

Fig. S1. Three-decade timeline of key publications documenting detrimental conditions affecting the giant barrel sponge *Xestospingia muta* across the Greater Caribbean and Atlantic region

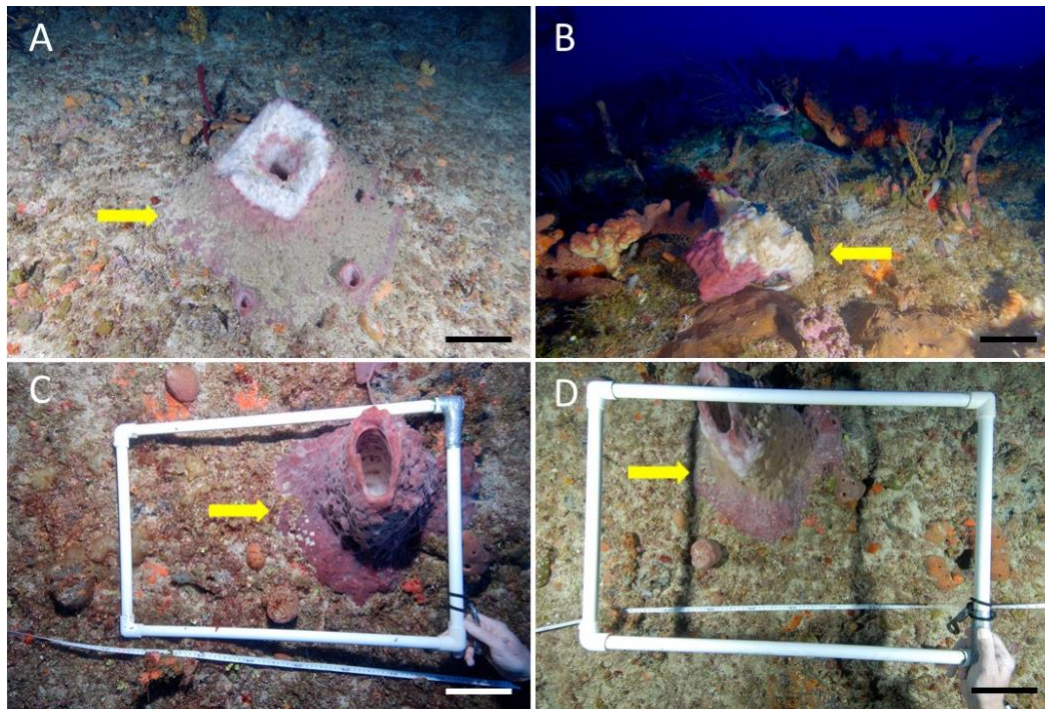


Fig. S2. *Xestospongia muta* inhabiting mesophotic coral reefs off LPNR. (A) *X. muta* covered with fine silt and displaying signs of X-TWD affecting osculum rim at 50 m depth. (B) *X. muta* affected with X-TWD broken off its base and rolling downslope at 70 m depth. (C) Healthy *X. muta* within a permanent transect survey (50 m) and (D) two months later displaying signs of X-TWD, scale bars = 10 cm

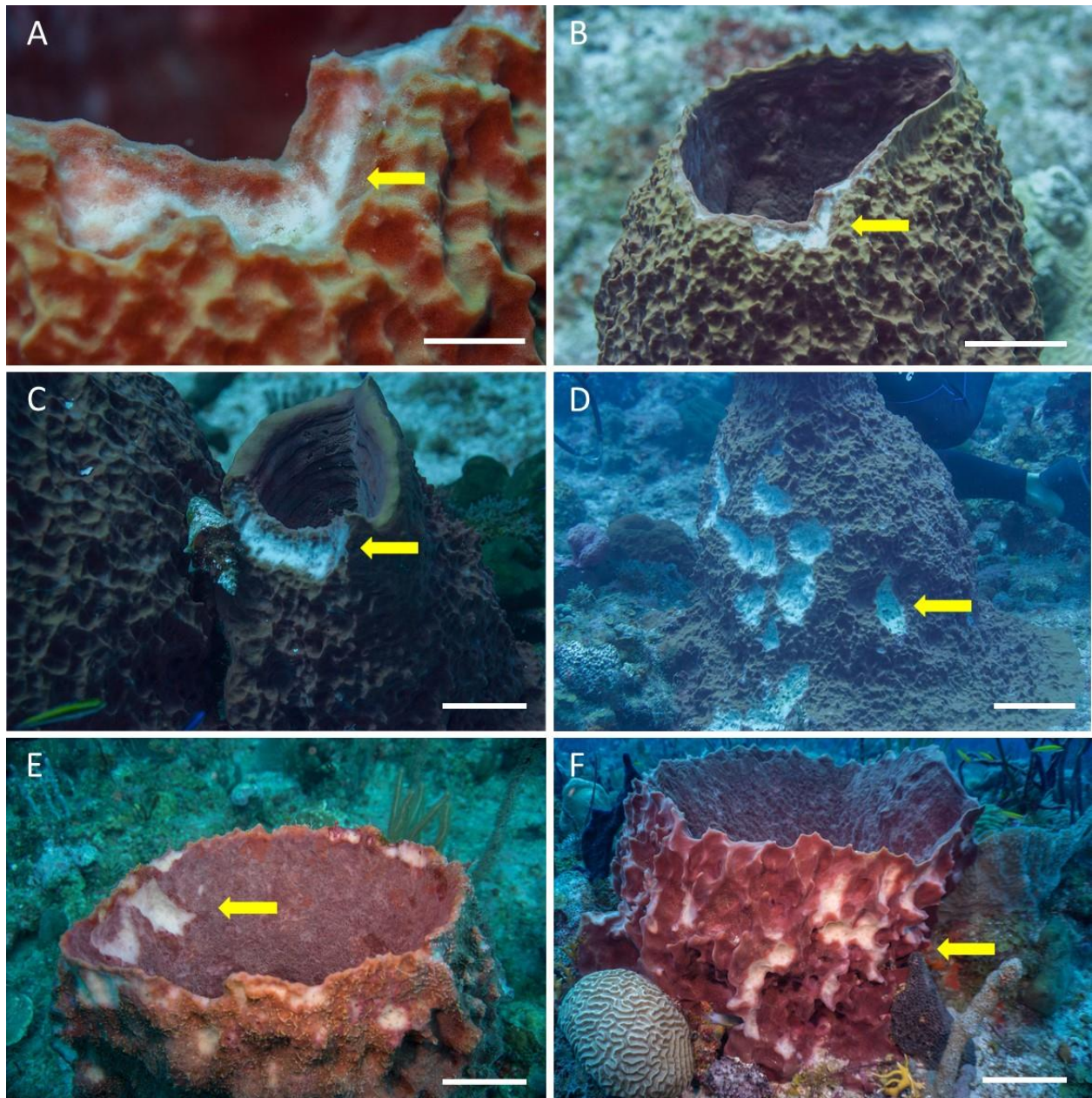


Fig. S3. Predation scars on *Xestospongia muta*. Photographed off LPNR and MIMR (22-27 m). All photographs, except A (scale bar = 1 cm) and B (scale bar = 5 cm), represent a different individual. (A-F) Lesions presumably caused by fish, turtles, or large gastropods (yellow arrows). Predation injuries may be susceptible to pathogenic infection, scale bars = 10 cm

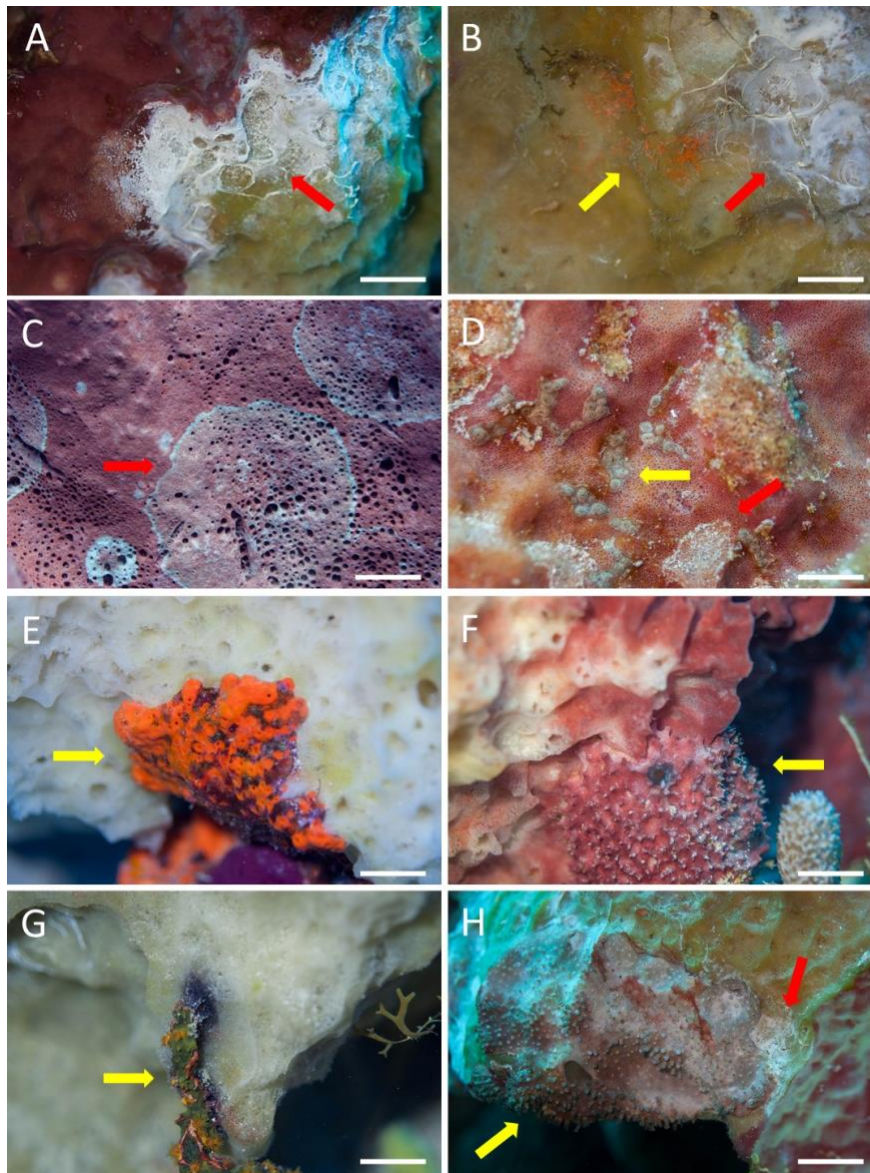


Fig. S4. *Xestospongia* tissue wasting necrotic areas being colonized by unidentified microorganisms. All photographs represent a different individual. (A) Unknown white microbial film (red arrow) overgrowing border between healthy and necrotic tissue. (B) Unknown orange (yellow arrow) and white (red arrow) microbes overgrowing necrotic surface of *X. muta*. (C) Unknown microbial spots (red arrow), resembling localized infection, within osculum of *X. muta*. (D) The zoantharian *Bergia catenularis* (yellow arrow) covered by a white microbial film (red arrow) on *X. muta* with X-TWD. (E) *Agelas* sp. and (F) *Ircinia* sp. in direct contact with diseased *X. muta*. (G) The rope green sponge *Iotrochota birotulata* in direct contact with diseased *X. muta*, *I. birotulata*-associated zoantharian *Parazoanthus swiftii* being overgrown by a red/brown filamentous microbe (yellow arrow). (H) *Briareum asbestinum* (yellow arrow) in direct contact with *X. muta* affected by X-TWD. Octocoral is being overgrown by the white microbial film (red arrow) and by a red/brown filamentous microbe. Scale bars = 1.0 cm

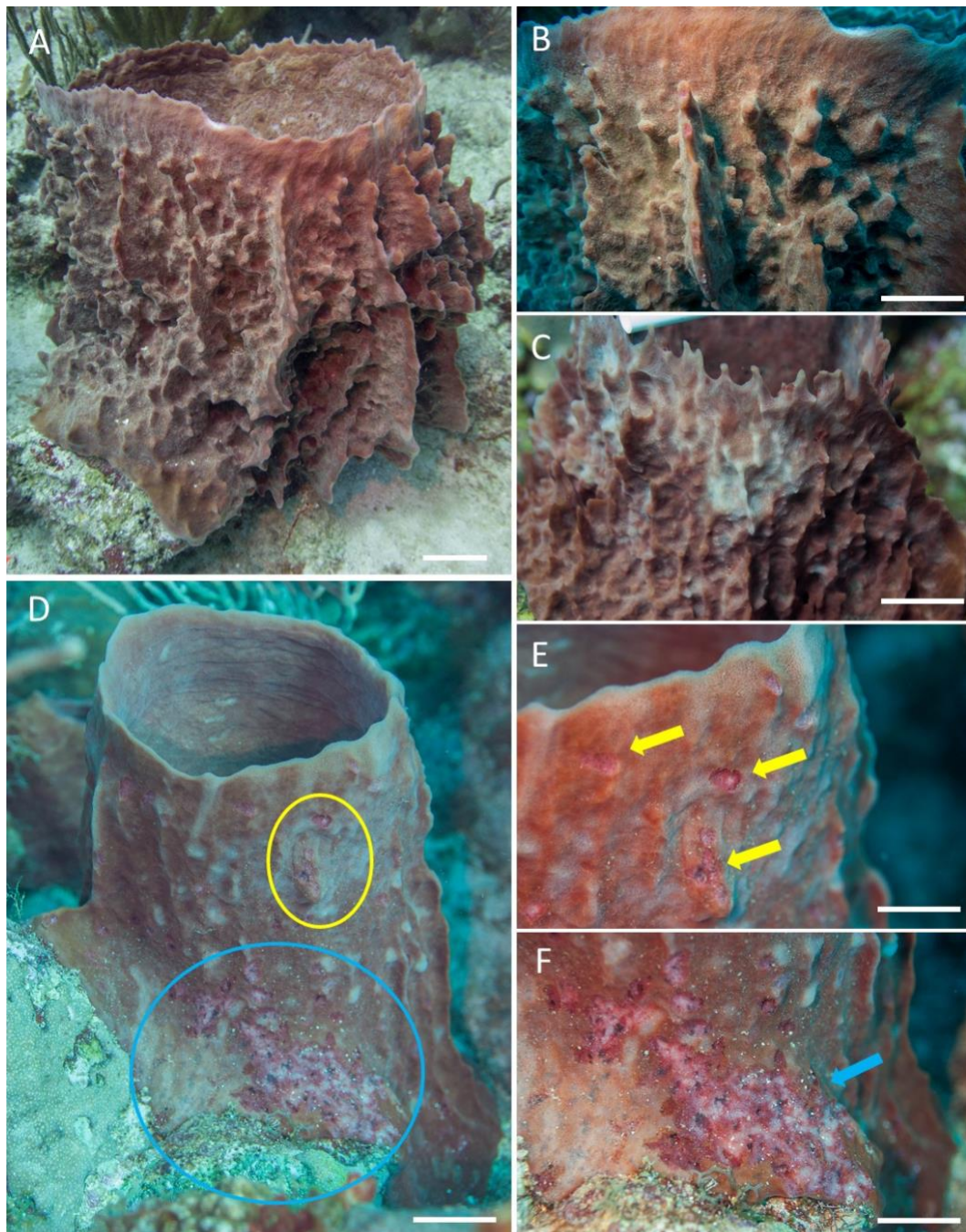


Fig. S5. Fine silt/detritus covering *Xestospongia muta*'s pinacoderm. (A) Typical lamellae morphology of *X. muta*, scale bar = 10 cm. (B) Close-up of *X. muta*'s lamellae and pinacoderm covered in silt/detritus, scale bar = 5 cm. (C) Silt free pinacoderm after *in situ* removal, exposing bleached (spots) tissue, scale bar = 5 cm. (D-F) Same individual of *X. muta* with signs of CSB and tissue damage: (D) post silt/detritus removal, scale bar = 5 cm. (E) Lesions close to the osculum rim (yellow arrows), scale bar = 1 cm. (F) Closed up of exposed subdermal tissue of *X. muta* due to damaged caused by presumably silt/detritus overloading (blue arrow), scale bar = 1 cm

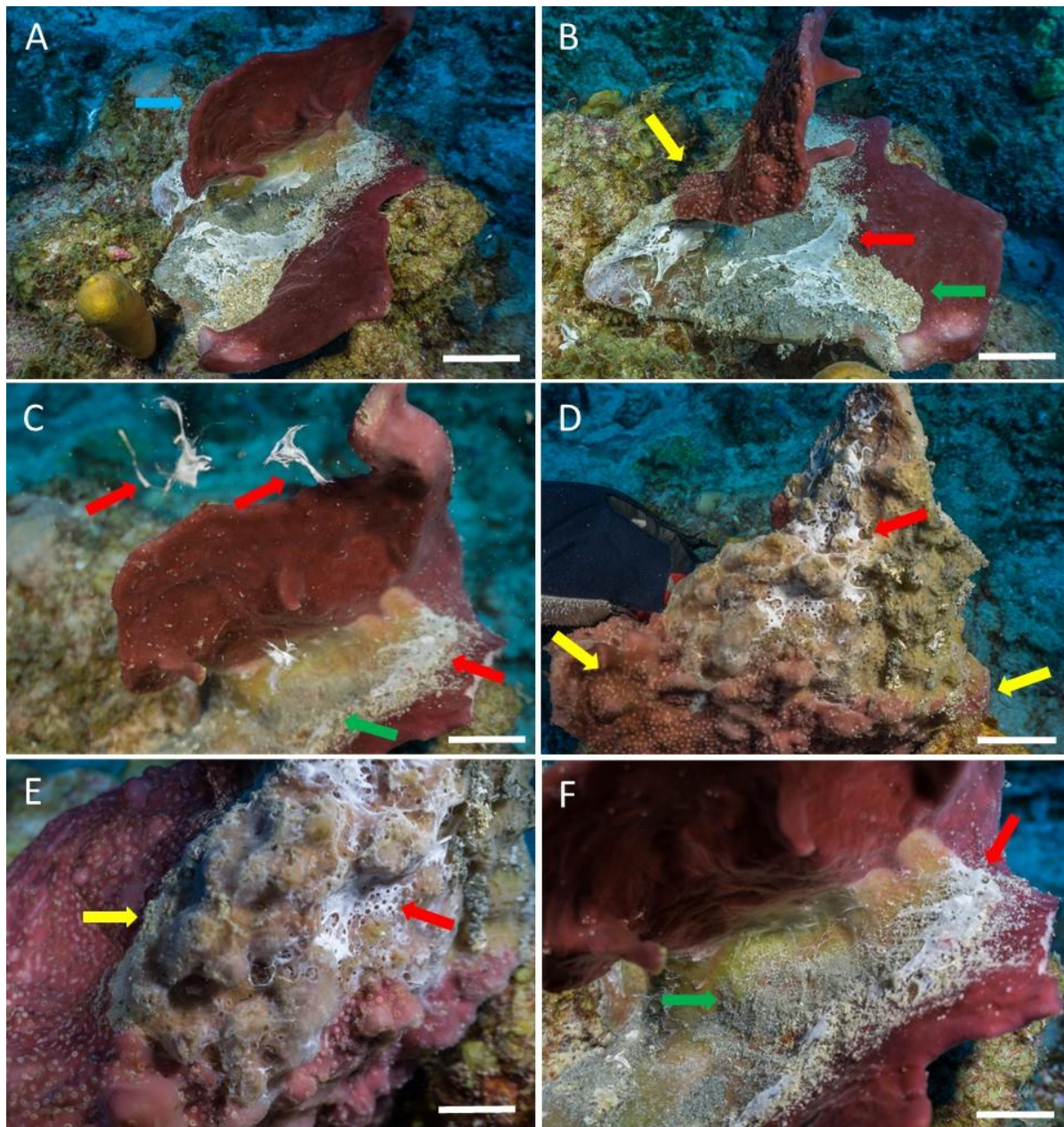


Fig. S6. Tissue wasting disease affecting the demosponge *Petrosia (Petrosia) pellarca*. (A) Diseased *P. pellarca* displaying signs of X-TWD (blue arrow). (B-F) Unknown white microbial film (red arrow) overgrowing border between healthy and necrotic tissue. (B, C, F) Silt accumulation on the sponge's pinacoderm (green arrow), zoantharian presumably affected by X-TWD (yellow arrow), scale bars = 5 cm (Fig. A-D), scale bars = 1 cm (Fig. E-F). *P. pellarca* was photographed off LPNA (33 m)

Table S1. Known Caribbean sponge conditions listed in chronological order by publication year and locality

Sponge condition	Acronym	Affected species	Locality [reference]
Mangrove sponge disease	MSD	<i>Geodia papyracea</i>	Belize [1]
Cyclic spotted bleaching	CSB	<i>Xestospongia muta</i>	Puerto Rico [2, 3]
<i>Xestospongia</i> - Tissue wasting disease	X-TWD	<i>Xestospongia muta</i> * <i>Petrosia (Petrosia) pellasarca</i>	Belize [4], Florida Keys [5], Curaçao [6], Florida Keys [7], Key Largo [8, 9], Florida Keys & Bahamas [10], Boynton Beach & Fort Lauderdale [11], *La Parguera Natural Reserve, Puerto Rico [this study]
<i>Aplysina</i> red band syndrome	ARBS	<i>Aplysina cauliformis</i> , <i>Aplysina fulva</i>	Bahamas [12], Panama [13], Bahamas [14, 15, 16, 17]
Sponge white patch	SWP	<i>Amphimedon compressa</i>	Florida Keys [18]
<i>Agelas</i> wasting syndrome	AWS	<i>Agelas tubulata</i>	Key Largo [19, 20]
<i>Xestospongia</i> – Tissue hardening condition	X-THC	<i>Xestospongia muta</i>	Mona Island, La Parguera, Puerto Rico [this study]

References: [1] Rützler 1988; [2] Vicente 1990; [3] Williams & Bunkley-Williams 1990; [4] Paz 1996; [5] Schmahl 1999; [6] Nagelkerken 2000; [7] Cowart et al. 2006; [8] López-Legentil et al. 2008; [9] López-Legentil et al. 2010; [10] Angermeier et al. 2011; [11] Mulheron 2014; [12] Olson et al. 2006; [13] Gochfeld et al. 2007; [14] Gochfeld et al. 2012; [15] Easson et al. 2013; [16] Olson et al. 2014; [17] Gochfeld et al. 2019; [18] Angermeier et al. 2012; [19] Deignan & Pawlik 2016; [20] Deignan et al. 2018b

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