



Great Barrier Reef Source Reduction Plan
for
Fishing related bait packaging



Australian Government

REEF TRUST



**AUSTRALIAN
MARINE DEBRIS INITIATIVE**



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June 2020

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This report is part of the ReeClean project. ReefClean is funded by the Australian Government's Reef Trust and delivered by Tangaroa Blue Foundation in partnership with OceanWatch Australia.

PART 1 Introduction

1.1 Rationale

One of Australia's leaders in removing and documenting marine debris from the shorelines of Australia is the Tangaroa Blue Foundation (TBF). Debris information is stored within the Australian Marine Debris Initiative (AMDI) Database. The AMDI Database's goal is primarily to reduce the amount of marine debris that is washed into the ocean and remove any debris that has already made its way into the marine system (Tangaroa Blue 2016). A strategy being employed to cut the debris at the source is termed a source reduction. A source reduction plan documents the process of investigating the debris classification, tracks it to a source, and identifies steps to mitigate the likelihood of that type of debris entering the system. For the purposes of this report, "marine debris" has been defined as any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment (UN Environment Program, 2009).

The TBF is a non-government organisation (NGO) that largely relies on trained volunteers to remove debris from beaches around Australia and classify that debris using a template and associated ID manual. This citizen science project informs source reduction plans; however, when looking further at specific items such as bait bags, it does have its limitations. There are challenges in accessing remote areas which can limit the regularity cleanups and data collection activities; and data rely on volunteers' understanding and willingness to complete the sorting and classification of debris to a standard.

Through funding, in this instance the Australian Governments Reef Trust marine debris tender, the ReefClean Program gave Tangaroa Blue and its partners the ability to focus their effort on a particular geographic region with support from paid staff. OceanWatch has partnered with Tangaroa Blue Foundation in the ReefClean program to utilise its extensive knowledge and contacts within the Australian Seafood Industry to compose this source reduction plan. OceanWatch, as the Marine Natural Resource Management (NRM) Group, works with the seafood industry and the community to ensure Australia's marine environment is healthy, productive, valued and used in a responsible way.

OceanWatch has successfully involved the seafood industry in solutions and practice change on several occasions. Through those involvement, OceanWatch has embraced the principle that a high level of end-user participation in the research and development phase is likely to result in higher levels of acceptance and adoption of the project results and associated products (Jennings and Pakula 2011). Accordingly, a concerted effort has been made to utilise fishers' knowledge and experience as an integral and foundational component of the source reduction plan presented in this report.

1.2 Source reduction plan project justification - defining the problem

This project was conducted to document and identify alternatives to plastic packaging for fishing bait, to minimise their likelihood of becoming harmful for marine life if becoming marine debris. This project had a geographic focus on the Great Barrier Reef in Queensland. It starts by utilising the citizen science data that exists in the AMDI Database, and takes a regional approach to the source reduction task given the irregular nature of bait bag density recorded on beaches.

1.3 Study Area

The Great Barrier Reef (GBR) stretches from the Torres Strait in the north to Bundaberg in the south of the eastern coast of Queensland, Australia (Figure 1).

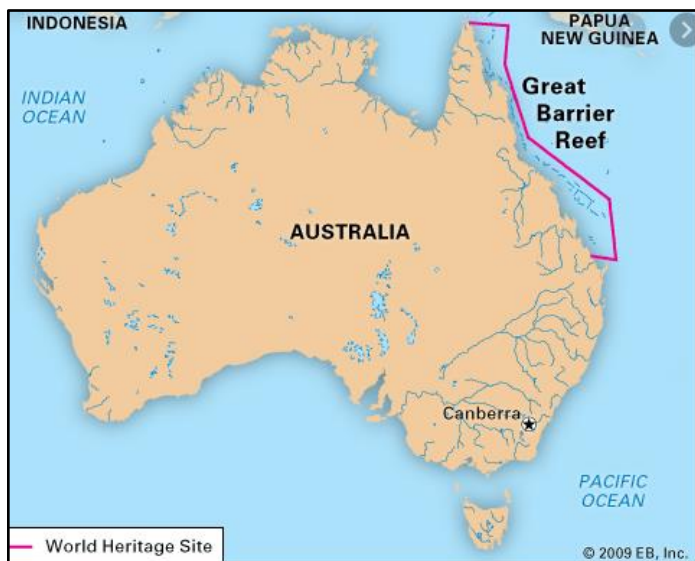


Figure 1. Area of the Great Barrier Reef

Source: Encyclopedia Britannica

Currents mix waters off the Australian continent, meaning the potential geographical sources of bait bags could be numerous (Figure 2). For the GBR region, bait bags found on beaches within this region could originate from a land base, the Pacific Ocean or Pacific Islands, or come from the North from PNG and Indonesia. Therefore, in investigating sources OceanWatch is required to look at numerous factors not only within the GBR, but also externally.

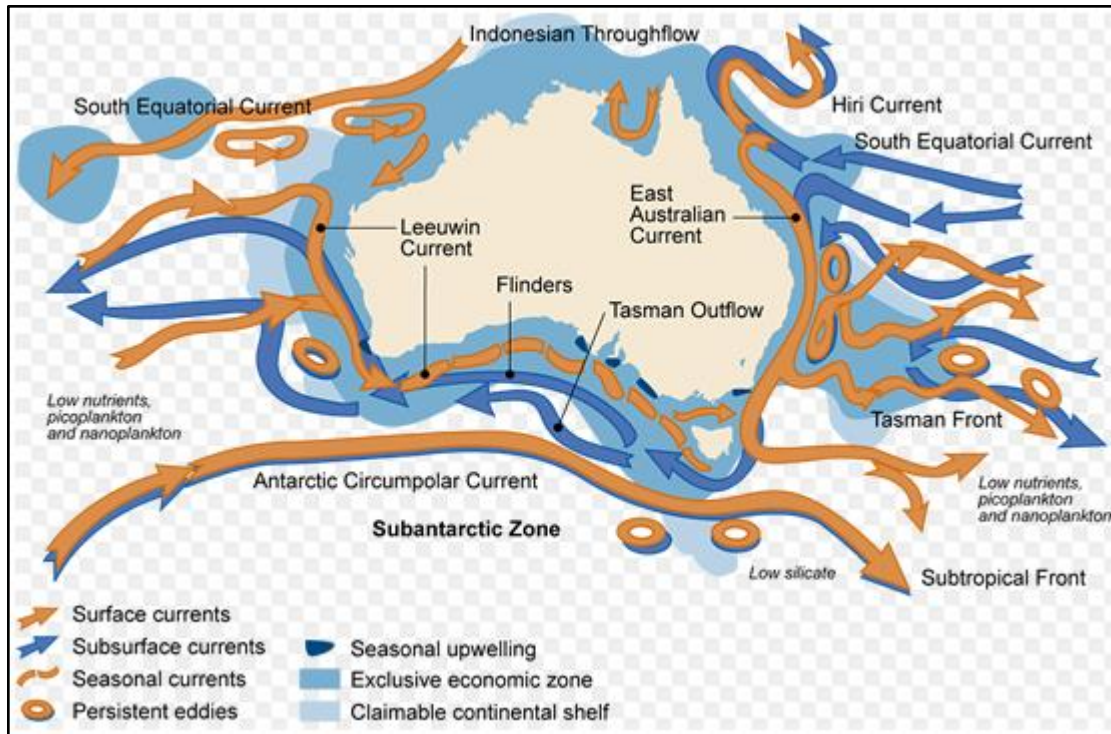


Figure 2. Ocean currents off Australia

Source: Wikipedia

1.4 Objectives

The objectives of this source reduction plan are to:

- Investigate the occurrence of bait packagings (i.e. bait bags) and use within the target geography
- Investigate contemporary use of bait packaging and requirements from bait users and retailers
- Document findings and formulate solution proposals, trials and analysis

1.5 Overview of bait bag

Bait bags are traditionally single-use plastic bags used for storing and handling bait. Those bags are packaged by seafood suppliers and are sold to fishermen. Bait bags have a specific user group and activity locations (i.e., popular recreational fishing spots), and targeted monitoring of those locations would produce good comparative data and shed light on the hotspot locations where bait bags are found. To date, data collected are from general cleanups including popular fishing spots, and show the presence of bait bags. Those data do not always provide details of the bait packaging debris (provenance, suppliers), or provide information on the reason why the debris was found in the environment.

Data on recovery

The AMDI Database classified data in categories. *Bait & tackle bags & packaging* is a subcategory of the *Plastic Fishing Items* category (Table 1). During the 2014-18 period plastic fishing items accounted for 5% of the items recorded (Table 1). Of that 5%, 2% were bait and tackle bags and packaging (Table 2).

Table 1. Top ranking categories from AMDI Database. Cleanup period: 2014 - 2018

Source: Australian Marine Debris Initiative

Cleanups 2014 - 2018		
<i>Top ranking datasheet categories</i>		
Category	Total items recorded	%
Plastic Remnants	1333389	49%
Plastic Packaging Items	640229	24%
Plastic Consumer Items	156216	6%
Plastic Fishing Items	149018	5%
Foam Items	100655	4%
Glass, Ceramic & Construction Items	98227	4%
Rubber Items	94356	3%
Metal Items	67497	2%
Paper & Cardboard items	26248	1%
Plastic Industrial, Commercial, Shipping & Miscellaneous	17085	1%
Other Materials	15390	1%
Wood Items	11030	0%
Cloth Items	9936	0%
Miscellaneous Categories	1594	0%
	2720870	100%

Table 2. Top ranking items in Plastic fishing items category from AMDI Database. Cleanup period: 2014 - 2018

Source: Australian Marine Debris Initiative

<i>Top ranking items in Plastic fishing items category</i>		
Items	Total items recorded	%
Rope & net scraps less than 1 metre	67523	45%
Rope (estimated length in metres)	42686	29%
Fishing line in metres (Recreation)	15485	10%
Commercial fishing remnants (float, pot, crate bits)	6049	4%
Chemical light sticks	3961	3%
Recreation fishing items (lures, floats, rods, reels)	3700	2%
Bait & tackle bags & packaging	2905	2%
Fishing net over 1 metre in metres	2103	1%
Plastic buoys and floats	1180	1%
Baskets, crates & trays	1115	1%
Bait containers & lids, bait savers	1026	1%

Fishing line in metres commercial (monofilament)	966	1%
Commercial fishing traps, pots & intact parts	172	0%
Aquaculture items	147	0%
	149018	100%

During the 2019 ReefClean period, plastic fishing items accounted for 4% of items recorded (Table 3). Of that 4%, 2% were bait and tackle bags and packaging (Table 4). This suggests that the number of bait bags found during cleanups has increased in occurrence (Table 5).

Table 3. Top ranking categories from AMDI Database. Cleanup period: 2019.

Source: Australian Marine Debris Initiative

Reefclean 2019		
<i>Top ranking datasheet categories</i>		
Category		Total items recorded
Plastic Remnants		333336
Plastic Packaging Items		96742
Foam Items		24134
Plastic Fishing Items		22969
Plastic Consumer Items		21737
Rubber Items		13712
Glass, Ceramic & Construction Items		12996
Metal Items		8838
Paper & Cardboard items		4246
Plastic Industrial, Commercial, Shipping & Miscellaneous		3626
Other Materials		1995
Cloth Items		1811
Wood Items		1542
Miscellaneous Categories		9
		547693

Table 4. Top ranking items in Plastic fishing items category from AMDI Database. Cleanup period: 2019

Source: Australian Marine Debris Initiative

Top ranking items in Plastic fishing item category		
Items	Total items recorded	%
Rope & net scraps less than 1 metre	10537	47%
Rope (estimated length in metres)	5852	26%
Fishing line in metres (recreation)	2951	13%
Commercial fishing remnants (float, pot, crate bits)	722	3%

Chemical light sticks	544	2%
Recreation fishing items (lures, floats, rods, reels)	527	2%
Bait & tackle bags & packaging	451	2%
Fishing net over 1 metre in metres	314	1%
Plastic buoys and floats	184	1%
Bait containers & lids, bait savers	131	1%
Fishing line in metres commercial (monofilament)	96	0%
Commercial fishing traps, pots & intact parts	65	0%
Aquaculture items	56	0%
Baskets, crates & trays	46	0%
	22476	100%

Table 5. Total and average count of bait bags per 1000 m of site cleaned during the periods 2014-2018 and 2019 submitted in the AMDI Database

Source: Australian Marine Debris Initiative

<i>Total and average per 1000m of site cleaned - ReefClean 2019 and 2014 - 2018 period</i>	Total bait bags	Average bait bags per 1000 m of site
ReefClean 2019	451	26
2014 - 2018	2820	14

The ReefClean 2019 activity included monitoring of one estuary and one coastal site in 3 different sections of each Natural Resource Management (NRM) region along the reef (Figure 3). It also included coastal cleanups in each NRM so the data are a representation of what could be found along the whole reef. The estuary sites (represented under ‘inland waterways’ in Figure 3) are strongly represented in the dataset and are usually popular fishing locations.

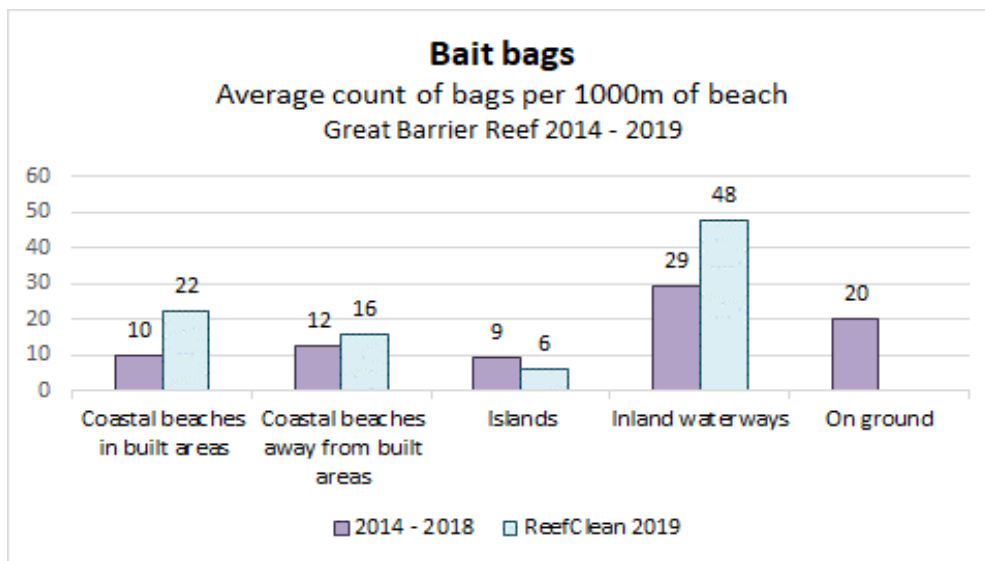


Figure 3. Average count of bait bags per 1000 m of beach in the Great Barrier Reef region per type of environment during the 2014-2018 and 2019 periods submitted in the AMDI Database

Source: Australian Marine Debris Initiative

The category “bait, tackle bags and packaging” is somewhat broad. The inclusiveness of tackle bags in the results further blurs the line on user and origin. During the 2014 - 2018 cleanup period, bait bags were found regularly and fairly evenly along the length of the reef (Tables 6-7 and Figure 4).

Table 6. Top 30 locations with highest number of bait bags found during cleanups in 2014 - 2018 period

Source: Australian Marine Debris Initiative

<i>Number of bait bags found per location during cleanups in 2014 - 2018</i>					
Coastal code	Site	Postcode	NRM Region	Count of bait bags	Percent
2	Lilleys Beach	4680	Fitzroy	29	5%
4	Cape Kimberley	4873	Wet Tropics	27	5%
1	Four Mile Beach, Middle Section	4877	Wet Tropics	21	4%
1	Cooya Beach	4873	Wet Tropics	16	3%
1	Wild Cattle Creek Mouth, Tannum Sands	4680	Burnett Mary	14	3%
1	Fisherman's Landing, Gladstone	4694	Fitzroy	13	2%
1	Wonga Beach North End	4873	Wet Tropics	9	2%
2	Harbour Beach, Mackay	4740	Mackay Whitsunday	8	1%
4	Cape Bedford	4895	Cape York	8	1%
5	North East Shore, Facing Island	4680	Fitzroy	8	1%

2	Lillys Beach North End, Tannum Sands	4680	Fitzroy	7	1%
7	Alva Estuary, Alva	4870	Burdekin	7	1%
2	Spring Head To Barwells Creek, Yeppoon	4703	Fitzroy	6	1%
4	Alligator Creek, Cape Bedford	4895	Cape York	6	1%
4	Archer Point First Beach East	4895	Cape York	6	1%
1	Four Mile Beach, North End	4877	Wet Tropics	5	1%
1	Grimstone Point Northern Beach Western Side, Airlie Beach	4802	Mackay Whitsunday	5	1%
1	Rowes Bay	4810	Burdekin	5	1%
2	McEwens Beach	4740	Mackay Whitsunday	5	1%
4	Walker Bay, Cooktown	4895	Cape York	5	1%
5	Lady Elliot Island	4805	Marine	5	1%
5	South Molle Island	4802	Mackay Whitsunday/ Marine	5	1%
6	Whitsunday Island, South of Hook Pass	4802	Mackay Whitsunday	5	1%
1	East Trinity Reserve Bund Wall	4871	Wet Tropics	4	1%
1	Pallarenda Beach	4810	Burdekin	4	1%
1	Shute Harbour	4802	Mackay Whitsunday	4	1%
1	Wild Cattle Creek Boat Ramp, Tannum Sands	4680	Fitzroy	4	1%
2	Barney Point, Gladstone	4680	Fitzroy	4	1%
2	Canoe Point, Tannum Sands	4680	Fitzroy	4	1%
3	Philippines Landing Rd, Targinnie	4694	Fitzroy	4	1%

Table 7. AMDI Coastal Code Legend

Source: Australian Marine Debris Initiative

Coastal code legend	
Coastal code	Coastal code name
1 and 2	Coastal beaches in built areas
3 and 4	Coastal beaches away from built areas
5 and 6	Islands
7	Inland waterways

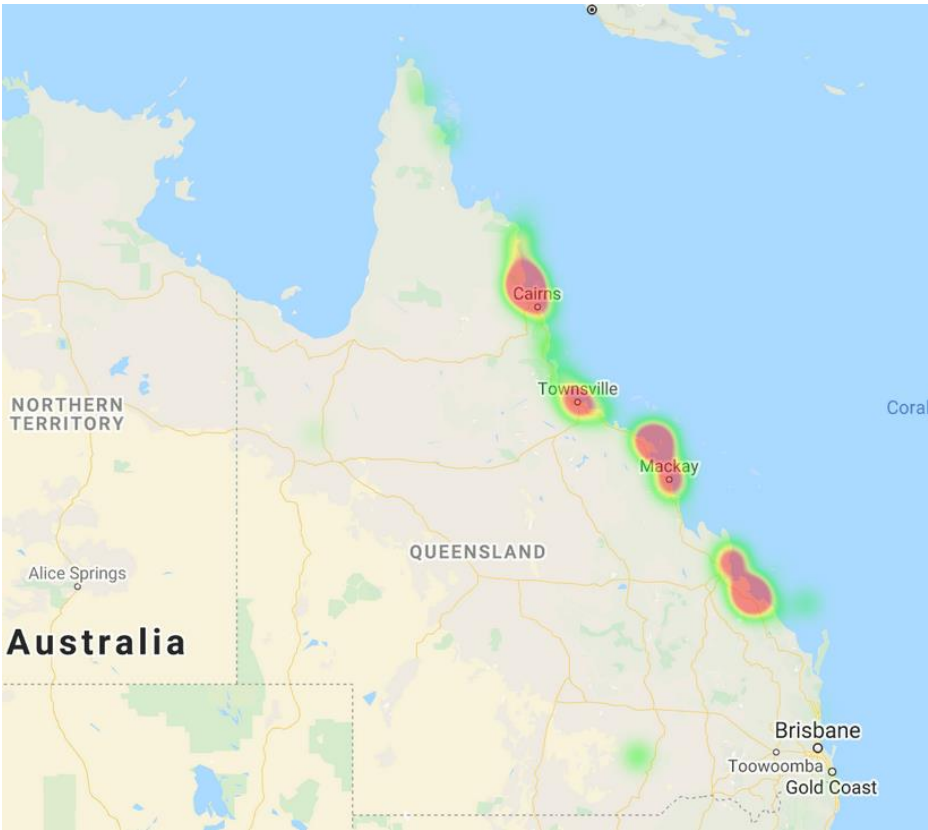


Figure 4. Broad heat mapping of bait bag collection sites - Data taken from Table 6
Source: AMDI Database 2014 - 2018 period - Related to Table 6

Analysis of Figures 5 and 6 indicate a spread of bag presence on the coast which could be used in a targeted local campaign to reduce discard. However the broad spread of bait bags found regularly and fairly evenly along the entire length of the reef suggests that an approach beyond local campaign might be more beneficial.

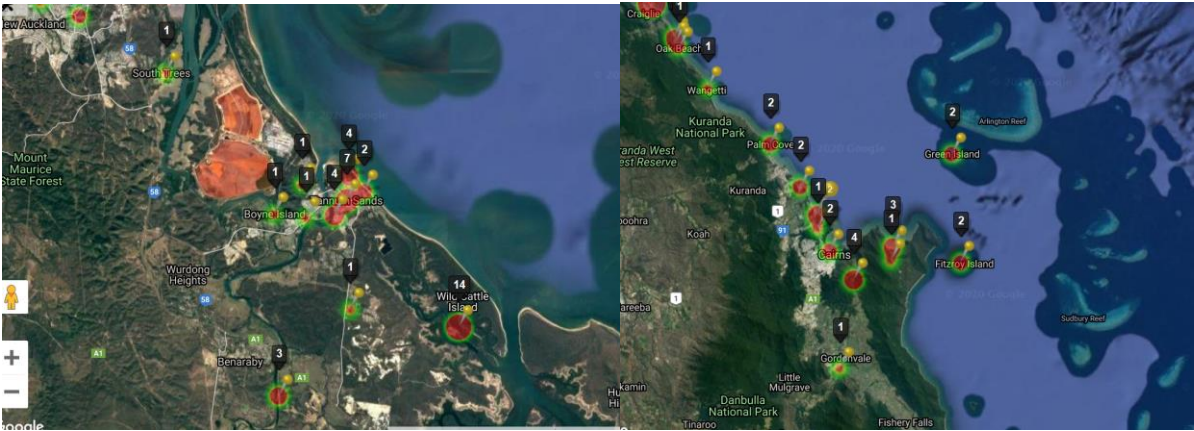


Figure 5 and 6. Detailed heat mapping of two regions with bait bags found (numbers indicate frequency)

Source: AMDI Database 2014 - 2018 period - Related to Table 6

It is important to note that cleanup efforts vary each year by location and frequency. Therefore, it is a difficult exercise to compare data by year as cleanup efforts and locations might have been different during the analysed periods.

1.6 Why are bait packaging an issue

Plastics are a diverse group of materials derived from petrochemicals (Thompson *et al.* 2009). Their global production has grown exponentially from 1,700,000 tonnes in 1950 to 280,000,000 tonnes in 2011. The disposability of plastics, together with their low recycling rates, has contributed to a significant rise in the amount of waste produced globally (Hoornweg *et al.* 2012). For instance, in Australia, 1,433,046 tonnes of plastics were used in 2010–2011, of which only 20% was recycled (reference). Moreover, around 37% of this plastic is produced for the manufacturing of single-use disposable packaging (Pacia, 2011). Plastics are transported from populated areas to the marine environment by rivers, wind, tides, rainwater, storm drains, sewage disposal, and even flood events. It can also reach the sea from vessels (e.g. fishing gear) and offshore installations (Ryan *et al.* 2009). Once in the oceans, plastics will either float on the ocean surface, or sink to the seafloor if made from polymers denser than seawater (Andrady, 2011). Buoyant plastics may be cast ashore by inshore currents or winds (Thiel *et al.* 2013), or may enter the open ocean.

The impacts of plastics on marine vertebrates, such as turtles, mammals and birds, have been well recognized since the 80's (Carr, 1987). However, only recently has the concern about the effects of small plastic particles on food webs and marine ecosystems been raised. More than half of modern plastics contain at least one hazardous ingredient (Rochman *et al.* 2013) and those that end up in aquatic systems can become increasingly toxic by adsorbing persistent organic pollutants on their surface (Rochman *et al.* 2013). These concentrated toxins might then be delivered to animals via plastic ingestion and/or endocytosis (Von Moos *et al.* 2012, Teuten *et al.* 2009), and then transferred up their food webs (Basheer *et al.* 2004; Choy *et al.* 2013). This biomagnification process is more likely to happen when plastics are small enough to be ingested by organisms that are close to the bottom of the ocean food web, such as planktivorous fish (Boerger *et al.* 2010) and zooplankton (Cole *et al.* 2013).

Bait bags are, in most of the cases, single use plastic packaging used for bait. The most recent national recreational fishing survey estimates that about 3.4 million Australians engage in recreational fishing each year (Campbell & Murphy 2005; Henry & Lyle 2003), many of whom use plastic bait bags for storing and handling their bait. In Queensland alone, over 3 million bait bags are used each year (West, 2016). When lost or disposed of, these plastic bags become an

entanglement risk to marine fauna and can break down further into microplastics and bioaccumulate in organisms. Despite the widespread willingness to take-up the cause against single-use plastics, the use of plastic bags among fishermen remains high because of these bags' physical properties of water resistance, strength, and high levels of hygiene.

1.7 Identifying Stakeholders

For the purposes of this project, “Stakeholders” have been defined as people who have an interest or are users of bait bag packaging. The following bait bag packaging user groups can be determined as bait bags stakeholders:

- seafood suppliers
- bait bag retailers
- professional fishing industry
- recreational fishing industry
- Indigenous customary fishers
- commercial divers
- recreational divers

1.8 Engagement Methodology

The following terms are defined as such for the scope of this report.

Engagement - a generic, inclusive term to explain a number of approaches, including one way communication or information delivery, consultation, involvement and collaboration in decision-making, and empowered action in informal groups or formal partnerships.

Stakeholder engagement - a planned process with identified groups of people, whether they are connected by geographic location, special interest or affiliation, to address issues affecting the marine environment.

OceanWatch follows five key principles when engaging with the fishing industry:

1. Stakeholder engagement is embedded in all OceanWatch does as the national Marine NRM;
2. Staff are actively supported to engage stakeholders, and empowered to build partnerships;
3. Stakeholder engagement is well planned, tailored, targeted, and evaluated;
4. Provide meaningful opportunities for stakeholders to contribute to marine NRM strategies and activities;
5. Work transparently and respectfully with stakeholders and establish clear roles and expectations.

According to OceanWatch, one of the most critical aspects of conducting good extension work is choosing the right model and related tools for the job. Importantly, it is recognised that industry engagement is critical, and should be undertaken at the earliest possible stage of the project, and also throughout the delivery of the project activities. OceanWatch has identified that effective engagement with the seafood industry should mostly utilise face to face communication. However, in the absence of face to face engagement (due to Covid-19 restrictions), OceanWatch has utilised secondary engagement methods such as surveys, emails, newsletters and phone calls.

PART 2 Solution proposals, trials and analysis

In seeking possible solutions to mitigate bait bag packaging presence along the Australian coastline, OceanWatch first sought out previous literature and ideas on the topic. It was felt that a key area of response that needs more attention is the development and implementation of less harmful alternatives to plastic bait bags, with an emphasis on degradability in sea water.

2.1 Stakeholders

An extensive range of stakeholders were engaged throughout this project (Table 8).

Table 8. List of stakeholders and their engagement type during the study





Category	Organisation	Contacted by	Date	Engagement type (consult or involve)
Bait retailer	Chandlery at the Sydney Fish market	OceanWatch	November 2020	Consulted as to range and sale of bait bags
Bait bag suppliers	Tweed Bait	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	Gotcha Bait	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	Earlybird Bait	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	Windybanks Bait Supply	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	Seaford Bait	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	Mendolia Seafood	OceanWatch	October 2020	Consulted through the bait bag suppliers survey





	Bonza Bait and Tackle	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	Bait'N'Go	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	SA Bait and Tackle Supplies	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
	WA Bait Supply	OceanWatch	October 2020	Consulted through the bait bag suppliers survey
Alternative bait bag packaging suppliers	Green Ocean Group	OceanWatch	August 2020	Consulted as part part of the trial
	Grounded Packaging	OceanWatch	September 2020	Consulted as part part of the trial
	BioPak	OceanWatch	September 2020	Consulted as part part of the trial

2.2 Understanding retailers - Market Review

Baits are principally purchased from three main sources: chandleries, camping and fishing shops, and service stations. OceanWatch undertook a market review of 10 leading Australian bait and tackle suppliers. This work allowed the identification of the biggest bait and tackle suppliers in Australia, their products, and their packaging (Table 9). This market review helped us identify the four most commonly sold baits on the Australian market (highlighted in green in Table 9): prawns, squid, pilchard, chicken guts. Those are the four types of bait OceanWatch decided to test during the trials described in section 2.6.

Table 9. Review of the Australian bait bag market

Supplier	Example of product sold	Products' types	Bait range
Tweed Bait		<ul style="list-style-type: none"> - Frozen 	<ul style="list-style-type: none"> - Anchovies - Blue Bait - Garfish - Mullet - Pilchards - Pipi - Prawns - Sand worms - Squid - Stripy Tuna - Bonito - Mackerel
Gotcha Bait & Burley		<ul style="list-style-type: none"> - Frozen - Pellets - Oil 	<ul style="list-style-type: none"> - Blue Bait - Pilchards - Eel - Garfish - Mackerel - Mussels - Pipi - Prawns - Salmon - Saurys - Yellow tail - Squid - Trevally - Tuna - Worms
Earlybird Bait		<ul style="list-style-type: none"> - Frozen - Oil 	<ul style="list-style-type: none"> - Gardies - Mullet - Cockles - Worms - Prawns - Octopus - Mullies - Squid
Windybanks Bait Supply		<ul style="list-style-type: none"> - Frozen 	<ul style="list-style-type: none"> - Prawns - Chicken guts - Mullet - Mullet guts - Yellowtail - Worms - Pipi - Whitebait - Pilchards

			- Squid
Seaford Bait		- Frozen - Live - Oil - Pellets	- Pilchards - Burley log - Pipi - Squid - Octopus - Mussels - Whitebait - Prawns - Glassies - Silverfish - Garfish - Bonito - Mackerel - Eel - Tuna - Salmon - Yabbies - Worms
Mendolia Seafoods		- Frozen	- Salmon - Sardine
Bonza Bait and Tackle		- Frozen - Oil	- Blue Bait - Chicken guts - Eel - Glassies - Mullet - Pilchards - Pippies - Prawns - Saurys - Silverfish - Silver whiting - Squid - Tuna Oil - White Bait - Worms
Bait'N'Go		- Frozen	- Prawns - Squid - Pilchards - Pippies - Mullet - Worms

SA Bait and Tackle Supplies		<ul style="list-style-type: none"> - Frozen - Live - Oil - Pellets 	<ul style="list-style-type: none"> - Cockles - Whiting heads - Carp - Squid - Prawns - Herring - Saury - White bait - Pilchards - Worms
WA Bait Supply		<ul style="list-style-type: none"> - Frozen 	<ul style="list-style-type: none"> - Whitebait - Mulies - Mackerel - Bluebait - Prawns - Squid - Octopus - Worms - Gardis - Mullet

2.3 Understanding bait use by professional fishers

OceanWatch conducted an internal discussion to consolidate the definition of the issue from the point of view of the SeaNet Extension officers, who for 10 years have worked on the back of boats during commercial fishing operations. It was felt the data collected often wrongly pointed the finger at professional fishers. Line fishers typically use bulk buys of tackle or construct them in house which is far more economical. Bait from beach haul fisheries such as the Australian salmon fishery is often used in traps along with bait such as frozen blocks of 30kg of chicken gut. Typically, the tuna industry uses purse seined slimy mackerel, yellow tail and other demersal species. The SeaNet Extension officers also noted that some commercial fisheries use bait sources such as chicken guts that are obtained in reuse tubs without disposable packaging.

2.4 Understanding professional bait suppliers views

To gain a better understanding of bait bags use and the physical and psychological limitations, OceanWatch invited bait suppliers to complete a survey. This survey was answered on the phone by 7 of 10 bait suppliers (Table 10).

Table 10. List of Australian bait bag suppliers contacted as part of the project

Name	Location	Progress	Interested in study
Tweed Bait	Australia-wide	Completed the survey	Yes
Gotcha Bait	Australia-wide	Completed the survey	Yes
Earlybird Bait	WA	Declined the survey	
Windybanks Bait Supply	NSW	Completed the survey	Yes
Seaford Bait	VIC	Completed the survey	No
Mendolia Seafoods	WA	Completed the survey	Yes
Bonza Bait and Tackle	Australia-wide	Declined the survey	
Bait'N'Go	Australia-wide	Declined the survey	
SA Bait and Tackle Supplies	SA	Completed the survey	Yes
WA Bait Supply	WA	Completed the survey	Yes

The objective of the survey was to address the question: What are the properties required for a bait bag and what conditions is that packaging subjected to before being discarded?

The survey indicated that most of the bait bags sold are packaged in plastic film (Figure 7). 5 suppliers out of 7 already tried alternative packaging, and 4 of them were not satisfied with the alternatives tried (Figure 9). The properties that Australian bait and tackle suppliers are considering as essential are: resistance to -20 degrees Celsius for at least 6 months, and cost-effectiveness (Figures 8 - 10).

Taking those properties into consideration during the search for alternative packaging was fundamental to estimate any future uptake of an alternative.

How are your products packaged?

7 responses

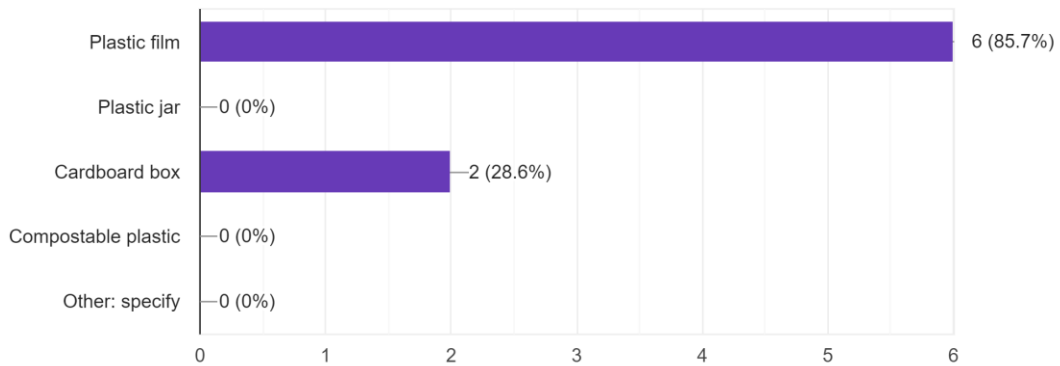


Figure 7. OceanWatch Supplier Survey - Question 3

What are the properties you required for a bait bag?

7 responses

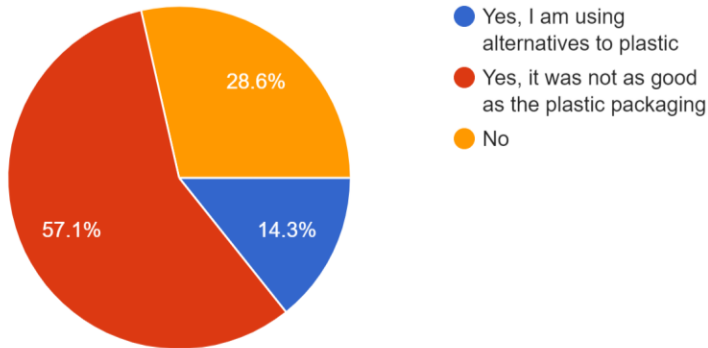
(This question was not limited to one answer. 7 out of the 7 participants answered)

Properties	Responses
Resistance to -20 degrees for up to 12 months	5
Good seal to prevent odor and leaks	3
Capable of retaining art work/logo	1
Good clarity to see content	1
Affordable	7

Figure 8. OceanWatch Supplier Survey - Question 5

Have you tried alternative bait packaging?

7 responses



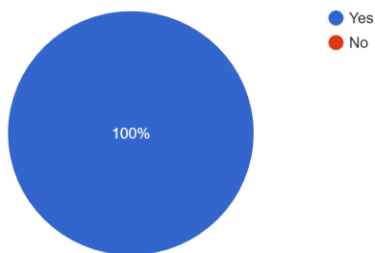
Yes, I am using alternatives to plastic (1 response)

Cardboard boxes

Yes, it was not as good as plastic packaging (4 responses)

Alternatives	Responses
Biodegradable bag: break down quickly in -20 degrees freezer	3
Cornstarch bag: Break down quickly in -20 degrees freezer and doesn't degrade quickly in the environment	1
Cardboard box: Doesn't retain the smell	1
Cardboard box: Can't be vacuum sealed so the product dries out and degrades after few days in a freezer	1

If no, did you already consider using alternatives to plastic (2 responses)



Clarification: In this case, customers are retail bait outlets. However the inquiries received by two of the bait suppliers surveyed are from community members who found bait bags on the beach and contacted them.

Figure 9. OceanWatch Supplier Survey - Questions 6/7/8/9

What do you think are the limitations to the use of alternatives to plastic in bait packaging?

7 responses

Limitations	Responses
Resistance to -20 degrees for at least 12 months	5
Cost effectiveness	4

Figure 10. OceanWatch Supplier Survey - Question 11

2.5 Alternative solutions

Viable alternatives to single-use plastics are in constant development. However, the expectations of suppliers and consumers in regards to the performance of a material are still a challenge. Indeed, often alternatives to plastic do not perform the exact same functions for the same period of time as plastic. A review was undertaken looking into alternatives to plastic bait packaging.

2.4.1 Bioplastics

Bioplastics are plastic materials produced from renewable biomass sources, such as vegetable fats and oils, corn starch, straw, woodchips, etc (Wikipedia, 2021). One type of bioplastic that is recyclable is Bio-derived polyethylene, which is the same material as traditional polyethylene made from fossil-fuels but instead manufactured from ethanol. Ethanol can in turn be produced from plants such as sugarcane, corn or bamboo (Wikipedia, 2021). However, these crops require land and water that could otherwise be used in food production, and production usually requires the use of chemicals and genetic engineering (Shields, 2021). The look and feel of bioplastic is much like conventional plastics, however the moisture barrier is reduced. Bioplastics can close the loop in a circular economy through an organic recycling process starting with biodegradable and compostable plastic products, which can then be recycled back into the same product (Figure 11).

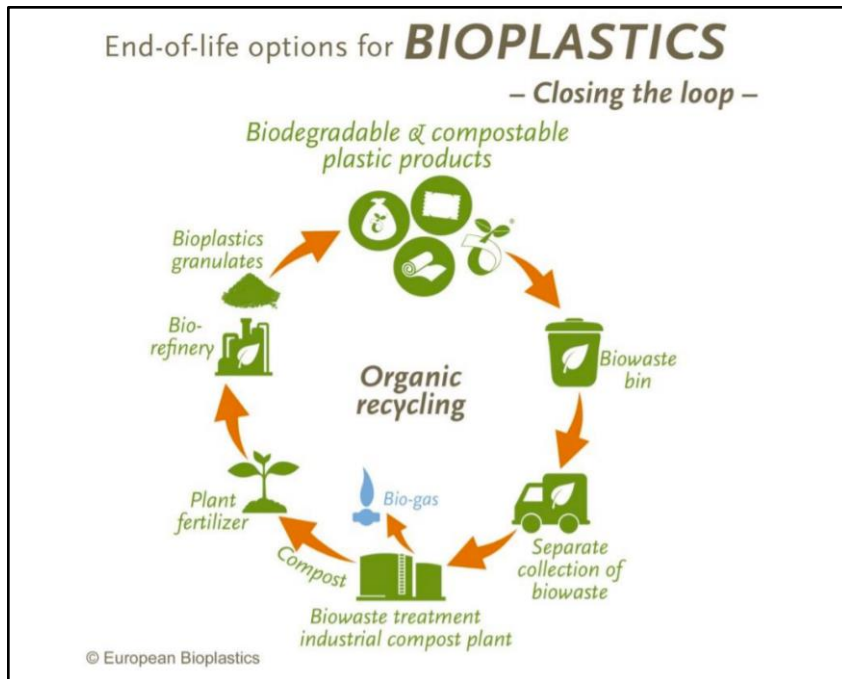


Figure 11. Biodegradable Bioplastic Recycling Loop

Source: *European Bioplastics (2020)*

2.4.2 Home compostable

When considering that some of the most difficult items to recycle are the “vacuum sealed, packaging around meat, and bakery products” it is welcome news to hear companies are

“developing a compostable version of this sort of plastic that can be composted in your own garden by simply burying it” (Corbley, 2020). Thus, one viable suggestion is the use of ‘Certified Home Compostable’ packaging and products which can be placed into compost heaps and home gardens with cardboard and paper, without disruption to any other recycling systems (Australasian Bioplastics Association, 2019). Packaging labelled as home compostable means the customer can place the packaging in their home compost bin or garden along with fruit and vegetable scraps. Home compostable packaging means that any component or material used in the packaging – including the printing ink and adhesives – decomposes into organic soil. Nutrients are found in Certified Home Compostable packaging, therefore disposing of these materials in the compost puts nutrients back into the soil (Figure 12).



Figure 12. Compostable packaging degradation

Source: PA Packaging Solutions (2018)

Even so this alternative is very convenient for people who have access to a compost, people who don't would have to discard the packaging in a general waste bin.

Grounded Packaging is an Australian-owned company developing alternatives to plastic films. Grounded Packaging offers a large range of compostable packaging (home or industrial). As part of the OceanWatch trials (described in section 2.6), OceanWatch selected the home compostable packaging. This alternative contains a maximum of 10% of petrochemical materials.

2.4.3 Industrial compostable

The difference between home compostable and industrial compostable materials is the requirement to collect, sort and process the industrial compostable packaging to ensure that it can “biologically

decompose and disintegrate in a commercial composting facility” (Haywood, 2018). The composting process must be at set levels and within a defined period of time. Industrial composting facilities treat the packaging with high temperatures (over 55 degrees Celsius, much higher than can be achieved in a backyard compost) to ensure the breakdown of the material, which will become organic rich soil. To be classified as industrial compostable packaging, the packaging must meet specific quality criteria relating to its ecotoxicity and other characteristics (Haywood, 2018).

2.4.2 Water soluble film

Water soluble film also known as PVA film is made of poly-vinyl alcohol that starts disintegrating the moment it comes in contact with water. This material is best known as the material that encapsulates laundry and dishwasher pods. Green Ocean Group is a recently established Sydney-based start-up offering two types of water soluble alternatives: hot and cold water soluble. Both alternatives were tested as part of the OceanWatch trials (described in section 2.6).

2.4.2 Sugar cane tray

Rethinking the idea of waste, some Australian companies are making trays from sugar cane pulp. Also known as bagasse, this stalk residue remains after the sugar has been extracted from the cane. Instead of burning this material, the bagasse is converted into an easily moulded packaging raw material. This versatile material is suitable for creating packaging for a wide range of hot, cold, solid, and liquid products. BioPak is an Australian company offering a large range of products made of this material. BioPak sugar cane tray and lid has been identified as a suitable alternative for bait packaging as part of OceanWatch trials.

2.4.3 Cardboard

Cardboard is a thick paper-based material, primarily used for packaging goods and materials and can also be recycled (Wikipedia, 2021). Mendolia Seafoods, a Western Australian seafood producer, developed the Burley Brick. This biodegradable corrugated cardboard box is filled with locally-sourced sardines – making the entire product plastic free.

2.4.4 Glass

Glass is one of the original forms of packaging, having been discovered over 5,000 years ago. Glass is 100% recyclable, and can be recycled and reprocessed indefinitely. Uncle Josh Bait Co, an American bait and tackle supplier, used to pack some of their products in glass jars (Figure 13). Today, all of their products are packaged in plastic jars (Figure 14). Uncle Josh switched to plastic jars as those are a cheaper, lighter and less fragile alternative.



Figure 13. Uncle Josh products in glass jar

Source: Ebay



Figure 14. Uncle Josh products in plastic jars

Source: Ebay

2.4.5 Cans

Aluminium and steel cans are containers of distribution or storage of goods, made of thin metal.

Aluminium and steel cans are stronger than cardboard or plastic, and less fragile than glass, protecting the product in transit and preventing leakage or spillage, while also reducing the need for secondary packaging.

Cans could be a good alternative; however, two of the suppliers interviewed by OceanWatch (through the supplier survey) said that they wanted the product to be easily visible by the customer to showcase bait quality.

2.4.6 Other alternatives in development

OceanWatch identified other potential alternative solutions that are still in development phases and not widely available on the market yet. Seaweed based plastic is one of them. Seaweeds are some of the fastest growing plants on the planet, with the ability to absorb significant amounts of carbon dioxide, nitrogen and phosphorus. Seaweed farms also provide habitat for marine life which is key for protecting and enhancing the value of the marine ecosystems and resources. Seaweed ocean farms require no addition of feed, freshwater or fertiliser and there is no waste from marine plants, making it the most sustainable form of agriculture on the planet. The 2019 London Marathon runners were given edible seaweed pouches carrying sports-drink. The pouches, called Oohoo, were developed by a London-based start-up, and can be bitten to release the liquid inside and then eaten entirely.

Another English start-up created an innovative material, MarinaTex, a plastic-like material made from scales and skin of fish. It is made from waste and is biodegradable. Unfortunately, as of 2019, there is no further detail available.

2.4.7 Petroleum-based biodegradable packaging

OceanWatch prefers solutions that move away completely from petro-chemicals. That is the reason why OceanWatch didn't include any petroleum-based biodegradable packaging in the trials presented in section 2.6. Indeed, petroleum-based biodegradable packaging breaks up into microplastics faster than regular plastic, in any conditions (compost, soil, marine environment). If ingested, those microplastics can cause gut blockage, physical injury, changes to oxygen levels in cells in the body, altered feeding behaviour among others (Alexander-White, 2016).

It is important to note that none of the alternatives identified have the exact same specifications as plastic packaging. Bait suppliers as well as consumers need to be aware of that and suppliers need to identify alternatives that best fit their needs.

2.6 Trials of alternatives to plastic packaging

While investigating the source reduction plan OceanWatch looked at the hurdles to a wholesaler changing packaging. Ultimately, bait wholesalers are reluctant to move to an alternative form of

packaging because they perceive that no viable alternatives exist. To move them beyond this reluctance, OceanWatch looked to document how alternatives to plastic bait packaging performed in realistic settings that simulated similar cold storage and handling then finally degradability in sea water. The experimental designs of the two trials are based on the evidence provided by the suppliers' surveys.

Hypothesis: Comparing different materials to assess their suitability in a controlled environment (using realistic bait handling and storage conditions) to perform as bait packaging. This assessment by a non vested third party will provide confidence to the suppliers and end consumers.

OceanWatch expects that the results of these trials will direct the manufacturers to modify the makeup of the materials tested to be a better fit for purpose if deemed unsatisfactory.

2.5.1 Alternative packaging identified

Based on the answers collected through the supplier survey, OceanWatch identified six suitable alternative packaging solutions that could fit bait and tackle suppliers' needs. The alternatives that were identified include water-soluble bags, compostable bag, recyclable bag, sugar cane trays with lids, and cardboard boxes (Table 11).

Table 11. List of the alternatives OceanWatch trialed

N	Product	Brand
1A	Hot water soluble film	Green Ocean Group
1B	Cold water soluble film	Green Ocean Group
2A	Home compostable film	Grounded Packaging
2B	Recyclable film	Grounded Packaging
3	Sugar cane tray with sugar cane lid	BioPak
4	Cardboard box	Mendolia Seafoods

2.5.2 Suitability trial

OceanWatch identified, through the market review, the four most commonly sold baits by suppliers in Australia: squid, pilchards, prawns, and chicken guts.

OceanWatch initiated trialing of these bait bag alternative materials to assess their suitability.

The trial experimental design was discussed with professionals in seafood quality at the Sydney Fish Market along with bait wholesalers and retailers. Combinations and treatments were based on commonly sold baits, realistic handling and packaging stock as quickly as possible to maintain product quality. Duplicates were limited to numbers of material on hand.

The trial products were filled with various types of bait fresh (unfrozen) and frozen bait (Figure 15), secured with a domestic quality vacuum heat sealer then stored in a -20 degrees Celsius commercial freezer at the Sydney Fish Market (Figure 16), and were monitored weekly to review product performance.

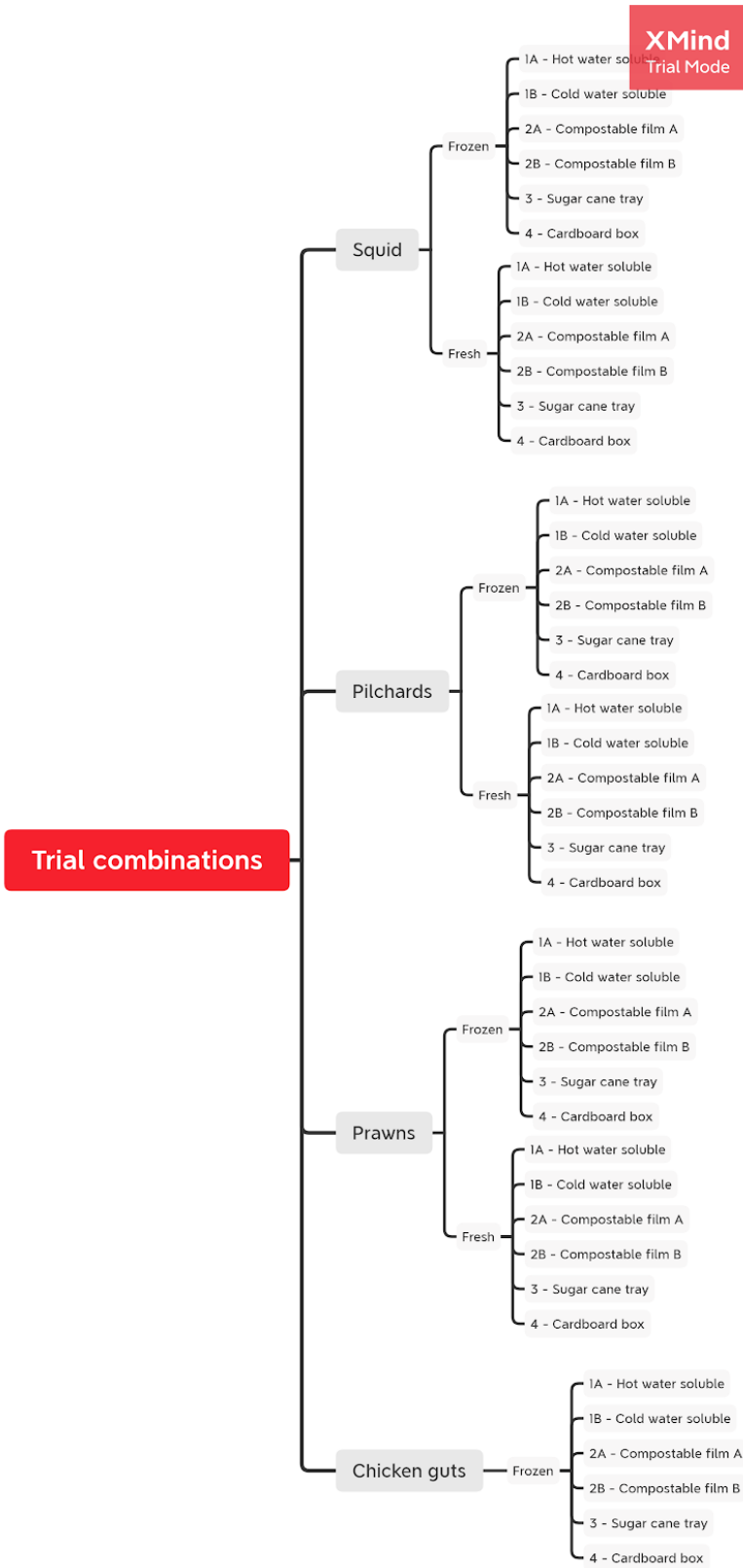


Figure 15. Combination map bait types and alternative packaging



Figure 16. Alternative packagings filled with baits were placed in a commercial freezer at the Sydney Fish Market

Observations were compiled in a document including pictures and comments on aspects of the packaging and product quality (Figure 17). Products were checked visually weekly for a period of 8 weeks after a 3 days period to capture initial possible failure of contact with moisture.

2A - Home compostable

	Fresh squid	Frozen squid	Fresh prawns	Frozen prawns	Fresh pilchard	Frozen pilchard	Chicken guts
Week 0 - Day 0							
Week 0 - Day 3							
Week 1							

Figure 17. Suitability trial results - Example of the home compostable packaging

2.5.3 Degradability and fragmentation trial

Following the suitability trial, OceanWatch decided to initiate a complimentary trial to assess the degradability and fragmentation of the alternative materials identified. The chemistry of each alternative material in our trial was somewhat commercial in confidence with each importer looking to protect the research and development behind the material. However, based on a paper that looked at the degradability of a number of polymers relative to seawater degradation and noted “The degradability of plastics in seawater is complex and requires an in-depth investigation and evaluation to provide an accurate basis for the practical application of materials” (Wang *et al* November 2020) OceanWatch commenced a simple experiment.

OceanWatch wanted to estimate how long the products would take to break down under real-life conditions as a slow decomposition will still pose a risk to wildlife if ingested in the marine.

New samples of the alternatives identified were placed in cotton bags and immersed in seawater in Blackwattle Bay - Sydney (Figure 18). The packaging were monitored weekly for 8 weeks to review bag degradability and fragmentation. Observations were compiled in a document including pictures and comments on aspects of the packaging and product quality.



Figure 18. Alternative packagings were placed in cotton bag and emerged in seawater in Pymont, NSW

2.5.4 Discussion of the trials

Both trials demonstrated that the tested materials performed differently under the conditions we subjected them to. Depending on its use, each alternative has merit. Bait suppliers should match their needs with stated attributes to determine best fit. Based on OceanWatch survey, the most suitable material allows sealability and transparency of packaging, tight storage in a -20 degree Celsius freezer and rapid degradability upon contact in seawater. An early loss of structure occurred with the cold water soluble packaging which is designed to degrade upon contact with water. Pre-treatment options such as snap freezing and drying bait may extend this initial failure time. Freezer burn was evident in samples where sealability was limited (ie. sugarcane tray and cardboard box).

Freezer burn is a condition that occurs when frozen food has been damaged by dehydration and oxidation, due to air reaching the food. It is generally caused by food not being wrapped in airtight packaging (Wikipedia, 2021). Signs of freezer burn include whitish splotches — ice crystals — on the food itself. Affected frozen fish might look discoloured or dry in spots. Colour changes result from chemical changes in the food's pigment. Freezer burn does not make the food unsafe, it only causes dry spots in foods. The food remains usable and edible. It is not known how bait appeal by predators declines with freezer burn, but according to bait retailers it can dictate a purchase decision.

With additional expert input, analysis could have been conducted using the Quality Index Method (Figure 19). The QIM is a method that takes into account the specific state of each species or product, and it is applied to determine the freshness and quality of fish, with a set of identified qualitative sensory features (Ismail 2018). The QIM is a process of determining the quality of a fish as a systematic and objective guide. The QIM is a commonly used method developed in Europe, with origins from Tasmania. The method is based on the characteristic changes that occur in raw fish. The QIM is based on significant, well-defined characteristic changes of the appearance of raw fish (eyes, skin, gills, and smell), and it includes a dermatologic index score of 0 (freshest state) to 3 (most deteriorated) for each character in the score system (Figure 19). The sum of the scores of all the characteristics gives the sensory score and is called the quality index.

Quality parameter	Character	Score (ice/seawater)
General appearance	Skin	0 Bright, shining 1 Bright 2 Dull
	Bloodspot on gill cover	0 None 1 Small, 10-30% 2 Big, 30-50% 3 Very big, 50-100%
	Stiffness	0 Stiff, in <i>rigor mortis</i> 1 Elastic 2 Firm 3 Soft
	Belly	0 Firm 1 Soft 2 Belly burst
	Smell	0 Fresh, seaweed/metallic 1 Neutral 2 Musty/sour 3 Stale meat/rancid
Eyes	Clarity	0 Clear 1 Cloudy
	Shape	0 Normal 1 Plain 2 Sunken
Gills	Colour	0 Characteristic, red 1 Faded, discoloured
	Smell	0 Fresh, seaweed/metallic 1 Neutral 2 Sweaty/slightly rancid 3 Sour stink/stale, rancid
Sum of scores		(min. 0 and max. 20)

Figure 19. Quality Index Method assessment scheme used to identify freshness of a raw product

2.5.5 Communicating the trials

OceanWatch communicated the suitability trial through the OceanWatch monthly Newsletter in January 2021. The newsletter is sent to 1,636 recipients (including fishermen, fishermen’s associations, natural resource management, eNGOs, council members, community members). OceanWatch also reposted a ReefClean article published on March 30th about the suitability trial on Facebook. The engagement numbers show that people are interested in the topic (Figure 20).

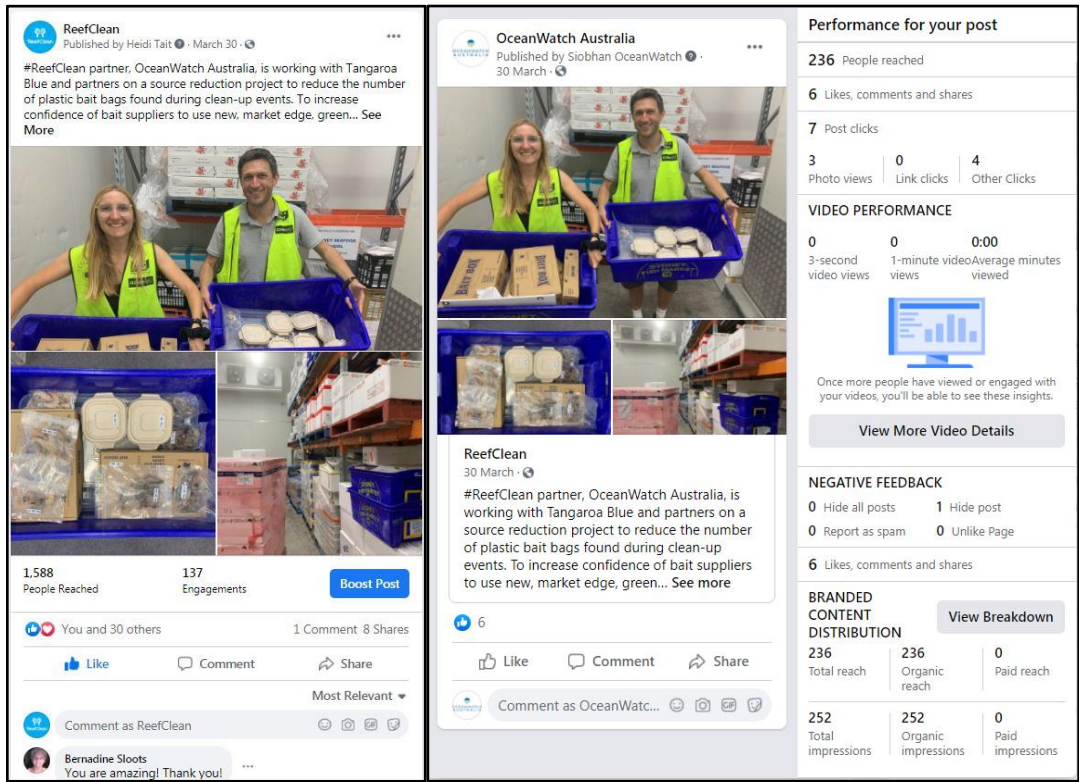


Figure 20. Reach and engagement numbers on 28/06/2021 of the ReefClean post and the OceanWatch repost around the suitability trial on Facebook
 Source: Facebook

OceanWatch communicated the degradability trial on social media (Facebook and Instagram) on 29th April 2021. The reach and engagement numbers (Figure 21) showcase the interest of the community about the topic of alternative packaging degradability in sea water.

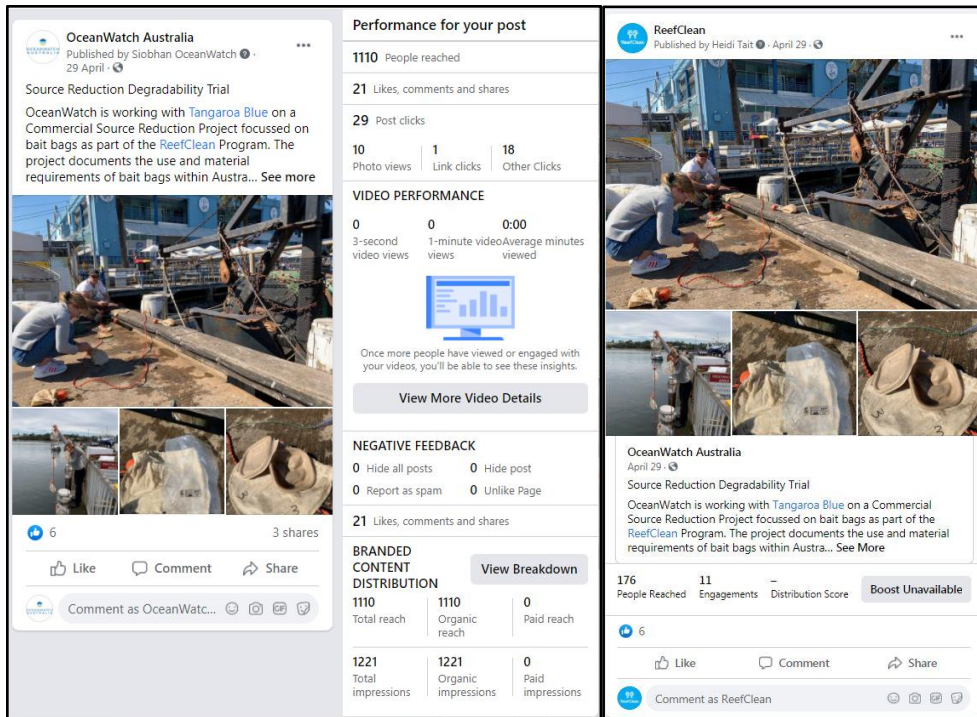


Figure 21. Reach and engagement numbers on 28/06/2021 of the OceanWatch Facebook post and ReefClean repost around degradability trial on Facebook

Source: Facebook

To communicate the results of the trial to bait wholesalers and packaging suppliers and other interested people, OceanWatch developed an infographic (Figure 22) which can be folded into a box. OceanWatch sent infographic-boxes filled with this report to the seven survey participants (Table 10) as well as other Australian bait suppliers identified (Chris Bolton Fishing, Bite Well, Earlybird Bait, Bonza Bait & Tackle, Bait'n'go).





OceanWatch intend to follow each with a discussion:

- To compare our thoughts with the suppliers of alternatives materials in the trial to try and hone needs with further product development or market segmentation.
- To try address bait wholesaler questions on what might be a suitable product for their bait and target demographic.

ASSESSING ALTERNATIVES TO PLASTIC BAIT PACKAGING



To support and encourage uptake of alternatives to plastic packaging within the fishing bait industry, OceanWatch initiated two trials for 8 weeks.

Bait	Prawn 		Squid 		Pilchard 		Chicken guts 
	frozen	fresh	frozen	fresh	frozen	fresh	frozen
Cold water soluble packaging	★	★	★	★	★	★	★
Hot water soluble packaging	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★
Recyclable packaging	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★
Home compostable packaging	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★
Sugar cane tray and lid	★	★	★★★★	★★★★	★★★★	★★★★	★★
Cardboard box	★	★	★★★★	★★★★	★★★★	★★★★	★★

EVALUATION CRITERIA

★ Quality of the bait visibly degrading after **1 week**

★★ Quality of the bait visibly degrading after **4 weeks**

★★★★ Quality of the bait not visibly degrading after **8 weeks**

ReefClean is funded by the Australian Government's Reef Trust and delivered by Tangaroa Blue Foundation in partnership with OceanWatch Australia.



OTHER CRITERIA	1 Ability to contain fresh yet to be frozen bait	2 Ability to contain frozen bait	3 Sealability with a vacuum heat sealer	4 Degradability in seawater	5 Cost of packaging
Cold water soluble packaging	★	★	★	★★★★	\$\$
Hot water soluble packaging	★★	★★★★	★★	★★★★	\$\$\$
Recyclable packaging	★★★★	★★★★	★★★★	★	\$\$
Home compostable packaging	★★★★	★★★★	★★★★	★	\$
Sugar cane tray and lid	★★	★★★★	★	★★	\$\$
Cardboard box	★★	★★★★	★	★★	\$

EVALUATION CRITERIA

1 Packaging resistance/Ability to contain fresh yet to be frozen bait over 8 weeks

- ★ Packaging failed to retain bait
- ★★ Average containment of fresh bait: Retained bait but packaging was soft to touch
- ★★★★ Contained fresh bait for length of trial (8 weeks)

2 Packaging resistance/Ability to contain frozen bait over 8 weeks

- ★ Packaging failed to retain bait
- ★★ Average containment of frozen bait: Retained bait but packaging was soft to touch
- ★★★★ Contained frozen bait for length of trial (8 weeks)

3 Sealability with a vacuum heat sealer

- ★ Not heat sealable at all
- ★★ Partly heat sealable
- ★★★★ Heat sealed well

4 Degradability in seawater

- ★ Does not degrade after 30 days in seawater
- ★★ Partly soft and weaker in seawater within 30 days
- ★★★★ Degrades in seawater within 7 days

5 Cost of packaging relative to alternatives trialed

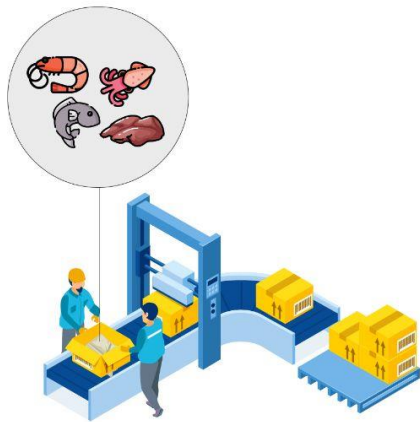
- \$ Low \$\$ Medium \$\$\$ High

ReefClean is funded by the Australian Government's Reef Trust and delivered by Tangaroa Blue Foundation in partnership with OceanWatch Australia.



Suitability Trial

Evaluating suitability of alternatives to plastic packaging



STEP 1

Bags were filled with various types of bait (fresh and frozen): prawns, squid, pilchard, chicken guts



STEP 2

After heat sealing all packagings (where possible), bags were placed in a -20 degrees Celcius commercial freezer at the Sydney Fish Market



STEP 3

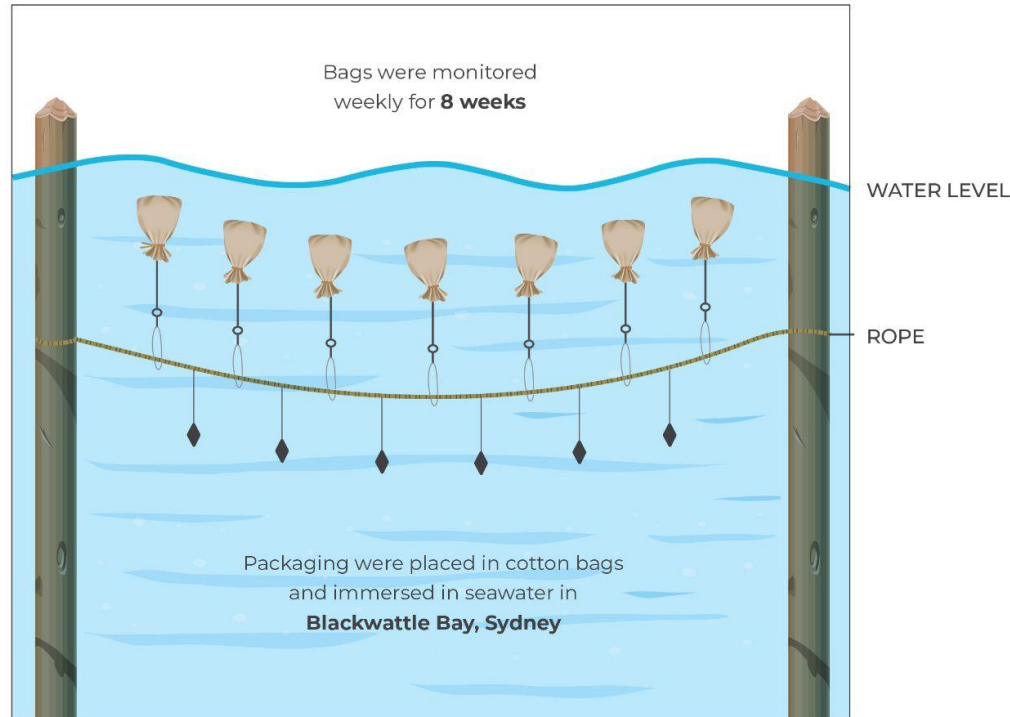
Monitoring the bags weekly to review success of each product for 8 weeks

ReefClean is funded by the Australian Government's Reef Trust and delivered by Tangaroa Blue Foundation in partnership with OceanWatch Australia.



Degradability Trial

Evaluating fragmentation and degradability of alternatives to plastic packaging in seawater to assess the risk of marine wildlife ingestion



For more information, visit the OceanWatch website – www.oceanwatch.org.au or contact us at simon@oceanwatch.org.au

Packaging Brand List*:

1. Cold water soluble
Green Ocean Group

2. Hot water soluble
Green Ocean Group

3. Recyclable packaging
Grounded Packaging

4. Home compostable packaging
Grounded Packaging

5. Sugar cane tray and lid
BioPak

6. Cardboard box

*The ingredients of the packaging above are unknown. We encourage you to seek independent advice on compliance with the Australian Standards.

ReefClean is funded by the Australian Government's Reef Trust and delivered by Tangaroa Blue Foundation in partnership with OceanWatch Australia.



Figure 22. Infographic - Results of the trials

2.7 Resistance to uptake of alternatives

Some of the bait suppliers OceanWatch contacted through this project experimented with environmental packaging (compostable, biodegradable) in the past, but discontinued their attempt due to expenses and an inability to find a packaging that would have the same performance as plastic. Those two aspects might explain the resistance to change to more expensive, environmental options, as well as the economic underpinning (relative cost to produce) of their control of the market.

PART 3 Discussion

3.1 Observations and challenges

3.1.1 Labelling

There is substantial misinformation around compostable or biodegradable plastics (Shields, 2021). According to Deby Fapyane “Biodegradable has no measurement and no certification. Yes it can break down, but perhaps not for 100 years or more” (Fabayne, 2019). Nonetheless, products labelled as Certified Home Compostable and Certified Industrial Compostable do break down.

Home Compostable is harder to achieve as it is dependent on climate. To be certified Home Compostable, 95% of the plastic needs to be broken down within 90 days and 100% broken down in 180 days. There can be no more than 1% residue from the packaging, including ink and glue used on the packaging (European Bioplastics, 2016). To ensure this is clear for consumers, the Australasian Bioplastics Association has developed a verification label for Home Compostable products which businesses can apply for and use the logo (Figure 23) to symbolise their products claim of biodegradability and compostability (Australasian Bioplastics Association, 2019). However, while there is this nationally recognised logo for Certified Home Compostable in Australia, there are no universal internationally recognised standards (at the time of this publication).



Figure 23. Home Compostable Verification Logo Australian Standard (AS 5810-2010)

Source: Australasian Bioplastics Association, 2019

In Europe for example, the “OK Compost Home” logo (Figure 24) belongs to their “certification system to guarantee complete biodegradability in the light of specific requirements, even in your garden compost heap”, but “it does not explicitly refer to a certain standard, but lists all technical requirements a product has to meet to obtain certification” (TÜV Austria, 2020). This logo is recognised in the EU, UK, and USA. Therefore, labelling will need to be more user-friendly and consumers will need better education on how to understand and treat these products and understand any logos.



Figure 24. OK Compost Home Logo - TÜV Austria

Source: TÜV Austria, 2020

Some solutions are marketed as environmentally friendly but the lack of enforcement policy on material credibility and industry standards result in a possible lack of truth and transparency around the sustainability of products available.

The cost for suppliers to go through industrial compostable certification (AS4736) in Australia is approximately \$20,000 and takes around 8-12 months. To small businesses this becomes cost prohibitive for a marketplace that does not currently demand such certification.

3.1.2 Fit for purpose alternatives

The study has shown that in 2021 there are a limited number of alternative packaging options that are suitable to contain bait in a sealed way, that doesn't degrade in a -20 degrees Celsius environment, that allows viewing of the product, that can retain products and are easy to stack. Innovators such as Mendolia Seafoods compromise on some functionality (visibility) but meet a demand in the marketplace for buyers that seek to be more environmentally friendly.

3.1.3 Suppliers' and consumers' expectations

Consumers' expectations in regards to packaging performance constitutes a barrier to the uptake of alternatives. Indeed, consumers want alternative packaging to perform the exact same function as petrochemical materials, at a similar price point. With many environmental alternatives there is a perceived understatement on performance. A 1972 study experimentally investigated the effects on product ratings of both overstatement and understatement of product quality. Results support common marketing practice in that overstatement resulted in more favourable ratings and understatement resulted in less favourable ratings (Olshavsky 1972). OceanWatch thinks it is important for bait wholesalers to “talk up the benefits” of new packaging choices and not focus on any shortcomings in function.

It is important to note that supplier's and consumer's expectations need to be reset. Indeed, alternatives to plastic can't perform the exact same function as petrochemical material at present, and OceanWatch argue nor should they. In endeavouring to “sell” a new packaging, marketing needs consideration. Rebollar (2017) examined the way a product, in their case a bag of chips, is represented in the image and how that influences expectations. They found the bag material had a

lesser effect than the way the product image is displayed and additional information is transmitted better through visual than verbal cues. With existing bait packaging visual cues feature prominently as a window to quality and freshness and a perception of value.

3.3 Recommendations

3.3.1 Encouraging consumers to use alternatives

OceanWatch recommends encouraging end consumers to try alternatives to plastic bait packaging. This could be possible through a hashtag campaign. This kind of marketing initiative is usually used to gain social media attention, to create engagement, or drive traffic for a specific topic, product or idea. Hashtags make it easier to search for conversations and to take part in them.

A hashtag could be developed for consumers to share their experience with alternatives and to encourage others to do the same.

OceanWatch ideas of potential hashtags:

- #Iusealternatives
- #Icare
- #Protectmarinelifefromdebris

3.3.2 Developing a co-working initiative for bait packaging suppliers and packaging suppliers

It is difficult for any one business to bear the risk and possible cost burden of moving a population to a new set of packaging norms.

OceanWatch recommends creating a space where bait packaging suppliers/wholesalers and packaging suppliers could share information and knowledge, breaking down silos. This could result in developing a perfectly fit-for-purpose solution for baits.

Further opportunities could come with the support for innovation and making solutions cost-effective.

3.3.3 Standardised labelling

Further investment is needed by the government into creating more affordable, standardised labelling and verifications so we can close the loop on recycling and disadvantage product suppliers with non-compostable items. Greenwashing confuses consumers and does not address the problem of marine debris.

3.3.4 Incentive program

Currently, there are very few incentives to make the switch to alternatives to plastic bait packaging, despite their increasingly widespread presence in the marketplace. In 2018, the Seafood Industry Australia (SIA) ran a *Plastic Free July* campaign, encouraging the seafood sector to opt-out of single use plastics and test out new materials (SIA, 2019). While these more sustainable alternatives will not be cheap, trial programs are effective in exposing the sector to new products. Perhaps subsidised Australian Standard certification would raise the bar so the onus to innovate and better product offering is supported and not fall on change maker businesses.

3.3.5 Community-based initiatives

Complimentary to incentives, community-based initiatives in education and outreach have the greatest potential to raise awareness of best practice and behaviour change when it comes to bait bag use. The development of programs aimed at relevant groups to target specific behaviours across the wider plastic packaging sector is useful in tackling such a social-rooted issue.

3.3.6 Testing physical and chemical toxicity

To have a better understanding of the impacts of the alternatives to plastic packaging, it would be worthwhile to test the physical and chemical toxicity of the products as well as undertake a dissolvability trial in marine wildlife's intestine environment (as a slow decomposition will still pose a risk to wildlife if ingested). This could consist of a lab experience re-creating such environment.

3.3.7 Waste Management Planning

Currently, the National Waste Policy 2018 nor the National Plastics Plan 2021 mention bait bags or marine debris at all. There needs to be a comprehensive and collaborative mechanism for long-term monitoring and communication across governments, industries, organizations, and vested-interest groups in coordination mitigative efforts from beach cleanups to development of disposal facilities that accept, or specialize in, marine debris. Debris management requirements should then be incorporated into existing legal, regulatory, and management regimes that reflect the willingness/excitement regarding economic opportunity and a growing desire to see waste recaptured and recirculated in the economy.

3.3.8 Encouraging volunteers to include extra information on the AMDI Database

The AMDI category "Bait & Tackle bags & packaging" is somewhat broad. OceanWatch did not purposely focus on the tackle bag aspect of this category. The inclusiveness of tackle bags in the results blurs the line on user and source origin.

While many categories of the AMDI Database are combined, there is an opportunity within to unpack them by getting users to add data separately for each individual item in the notes section. While this would be beneficial across the country, as the higher incidence of this category of marine debris is limited to certain locations on the GBR, it is a low priority in terms of marine

debris prevalence (Table 4). OceanWatch would suggest this is encouraged in regions identified as hotspots (Table 6).

3.4 Closing Statement

This project allowed us to understand the use of bait bags from multiple perspectives: bait supplier, packaging supplier, and the final consumer. Both trials demonstrated that the tested materials performed differently under the conditions we subjected them to. Depending on its use, each alternative has merit. Bait suppliers should match their needs with stated attributes to determine best fit. OceanWatch believes that the trials and associated communication will help address an information gap perceived as a limiting factor to businesses implementing alternative material packaging at this point in time.

This source reduction plan has been designed through conducting a source analysis approach rather than working from a littering reduction perspective. OceanWatch felt that this approach would allow for the adoption of new innovation which can work alongside traditional behaviour change mechanisms to do the right thing reducing the incidence of bait bags recorded on waterways.

In order for environmentally-friendly packaging to be accepted as an alternative, there needs to be a demand built and consumers that seek out this new type of packaging, knowing its limitations and using the packaging accordingly. Suppliers and consumers expectations need to be reset, innovators need support and packaging needs to meet national standards so confidence in labels creates a trusted alternative. Then, by convincing a significant number of companies to use sustainable alternatives, it is possible to push the market to a tipping point where the environmental solution becomes a cost-effective norm. Businesses are the source of the problem and the heart of the solution.

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5. Appendix

5.1 OceanWatch suppliers survey - Blank

Questions:

1. Business name

2. Which type of baits are you offering?

Live

Unfrozen

Frozen

Soft plastics

All options above

3. How are your products packaged?

Plastic film

Plastic jar

Cardboard box

Compostable plastic

Other: specify

4. What is the minimum shelf life expected from your products?

3 months

6 months

12 months

5. What are the properties you required for a bait bag?

Your answer

6. Have you tried alternative bait packaging?

a. Yes, I am using alternatives to plastic

b. Yes, it was not as good as the plastic packaging

c. No

7. If answer A, which type of alternatives are you using?

Your answer

8. If answer B, why?

Your answer

9. If answer C, did you already consider using alternatives to plastic packaging?

Yes

No

10. Have your customers inquired about alternative packaging?

Yes
No

11. What do you think are the limitations to the use of alternatives to plastic in bait packaging?

Your answer

12. We are currently trialling alternatives to plastic bait packaging. Would you be interested to hear more?

Yes
No

13. If yes, best contact detail:

Your answer

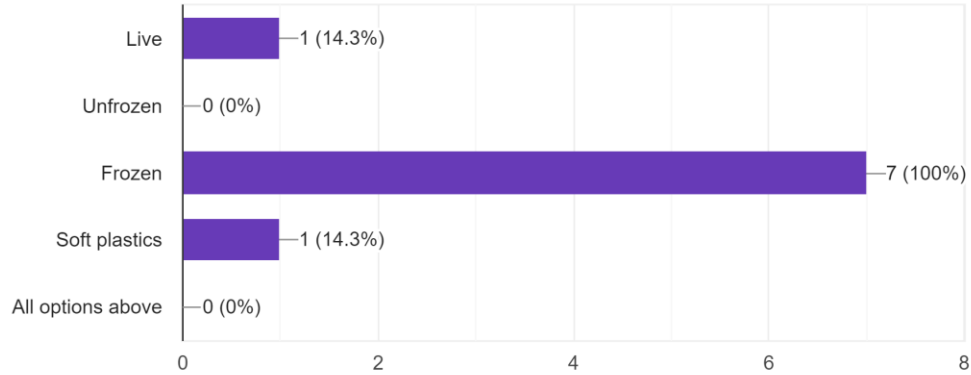
14. If no, please provide comment

Your answer

5.1 OceanWatch suppliers survey - Responses

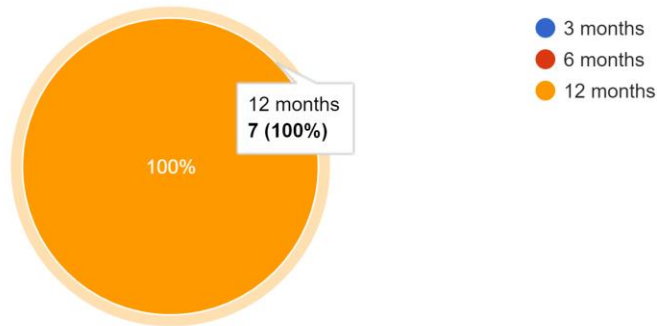
Which type of baits are you offering?

7 responses



What is the minimum shelf life expected from your products?

7 responses



Comment: During the winter season, baits can stay up to 20months in the freezer before being sold.

What are the properties you required for a bait bag?

7 responses

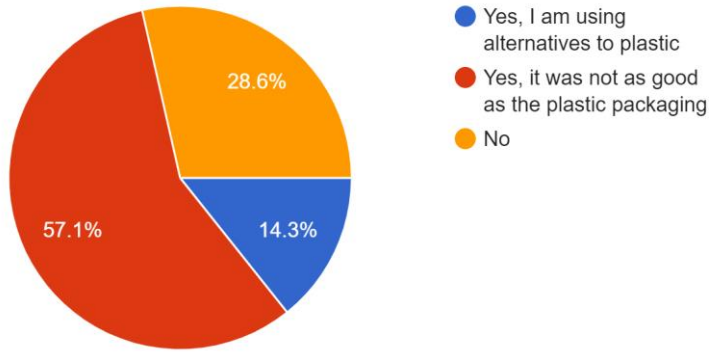
(This question was not limited to one answer. 7 out of the 7 participants answered)

Properties	Responses
Resistance to -20 degrees for up to 12 months	5
Good seal to prevent odor and leaks	3
Capable of retaining art work/logo	1
Good clarity to see content	1

Affordable	7
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Have you tried alternative bait packaging?

7 responses



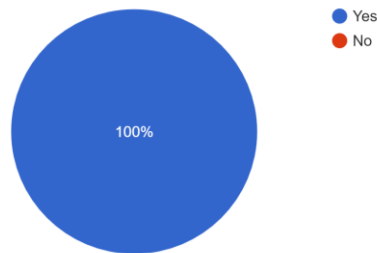
Yes, I am using alternatives to plastic (1 response)

Cardboard boxes

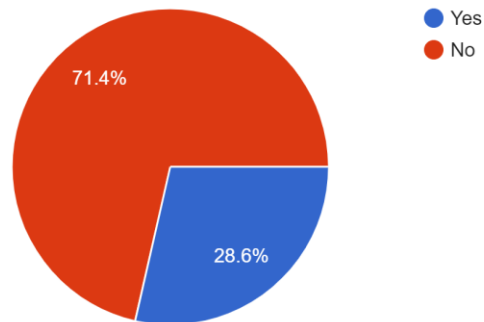
Yes, it was not as good as plastic packaging (4 responses)

Alternatives	Responses
Biodegradable bag: break down quickly in -20 degrees freezer	3
Cornstarch bag: Break down quickly in -20 degrees freezer and doesn't degrade quickly in the environment	1
Cardboard box: Doesn't retain the smell	1
Cardboard box: Can't be vacuum sealed so the product dries out and degrades after few days in a freezer	1

If no, did you already consider using alternatives to plastic (2 responses)



Have your customers inquired about alternative packaging?
7 responses



Clarification: In this case, customers are retail bait outlets. However the inquiries received by two of the bait suppliers surveyed are from community members who found bait bags on the beach and contacted them.

What do you think are the limitations to the use of alternatives to plastic in bait packaging?

7 responses

Limitations	Responses
Resistance to -20 degrees for at least 12 months	5
Cost effectiveness	4