



**SUSTAINABLE
SEAS**

Ko ngā moana
whakauka

Composition of two starfish (*Sticaster australis* and *Coscinasterias muricata*) in Ōhiwa harbour

An over-abundance of Pātangaroa, (*Coscinasterias muricata* and *Sticaster australis*), eleven-armed sea-stars are depleting shellfish stocks and causing management issues in coastal areas of Aotearoa New Zealand.

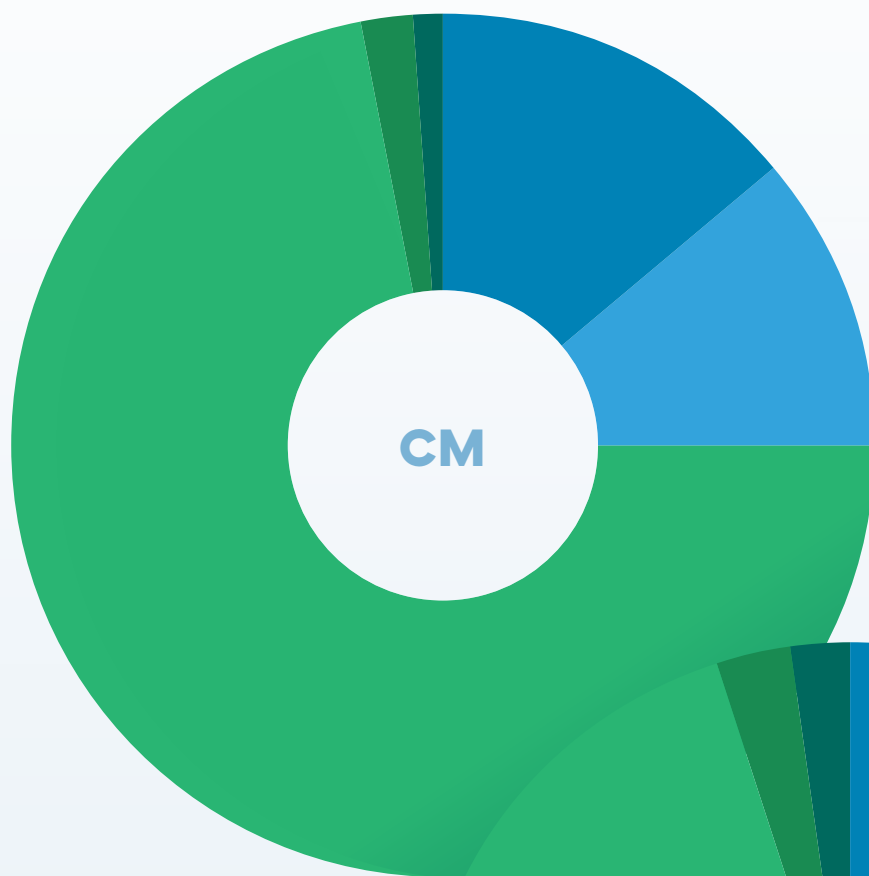
Pātangaroa are voracious predators of shellfish, and are causing a decline in mussels, pipi and cockles in Ōhiwa Harbour. Pātangaroa are a potential bioactive resource, particularly as a source of marine collagen which is in high demand for cosmetics.

This data sheet contains the potential bioactives and composition data within these two species samples over 2021-2022.

The purpose of this information is to help decision-making on potential products and the economic value of harvesting Pātangaroa as a part of population management.

Total composition of Pātangaroa in Ōhiwa harbour

Average of 4 seasonal sampling events



Coscinasterias muricata (CM)

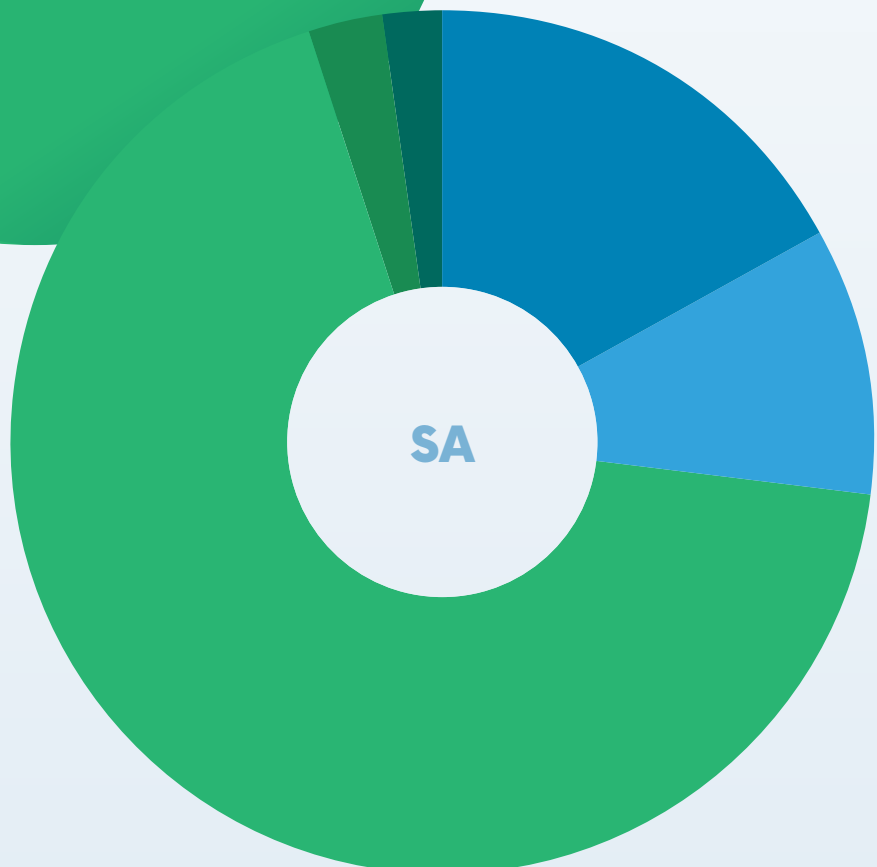
Wet weight

- Ash **14%**
- Protein **11%**
- Moisture **72%**
- Lipid **2%**
- Carbohydrate **1%**

Sticaster australis (SA)

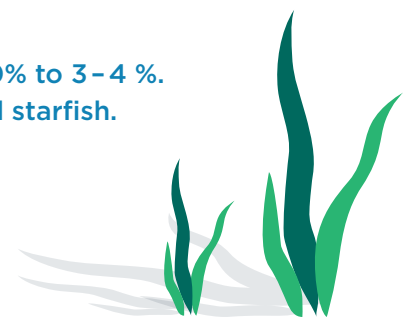
Wet weight

- Ash **17%**
- Protein **10%**
- Moisture **68%**
- Lipid **3%**
- Carbohydrate **2%**



After freeze drying, the water content (moisture) is reduced from 70% to 3–4%.
All the other analysis in this summary is calculated from freeze dried starfish.
All data is an average of 4 sampling events over 1 year.

Seasonal data on request from matt.miller@cawthron.org.nz.



Proteins

Proteins are a family of large molecules made up of a long chain of amino acids. They play many different critical roles in the body including controlling metabolism and building structural support. Possible uses for starfish proteins include food, nutraceuticals and cosmetics.

Pātangaroa powders are rich in protein, particularly collagen. There is commercial interest in marine sourced collagen as a cosmetic ingredient.

The protein, collagen, and amino acid content can fluctuate over the season.

Proteins g/100g dry weight	CM	SA
Protein content	36.4	31.8
Collagen content	9.3	9.7
Amino acids g/100g dry weight	CM	SA
Histidine	0.4	0.3
Serine	1.8	1.5
Arginine	2.2	1.8
Glycine	6.5	4.8
Aspartic Acid and Asparagine	2.7	2.3
Glutamic Acid and Glutamine	3.8	3.0
Threonine	1.3	1.1
Alanine	2.1	1.7
Proline	2.2	1.8
Lysine	1.3	1.0
Tyrosine	0.7	0.6
Total Methionine	0.6	0.6
Valine	1.1	0.8
Isoleucine	0.8	0.7
Leucine	1.4	1.1
Phenylalanine	0.7	0.5
Tryptophan	0.3	0.2
Hydroxyproline	0.7	0.7

Carbohydrates

Carbohydrates are a possible source of bioactive compounds. Carbohydrates consist of building blocks called 'saccharides' or 'sugars'. Negatively charged sulphate groups on carbohydrates can provide interesting and useful materials such as glycosaminoglycans (GAGs). GAGs have been used to help treat mobility issues like osteoarthritis (OA).

Carbohydrates g/100g dry weight	CM	SA
Carbohydrate content	4.1	5.0
Glycosaminoglycans (GAGs) content	0.4	0.4

Lipids

Lipids have important biological roles and are known nutraceuticals and pharmaceuticals (eg, omega 3 oils).

Lipids building blocks are fatty acids and can be categorised into different lipids classes.

Lipids soluble pigments such as carotenoids have been shown to exert strong antioxidant, antiproliferative and anti-inflammatory effects. Major carotenoids found were Lutein, Alloxanthin, Diadinoxanthin and Diatoxanthin. Overall, the lipid content for sea stars is low therefore the likelihood of potential bioactives is low.

Lipids g/100g dry weight	CM	SA
Lipid content	8.2	7.9
Lipid class % lipid	CM	SA
Hydrocarbon	7.0	4.3
Free Fatty Acids	50.5	41.0
Triacylglycerols	4.4	21.9
Sterols	5.9	4.1
Polar lipids	32.3	29.0
Fatty acid (% fatty acids)	CM	SA
C14:0 myristic acid	3.6	8.6
C16:0 palmitic acid	9.9	10.1
C16:1 palmitoleic acid	5.0	2.6
C18:0 stearic acid	6.7	5.1
C18:1n7 vaccenic acid	4.3	6.3
C20:1 gadoleic acid	9.9	9.3
C20:4n6 arachidonic acid (AA)	4.5	3.0
C20:5n3 eicosapentaenoic acid	10.4	9.2
C22:6n3 docosahexaenoic acid (DHA)	6.3	6.2
Saturated fatty acids (SFA)	23.0	27.2
Monounsaturated fatty acid (MUFA)	31.6	36.2
Polyunsaturated fatty acids (PUFA)	26.2	22.8
Omega 3	19.3	17.5
Omega 6	5.4	4.0
Plasmalogens	4.4	5.0
Carotenoids mg/100g dry weight	CM	SA
Total Carotenoids	1.2	0.8



Other compounds found in pātangaroa

Marine toxins

Micro algal species produce a vast series of toxic compounds that can be bioaccumulated in shellfish and animals that eat shellfish.

We tested the starfish for toxins for paralytic shellfish poisoning (PSP), amnesic shellfish poisoning (ASP), diarrhetic shellfish poisoning (DSP), neurotoxic shellfish poisoning (NSP), cyclic imines and tetrodotoxin. All compounds detected were low to trace levels, well under regulatory limits.

During toxic blooms in the harbour, it is possible that these levels could rise, but during those times shellfish gathering in Ōhiwa Harbour is not recommended.

Ash

Ash is mainly minerals and salts. As starfish are marine creatures, ash contains a high amount of salt (sodium chloride). The endoskeleton of starfish is a honeycombed structures of calcium carbonate components. Levels of calcium and phosphorus are high while elements associated with salts (Magnesium, Sodium and Potassium) are also elevated.



Sticaster australis © MUSA Environmental

Heavy metals

As starfish are benthic (sea-floor) feeders, they have potential to bioaccumulate heavy metals. Major heavy metals were also surveyed (Cadmium Arsenic, mercury, and lead) and were present but below regulatory limits. Cadmium levels (Ave 2.8 mg/kg) in *Coscinasterias muricata* is near regulatory limits in the European Union (3mg/kg). As we are not intending this to be a food product these levels are fine, but any products from waste streams need to be tested to suit their use.

Ash g/100g	CM	SA
Ash content	47.7	51.8
Major minerals/elements (mg/Kg)	CM	SA
Aluminium	22.4	37.1
Arsenic*	5.9	5.3
Barium	2.3	2.7
Boron	36.8	41.3
Cadmium*	2.8#	0.6
Calcium	145000	182500
Chromium	1.9	1.3
Copper	3.5	4.8
Iron	64	36
Lead*	0.7	0.5
Lithium	2.0	2.4
Magnesium	16250	20000
Manganese	5.4	5.3
Mercury*	0.2	0.1
Nickel	0.8	0.9
Phosphorus	3300	1825
Potassium	7125	4225
Rubidium	2.7	1.6
Sodium	20750	19750
Strontium	880	1118
Sulphur	10500	7575
Tin	0.1	13.0
Zinc	66	28

*Major heavy metals, #near regulatory limits



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