



forestry, fisheries  
& the environment

Department:  
Forestry, Fisheries and the Environment  
REPUBLIC OF SOUTH AFRICA

# SALDANHA BAY SEA BASED AQUACULTURE DEVELOPMENT ZONE SPECIALIST ENVIRONMENTAL MONITORING QUALITATIVE BIOFOULING SURVEY 2



July 2023



ANCHOR  
environmental

---

Cover photo: Steve Benjamin

---

---

**SALDANHA BAY SEA BASED  
AQUACULTURE DEVELOPMENT ZONE  
SPECIALIST ENVIRONMENTAL MONITORING  
QUALITATIVE BIOFOULING SURVEY 2  
July 2023**

Report prepared for:

**Department of Forestry, Fisheries and the Environment**  
473 Steve Biko & Soutpansberg Roads, Arcadia, Pretoria, 0083



**forestry, fisheries  
& the environment**

Department:  
Forestry, Fisheries and the Environment  
REPUBLIC OF SOUTH AFRICA

by:

**Anchor Environmental Consultants (Pty) Ltd**  
8 Steenberg House, Silverwood Close, Tokai, South Africa  
[www.anchorenvironmental.co.za](http://www.anchorenvironmental.co.za)



Authors: Robyn Payne, Ken Hutchings, Aiden Biccard, Cheruscha Swart and Barry Clark

Citation: Payne R, Hutchings K, Biccard A, Swart C & Clark B. 2023. Saldanha Bay Sea Based Aquaculture Development Zone Specialist Environmental Monitoring, Qualitative Biofouling Survey 2. Report no. 1974/22 prepared by Anchor Environmental Consultants (Pty) Ltd for the Marine Living Resources Fund. 44 pp.

© Anchor Environmental Consultants 2023

Use of material contained in this document by prior written permission of Anchor Environmental Consultants only.

---

---

---

---

# EXECUTIVE SUMMARY

---

## Introduction

The Marine Living Resources Fund (MLRF), a Schedule 3A Public Entity established in terms of the Public Finance Management Act, 1999 (Act No 1 Of 1999), under the auspices of the Department of Forestry, Fisheries and the Environment (DFFE), appointed Anchor Research and Monitoring (Pty) Ltd (Anchor) to undertake specialist monitoring in compliance with the environmental Sampling Plan, Environmental Management Program and Environmental Authorisation (EA) for the Saldanha Bay ADZ, for a period of two years (2021/2022). One of the specific tasks of this appointment was to conduct annual non-quantitative (i.e. qualitative) sampling of fouling organisms. This report presents the findings of diver surveys conducted in the Big Bay and Small Bay shellfish precincts during 2021 and 2022, and includes a list of alien species and digital invertebrate taxonomic reference library.

## Methodology

Fouling organisms were collected from aquaculture farm structures (buoys, ropes, chains and rafts) at two (September 2021) and seven (July 2022) sites in the Saldanha ADZ Big Bay and Small Bay shellfish precincts. This comprised a scientific diver scraping a 20 cm length of chain or rope. Alternatively, on larger structures, wall scrapes were undertaken using 0.04 m<sup>2</sup> quadrats. Once collected, samples were transferred to 2 litre buckets and preserved in 8% buffered formalin. Specimens were identified to species level where possible, with the aid of Anchor's comprehensive taxonomic reference collection of benthic macrofauna from this system, and the results of this analysis were compared to data collected by Llyod Sassman (DFFE). To determine whether the biofouling communities from the different bays are significantly different, presence/absence data was converted to a similarity matrix using the Bray-Curtis similarity coefficient, and an Analysis of Similarity (ANOSIM) test was conducted using the multivariate PRIMER V6 software.

## Findings & Remarks

Previous research by DFFE identified 66 fouling species from aquaculture farm structures in the Saldanha ADZ. In total, this fauna comprises three kingdoms, 13 phyla, 22 classes, 48 orders, 75 families and 101 taxa. It is dominated by the phyla Arthropoda, Mollusca and Annelida, with 88% of the taxa identified to species level. Twenty-five and 40 taxa were identified from the 2021 and 2022 Anchor surveys respectively, with ten species shared with both sites and the DFFE study, including *Porcellana africana* (invasive), *Tanystylum brevipes*, *Notomegalanus algicola*, *Ciona robusta* (invasive), *Anthothoe chilensis*, *Parechinus angulosus*, *Thyone aurea*, *Aulacomya atra*, *Mytilus galloprovincialis* (invasive) and *Fissurella mutabilis*. However, discrepancies are likely due to differences in sampling season, intensity and methodology. Nevertheless, there was no significant difference in the biofouling communities inhabiting Small and Big Bay. Overall, one alien and five invasive species were identified.

# TABLE OF CONTENTS

---

<b>EXECUTIVE SUMMARY</b> .....	<b>I</b>
<b>TABLE OF CONTENTS</b> .....	<b>II</b>
<b>GLOSSARY</b> .....	<b>III</b>
<b>LIST OF ABBREVIATIONS</b> .....	<b>IV</b>
<b>I INTRODUCTION</b> .....	<b>I</b>
1.1 BACKGROUND .....	1
1.2 BIOFOULING .....	2
<b>2 METHODOLOGY</b> .....	<b>3</b>
2.1 COLLECTION .....	3
2.2 ANALYSIS .....	4
<b>3 FINDINGS &amp; REMARKS</b> .....	<b>5</b>
3.1 JAPANESE SKELETON SHRIMP <i>CAPRELLA MUTICA</i> , INVASIVE .....	6
3.2 PORCELAIN CRAB <i>PORCELLANA AFRICANA</i> , INVASIVE .....	6
3.3 DISC LAMP SHELL <i>DISCINISCA TENUIS</i> , INVASIVE .....	7
3.4 SOLITARY TUNICATE <i>CIONA ROBUSTA</i> , INVASIVE .....	7
3.5 PINKMOUTH HYDROID <i>ECTOPLEURA CROCEA</i> , ALIEN .....	7
3.6 MEDITERRANEAN MUSSEL <i>MYTILUS GALLOPROVINCIALIS</i> , INVASIVE .....	7
<b>4 REFERENCES</b> .....	<b>12</b>
<b>APPENDICES</b> .....	<b>14</b>

## GLOSSARY

---

**Alien species:** Species whose presence in a region is attributable to human actions that enabled them to overcome fundamental biogeographical barriers (i.e. human-mediated extra-range dispersal) (synonyms: Introduced, non-indigenous, non-native, exotic).

**Aquaculture:** The sea-based or land-based rearing of aquatic animals or the cultivation of aquatic plants for food.

**Biofouling:** The undesirable accumulation of microorganisms, plants and/or animals on wet surfaces that have a mechanical function, causing structural or other functional deficiencies (synonyms: biological fouling).

**Biota:** The animal and plant life of a particular region, habitat, or geological period.

**Environmental Authorisation:** Permission granted by the competent authority for the applicant to undertake listed activities in terms of the NEMA EIA Regulations, 2014.

**Fauna:** General term for all the animals found in a particular location.

**Invasive:** Alien species that have self-replacing populations over several generations and that have spread from their point of introduction.

**Invertebrate:** Animals that do not have a backbone. Invertebrates either have an exoskeleton (e.g. crabs) or no skeleton at all (worms).

**Macrobenthos/macrofauna:** Those animals retained by a 1.0-mm-mesh sieve. Macrobenthic invertebrates are defined as organisms that live on or inside the deposit at the bottom of a water body.

**Native:** Indigenous to a particular locality.

## **LIST OF ABBREVIATIONS**

---

ADZ	Aquaculture Development Zone
Anchor	Anchor Environmental Consultants
ANOSIM	Analysis of Similarities
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
MLRF	Marine Living Resources Fund
PRIMER	Plymouth Routines in Multivariate Ecological Research
SANBI	South African National Biodiversity Institute



# I INTRODUCTION

---

## I.1 BACKGROUND

An Aquaculture Development Zone (ADZ) comprises areas of water selected for their suitability for specific aquaculture sectors. The Saldanha ADZ provides opportunities for existing aquaculture operations to expand and new ones to be established, providing economic benefits to the local community through job creation and regional economic diversification. ADZs are intended to boost investor confidence by providing ‘investment ready’ platforms with strategic environmental approvals and management policies already in place, allowing commercial aquaculture operations to be set up without the need for lengthy, complex and expensive approval processes. It is anticipated that ADZs will create incentives for industry growth, provide marine aquaculture services and enhance consumer confidence.

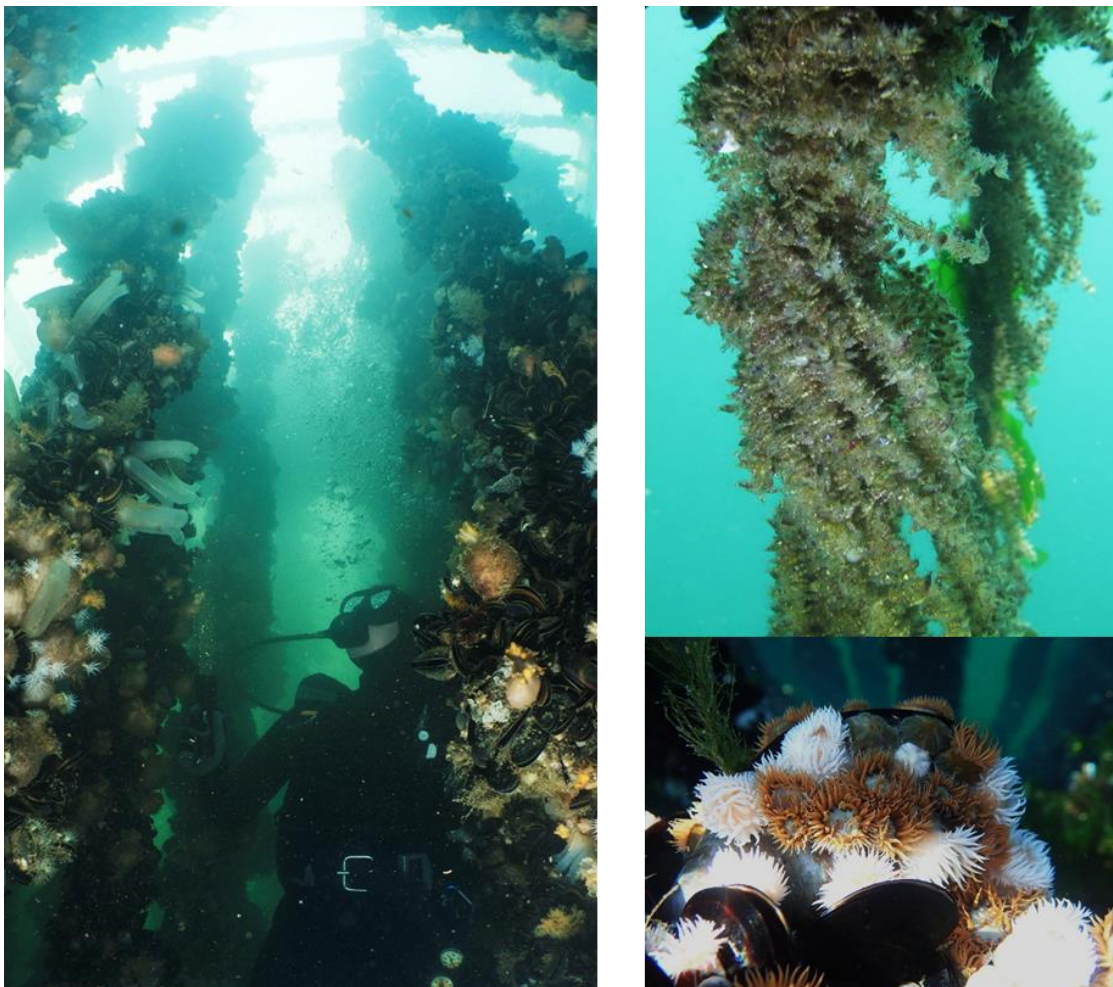


Figure 1. Fouling communities present in the Saldanha Bay ADZ.

The Marine Living Resources Fund (MLRF), a Schedule 3A Public Entity established in terms of the Public Finance Management Act, 1999 (Act No 1 Of 1999), under the auspices of the Department of Forestry, Fisheries and the Environment (DFFE), appointed Anchor Research and Monitoring (Pty) Ltd (Anchor) to undertake specialist monitoring in compliance with the environmental Sampling Plan, Environmental Management Program and Environmental Authorisation (EA) for the Saldanha Bay ADZ, for a period of two years (2021/2022). One of the specific tasks of this appointment was to conduct annual non-quantitative (i.e. qualitative) sampling of fouling organisms. This report presents the findings of diver surveys conducted in the Big Bay and Small Bay shellfish precincts during 2021 and 2022, and includes a list of alien species and digital invertebrate taxonomic reference library.

## 1.2 BIOFOULING

Aquaculture farm structures provide a novel surface for the quick colonisation and proliferation of various fast-growing and highly competitive marine species with short-lived larvae (Fitridge *et al.* 2012, Megina *et al.* 2013, Janiak & Branson 2021). These fouling communities are commonly dominated by sessile, suspension-feeding organisms including ascidians, barnacles, bivalves, bryozoans, hydroids, polychaetes and sponges (Figure 1) (Millard 1951, Dicken *et al.* 2011, Fitridge *et al.* 2012). They also frequently include alien species that have been transferred both regionally and globally via shipping activity (Fitridge *et al.* 2012, Megina *et al.* 2016, Leclerc & Viard 2018). Consequently, hard artificial substratum within ports facilitates the introduction, establishment and regional spread of alien species (Janiak & Branson 2021, Outinen *et al.* 2021). Indeed, harbours are one of the most invaded habitats of the marine realm (Leclerc & Viard 2018), and comprise the highest concentration of marine alien species in South Africa (Picker & Griffiths 2017). Shipping is responsible for roughly 91% of marine introductions to South Africa, with the majority originating from the North Atlantic Ocean, and the likely vectors being ballast water and/or hull fouling (Robinson *et al.* 2020).

To date, 95 marine alien species have been reported from the South African coastline (Robinson *et al.* 2020) (Appendix 1). Of these, at least 67 alien species are known to occur along the west coast (Robinson *et al.* 2020). Indeed, one alien (fat-feeler amphipod *Monocorophium acherusicum*) and four invasive species (western pea crab *Rathbunixa occidentalis*, amphipod *Erichthonius brasiliensis*, Mediterranean mussel *Mytilus galloprovincialis*, tuberculate pear crab *Pyromaia tuberculata*) have previously been recorded by Anchor when identifying benthic macrofauna for the annual State of Saldanha Bay and Langebaan Lagoon technical report (2008-2022).

## 2 METHODOLOGY

---

### 2.1 COLLECTION

Fouling organisms were collected from aquaculture farm structures (buoys, ropes, chains and rafts) at two (September 2021) and seven (July 2022) sites in the Saldanha ADZ Big Bay and Small Bay shellfish precincts (Figure 2, Figure 3). This comprised a scientific diver scraping a 20 cm length of chain or rope. Alternatively, on larger structures, wall scrapes were undertaken using 0.04 m<sup>2</sup> quadrats. Once collected, samples were transferred to 2 litre buckets and preserved in 8% buffered formalin.

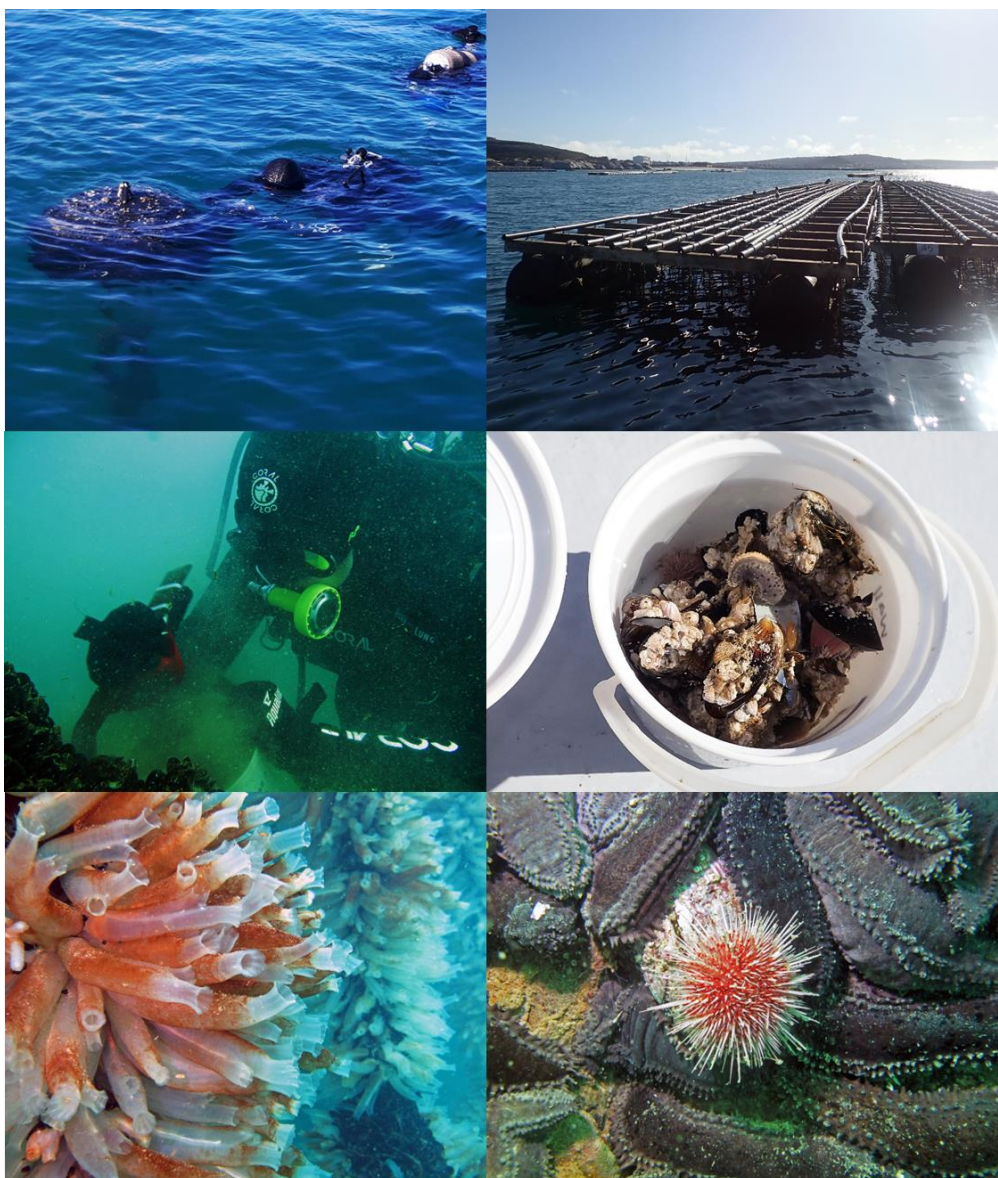


Figure 2. Anchor scientific divers collecting biota from aquaculture farm structures in the Saldanha Bay ADZ during the 2021/2022 surveys, and an example of the resultant sample prior to sorting and preservation (middle right).

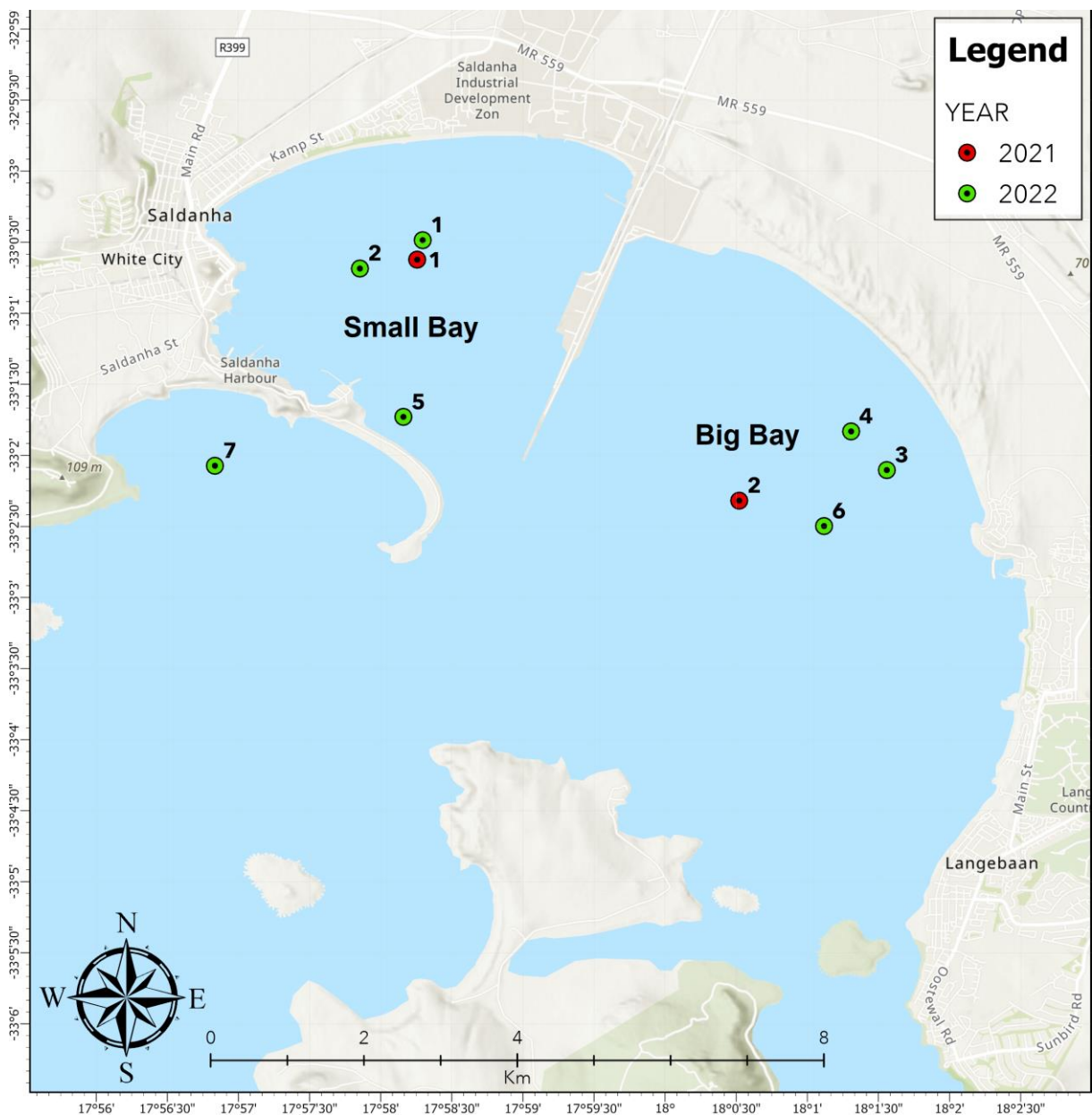


Figure 3. Sampling locations on aquaculture farm structures in the Saldanha Bay ADZ (Anchor surveys, 2021 and 2022).

## 2.2 ANALYSIS

Specimens were identified to species level where possible, with the aid of Anchor's comprehensive taxonomic reference collection of benthic macrofauna from this system (Appendix 2), and the results of this analysis were compared to data collected by Llyod Sassman (DFFE). To determine whether the biofouling communities from the different bays are significantly different, presence/absence data was converted to a similarity matrix using the Bray-Curtis similarity coefficient, and an Analysis of Similarity (ANOSIM) test was conducted using the multivariate PRIMER V6 software (Clarke & Warwick, 2001). The ANOSIM test produces a probability value ( $p$ ) and an R statistic value that ranges between 0 and 1, with 0 indicating 100% similarity and 1 indicating 100% dissimilarity.

### 3 FINDINGS & REMARKS

Previous research by DFFE identified 66 fouling species from aquaculture farm structures in the Saldanha ADZ (Table 1, Figure 4). In total, this fauna comprises three kingdoms, 13 phyla, 22 classes, 48 orders, 75 families and 101 taxa (Table 1, Appendix 3). It is dominated by the phyla Arthropoda, Mollusca and Annelida (Figure 5), with 88% of the taxa identified to species level. Twenty-five and 40 taxa were identified from the 2021 and 2022 Anchor surveys respectively, with ten species shared with both sites and the DFFE study, including *Porcellana africana* (invasive), *Tanystylum brevipes*, *Notomegabalanus algicola*, *Ciona robusta* (invasive), *Anthothoe chilensis*, *Parechinus angulosus*, *Thyone aurea*, *Aulacomya atra*, *Mytilus galloprovincialis* (invasive) and *Fissurella mutabilis*. However, discrepancies are likely due to differences in sampling season, intensity and methodology. Nevertheless, there was no significant difference in the biofouling communities inhabiting Small and Big Bay (ANOSIM,  $R = 0.215$ ,  $p = 0.143$ ). Overall, one alien and five invasive species were identified. A synopsis of the state of knowledge of these introduced taxa is provided below.

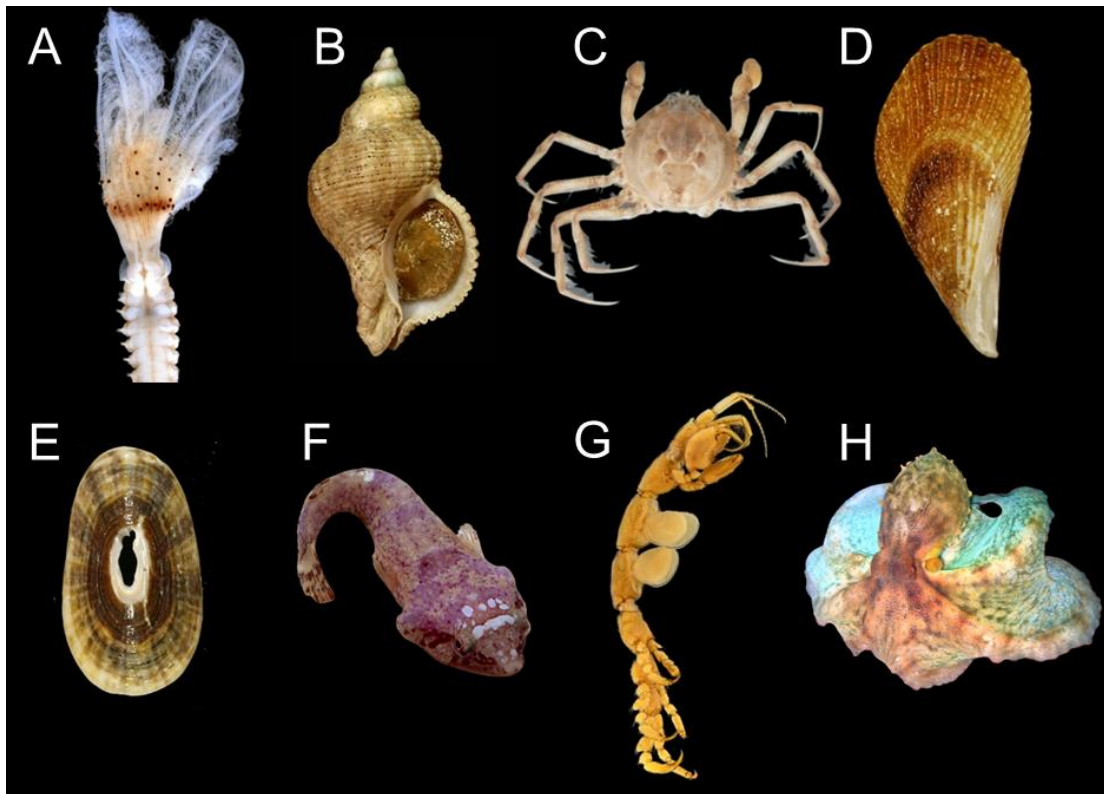


Figure 4. Selection of species from aquaculture farm structures in the Saldanha Bay ADZ as documented by DFFE and/or identified from the 2021 and 2022 Anchor surveys. A) gregarious fanworm *Pseudopotamilla reniformis* (E.A. Lazo-Wasem), B) dogwhelk *Nucella wahlbergi* (Joop Trausel & Frans Slieker), C) crown crab *Hymenosoma orbiculare* (J. Dawson), D) ribbed mussel *Aulacomya atra* (Joop Trausel & Frans Slieker), E) Cape keyhole-limpet *Fissurella mutabilis* (Joop Trausel & Frans Slieker), F) chubby clingfish *Apletodon pellegrini* (G. Zsilavec), G) skeleton shrimp *Caprella penantis* (NCSM), H) common octopus *Octopus vulgaris* (Roberto Pillon).

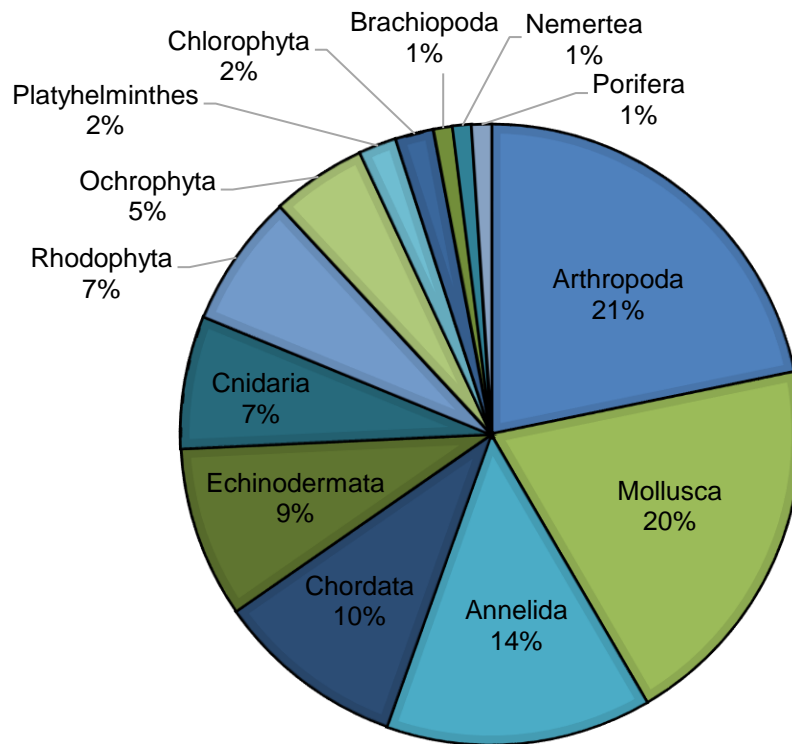


Figure 5. Phyla composition of the biota collected from aquaculture farm structures in the Saldanha Bay ADZ as documented by DFFE and/or identified from the 2021 and 2022 Anchor surveys.

### 3.1 JAPANESE SKELETON SHRIMP *CAPRELLA MUTICA*, INVASIVE

*Caprella mutica* is indigenous to north-east Asia and has invaded several regions, including Europe, North America and New Zealand. It was first recorded in South Africa from False Bay Marina, with the likely vector being ship fouling (Peters & Robinson, 2017). This marine amphipod has already reached substantial densities in the marina environment, and is of concern due to its fast reproductive cycle and high reproductive output.

### 3.2 PORCELAIN CRAB *PORCELLANA AFRICANA*, INVASIVE

*Porcellana africana* was previously incorrectly identified as the European *P. platycheles* (Griffiths et al. 2018). To date, it is the first and only known alien porcelain crab in South Africa. This species is native to the region between Senegal and Western Sahara in Northwest Africa. It was most likely introduced via shipping, by means of ballast water or hull fouling. This species was first discovered in South Africa in relatively high numbers on Schaapen Island, Langebaan Lagoon in 2012 (Prof. George Branch 2012, pers. obs.). However, its' date of introduction has been estimated to be between 2003 and 2009. It is now well established and abundant in Saldanha Bay, occurring across the intertidal zone under boulders and loose rocks, as well as in beds of *Mytilus galloprovincialis*. This species should be monitored as it has the ability to expand its range and increase in number in a relatively short time period (Griffiths et al. 2018).

### 3.3 DISC LAMP SHELL *DISCINISCA TENUIS*, INVASIVE

*Discinisca tenuis* is a small disc-shaped brachiopod with a semi-transparent, hairy, fringed shell. It was first recorded in 2008 on oysters grown in Saldanha Bay (Haupt *et al.* 2010), and later recorded outside of the oyster culture operation on Schaapen Island (Peters *et al.* 2014). This species is endemic to Namibia, and is thought to have been introduced to South Africa via cultured oyster imports (Haupt *et al.* 2010). This species can reportedly reach very high densities and could become a significant fouling species in Saldanha Bay.

### 3.4 SOLITARY TUNICATE *CIONA ROBUSTA*, INVASIVE

*Ciona robusta* was initially misidentified as *C. intestinalis*, which was found to comprise two morphologically separate species. This species is a tall and cylindrical solitary ascidian with a soft, transparent test. It forms large aggregations on submerged structures in harbours and lagoons from Saldanha Bay to Durban. It was originally introduced from the North Atlantic prior to 1955. This species is an economically important pest and is known to smother mussels on aquaculture infrastructure, especially mussel ropes.

### 3.5 PINKMOUTH HYDROID *ECTOPLEURA CROCEA*, ALIEN

*Ectopleura crocea* is a North Atlantic species with a complex taxonomic history. It was first recorded in South Africa from Durban Harbour in 1947 and was inadvertently re-described as a new species (*Tubularia warreni*). This species is common in dock areas on pylons and ships hulls (Millard 1975), and the likely vectors are ship fouling and ballast water (Mead *et al.* 2011).

### 3.6 MEDITERRANEAN MUSSEL *MYTILUS GALLOPROVINCIALIS*, INVASIVE

*Mytilus galloprovincialis* was first detected from South Africa in 1979 (Mead *et al.* 2011), but its presence was only confirmed in 1984, likely due to confusion with the indigenous black mussel *Choromytilus meridionalis*. At this point, the population was already widespread in the country, being the most abundant mussel species on rocky shores between Cape Point and Lüderitz. This species has subsequently extended its distribution range as far as East London (Robinson *et al.* 2005). It is commercially cultured in Saldanha Bay and elsewhere, and is widely exploited by recreational and subsistence fishers (Robinson *et al.* 2005 & 2007).





Phylum	Class	Order	Family	Taxa	DFFE	2021		2022						
						I	2	1	2	3	4	5	6	7
						A	B	Wall 2	Wall 4	Wall 7	Wall 9	Wall 2	Wall 5	Wall 20
				<i>Exosphaeroma varicolor</i>									X	
		Tanaidacea		Tanaidacea sp.		X	X		X	X				
	Pycnogonida	Pantopoda	Ammonotheidae	<i>Tanystylum brevipes</i>	X	X							X	
		Balanomorpha	Balanidae	<i>Austromegabalanus</i> sp.	X									
		Thecostraca		<i>Notomegabalanus algicola</i>	X	X			X	X	X			
		Scalpellomorpha	Lepadidae	<i>Lepas (Lepas) anatifera</i>					X	X				
				<i>Lepas (Lepas) testudinata</i>	X									
Brachiopoda	Lingulata	Lingulida	Discinidae	<i>Discinisca tenuis</i>	X	X								
			Asciidiidae	<i>Ascidia caudata</i>	X									
		Phlebobranchia												
		Ascidiacea	Cionidae	<i>Ciona robusta</i>	X	X			X		X	X		
			Pyuridae	<i>Pyura stolonifera</i>	X	X								
		Stolidobranchia												
			Styelidae	<i>Botrylloides magnicoecus</i>	X									
				<i>Botryllus gregalis</i>	X									
Chordata		Atheriniformes	Atherinidae	<i>Atherina breviceps</i>	X									
		Blenniiformes	Blenniidae	<i>Scartella emarginata</i>	X									
		Teleostei	Clinidae	<i>Clinus heterodon</i>	X									
				<i>Apletodon pellegrini</i>		X								
		Gobiesociformes	Gobiesocidae	<i>Eckloniaichthys scylliorhiniceps</i>	X									
				<i>Actinia mandelae</i>	X									
		Anthozoa	Actiniaria	<i>Bunodactis reynaudi</i>					X			X	X	X
				<i>Pseudactinia flagellifera</i>					X					
			Sagartiidae	<i>Anthothoe chilensis</i>	X	X		X						
				Actiniaria sp.				X	X				X	
Cnidaria		Hydrozoa	Anthoathecata	Tubulariidae							X			
			Leptothecata	Sertulariidae										
				<i>Ectopleura crocea</i>										
				<i>Amphisbetia operculata</i>		X								
		Asterozoa	Velatida	Pterasteridae	X									
				<i>Pteraster capensis</i>										
		Crinozoa	Comatulida	Antedonidae								X		
				<i>Annametra occidentalis</i>										
		Echinozoa	Camarodonta	Tropiometridae	X									
				<i>Tropiometra carinata</i>										
Echinodermata				<i>Parechinus angulosus</i>	X	X		X				X	X	X
				<i>Pentacta doliolum</i>		X		X	X		X			
				<i>Roweia frauenfeldi frauenfeldi</i>	X									
		Holothurozoa	Dendrochirotida	Cucumariidae										
				<i>Thyone aurea</i>	X	X		X						
				Phylloporidae				X						





## 4 REFERENCES

---

- Clarke KR & RM Warwick. 2001. Change in marine communities: an approach to statistical analysis and interpretation. 2nd edition. Primer-E, Plymouth. Plymouth, United Kingdom. 172.
- Dicken ML, Parker Nance S & MJ Smale. 2011. Sessile biofouling on tags from recaptured raggedtooth sharks (*Carcharias taurus*) and their effects on tagging studies. *Marine and Freshwater Research* 62(4): 359–364.
- Fitridge I, Dempster T, Guenther J & R de Nys. 2012. The impact and control of biofouling in marine aquaculture: a review. *Biofouling* 28(7): 649–669.
- Griffiths CL, Roberts S, Branch M, Eckel K, Schubart CD & R Lemaitre. 2018. The porcelain crab *Porcellana Africana* Chace, 1956 (Decapoda: Porcellanidae) introduced into Saldanha Bay, South Africa. *BioInvasions Records* 7(2): 133–142.
- Haupt TM, Griffiths CL, Robinson TB & AFG Tonin. 2010. Oysters as vectors of marine aliens, with notes on four introduced species associated with oyster farming in South Africa. *African Zoology* 45(1): 52–62.
- Janiak DS & D Branson. 2021. Impacts of habitat and predation on epifaunal communities from seagrass beds and artificial structures. *Marine Environmental Research* 163: 105225.
- Leclerc J-C & F Viard. 2018. Habitat formation prevails over predation in influencing fouling communities. *Ecology and Evolution* 8(1): 477–492.
- Mead A, Carlton JT, Griffiths CL & M Rius. 2011. Revealing the scale of marine bioinvasions in developing regions: a South African re-assessment. *Biological Invasions* 13: 1991–2008.
- Megina C, González-Duarte MM & PJ López-González. 2016. Benthic assemblages, biodiversity and invasiveness in marinas and commercial harbours: an investigation using a bioindicator group. *Biofouling* 32(4): 465–475.
- Megina C, González-Duarte MM, López-González PJ & S Piraino. 2013. Harbours as marine habitats: hydroid assemblages on sea-walls compared with natural habitats. *Marine Biology* 160(2): 371–381.
- Millard N. 1951. Observations and experiments on fouling organisms in Table Bay Harbour, South Africa. *Transactions of the Royal Society of South Africa* 33(4): 415–446.
- Millard N. 1975. Monographs on the Hydroida of southern Africa. *Annals of the South African Museum* 68: 1–513.
- Outinen O, Puntilla-Dodd R, Barda I, Brzana R, Hegele-Drywa J, Kalnina M, Kostanda M, Lindqvist A, Normant-Saremba M, Ścibik M, Strake S, Vuolamo J & M Lehtiniemi. 2021. The role of marinas in the establishment and spread of non-indigenous species in Baltic Sea fouling communities. *Biofouling* 37(9–10): 984–997.
- Peters K, Griffiths C & TB Robinson. 2014. Patterns and drivers of marine bioinvasions in eight Western Cape harbours, South Africa. *African Journal of Marine Science* 36(1): 49–57.
- Peters K & TB Robinson. 2017. First record of the marine alien amphipod *Caprella mutica* (Schurin, 1935) in South Africa. *BioInvasions Records* 6(1): 61–66.

- Picker MD & CL Griffiths. 2017. Alien animals in South Africa—composition, introduction history, origins and distribution patterns'. *Bothalia* 47(2): a2147.
- Robinson TB, Griffiths C, McQuaid C & M Rius. 2005. Marine alien species of South Africa - status and impacts. *African Journal of Marine Science* 27: 297–306.
- Robinson TB, Griffiths CL, Branch GM & A Govender. 2007. The invasion and subsequent die-off of *Mytilus galloprovincialis* in Langebaan Lagoon, South Africa: effects on natural communities. *Marine Biology* 152: 225–232.
- Robinson TB, Peters K & B Brooker. 2020. Coastal invasions: the South African context. In: Van Wilgen BW, Measey J, Richardson DM, Wilson JR & TA Zengeya (eds.). *Biological Invasions in South Africa*. Springer: Cham. pp. 229–247.

## APPENDICES

Appendix I. The marine alien and invasive species recorded along the coastline of South Africa, according to SANBI (South African National Biodiversity Institute), updated with additional species from Robinson *et al.* (2020).

Kingdom	Phylum	Class	Species	Common name	Status	Natural Range	
Animalia	Annelida	Polychaeta	<i>Alitta succinea</i>	Pile/clam worm	Invasive	Atlantic Coast	
			<i>Boccardia proboscidea</i>	Shell worm	Invasive	Northern Pacific	
			<i>Dodecaceria pacifica</i>	Colonial tubeworm	Alien	Pacific Northern America	
			<i>Ficopomatus enigmaticus</i>	Estuarine tubeworm	Invasive	Australia	
			<i>Janua heterostropha</i>	-	Alien	Europe	
			<i>Neodexiospira brasiliensis</i>	-	Invasive	West Indies, Brazil	
			<i>Polydora hoplura</i>	-	Invasive	Europe, Mediterranean	
			<i>Polydora websteri</i>	Oyster mudworm	Alien	-	
			<i>Simplaria pseudomilitaris</i>	-	Alien	Europe	
				Copepoda	<i>Acartia (Odontacartia) spinicauda</i>	-	Alien
		Hexapoda	<i>Anisobabis maritima</i>	Maritime Earwig	Alien	-	
			<i>Cafius xantholoma</i>	-	Invasive	Europe	
		Arthropoda	Malacostraca	<i>Apocorophium acutum</i>	-	Alien	Northern Atlantic
				<i>Caprella mutica</i>	Japanese skeleton shrimp	Invasive	Japan
				<i>Carcinus maenas</i>	European shore-crab	Invasive	Europe, Mediterranean
				<i>Cerapus tubularis</i>	Tubular amphipod	Invasive	-
				<i>Chelura terebrans</i>	Wood-boring amphipod	Invasive	Northern Atlantic
				<i>Dynamene bidentata</i>	-	Invasive	Europe
				<i>Erichthonius brasiliensis</i>	-	Invasive	Northern Atlantic
				<i>Erichthonius difformis</i>	Tube-dwelling amphipod	Alien	-
				<i>Homalaspis plana</i>	Chilean Stone Crab	Alien	Chile
				<i>Ischyrocerus anguipes</i>	-	Invasive	Northern Atlantic

Kingdom	Phylum	Class	Species	Common name	Status	Natural Range	
			<i>Jassa marmorata</i>	Tube amphipod	Alien	Northern Atlantic	
			<i>Jassa morinoi</i>	-	Invasive	-	
			<i>Jassa slatteryi</i>	-	Invasive	Pacific Northern America	
			<i>Ligia (Megaligia) exotica</i>	Wharf Roach	Alien	North Atlantic	
			<i>Limnoria quadripunctata</i>	Quadripunctate gribble	Alien	-	
			<i>Limnoria tripunctata</i>	Tripunctate gribble	Alien	-	
			<i>Monocorophium acherusicum</i>	Fat-feeler amphipod	Alien	Northern Atlantic	
			<i>Orchestia gammarellus</i>	Shore-hopper	Invasive	Europe, Mediterranean	
			<i>Paracerceis sculpta</i>	Sponge isopod	Alien	North-east Pacific	
			<i>Platorchestia platensis</i>	Beach flea	Invasive	-	
			<i>Porcellana africana</i>	Porcelain crab	Invasive	North-west Africa	
			<i>Rathbunixa occidentalis</i>	Western pea crab	Invasive	Pacific Northern America	
			<i>Sphaeroma serratum</i>	Sea slater	Alien	Europe	
			<i>Sphaeroma walkeri</i>	Fouling isopod	Alien	Northern Indian Ocean	
			<i>Xantho hydrophilus</i>	Variable xanthid	Alien	Europe, Mediterranean	
		Pycnogonida	<i>Ammothella appendiculata</i>	-	Alien	Pacific	
		Thecostraca	<i>Amphibalanus venustus</i>	Striped barnacle	Invasive	Tropical Northern Atlantic	
			<i>Austrominius modestus</i>	Modest barnacle	Alien	Australasia	
			<i>Balanus glandula</i>	Pacific barnacle	Invasive	Northern American Pacific	
			<i>Perforatus perforatus</i>	Perforated barnacle	Alien	Atlantic Ocean	
	Brachiopoda	Lingulata	<i>Disciniscia tenuis</i>	Disc lamp shell	Invasive	Namibian Coast	
	Bryozoa	Gymnolaemata	<i>Bugula neritina</i>	Fouling moss animal	Invasive	-	
				<i>Bugulina flabellata</i>	Fan-shaped moss animal	Invasive	-
				<i>Conopeum seurati</i>	-	Invasive	Europe
				<i>Cryptosula pallasiana</i>	Red crust	Invasive	Europe
				<i>Virididentula dentata</i>	Dentate moss animal	Invasive	Indo-Pacific
				<i>Watersipora subtorquata</i>	Red-rust bryozoan	Invasive	Caribbean
	Chordata	Ascidiacea	<i>Ascidia sydneiensis</i>	Yellow-green sea squirt	Invasive	Asia	

Kingdom	Phylum	Class	Species	Common name	Status	Natural Range		
			<i>Asciodiella aspersa</i>	Dirty sea squirt	Invasive	North Sea		
			<i>Asterocarpa humilis</i>	-	Invasive	-		
			<i>Botryllus schlosseri</i>	Golden star ascidian	Invasive	Northeastern Atlantic		
			<i>Ciona robusta</i>	Sea vase	Invasive	Europe		
			<i>Clavelina lepadiformis</i>	Bell ascidian	Invasive	Europe		
			<i>Diplosoma listerianum</i>	Gossamer ascidian	Invasive	Europe		
			<i>Microcosmus squamiger</i>	Microcosmus	Invasive	Australia		
			<i>Styela plicata</i>	Pleated sea squirt	Invasive	West Pacific		
			Teleostei	<i>Cyprinus carpio</i>	Common carp	Invasive	Asia	
			Cnidaria	Anthozoa	<i>Cylista ornata</i>	Rooted anemone	Alien	Europe, Mediterranean
					<i>Metridium senile</i>	Plumose anemone	Alien	North Atlantic
				Hydrozoa	<i>Coryne eximia</i>	-	Invasive	North Atlantic, Pacific
					<i>Ectopleura crocea</i>	Pinkmouth hydroid	Alien	North Atlantic
					<i>Ectopleura larynx</i>	Ringed tubularia	Alien	North Atlantic
	<i>Gonothyrea loveni</i>	-			Alien	North Atlantic		
	<i>Laomedea calceolifera</i>	-			Alien	North Atlantic		
	<i>Obelia bidentata</i>	Doubletoothed hydroid			Alien	-		
	<i>Obelia dichotoma</i>	Thin-walled obelia			Alien	-		
	<i>Obelia geniculata</i>	Zigzag wineglass hydroid			Alien	Europe, Mediterranean		
	<i>Odessia maeotica</i>	-			Invasive	Black Sea Region		
	<i>Pachycordyle michaeli</i>	Brackish hydroid			Alien	Europe, Mediterranean		
	<i>Pennaria disticha</i>	Sea-fern hydroid			Invasive	-		
	Echinodermata	Asteroidea	<i>Heliaster helianthus</i>	South American Sunstar	Alien	South America		
		Ophiuroidea	<i>Ophiactis savignyi</i>	Savigny's brittle star	Alien	North Indian and Pacific Oceans		
	Mollusca	Bivalvia	<i>Lyrodus pedicellatus</i>	Blacktip shipworm	Alien	-		
			<i>Magallana gigas</i>	Pacific oyster	Invasive	Japan, Northwestern Pacific		
			<i>Mytilus galloprovincialis</i>	Mediterranean mussel	Invasive	Mediterranean, Northeastern Atlantic		
<i>Perna viridis</i>			Asian green mussel	Alien	Southeast Asia			



Kingdom	Phylum	Class	Species	Common name	Status	Natural Range	
		Gastropoda	<i>Semimytilus patagonicus</i>	Bisexual mussel	Invasive	Pacific South America	
			<i>Teredo navalis</i>	Naval shipworm	Invasive	Europe, Mediterranean	
			<i>Catriona columbiana</i>	British Columbia aeolid	Alien	North Pacific	
			<i>Indothais blanfordi</i>	-	Invasive	Tropical Indo-Pacific	
			<i>Littorina saxatilis</i>	British periwinkle	Invasive	Europe, Mediterranean, Western Atlantic	
			<i>Semiricinula tissoti</i>	Tissot's rock shell	Invasive	Tropical Indo-Pacific	
			<i>Tarebia granifera</i>	Quilted melania	Invasive	Southeast Asia	
	Porifera	Demospongiae	<i>Suberites ficus</i>	Sea orange/fig sponge	Invasive	Northeastern Atlantic and Mediterranean	
	Chromista	Ciliophora	Heterotrichea	<i>Mirofolliculina limnorica</i>	-	Alien	-
		Myzozoa	Dinophyceae	<i>Alexandrium minutum</i>	Red tide phytoplankton/dinoflagellate	Alien	-
<i>Alexandrium tamarense-complex</i>				Alexandrium	Alien	-	
			<i>Dinophysis acuminata</i>	-	Alien	-	
Plantae	Chlorophyta	Ulvophyceae	<i>Cladophora prolifera</i>	Rough cladophora	Invasive	-	
			<i>Codium fragile</i>	Fragile upright codium	Invasive	Korea	
	Rhodophyta	Florideophyceae	<i>Antithamnionella spirographidis</i>	-	Invasive	-	
			<i>Asparagopsis armata</i>	Harpoon weed	Invasive	Southern Australia and New Zealand	
			<i>Asparagopsis taxiformis</i>	Supreme limu	Invasive	-	
			<i>Schimmelmannaia elegans</i>	-	Alien	Atlantic Island of Tristan da Cunha and Venezuela	

Appendix 2. Benthic macrofauna taxa from the Saldanha Bay/Langebaan Lagoon system, as identified by Anchor. Alien species are highlighted in red.

Phylum	Class	Order	Family	Taxa		
Annelida	Clitellata			Oligochaeta		
	Polychaeta	Amphinomida	Amphinomidae	Amphinomidae		
		Echiuroidea	Eunicida	Thalassematidae	<i>Listriolobus capensis</i>	
				Dorvilleidae	<i>Schistomeringos rudolphi</i>	
				Eunicidae	Eunicidae	Eunicidae
					<i>Lysidice</i> sp.	
					<i>Marphysa depressa</i>	
					<i>Marphysa sanguinea</i>	
					<i>Paucibranchia purcellana</i>	
					Lumbrineridae	<i>Kuwaita heteropoda</i>
						<i>Lumbrineris coccinea</i>
						<i>Lumbrineris hartmani</i>
						<i>Lumbrineris heteropoda difficilis</i>
						<i>Lumbrineris magalhaensis</i>
				<i>Lumbrineris meteorana</i>		
				<i>Lumbrineris papillifera</i>		
				<i>Lumbrineris</i> spp. ( <i>cavifrons</i> )		
				<i>Scoletoma tetraura</i>		
				Oeonidae		<i>Arabella iricolor</i>
					<i>Drilonereis falcata</i>	
					<i>Drilonereis monroi</i>	
					<i>Notocirrus australis</i>	
				Onuphidae	<i>Diopatra cuprea</i>	
<i>Diopatra monroi</i>						
<i>Diopatra neapolitana capensis</i>						
<i>Onuphis eremita</i>						

Phylum	Class	Order	Family	Taxa
				<i>Onuphis holobranchiata</i>
				<i>Paradiopatra antarctica</i>
		Phyllodocida	Glyceridae	<i>Glycera benguellana</i>
				<i>Glycera tridactyla</i>
			Goniadidae	<i>Goniada emerita</i>
				<i>Goniadopsis incerta</i>
			Hesionidae	Hesionidae
				<i>Podarkeopsis capensis</i>
				<i>Syllidia armata</i>
			Nephtyidae	<i>Micronephthys sphaerocirrata</i>
				<i>Nephtys capensis</i>
				<i>Nephtys hombergii</i>
			Nereididae	<i>Nereis</i> spp.
				<i>Platynereis australis</i>
				<i>Platynereis dumerilii</i>
				<i>Simplisetia erythraeensis</i>
			Phyllodocidae	<i>Eulalia</i> sp.
				<i>Hypereteone foliosa</i>
				<i>Notophyllum splendens</i>
				Phyllodocidae
				<i>Protomystides capensis</i>
			Pilargidae	<i>Ancistrosyllis falcata</i>
			<i>Cabira capensis</i>	
			<i>Sigambra parva</i>	
			<i>Synelmis rigida</i>	
		Polynoidae	<i>Antinoe lactea</i>	
			<i>Eunoe nodulosa</i>	
			<i>Harmothoe</i> spp.	

Phylum	Class	Order	Family	Taxa
				<i>Polynoe scolopendrina</i>
				<i>Euthalenessa oculata</i>
				<i>Pholoe minuta</i>
			Sigalionidae	<i>Sigalion capensis</i>
				<i>Sigalion sp.</i>
				<i>Sigalion squamosus</i>
				<i>Sthenelais boa</i>
			Syllidae	<i>Exogone heterosetosa</i>
				<i>Syllis sp.</i>
		Sabellida	Sabellidae	<i>Jasmineira elegans</i>
				<i>Aonidella cirrobranchiata</i>
				<i>Aonides oxycephala</i>
				<i>Dispio magna</i>
				<i>Paraprionospio pinnata</i>
				<i>Polydora sp.</i>
				<i>Prionospio cirrifera</i>
				<i>Prionospio saldanha</i>
				<i>Prionospio sexoculata</i>
				<i>Prionospio sp.</i>
				<i>Rhynchospio glutaea</i>
				<i>Scolelepis (Parascolelepis) gilchristi</i>
				<i>Scolelepis (Scolelepis) squamata</i>
				<i>Spio filicornis</i>
			Spionidae	
				<i>Ampharete capensis</i>
				<i>Ampharete luederitzi</i>
				<i>Ampharete spp.</i>
				<i>Amphicteis gunneri</i>
		Terebellida	Ampharetidae	

Phylum	Class	Order	Family	Taxa
			Cirratulidae	<i>Aphelochaeta filiformis</i>
				<i>Caulleriella acicula</i>
				<i>Caulleriella capensis</i>
				<i>Chaetozone setosa</i>
				Cirratulidae sp.
				<i>Cirratulus gilchristi</i>
				<i>Cirriformia capensis</i>
				<i>Cirriformia tentaculata</i>
				<i>Kirkegaardia dorsobranchialis</i>
			Flabelligeridae	<i>Stylarioides swakopianus</i>
			Pectinariidae	<i>Amphictene capensis</i>
			Terebellidae	<i>Amaeana trilobata</i>
				<i>Nicolea macrobranchia</i>
				<i>Nicolea venustula</i>
				<i>Paramphitrite pauciseta</i>
				<i>Pista quadrilobata</i>
				<i>Telothelepous capensis</i>
				<i>Terebella pterochaeta</i>
			Arenicolidae	<i>Abarenicola affinis africana</i>
				<i>Arenicola loveni</i>
			Capitellidae	<i>Capitella capitata</i>
				<i>Mediomastus capensis</i>
				<i>Notomastus latericeus</i>
			Cossuridae	<i>Cossura coasta</i>
			Magelonidae	<i>Magelona capensis</i>
				<i>Magelona debeerei</i>
			Maldanidae	<i>Asychis capensis</i>
				<i>Euclymene</i> sp.

Phylum	Class	Order	Family	Taxa		
				Maldanidae		
			Opheliidae	<i>Ophelia capensis</i>		
			Orbiniidae	<i>Leodamas johnstonei</i>		
				<i>Orbinia angrapequensis</i>		
				<i>Phylo foetida ligustica</i>		
				<i>Scolaricia dubia</i>		
			Oweniidae	<i>Owenia fusiformis</i>		
			Paraonidae	<i>Aricidea longobranchiata</i>		
				<i>Paradoneis lyra capensis</i>		
				Paraonidae		
	Scalibregmatidae	<i>Polyphysia</i>				
<i>Scalibregma inflatum</i>						
	Sipuncula	Sipunculidae	Sipunculidae			
<b>Arthropoda</b>	Copepoda			Copepoda		
	Malacostraca	Amphipoda	Ampeliscidae	<i>Ampelisca anomala</i>		
				<i>Ampelisca brachyceras</i>		
				<i>Ampelisca brevicornis</i>		
				<i>Ampelisca fusca</i>		
				<i>Ampelisca palmata</i>		
				<i>Ampelisca spinimana</i>		
			Ampithoidae	<i>Ampithoe ramondi</i>		
				Ampithoidae		
				<i>Sunamphitoe falsa</i>		
			Aoridae	<i>Aora gibbula</i>		
				<i>Aora kergueleni</i>		
				<i>Lemboides acanthiger</i>		
				<i>Lemboides afer</i>		
						<i>Lembos</i> spp.

Phylum	Class	Order	Family	Taxa
			Atylidae	<i>Nototropis guttatus</i> <i>Nototropis homochir</i> <i>Nototropis swammerdamei</i>
			Bathyporeiidae	<i>Bathyporeia</i> sp.
			Caprellidae	Caprellidae <i>Eupariambus fallax</i> <i>Orthoprotella mayeri</i> <i>Phtisica marina</i>
			Corophiidae	Corophiidae <i>Monocorophium acherusicum</i>
			Cyproideidae	<i>Hoplopleon medusarum</i>
			Dexaminidae	Dexaminidae ( <i>Dexamine spiniventris?</i> )
			Gammaridae	Gammaridae
			Hyperiidae	<i>Themisto gaudichaudii</i>
			Ischyroceridae	<i>Ericthonius brasiliensis</i> <i>Ischyrocerus carinatus</i>
			Kamakidae	<i>Aorcho delgadus</i>
			Leucothoidae	<i>Leucothoe euryonyx</i> <i>Leucothoe richiardii</i> <i>Leucothoe spinicarpa</i>
			Liljeborgiidae	<i>Idunella lindae</i> <i>Idunella saldanha</i> <i>Liljeborgia epistomata</i> <i>Liljeborgia</i> spp.
			Lysianassidae	<i>Lysianassa ceratina</i> <i>Phoxostoma algoense</i> <i>Socarnes filicornis</i> <i>Socarnes septimus</i>

Phylum	Class	Order	Family	Taxa
			Maeridae	<i>Ceradocus (Denticeradocus) rubromaculatus</i>
				<i>Elasmopus rapax</i>
				<i>Linguimaera boeckii</i>
				<i>Quadrimaera inaequipēs</i>
			Megaluropidae	<i>Megaluropus agilis</i>
				<i>Megaluropus namaquaeensis</i>
			Melitidae	<i>Melita</i> spp.
			Oedicerotidae	<i>Monoculodopsis longimana</i>
				<i>Perioculodes longimanus</i>
			Photidae	<i>Latigammaropsis afra</i>
				<i>Photis longidactyla</i>
				<i>Photis longimana</i>
				<i>Photis</i> spp.
			Phoxocephalidae	<i>Heterophoxus opus</i>
				<i>Paraphoxus oculatus</i>
				Phoxocephalidae
			Platyischnopidae	<i>Indischnopus herdmani</i>
			Pontogeneiidae	<i>Paramoera bidentata</i>
				<i>Paramoera capensis</i>
			Tryphosidae	<i>Hippomedon longimanus</i>
				<i>Hippomedon normalis</i>
				<i>Hippomedon onconotus</i>
				<i>Lepidepecreum twalae</i>
				<i>Orchomene plicatus</i>
			Urothoidae	<i>Cunicus profundus</i>
				<i>Urothoe coxalis</i>
				<i>Urothoe elegans</i>
				<i>Urothoe grimaldii</i>



Phylum	Class	Order	Family	Taxa	
				<i>Urothoe pinnata</i>	
				<i>Urothoe</i> sp.	
				<i>Urothoe tumorosa</i>	
		Cumacea	Bodotriidae	Bodotriidae	
				<i>Iphinoe africana</i>	
				Cumacea	
		Decapoda		Alpheidae	<i>Betaeus jucundus</i>
				Callianassidae	<i>Gilvossius rotundicaudatus</i>
				Callichiridae	<i>Kraussilichirus kraussi</i>
				Camptandriidae	<i>Danielella edwardsii</i>
					<i>Paratylo diplax algoensis</i>
				Diogenidae	<i>Diogenes brevisrostris</i>
				Goneplacidae	<i>Goneplax rhomboides</i>
				Hexapodidae	<i>Spiroplax spiralis</i>
				Hippolytidae	<i>Hippolyte kraussiana</i>
				Hymenosomatidae	<i>Hymenosoma orbiculare</i>
				Inachoididae	<i>Pyromaia tuberculata</i>
				Leucosiidae	<i>Afrophila punctata</i>
				Nautilocorystidae	<i>Nautilocorystes ocellatus</i>
				Ogyrididae	<i>Ogyrides saldanhae</i>
				Ovalipidae	<i>Ovalipes trimaculatus</i>
				Palaemonidae	<i>Palaemon pacificus</i>
				Parapaguridae	<i>Parapagurus</i> sp.
		Pinnotheridae	<i>Rathbunixa occidentalis</i>		
		Upogebiidae	<i>Upogebia africana</i>		
			<i>Upogebia capensis</i>		
		Isopoda	Anthuridae	<i>Amakusanthura africana</i>	
<i>Haliophasma coronicauda</i>					

Phylum	Class	Order	Family	Taxa
				<i>Haliophasma tricarinata</i>
				<i>Malacanthura</i> spp.
				<i>Notanthura caeca</i>
				<i>Quantanthura remipes</i>
				<i>Quantanthura serenasinus</i>
			Arcturidae	Arcturidae
				<i>Neastacilla</i>
			Bopyridae	Bopyridae
			Cirolanidae	<i>Eurydice kensleyi</i>
				<i>Eurydice longicornis</i>
				<i>Natatolana hirtipes</i>
				<i>Natatolana pilula</i>
			Holidoteidae	<i>Austroarcturus quadriconus</i>
			Idoteidae	<i>Idotea indica</i>
				<i>Paridotea reticulata</i>
				<i>Paridotea unguata</i>
				<i>Synidotea hirtipes</i>
			Leptanthuridae	<i>Leptanthurus agulhasensis</i>
			Sphaeromatidae	<i>Exosphaeroma porrectum</i>
	<i>Exosphaeroma truncatitelson</i>			
<i>Exosphaeroma varicolor</i>				
Sphaeromatidae (Hemibranchiatae)				
Stenetriidae	<i>Stenetrium saldanha</i>			
	<i>Asellota</i>			
Leptostraca	Nebaliidae	<i>Nebalia capensis</i>		
Stomatopoda	Squillidae	<i>Pterygosquilla capensis</i>		
Tanaidacea		Tanaidacea sp.		
Ostracoda		Ostracoda		

Phylum	Class	Order	Family	Taxa	
	Pycnogonida	Pantopoda	Ascorhynchoidea <i>incertae sedis</i>	<i>Queubus jamesanus</i>	
				Pycnogonida sp.	
<b>Chordata</b>	Ascidiacea			Ascidiacea (solitary)	
<b>Cnidaria</b>	Anthozoa	Actiniaria	Actiniidae	<i>Bunodosoma capense</i>	
			Haloclavidae	<i>Haloclava capensis</i>	
			Sagartiidae	<i>Anthothoe chilensis</i>	
				Actiniaria	
		Scleralcyonacea	Virgulariidae	<i>Virgularia schultzei</i>	
		Spirularia	Cerianthidae	Cerianthidae	
<b>Echinodermata</b>	Asteroidea	Valvatida	Asterinidae	<i>Parvulastra exigua</i>	
	Echinoidea	Camarodonta	Parechinidae	<i>Parechinus angulosus</i>	
	Holothuroidea	Apodida	Chiridotidae	<i>Chiridota violacea</i>	
			Cucumariidae	<i>Pentacta doliolum</i>	
		Dendrochirotida	Phyllophoridae	<i>Thyone aurea</i>	
					Holothuroidea sp.
	Ophiuroidea	Ophiacanthida	Ophiodermatidae	<i>Ophioderma wahlbergii</i>	
				Ophiuroidea	
<b>Mollusca</b>	Bivalvia	Adapedonta	Pharidae	<i>Afrophaxas decipiens</i>	
			Solenidae	<i>Solen capensis</i>	
		Cardiida	Tellinidae		<i>Homalina trilatera</i>
					<i>Macomopsis ordinaria</i>
					<i>Moerella analogica</i>
					<i>Moerella tulipa</i>
					<i>Pallidea palliderosea</i>
		Carditida	Carditidae	<i>Carditella capensis</i>	
			Condylocardiidae	<i>Carditopsis rugosa</i>	
		Galeommatida		Lasaeidae	Lasaeidae
<i>Tellimya</i> sp.					

Phylum	Class	Order	Family	Taxa	
		Mytilida	Mytilidae	<i>Aulacomya atra</i>	
				<i>Choromytilus meridionalis</i>	
				<i>Mytilus galloprovincialis</i>	
		Nuculida	Nuculidae	<i>Nucula nucleus</i>	
		Venerida	Mesodesmatidae	<i>Atactodea striata</i>	
			Ungulinidae	<i>Microstagon trigonum</i>	
			Veneridae	<i>Dosinia orbigny</i>	
				<i>Venerupis corrugata</i>	
				Bivalvia	
		Gastropoda	[unassigned] Caenogastropoda	Turritellidae	<i>Turritella capensis</i>
	Cephalaspidea		Haminoeidae	<i>Haminoea natalensis</i>	
			Philinidae	<i>Philine aperta</i>	
	Lepetellida		Fissurellidae	<i>Dendrofissurella scutellum</i>	
				<i>Fissurella mutabilis</i>	
	Littorinimorpha		Calyptraeidae	<i>Calyptrea chinensis</i>	
				<i>Crepidula porcellana</i>	
			Naticidae	<i>Tectonatica tecta</i>	
	Neogastropoda		[unassigned] Buccinoidea		<i>Burnupena</i> sp.
			Clavatulidae		<i>Clionella sinuata</i>
		Columbellidae		<i>Anachis kraussii</i>	
Marginellidae			<i>Marginella musica</i>		
			<i>Prunum capense</i>		
Nassariidae			<i>Bullia annulata</i>		
			<i>Bullia digitalis</i>		
		<i>Bullia laevissima</i>			
		<i>Nassarius kraussianus</i>			
		<i>Nassarius niveus</i>			
		<i>Nassarius speciosus</i>			

---

Phylum	Class	Order	Family	Taxa
				<i>Nassarius vinctus</i>
		Nudibranchia		Nudibranchia
		Pleurobranchida	Pleurobranchidae	Pleurobranchidae
		Trochida	Trochidae	<i>Gibbula</i> sp.
				Gastropoda sp.
<b>Nematoda</b>				Nematoda
<b>Nemertea</b>				Nemertea sp. 1
				Nemertea sp. 2 (small, white)

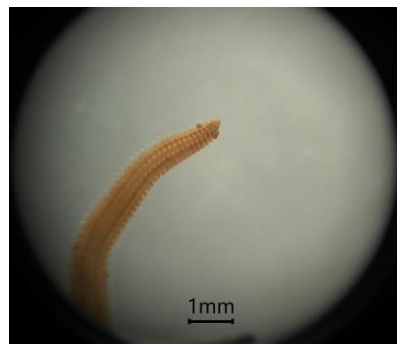
---

Appendix 3. Taxa identified from aquaculture farm structures in the Saldanha Bay ADZ (Anchor surveys in 2021 and 2022). Alien species are highlighted in red.

### Annelida



*Nereididae* sp.



*Eulalia* sp.



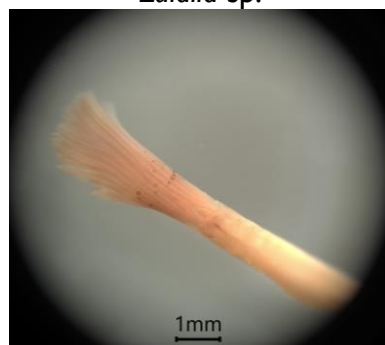
*Lepidonotus semitectus*



*Sigalion capensis*



*Syllis* sp.



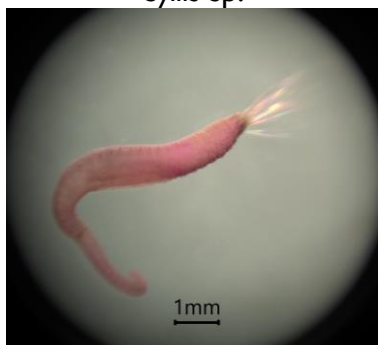
*Pseudopotamilla reniformis*



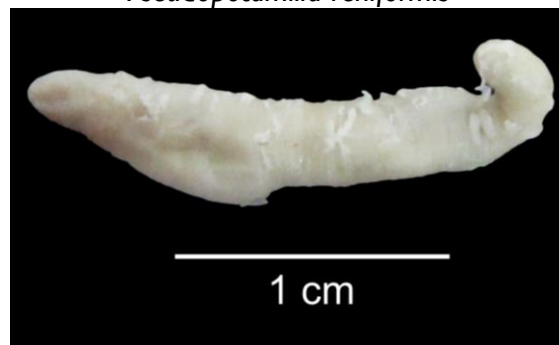
*Cirratulus gilchristi*



*Cirriformia tentaculata*



*Pherusa* sp.

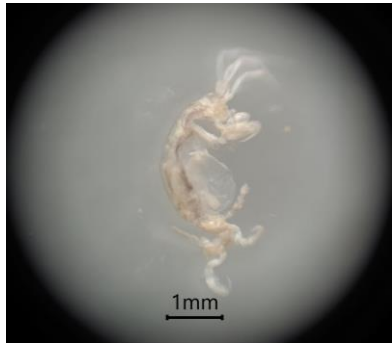


*Telothelepys capensis*



*Terebellides stroemii*

Arthropoda



*Caprella circur*



*Caprella mutica*



*Caprella penantis*



*Latigammaropsis afra*



*Paramoera capensis*



*Hippomedon longimanus*



*Porcellana africana*



*Exosphaeroma varicolor*



Tanaidacea sp.



*Tanystylum brevipes*



*Notomegabalanus algicola*



*Lepas (Lepas) anatifera* (WoRMS)

**Brachiopoda**



*Discinisca tenuis*

**Chordata**



*Ciona robusta*



*Pyura stolonifera*



*Apletodon pellegrini*

**Cnidaria**



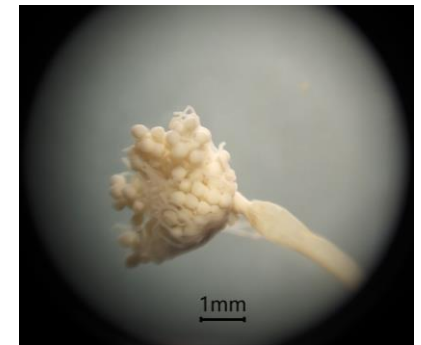
*Bunodactis reynaudi*



*Pseudactinia flagellifera*



*Anthothoe chilensis*



*Ectopleura crocea*





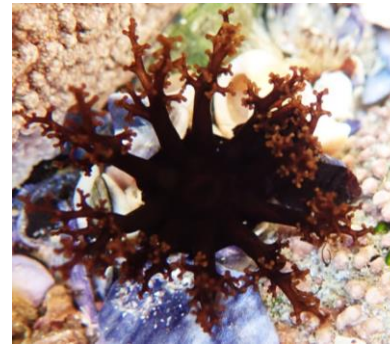
*Amphisbetia operculata*  
**Echinodermata**



*Annametra occidentalis*  
(Georgina Jones)



*Parechinus angulosus*



*Pentacta doliolum*



*Thyone aurea*



*Thyone* sp.



*Amphipholis squamata*

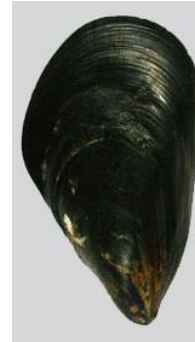
Mollusca



*Aulacomya atra* (WoRMS)



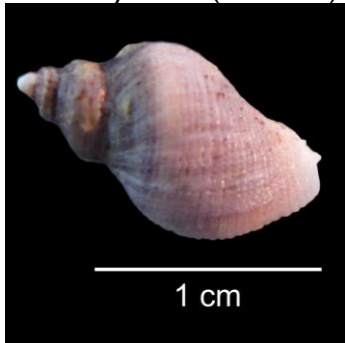
*Choromytilus meridionalis* (WoRMS)



*Mytilus galloprovincialis* (WoRMS)



*Fissurella mutabilis*



*Nucella wahlbergi*

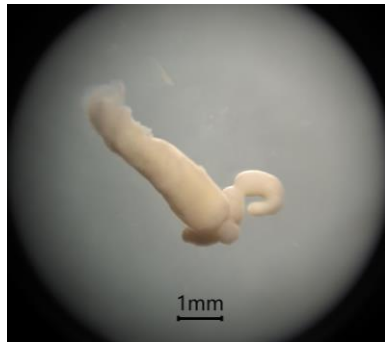


*Gibbula zonata*



*Helcion* sp.

Nemertea & Platyhelminthes



*Nemertea* sp.



*Planocera gilchristi*



*Platyhelminthes* sp.

---

Ochrophyta & Chlorophyta



*Colpomenia sinuosa*



*Ulva* sp. (Example)



**ANCHOR**  
environmental