will be important in the management of these areas.

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