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UNUSUAL EXPANSION OF *LAURENCIA OBTUSA* (HUDSON) J.V. LAMOUREUX IN THE ZAMBRATIJA BAY (NORTHERN ADRIATIC SEA)*Martina ORLANDO-BONACA*Marine Biology Station, National Institute of Biology, SI-6330 Piran, Fornače 41
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ABSTRACT

The paper reports an unusual expansion of the red alga *Laurencia obtusa* in shallow waters of the Zambratija Bay (northern Adriatic Sea). The large population of *L. obtusa* was never observed during underwater surveys conducted in recent years. In this area, benthic communities dominated by brown algae from the genus *Cystoseira* were present. The authors therefore assume that some environmental factors have probably changed and have favoured the extension of this red alga. The hypothesis for this phenomenon takes into account the possibility that the establishment of the invasive green alga *Caulerpa cylindracea* in the Zambratija bay has had a negative impact on native macroalgal assemblages.

Key words: *Laurencia obtusa*, monospecific population, Zambratija Bay, Adriatic Sea

ESPANSIONE INSOLITA DI *LAURENCIA OBTUSA* (HUDSON) J.V. LAMOUREUX NELLA BAIA DI ZAMBRATTIA (ADRIATICO SETTENTRIONALE)

SINTESI

L'articolo riporta un'insolita espansione dell'alga rossa *Laurencia obtusa* in acque poco profonde della baia di Zambrottia (Adriatico settentrionale). Ampie popolamenti di *L. obtusa* non sono mai stati osservati durante le indagini subacquee effettuate negli ultimi anni. In quest'area erano presenti comunità bentoniche dominate da alghe brune del genere *Cystoseira*. Gli autori pertanto suppongono che alcuni fattori ambientali siano cambiati e abbiano favorito l'estensione di quest'alga rossa. L'ipotesi per questo fenomeno prende in considerazione la possibilità che l'insediamento dell'alga verde invasiva *Caulerpa cylindracea* nella baia di Zambrottia abbia avuto un impatto negativo sulle associazioni macroalgali autoctone.

Parole chiave: *Laurencia obtusa*, popolamento monospecifico, baia di Zambrottia, mare Adriatico

INTRODUCTION

The red alga *Laurencia obtusa* (Hudson) J.V. Lamouroux is commonly found in the Adriatic Sea, from the northern to the central and southern part of the basin (Avčin *et al.*, 1973, 1974; Matjašič *et al.*, 1975; Giaccone, 1978; Munda, 1979; Vukovič, 1980, Gómez Garreta *et al.*, 2001; Antolić *et al.*, 2011; Curiel *et al.*, 2012). The species usually grows on rocky substrata moderately exposed to wave actions in the lower mediolittoral belt, and with other photophilous taxa in the association *Cystoseiretum crinitae* Molinier 1958 in the upper infralittoral belt (Giaccone *et al.*, 1994). However, it was found also on rocky outcrops in the lower infralittoral and circalittoral belts in the northern Adriatic Sea (Curiel *et al.*, 2012).

According to the available literature, *L. obtusa* was never found forming dense and extended monospecific populations in the Adriatic Sea. However, dense stands of *Laurencia* species were reported for the Florida Bay (Zieman *et al.*, 1989) and for the Gulf of Siam in the South China Sea (Latypov, 1986). The aim of the present paper is to report the finding of a dense monospecific population of *L. obtusa* in the Zambratija Bay (northern Adriatic Sea) and to discuss the possible factors that led to this phenomenon.

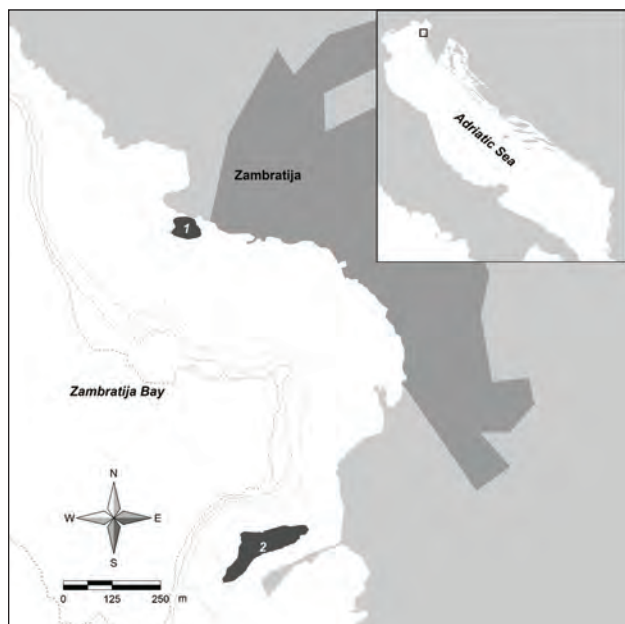


Fig. 1: The map of the Zambratija Bay with the sites (1 and 2) where a dense monospecific population of *Laurencia obtusa* were found.

Sl. 1: Zemljevid zambratijskega zaliva z označenima lokalitetama (1 in 2), kjer je bila ugotovljena gosta monospecifična populacija vrste *Laurencia obtusa*.

MATERIAL AND METHODS

The Zambratija Bay is located in the northwestern part of the Istrian peninsula, near Cape Savudrija, in Croatia (Fig. 1). The sea bottom is predominantly rocky, locally mixed sandy-rocky (Sladonja & Banovac-Kuča, 2014). A recent study concerning the reduction of chlorophyll *a* concentrations in a wider area, consistent with the decrease in concentrations of phosphate and ammonia (Solidoro *et al.* 2009; Mozetič *et al.* 2012), underlined the oligotrophication of the whole northern Adriatic basin over the last decade (Mozetič *et al.* 2010).

In September 2016, during a scuba diving survey in the upper-infralittoral belt of the Zambratija Bay, a dense monospecific population of *L. obtusa* were found. The area covered by the species was photographed and filmed. Its extension was measured by the use of satellite imagery (Google Earth) and the GIS program Manifold®.

Fresh samples were taken to the laboratory of the Marine Biology Station (NIB) in Piran and fixed in 4% formaldehyde solution. The species identification was made using a stereomicroscope Olympus SZH-ILLK, and a microscope Olympus BX51, and was in accordance with Falace *et al.* (2013) and Rodríguez-Prieto *et al.* (2013).

RESULTS AND DISCUSSION

In the middle part of the Zambratija Bay, a dense monospecific population of the invasive non-indigenous species *Caulerpa cylindracea* Sonder was found in 2016, but the record is not new, since the Zambratija Bay is currently considered the northernmost site where the establishment of *C. cylindracea* was confirmed earlier (Sladonja & Banovac-Kuča, 2014; Iveša *et al.*, 2015). But at two sites, which can be considered the entrance and the exit points of the bay, a dense monospecific population of *L. obtusa* (Fig. 2) were recorded for the first time. The two sites were characterized by carpets of interwoven thalli of this red alga, where holes made by fish species were evident (Fig. 3). In these cavities the presence of blennies was observed, mostly *Parablennius tentacularis* (Brünnich, 1768) and *Parablennius rouxi* (Cocco, 1833). The extension of the area covered by *L. obtusa* was estimated to be about 3215 m² at site 1 and 11618 m² at site 2 (Fig. 1), in a depth range from 1.0 m to 2.5 m. When thalli of *L. obtusa* were manually lifted from the substrate, thalli of *Halimeda tuna* (J. Ellis & Solander) J.V. Lamouroux were found at the sea bottom. The segments of thalli of this green alga were mostly whitish, which is normal after the release of gametes, when the outer involucres remain light due to the presence of calcium carbonate in cell walls (Lipej *et al.*, 2016). However, in this case the whitish colour of thalli could also be related to the overgrowing by *L. obtusa* and the consequent reduction of the light that reaches the green alga.



Fig. 2: Details of the apical portion of *Laurencia obtusa*; scale bar: 5 mm (photo: Martina Orlando-Bonaca).

Sl. 2: Podrobnosti apikalnega dela vrste *Laurencia obtusa*; velikostna lestvica: 5 mm (foto: Martina Orlando-Bonaca).

The wide population of *L. obtusa* was never observed during underwater surveys conducted in recent years. In this area, benthic communities dominated by brown algae from the genus *Cystoseira* (mainly *C. compressa* (Esper) Gerloff & Nizamuddin), *Padina pavonica* (Linnaeus) Thivy, and *H. tuna* were present (*pers. obs.*). Therefore, we assume that some environmental factors have probably changed and have favoured the extension of this red alga. Our hypothesis for this phenomenon takes into account the possibility that the establishment of the invasive green alga *C. cylindracea* in the Zambratija bay has had a negative impact on native macroalgal assemblages, as reported by Bulleri *et al.* (2010). According to Bulleri *et al.* (2016), the species is able to enhance the competitive ability of algal turfs in respect to canopy-forming and encrusting macroalgae, by the alteration of some abiotic factors, like the enhanced trapping of sediments. Therefore, the spreading of *C. cylindracea* in the Zambratija bay, may have led to the disappearance of *Cystoseira* spp. and other canopy forming macroalgae, with the consequent dense growth

of the lower vegetation cover. Such significant changes at the community level may have favoured the unusual formation of monospecific stands of *L. obtusa*. Additionally, Bulleri *et al.* (2016) reported that at pristine sites, the prevention of the re-invasion of *C. cylindracea* on experimental cleared plots, had favoured the recovery of canopy-forming and encrusting macroalgae.

However, in order to test this hypothesis, other sites along the Istrian coast, where the establishment of *C. cylindracea* was already confirmed (Sladonja & Banovac-Kuča, 2014; Iveša *et al.*, 2015), should also be surveyed in the nearby future. This is needed to verify all the changes in the composition and density of native macroalgal assemblages.

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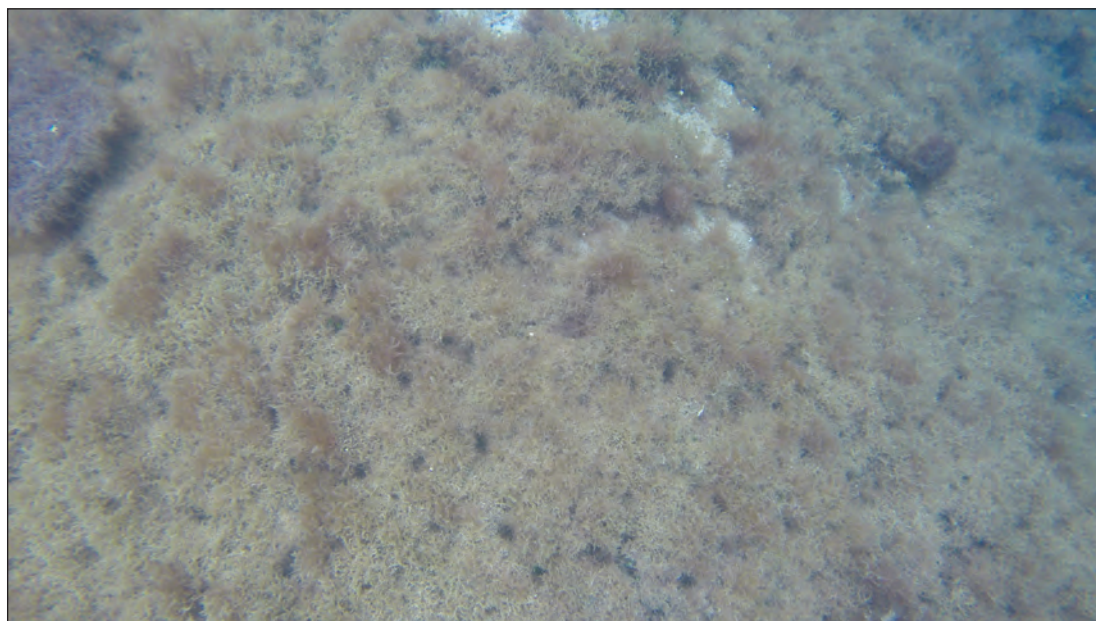


Fig. 3: A dense monospecific population of *Laurencia obtusa* were found in the Zambratija Bay (northern Adriatic Sea) in September 2016. The holes in the carpet of interwoven thalli were made by fish species, mainly blennies (photo: Monica Moras).

Sl. 3: Gosta monospecifična populacija vrste *Laurencia obtusa*, opažena v zambratijskem zalivu (severni Jadran) septembra 2016. Rove v preprogi steljk so naredile ribe, predvsem babice (foto: Monica Moras).

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NENAVADNO RAZŠIRJANJE ALGE *LAURENCIA OBTUSA* (HUDSON) J.V. LAMOUREUX V ZAMBRATIJSKEM ZALIVU (SEVERNI JADRAN)

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POVZETEK

Avtorja poročata o nenavadnem razširjanju rdeče alge *Laurencia obtusa* v plitvinah zambratijskega zaliva (severni Jadran). V zadnjih letih nista nikoli imeli priliko opazovati velike populacije te alge. V tem predelu so prevladovali rjave alge iz rodu *Cystoseira*. Avtorja domnevata, da so spremembe v okoljskih dejavnikih verjetno spodbudile razširjanje te rdeče alge. Ta hipoteza vključuje možnost, da je do tega pojava prišlo zaradi naselitve invazivne zelene alge *Caulerpa cylindracea* v zambratijskem zalivu, ki je imela negativen vpliv na samoniklo skupnost makroalg.

Ključne besede: *Laurencia obtusa*, monospecifična populacija, zambratijski zaliv, Jadransko morje

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