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MARINE BIOACTIVES FROM NEW ZEALAND

Supporting investment in the emerging marine bioactives platform

FINAL REPORT; v1.00; June 2023

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GENERAL

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STEERING & GUIDANCE

This project would not have been possible without the strong guidance of our Steering Committee. In particular, we would like to thank Andrew McCallum of MBIE for his tireless energy in keeping this project on track, while at the same time pushing us forward.

We are grateful for all of the input we have received, but the report is ours and any errors are our own.

Finally, we acknowledge the support of the Ministry of Business, Innovation and Employment (MBIE), New Zealand Trade and Enterprise (NZTE) and the Ministry for Primary Industries (MPI). It is their funding that has made this report possible.

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All cross-country international trade data analysed in this report is calculated and displayed in US$. This is done for a range of reasons:

- *It is the currency most used in international trade*
- *It allows for cross country comparisons (e.g. vs. Denmark)*
- *It removes the impact of NZD exchange rate variability*
- *It is more comprehensible to non-NZ audiences (e.g. foreign investors)*
- *It is the currency in which the United Nations collects and tabulates global trade data*

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MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

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EXECUTIVE SUMMARY

This report "Marine Bioactives from New Zealand: Supporting investment in the emerging marine bioactives platform" was commissioned by MBIE as part of the Emerging and Future Platforms in New Zealand's Bioeconomy project. Marine bioactives were identified as a high potential growth opportunity as it emerged from a multi-stage screen designed to identify new and emerging platforms for New Zealand.

This report is part of a wider suite of work supporting New Zealand farming, forestry, fishing and further processing sectors as they move towards a circular economy with a thriving bioeconomy that seizes the opportunities from global trends and shifting consumer preferences.

This research is focused on 'marine bioactives' being nutraceutical extracts derived from marine plants and animals.

MARINE BIOACTIVES

WHAT ARE BIOACTIVES?

Bioactives are substances typically extracted from living organisms that produce an effect in other living organisms. The American Academy of Nutrition and Dietetics defines them as:

"Bioactive food components are physiologically active constituents in foods or dietary supplements derived from both animal and plant sources, including those needed to meet basic human nutrition needs, that have been demonstrated to have a role in health and to be safe for human consumption in intended food and dietary supplement uses."

In practice, the terms 'bioactive' and 'nutraceutical' are used interchangeably. As once source said: "Terms such as phytonutrient, phytochemical, polyphenol, bioactive, and nutraceutical are used widely, loosely, and somewhat interchangeably".

WHY MARINE BIOACTIVES?

Globally, the marine environment is seen as both (1) underexplored and (2) having a capacity to produce new, unique compounds. As one source said: "The oceans occupy more than 70% of the earth and are a rich natural resource for many bioactive compounds in organisms such as fish, shellfish, molluscs, univalves, cephalopods, crustaceans, and echinoderms." Another source added: "The marine environment hosts a wide variety of species that have evolved to live in harsh and challenging conditions."

New Zealand firms produce and sell a wide range of marine bioactives as nutraceuticals. As an example, Goodhealth sells eight different nutraceutical products produced from marine species: mussel powder, fish oil, marine collagen, oyster powder, shark liver oil, shark cartilage, abalone extract and krill oil. Clearly New Zealand has a wide range of marine bioactives being processed, packaged and marketed.

WHAT IS THE BIG PICTURE? WHAT IS THE SITUATION WITH NEW ZEALAND'S MARINE RESOURCES?

New Zealand has a sustainable seafood industry, leading to less output and fewer, larger producers.

On paper, New Zealand is well endowed with fresh and salt water resources. New Zealand has 4.4 million km^2 of controlled ocean space (15x land area); much of this is relatively unproductive water over a kilometre deep. 94% of the total area of the planet controlled by New Zealand is water and the country has the ninth largest area of claimed/controlled ocean space of any country in the world. At the same time, New Zealand has the tenth largest coastline of any country; Southland, Northland, Auckland and Marlborough all stand out as regions with extensive coastline.

New Zealand seafood production system is sustainable, but as a result highly regulated with declining volumes. The amount of seafood produced in New Zealand is almost exclusively a function of government regulations (and the economics they create). Due to this system, New Zealand wild capture production peaked in 1997/98 and has been trending down since as quotas are reduced to maintain stocks at sustainable levels.

Falling allowable capture and growing economies of scale have led to falling commercial vessel numbers; landed tonnes/vessel has been stable at ~350.

At the same time as wild capture is declining, aquaculture has stalled in New Zealand waters. New Zealand aquacultural production grew through around ~2004 and growth has stalled since. Three main species are produced in aquaculture (greenshell™ mussels, king/chinook salmon and pacific oysters) and beyond these, all new species attempted in the past fifty years have failed.

As a result of these forces, the New Zealand seafood industry has been consolidating into fewer, larger producers and this is expected to continue. Turning to employment, the New Zealand seafood industry has growing employment at sea and on-farm, but declining employment on land in primary processing/handling. The industry is not increasing productivity; tonnes per employee is falling, suggesting further consolidation is likely going forward.

The time is right for the industry to look at maximising value from the current stock.

EXECUTIVE SUMMARY

SPECIFIC PRODUCTS

There is very limited data available on the New Zealand marine bioactives industry. Therefore, a scan of marine bioactives production and branding was conducted to assess which products were the market leaders. This scan showed the most popular product made and sold into retail by the New Zealand industry was greenshell™ mussel extracts, followed by marine collagen and fish oil. Beyond these three, there were a range of smaller emerging and tertiary products. Each is evaluated separately.

LARGE - MUSSELS DEEP DIVE

Greenshell™ mussel based bioactives are clearly the "hero product" of the New Zealand marine bioactive sector. Mussel extracts are both (1) the largest industry sector (80%+ of value) and (2) the product with the best supporting research. Therefore, a deep dive into this sector is needed.

THE GLOBAL MUSSEL SITUATION

Mussels are a large family of bivalves; "blue" (Mytilus) and "green" (Pena) are the major aquaculture families. Mussels are produced globally from both wild capture and aquaculture. Blue mussels dominate wild collection of mussels and wild collection is centered in Europe and the Americas. Mussel aquaculture is centered in China, Chile and Europe.

Mussel production is growing through large expansions in aquaculture in China and Chile. Global mussel production is growing, driven by growing aquaculture production; wild capture continues to drift down. Declines in global wild mussel capture have come from overfishing, particularly in Europe and SE Asia. Global production of mussels in aquaculture is growing strongly driven by China and Chile.

The global mussel market had a "farmgate"/dockside value of $3.0 billion in 2021; the industry was hit hard by COVID, with value falling by a third.

NEW ZEALAND SITUATION IN MUSSELS

In this complex global environment, New Zealand is a secondary mussel producer that accounts for 4% of global mussel aquaculture. New Zealand has a consolidated and mature mussel industry. New Zealand mussel production appears to have stalled or plateaued in the 80-100 kilotonnes range for the last twenty years. It is quite clear that the stall or plateau in New Zealand mussel production is a domestic issue when New Zealand is compared with Chile that has continued to grow.

Instead, the New Zealand mussel industry has been focused on adding value to existing volumes rather than adding new capacity. The New Zealand mussel industry has a farmgate value of $627m and an export value of $300m; size of intermediate stages unclear at this point.

EXPORT MARKETS FOR MUSSEL PRODUCTS

New Zealand mussel products export are growing value on flat-to-declining volumes. New Zealand mussel exports are achieving growing prices and growing total value on flat-to-declining volume (since the mid 2000s). In volume terms, export markets take predominantly frozen half shell, followed by live, frozen meat and frozen whole. Prices are up for traditional mussel products, down for bioactive powders and very high for bioactive mussel oils. In value terms, export markets take predominantly frozen half shell, followed by various whole mussel products and nutraceuticals (mussel oil and powder).

EXPORTS OF MUSSEL BIOACTIVES

Overall, mussel oil value and volume have been trading in a band since 2016; the United States appears to be the most stable market. Prices have been converging across markets to around ~$2,000/kg for the past five years.

Overall, mussel powder volumes and values were trending up through 2021; there has been a clear COVID impact in 2022. Mussel powder export prices are trending flat-to-down across all markets; Japan stands out as a market that pays premium prices.

USAGE

Green-lipped mussels are used in three very different ways across three distinct segments: human consumption, petfood ingredients and supplements.

HUMAN CONSUMPTION

The majority of mussels are purchased as a shellfish (live, frozen or minimally processed).

PETFOOD

Green-lipped mussels are used as a petfood ingredient as a whole snack, an ingredient in a wet or dry meal, or as a supplement.

SUPPLEMENTS

Greenshell™ mussel extracts have a range of recognised health-giving properties driving demand. Numerous brands sell greenshell™ mussel powder and oil, which now comes in a range of concentrations (of the active ingredient).

MEDIUM - FISH OIL

In New Zealand, fish oil is primarily a byproduct from rendering fish waste into "meal", producing at the same time an oil. Why fish oil? Fish oil is promoted as being high in omega-3, for which numerous health claims are made. Numerous fish oil products are sold by New Zealand firms. Antler Farms' New Zealand fish oil provides an excellent example of a product making clear, strong product claims, including "wild caught in clean, cold waters", "certified sustainable" and "promotes a health heart". Most fish oil for human consumption is imported.

MEDIUM - MARINE COLLAGEN

What is collagen? "Collagen is the main protein in many structural supportive connective tissues in the body such as skin, bones, ligaments, tendons, and muscle. It consists of protein fibrils wound in a strong triple helical structure. Collagen constitutes at least 70% of the dry weight of human skin." [Dermnet]. There are five main types of collagen, of which two (Type I and II) are the primary focus of the marine sector. Marine collagen is made primarily from the skins, bones and scales of fish. Why marine collagen? Collagen is promoted as good for the skin and for joint health.

A large and growing number of marine collagen products are made by New Zealand firms, with most being sourced from New Zealand waters. Most products are sold as protein powders or in capsules.

Beyond traditional products, marine collagen fibres using hoki skins has been developed into a skincare product that releases collagen and other products directly into the skin.

SMALL/EMERGING OTHER MARINE BIOACTIVES

Beyond the 'top three' there are a wide range of other smaller or emerging marine bioactives.

KRILL

Locally processed krill is sourced from the waters of Antarctica. It is imported and processed in New Zealand. Why krill oil? Krill oil is promoted as being good for cardiovascular health, eye and liver health, and as having a range of other benefits. Krill oil is marketed by numerous New Zealand firms.

SHARK

Shark is by-catch from the deep sea commercial fishing sector. Three key bioactives are made from shark, shark liver oil, squalene and cartilage, all of which are used as nutraceutical ingredients.

Why shark squalene and liver oil? Shark live oil is promoted as a strong anti-oxidant that boosts immunity and is good for the skin. Shark liver oil and squalene are now well established and known products sold by a wide range of New Zealand firms.

Why shark cartilage? Cartilage is promoted as a good supply of chondroitin, marketed as good for joint health and pain. Shark cartilage is now a well established and known product sold by a wide range of New Zealand firms.

ABALONE

Black foot abalone or pāua are a wild shellfish collected in New Zealand waters. Why abalone? Abalone is promoted as good for eye health, immunity health and as being a good supplier of essential minerals. Abalone-based products sourced from New Zealand waters are branded and sold by several New Zealand firms.

OYSTERS

Pacific oysters were introduced to New Zealand and today they both grow in the wild and are farmed under aquaculture. Why oysters? Oysters are promoted as being high in zinc and other micro nutrients, as well as supporting sex drive and a healthy immune system. Oyster extracts are sourced from both New Zealand aquaculture and wild caught sources and processed and branded by multiple firms.

FISH CALCIUM

Fish calcium is derived from bones of fish byproduct. Why fish calcium? Fish calcium is promoted as a support for bone health. Fish bone calcium is currently more of a specialist item not sold by the larger brands.

A range of other products, including sea cucumber, ling maw collagen, algae and seaweed, are on the market, with all being sold in lower volumes. Other products, such as sea urchins, red algae and marine toxins, are in discovery and trial stages.

As the population ages products that support bone and joint health plus brain health will become increasingly important.

WHAT ARE THE STRATEGIC THEMES IN MARINE BIOACTIVES?

Five broad strategic themes are driving the growth of the New Zealand marine bioactives platform.

First, firms are investing in scaling up marine extraction technologies and processing. Firms across the supply chain are investing in marine collagen and marine extraction production. Local investment is occurring across the supply chain from major seafood companies to access supply, extraction technology and brands. As a recent example, Aroma acquired Biolane - the original greenshell mussel product - from Vitaco in 2020.

In addition, acquisitions and investments are occurring from firms outside New Zealand, reflecting the global appetite for investing in the New Zealand health and wellness sector. Private Equity and Capital Funds are also investing in the sector. In addition, large global firms are also investing in the wider New Zealand based nutraceutical, health and wellness industry (all with marine bioactive products).

Second, firms are branding and trademarking specific types and formulations of marine bioactives.

Third, the industry is rallying around measurable standards for concentration and in doing so, 'taking a page out of the manuka honey playbook'. The greenshell™ mussel industry is in the process of developing a quality assurance standard for greenshell™ mussel powder.

Fourth, firms are seeking to demonstrate efficacy through stronger science. Universities across New Zealand are researching marine bioactives and supporting firms researching bioactives. At the same time, New Zealand's Universities, Crown research Institutes and other research organisations are undertaking research into marine bioactives, and supporting firms with their research and development.

Finally, firms are delivering and marketing their sustainability. As an example, firms that source New Zealand marine collagen products focus on selling the pristine nature of the environment and sustainable sourcing. It is important that all sectors and segments of the industry are sustainable and ethical.

APPLYING A CIRCULAR FRAMEWORK

The marine bioactive sector is a part of the wider circular system, in particular adding value to generically rendered fish carcasses. For example, Plant and Food Research have a number of programs working towards the goal of supporting marine products in being more circular and optimising the whole resource. NanoLayr is an example of a firm combining the principles of the circular economy by using a low value product to produce a high value cosmeceutical. Recent research highlighted the relatively low environmental impact of New Zealand aquaculture relative to alternative proteins.

WHAT IS THE SITUATION IN THE NEW ZEALAND MARINE BIOACTIVE INDUSTRY?

New Zealand has a successful marine bioactives sector built on the back of a sustainably managed wild capture seafood and aquaculture industry. The New Zealand marine bioactives industry has a diverse supply chain that delivers ingredients and finished products to worldwide. The New Zealand marine bioactives sector is supported by a large, robust seafood industry with strong capabilities in place across the total supply chain. New Zealand's marine bioactive processors and extractors are primarily located in two clear clusters in Nelson and Christchurch.

The New Zealand marine bioactives sector is well positioned for further growth.

All identified firms participating in the New Zealand marine bioactives industry are profiled at the end of the report.

This project works to a clear client brief

CLIENT BRIEF: SELECT KEY CONCEPTS

"Currently New Zealand's economic activity exceeds environmental limits on several measures, of which high emissions (in absolute terms and per capita) is one. As a signatory to the Paris Agreement, New Zealand's Nationally Determined Contributions (NDC) target is to reduce New Zealand's net emissions by 50 per cent below gross 2005 levels by 2030. This equates to a 41 per cent reduction on 2005 levels using what is known as an 'emissions budget' approach."

CHALLENGE

"The purpose of this bioeconomy research is to establish an evidence base to enable New Zealand's bioeconomy to further develop. To support investment, innovation and the further development of New Zealand's bioeconomy, business decision makers and policy makers need high quality information on emerging and future bioeconomy platforms as well as up to date intelligence on technological developments, market opportunities and trends, both local and global."

PURPOSE OF RESEARCH

"This research identifies commercial opportunities that are emerging now, and potential opportunities that might be viable in the future. The research will focus on identifying platforms as distinct from individual products. As an illustration, examples of emerging and future bioeconomy platforms could include nutraceuticals and foods for health, biotechnology (as an enabler), alternative proteins, biomaterials, essential oils, botanical waste streams (transforming the waste streams from existing plant-based food systems into health products), health focused Alt/Dairy (leveraging existing arable crop and dairy capabilities into innovative, health focused milks).

We are seeking a report that provides this comprehensive set of information. The report will provide businesses (particularly start-ups and small and medium enterprises), investors, Māori enterprises, research organisations and policy makers access to a baseline of market information and analysis and a common framework of facts, figures, and analysis. This information is currently either missing, fragmented or too costly to obtain for all but the largest businesses.

The report must be in a format that is familiar and useful to business. It must include data, analysis and commentary on trends and opportunities in a form that will materially assist with business strategy and government policy."

REQUIREMENTS

Source: MBIE RFQ 8 Dec 2022

This report is part of a wider suite of related and associated analysis

STAGE I – FINDING THE WAY

Finding and screening all emerging and future platforms in the New Zealand bioeconomy

STAGE II – 30 OPPORTUNITIES

Developing thirty emerging and future opportunities in the New Zealand bioeconomy

SPORTS NUTRITION & WEIGHT MANAGEMENT

BIOCOSMETICS

THIS REPORT

MARINE BIOACTIVES

STAGE III – THREE HIGH POTENTIAL PLATFORMS

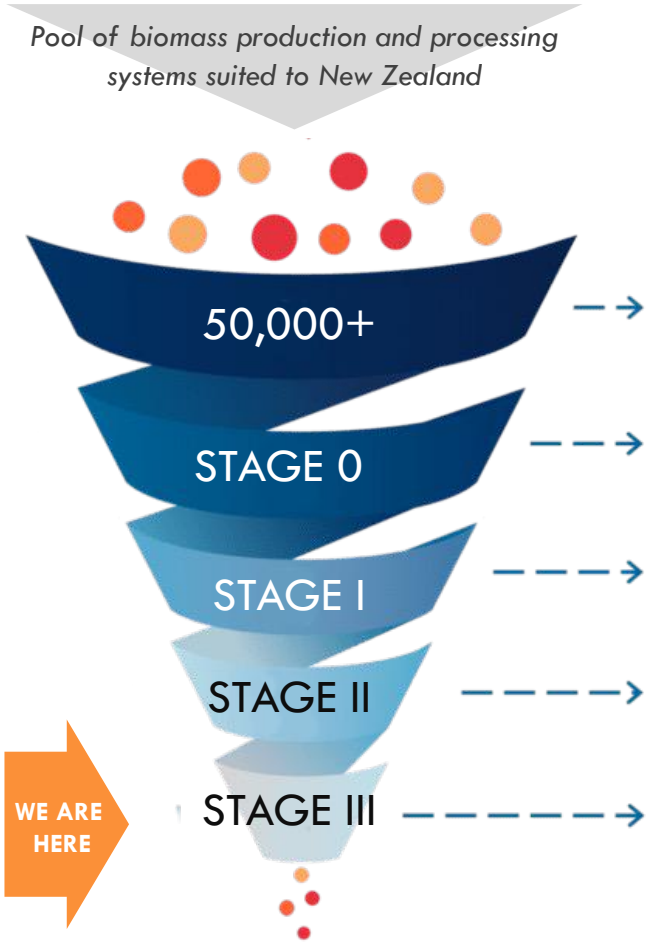
Detailed analysis to make the high level case for investment in three high potential platforms in the New Zealand bioeconomy

BACKGROUND & SUPPORTING MATERIAL

SITUATION & CAPABILITIES

Providing a granular assessment of New Zealand's available biological resources

Marine bioactives emerged from a multi-stage screening process to identify bioeconomy platforms with desirable future focused characteristics



50,000+	*Hypothetical Universe*	All plants and animals farmed or fished by humans
STAGE 0	*Someone, Somewhere ~1,000*	Having at least one champion in NZ and at least minimal merit
STAGE I	*100 Products & Processes*	Production and processing across a common set of metrics
STAGE II	*30 Opportunities*	High potential products with real potential
STAGE III	*3 Priority Platforms*	Detailed analysis to support investment in these platforms

Source: Coriolis analysis

What are bioactives? Bioactives are substances typically extracted from living organisms that produce an effect in other living organisms

"Bioactive food components are constituents in foods or dietary supplements, other than those functioning to meet basic nutritional needs, that effect changes in health status or changes in the structure or function of the body."

AHPA
AMERICAN HERBAL PRODUCTS ASSOCIATION

"All of the following categories be considered as potentially within the definition of bioactive food component:

- Amino acids and peptides
- Fats and Oils
- Botanicals
- Biochemicals (e.g., Inositol, Coenzyme Q10)
- Enzymes
- Probiotics and Single Cell Products (e.g., yeast powder)
- Minerals and Trace Elements; and
- Vitamins."

Natural Products ASSOCIATION™

"Bioactive food components are substances in foods, including dietary supplements that have biological activity that directly affect structure or function of the body. This includes substances that have been defined as nutrients. It also includes components other than those required to meet basic nutritional needs, such as less refined components (e.g. bran, soy protein isolates, marigold powder), families of compounds (e.g. phytosterols, polyphenolics, flavanoids, proanthocyanadins), and specific chemical moities (e.g. lutein, lycopene, DHA EPA)."

IFT
feeding the minds that feed the world

"A bioactive compound is a compound that has an effect on a living organism, tissue or cell, usually demonstrated by basic research in vitro or in vivo in the laboratory. While dietary nutrients are essential to life, bioactive compounds have not been proved to be essential – as the body can function without them – or because their actions are obscured by nutrients fulfilling the function.

Bioactive compounds lack sufficient evidence of effect or safety, and consequently they are usually unregulated and may be sold as dietary supplements." *Accessed June 8, 2023*

WIKIPEDIA
The Free Encyclopedia

"bioactive: (of a substance) having or producing an effect on living tissue."

Collins DICTIONARIES

"Bioactive food components are physiologically active constituents in foods or dietary supplements derived from both animal and plant sources, including those needed to meet basic human nutrition needs, that have been demonstrated to have a role in health and to be safe for human consumption in intended food and dietary supplement uses."

eat right. Academy of Nutrition and Dietetics

Source: select articles; select websites; Coriolis analysis

In practice, the terms 'bioactive' and 'nutraceutical' are used interchangeably

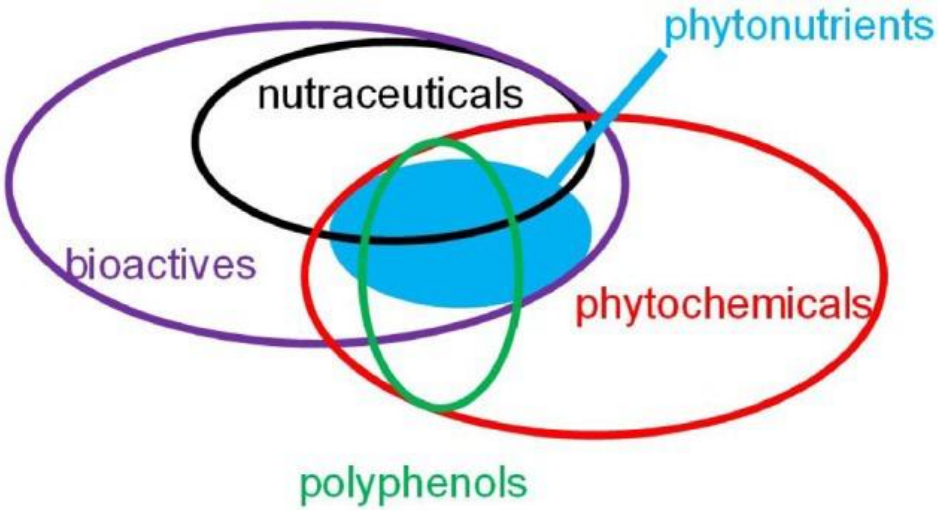
"Although vitamins have been well defined and characterized, there are a large number of compounds in the diet derived from plants which may impact health, but are not classified as vitamins. For this class, often referred to as phytochemicals, a variety of terms are used in the research, industry, agricultural, and regulatory communities. Terms such as phytonutrient, phytochemical, polyphenol, bioactive, and nutraceutical are used widely, loosely, and somewhat interchangeably in the scientific, regulatory, and popular literature. The lack of standardization may confound literature searches, hamper scientific consensus, and prevent harmonization of results. Since most terms are neither appropriately defined nor officially recognized, use of different terminology to describe the same substances can cause confusion.

A **bioactive** compound is a descriptor based on a biological activity and refers to phytochemicals or animal-derived components with demonstrated activity in biological systems, usually animals and/or humans, without specifying whether the activity is beneficial or harmful…

Nutraceutical is another activity-based term that also belongs to the category of "bioactive compounds." It should only be used to refer to bioactive compounds (plant, animal, fungal, or bacterial) that exert reproducible therapeutic effects in randomized and controlled animal or human trials. The current literature does not indicate whether a minimum effective dose should be specified, and some efficacy data, safety data, possible side effects, an analytical protocol to confirm identity, precise composition, and precise content of the active ingredients (and for pharmaceuticals, which specific ingredients) may also be needed."

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7212822/#nuz081-B1

National Library of Medicine
National Center for Biotechnology Information



"Foods contain numerous kinds of molecules that are claimed to improve our health or performance. These bioactive molecules are often called nutraceuticals because they have characteristics similar to both nutrients and pharmaceuticals."

David Julian McClements; Future Foods: How Modern Science Is Transforming the Way We Eat; April 2019

Source: select articles; select websites; Coriolis analysis

Why marine bioactives? The marine environment is seen as (1) underexplored and (2) having a capacity to produce new, unique compounds

"The oceans occupy more than 70% of the earth and are a rich natural resource for many bioactive compounds in organisms such as fish, shellfish, molluscs, univalves, cephalopods, crustaceans, and echinoderms, which significantly contribute to economic and research development. Since marine organisms live in complex habitats and are exposed to extreme conditions, such as salinity, pressure, temperature, and illumination, they produce a wide variety of secondary metabolites that cannot be found elsewhere. In addition, the marine organisms also have special structures and constitute nearly half of the worldwide biodiversity, like antioxidant activity, antimicrobial activity, anticancer activity, antihypertensive activity, anti-inflammatory activity, and so forth." https://www.hindawi.com/journals/bmri/2017/9746720/

BioMed Research International

"Marine microbiota and fauna are valuable sources of bioactive compounds for the food and pharmaceutical industries. Bioactive compounds can be isolated from macroalgae (seaweeds), microalgae, echinoderms, crustaceans (for example, crayfish, crab, shrimp, and lobster), cephalopods (such as squid, cuttlefish, and octopus), mollusks (including mussel, clam, oyster, scallop, abalone, snail, and conch) and fish. So far, more than 36,000 compounds have been isolated from marine micro-and macro-organisms. The most widely isolated and researched marine bioactive compounds include carbohydrates, pigments, polyphenols, peptides, proteins, essential fatty acids, vitamins, and minerals." https://www.frontiersin.org/articles/10.3389/fnut.2022.1047026/full

frontiers | Nutrition

"Marine natural resources can be explored providing an alternative and sustainable source of new compounds with biological properties (bioactive compounds)… [M]arine sources/samples include[e] microorganisms such as microalgae, fungi, and bacteria; macroorganisms such as sponge, macroalgae, coelenterates, tunicates (ascidians), and mollusks; and marine by-products and fisheries waste streams."
https://www.sciencedirect.com/science/article/abs/pii/B978044463359000001X

COMPREHENSIVE ANALYTICAL CHEMISTRY

"The marine environment hosts a wide variety of species that have evolved to live in harsh and challenging conditions. Marine organisms are the focus of interest due to their capacity to produce biotechnologically useful compounds. They are promising biocatalysts for new and sustainable industrial processes because of their resistance to temperature, pH, salt, and contaminants, representing an opportunity for several biotechnological applications. Encouraged by the extensive and richness of the marine environment, marine organisms' role in developing new therapeutic benefits is heading as an arable field." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8790952/

Springer Journal of Genetic Engineering & Biotechnology

Source: select articles; select websites; Coriolis analysis

New Zealand firms produce and sell a wide range of marine bioactives as nutraceuticals, as these example products from Goodhealth illustrate

EXAMPLE: MARINE BIOACTIVES RANGE OF GOODHEALTH NZ

MUSSEL POWDER

FISH OIL

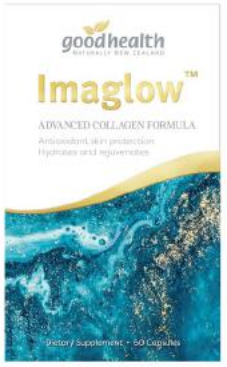
OYSTER POWDER

"Naturally packed with marine nutrients, our range of antioxidant-rich supplements have been formulated for healthy joints, skin, and immune systems. All have been tested using methods that meet international testing requirements, ensuring that the levels of purity and quality comply with strict regulatory standards. Our range includes New Zealand sourced mussel extract – known for its nutritional benefits for joint health; New Zealand abalone, which is a rich source of marine nutrients, including essential B vitamins; and squalene that offers a unique form of antioxidant protection."

SHARK LIVER OIL

SHARK CARTILAGE

ABALONE EXTRACT



MARINE COLLAGEN

KRILL OIL

Source: photo credit (fair use/fair dealing; low resolution; complete product/brand for illustrative purposes); Company website

Beyond supplements, multiple sectors use marine bioactives (and other marine products) as ingredients; this research focuses on human nutraceuticals

WHERE DO BYPRODUCTS FROM THE SEAFOOD INDUSTRY GO?

HUMAN SUPPLEMENTS/ NUTRACEUTICALS

- Used as a supplement for humans
- Taken in powder or pill/encapsulated form or as an oil
- Primarily for joint mobility
- Products backed by science

This research focuses on the use of marine bioactives in supplements targeting humans.

PET SUPPLEMENTS & PETFOOD INGREDIENTS

See related pet food document*

- Used as an ingredient in petfood and as a snack/treat for pets (cats, dogs), petceuticals
- Key characteristics is for nutritional value and for joint mobility and arthritis (in particular in older dogs)

COSMETICS

See related cosmetics document

- Used as an ingredient in cosmetics
- Used in beauty/sports nutrition overlap products (e.g. marine collagen powder)

FUNCTIONAL FOODS

- Omega-3 from fish or marine plants can be added to food and beverage products

INDUSTRIAL

- This project defines "marine bioactives" as those "claimed to improve our health or performance"
- Industrial users are primarily using other non-active byproducts and waste steams of fishing
- Seaweed, while it has many interesting qualities, is not a bioactive by the definition used in this project when it is used in a soil amendment

There was some discussion on the definition of marine bioactives and what was in and out of scope. Both wild capture and aquaculture seafood produce large amounts of secondary products, byproducts and waste. The vast majority of this is not 'bioactive' by default. A bioactive must both be extracted or refined (not raw materials) and have reasonable evidence for efficacy and biological activity.

*https://www.coriolisresearch.com/reports/taking-new-zealand-pet-food-exports-to-a-billion

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New Zealand has a sustainable seafood industry, leading to less output and fewer, larger producers

On paper, New Zealand is well endowed with fresh and salt water resources

- New Zealand has 4.4m km^2 of controlled ocean space (15x land area); much of this is relatively unproductive water over a kilometre deep
- 94% of the area of the planet controlled by New Zealand is water and the country has the ninth largest area of claimed/controlled ocean space of any country in the world
- New Zealand has the tenth largest coastline of any country; Southland, Northland, Auckland and Marlborough stand out

New Zealand seafood production is sustainable, but as a result highly regulated with declining volumes

- The amount of seafood produced in New Zealand is almost exclusively a function of government regulations (and the economics they create)
- New Zealand wild capture production peaked in 1997/98 and has been trending down since as quotas are reduced to maintain stocks
- Falling allowable capture and growing economies of scale have led to falling commercial vessel numbers; landed tonnes/vessel has been stable at ~350

Aquaculture has stalled in New Zealand

- New Zealand aquacultural production grew to around ~2004; growth has stalled since; all new species attempted in the past fifty years have failed

As a result of these forces, the New Zealand seafood industry has been consolidating into fewer, larger producers and this is expected to continue

- The seafood industry has declining unit numbers
- The seafood industry has growing employment at sea and on-farm, but declining employment on land in primary processing/handling
- The industry is not increasing productivity; tonnes per employee is falling, suggesting further consolidation is likely going forward

New Zealand has 4.4m km² of controlled ocean space (15x land area); much of this is relatively unproductive water over a kilometre deep

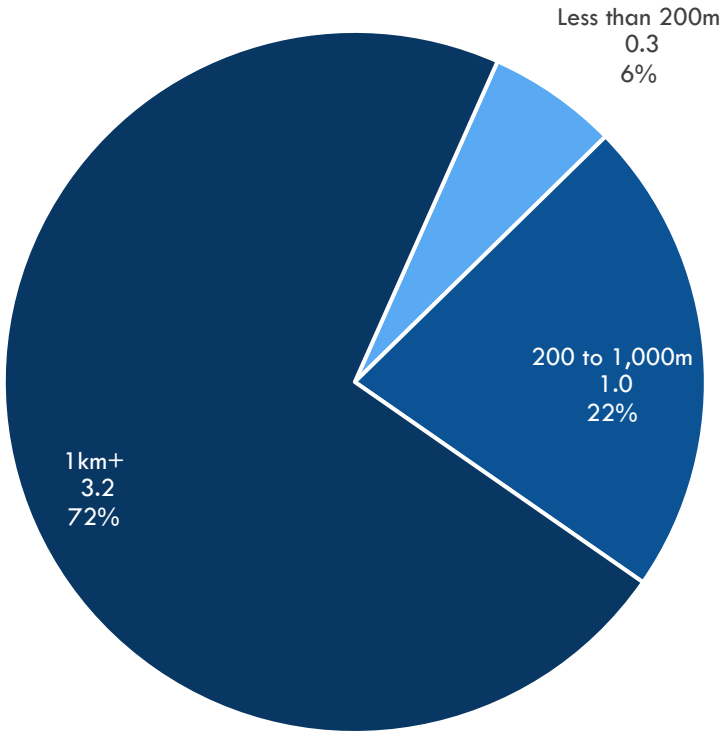
EXCLUSIVE ECONOMIC ZONE (EEZ)*

km²; depth; 2023

Defined as 200 nautical miles from coastline

AREA OF EEZ BY DEPTH

km²; % of area; 2023



TOTAL AREA IN EEZ = 4.4m km²

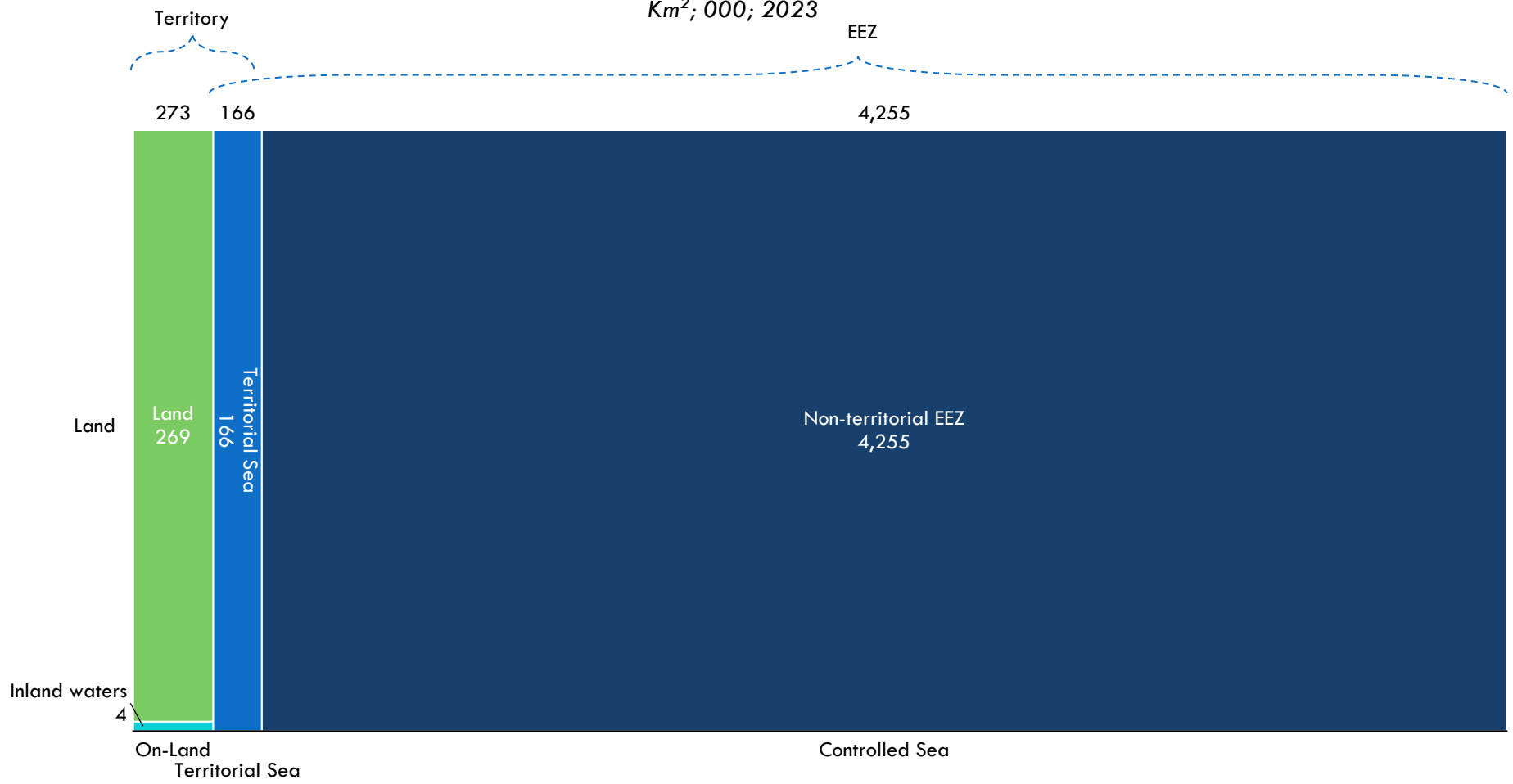
** Excluding the Cook Islands (1.96m) and Niue (0.3m); note: a nautical mile is 1,852 metres; Source: Wikipedia (http://en.wikipedia.org/wiki/Exclusive_Economic_Zone); Sealord; Coriolis analysis*

*94% of the area of the planet controlled by New Zealand is water**

NEW ZEALAND LAND/WATER USE DISTRIBUTION BY TYPE

TOTAL = 4,860km² (000)

Km²; 000; 2023

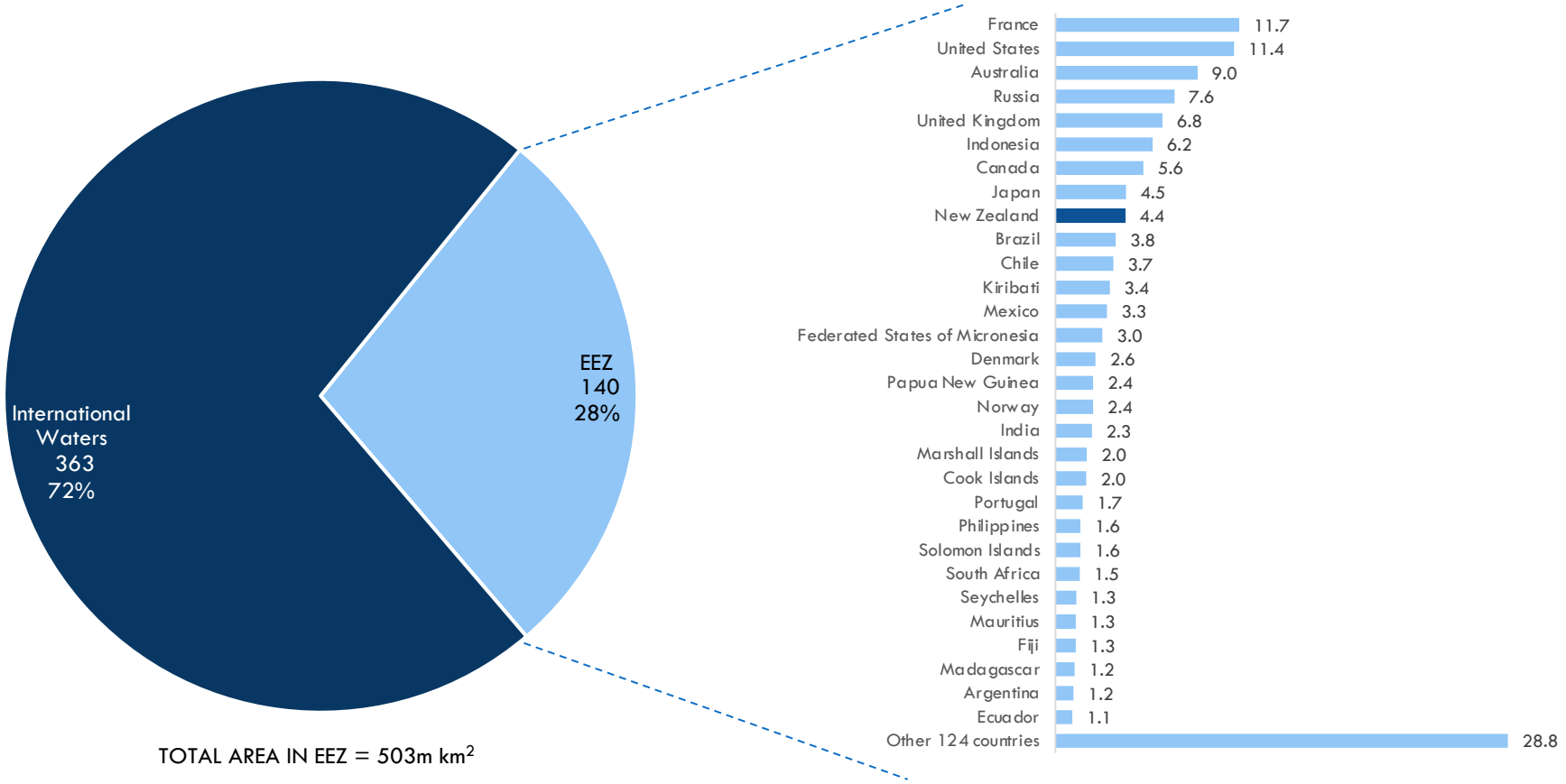


** Excluding Ross Dependency, Niue and Cook Islands; Source: CIA World Fact Book; LINZ; Coriolis analysis and estimates*

New Zealand has the ninth largest area of claimed/controlled ocean space of any country in the world

TOP 30 COUNTRIES AND TOTAL GLOBAL CLAIMED EXCLUSIVE ECONOMIC ZONE (EEZ)

million; km^2; 2023

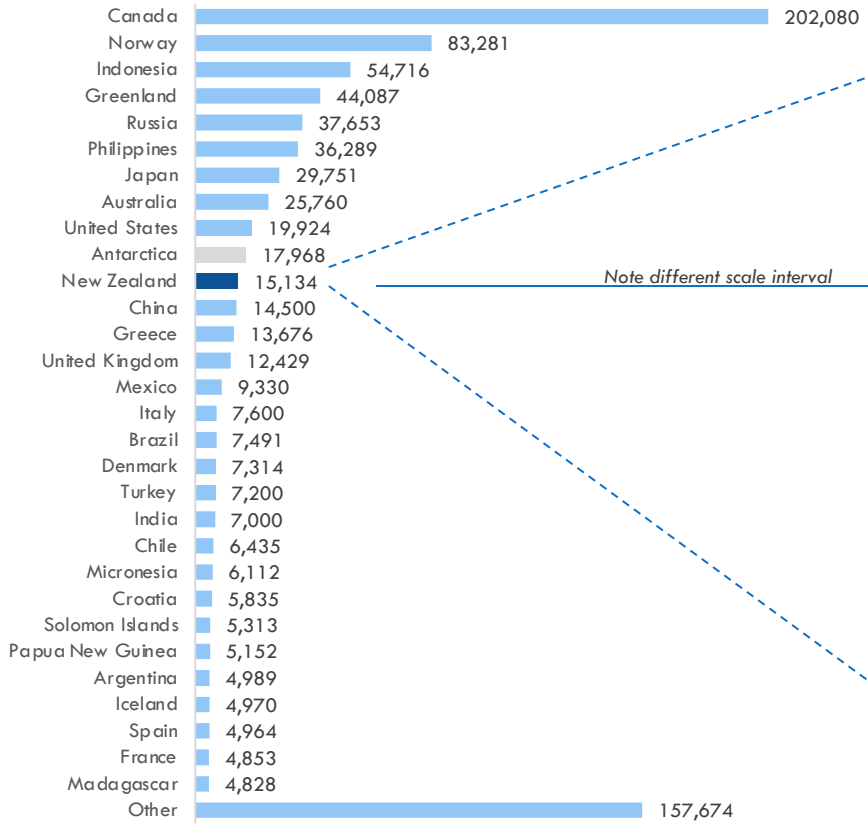


Note: New Zealand excludes the Cook Islands (1.96m) and Niue (0.3m); data is generally claimed; some areas are disputed; Source: Wikipedia (from other sources) [http://en.wikipedia.org/wiki/Exclusive_Economic_Zone]

New Zealand has the tenth largest coastline of any country; Southland, Northland, Auckland and Marlborough stand out

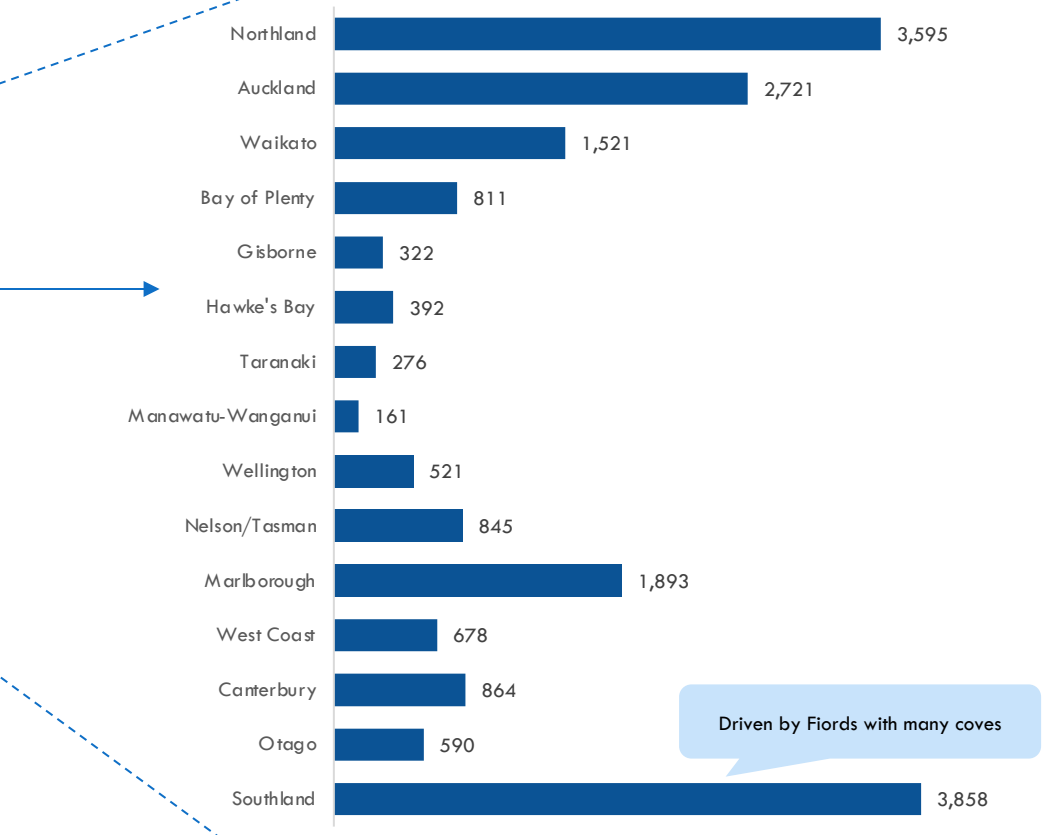
TOP 30 COUNTRIES BY COASTLINE LENGTH

km; 2023



NZ COASTLINE LENGTH BY REGION

km; 2023



Note: coastline lengths are fractal and different scale intervals give different answers; data presented is a constant scale interval on each chart (but not across both) and is generally as claimed; some areas are disputed; total NZ coastline length chart right is 19,049km due to different interval length; Source: CIA World Fact Book (https://www.cia.gov/the-world-factbook/); LINZ; Coriolis analysis

The amount of seafood produced in New Zealand is almost exclusively a function of government regulations (and the economics they create)

KEY DRIVERS: NEW ZEALAND SEAFOOD BIOMASS

WILD CAPTURE

Tonnes of total allowable commercial catch (by managed species)[TACC]

X

% of TACC which is actually captured

=

Tonnes of wild catch seafood of quota species

+

Tonnes of wild catch seafood of non-quota species

=

Tonnes of landed catch

The amount of wild capture seafood removed from the sea is likely close to the sustainable limit (based on current science)

AQUACULTURE

Area where aquaculture is permitted (hectares)

X

Production per hectare of specific species permitted in this area

=

Tonnes of aquaculture seafood

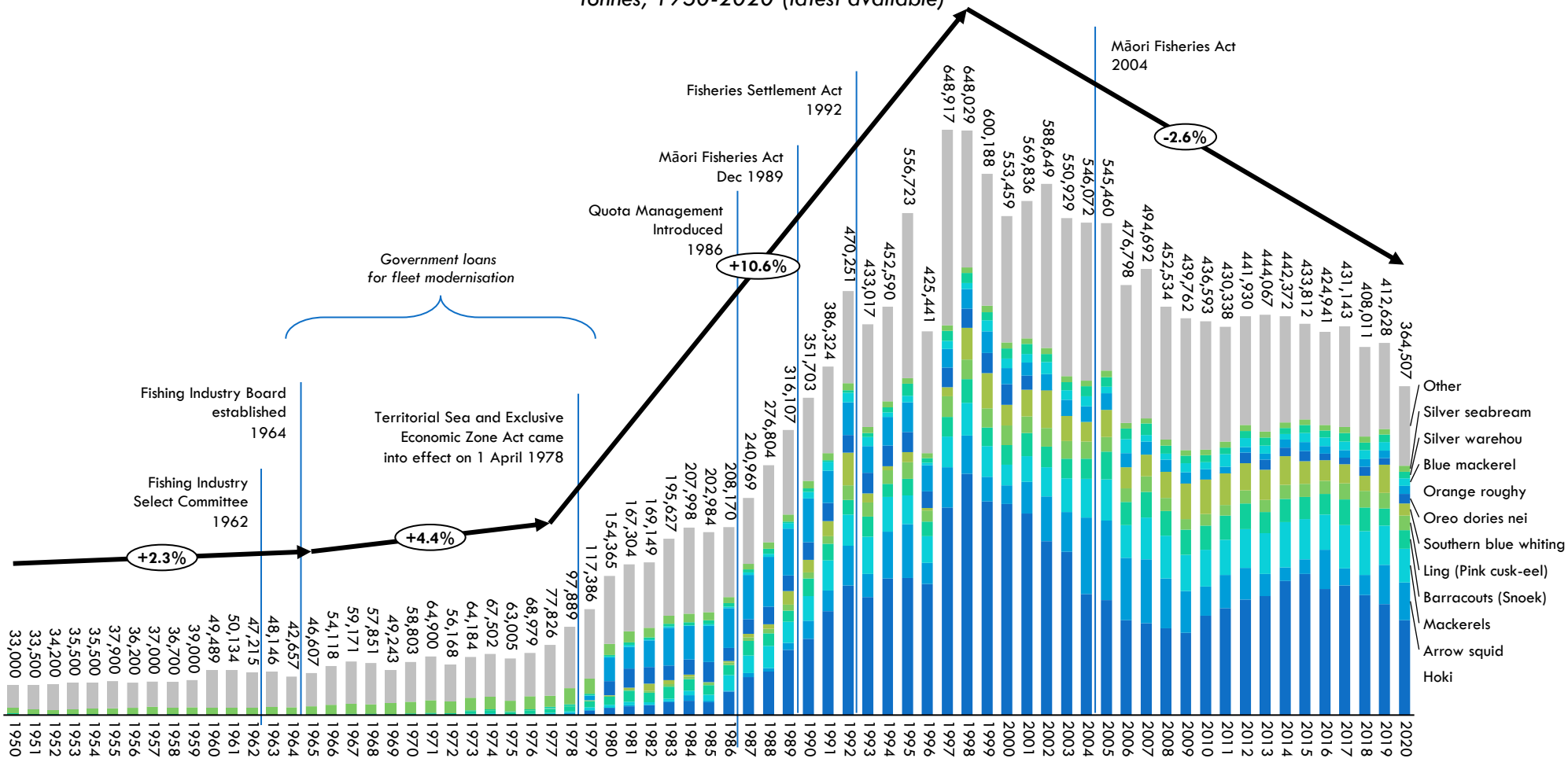
New Zealand could produce 100x or 1,000x more seafood from aquaculture with different rules. Open Ocean Aquaculture is one option to overcome existing issues.

Source: Coriolis research and analysis

New Zealand wild capture production peaked in 1997/98 and has been trending down since as quotas are reduced to maintain stocks

NEW ZEALAND BIOMASS WILD HARVEST FROM WILD CAPTURE

Tonnes; 1950-2020 (latest available)

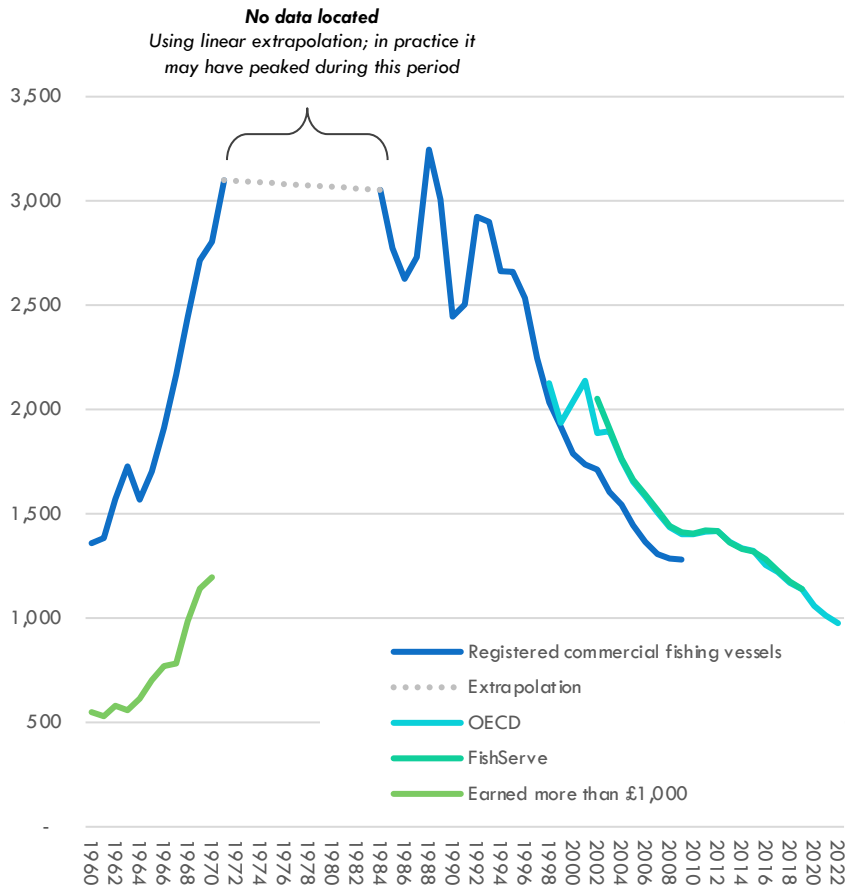


Source: UN FAO Fishstat database; Coriolis classification and analysis

Falling allowable capture and growing economies of scale have led to falling commercial vessel numbers; landed tonnes/vessel has been growing

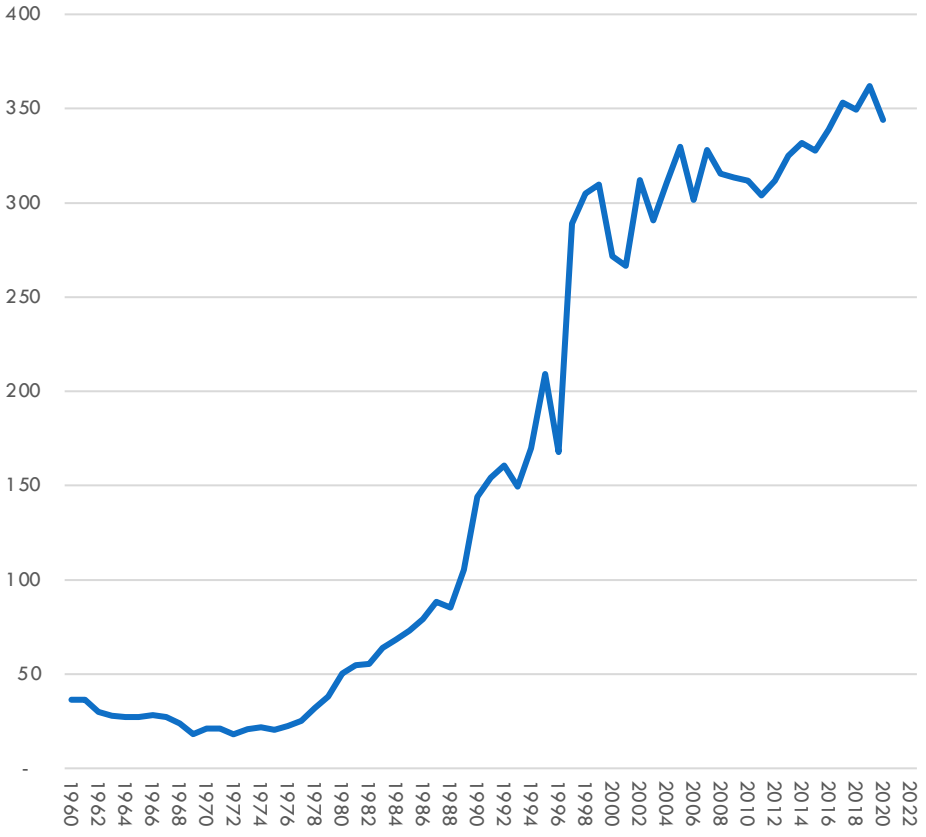
REGISTERED FISHING BOATS IN NZ WATERS

Vessels; 1960-2022



AVERAGE LANDED TONNES PER VESSEL

Tonnes/unit; 1960-2022

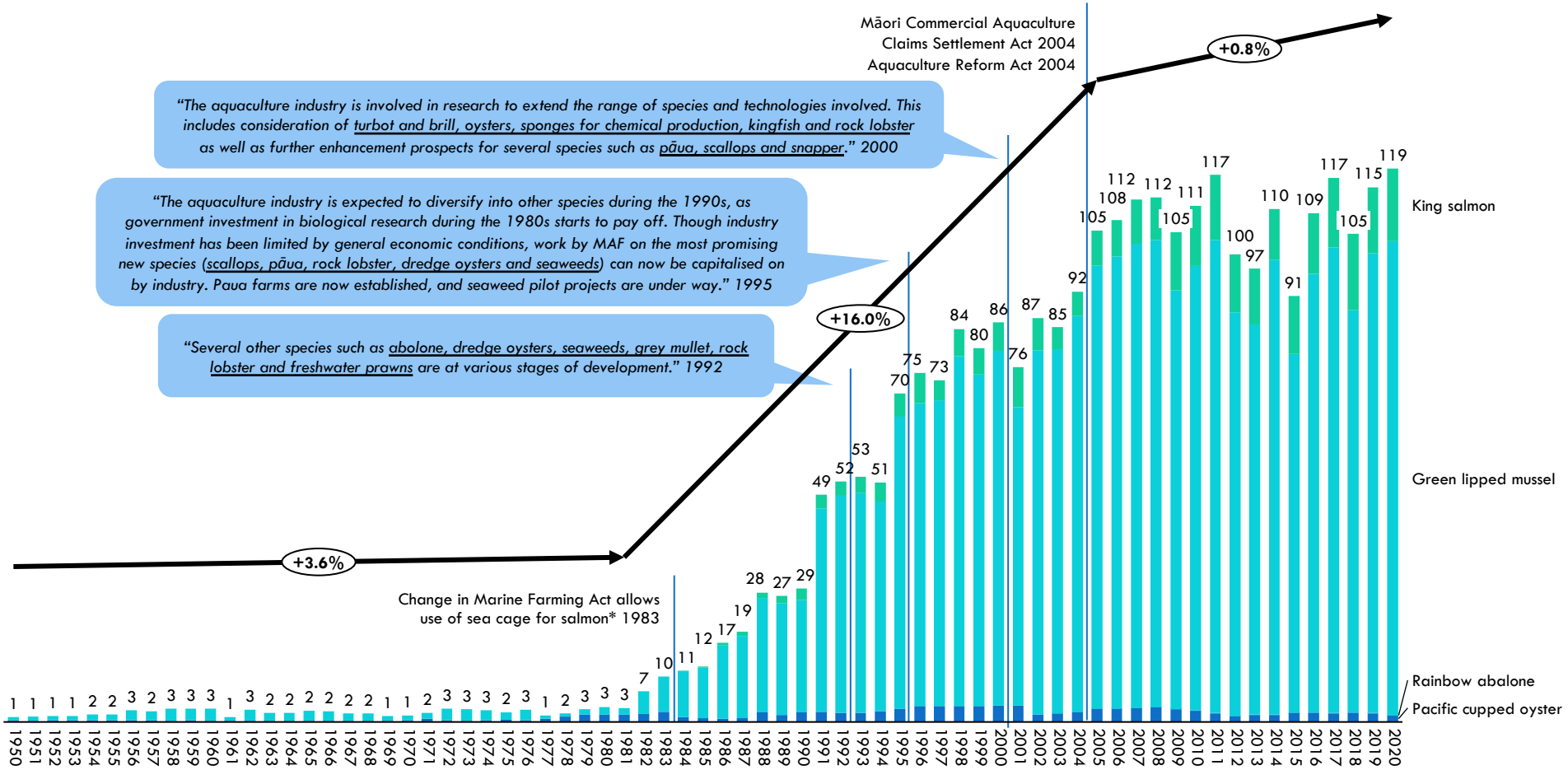


Note: Excludes recreational fishing vessels; Source: Ministry of Fisheries (historical); StatisticsNZ (historical); FishServe; Coriolis analysis

New Zealand aquacultural production grew to around ~2004; growth has stalled since; all new species attempted in the past fifty years have failed

NEW ZEALAND BIOMASS HARVEST FROM AQUACULTURE

Kilotonnes (t; 000); 1950-2020 (latest available)



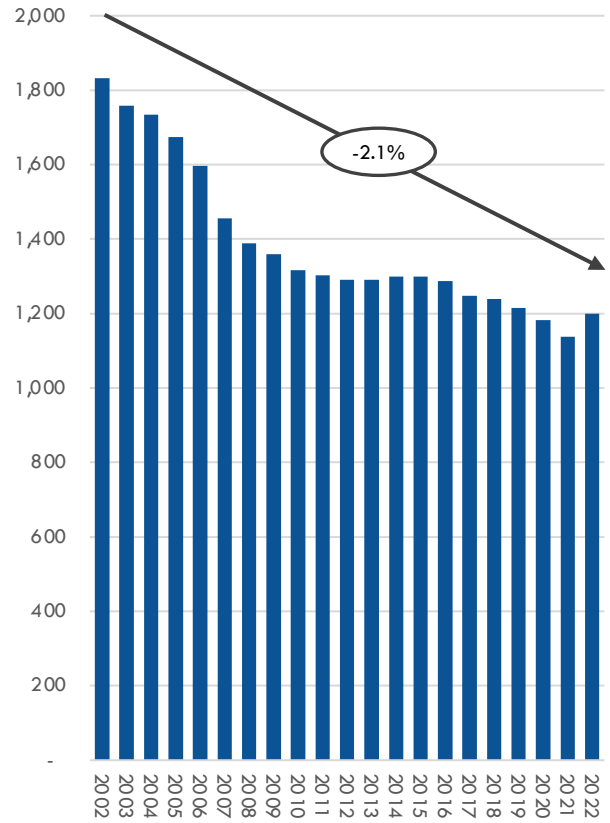
** Prior to this, river and "ocean ranching" of salmon had been conducted in NZ; Source: UN FAO Fishstat database; Coriolis classification and analysis*

The seafood industry has declining unit numbers

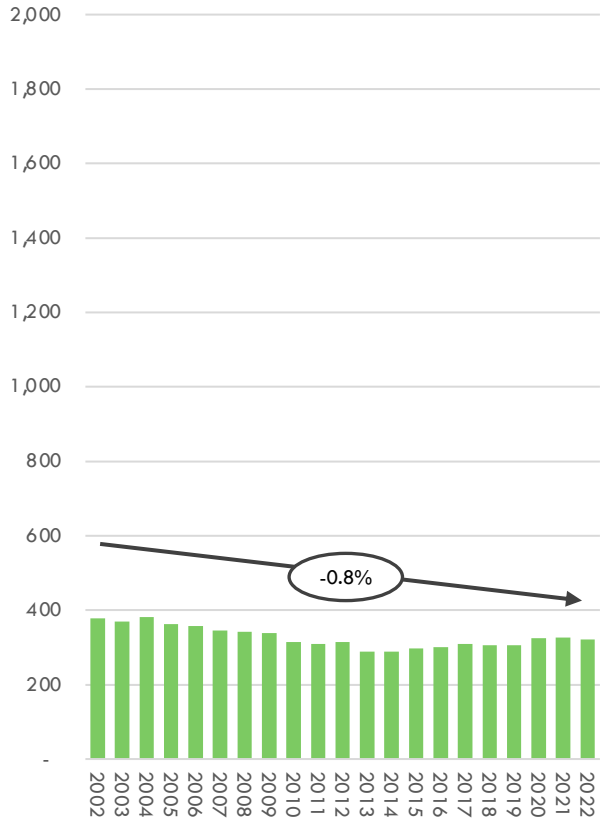
NUMBER OF ACTIVITY/GEOGRAPHIC UNITS BY SECTOR

Business units ("front doors"); 2002-2022

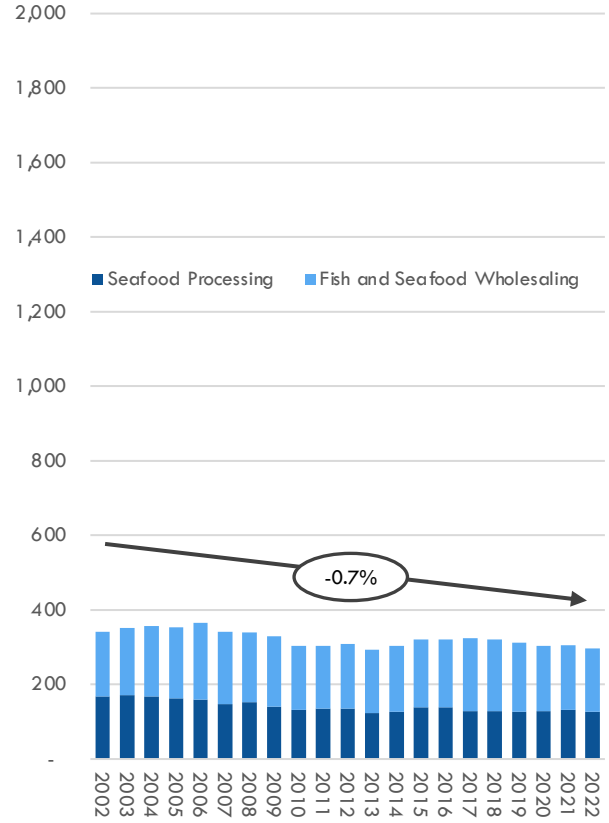
WILD CAPTURE



AQUACULTURE



PRIMARY PROCESSING



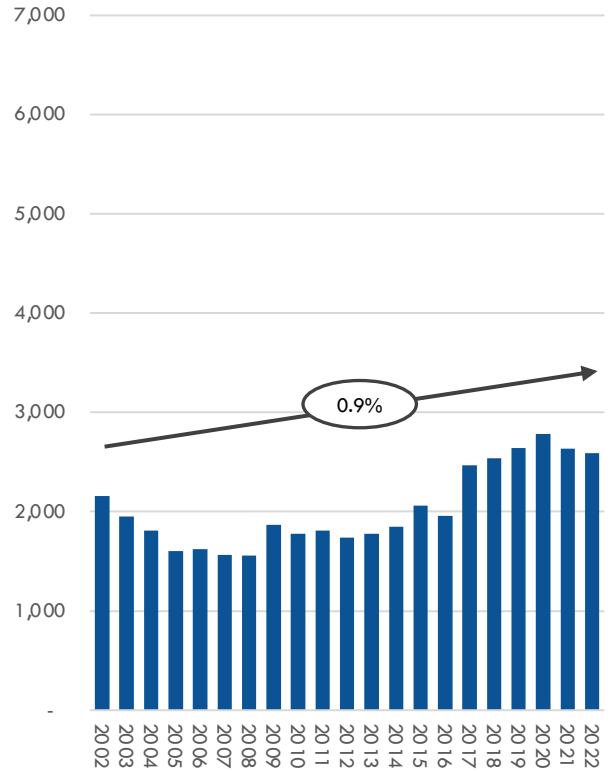
Source: StatisticsNZ (business demographics); Coriolis analysis

The seafood industry has growing employment at sea and on-farm, but declining employment on land in primary processing/handling

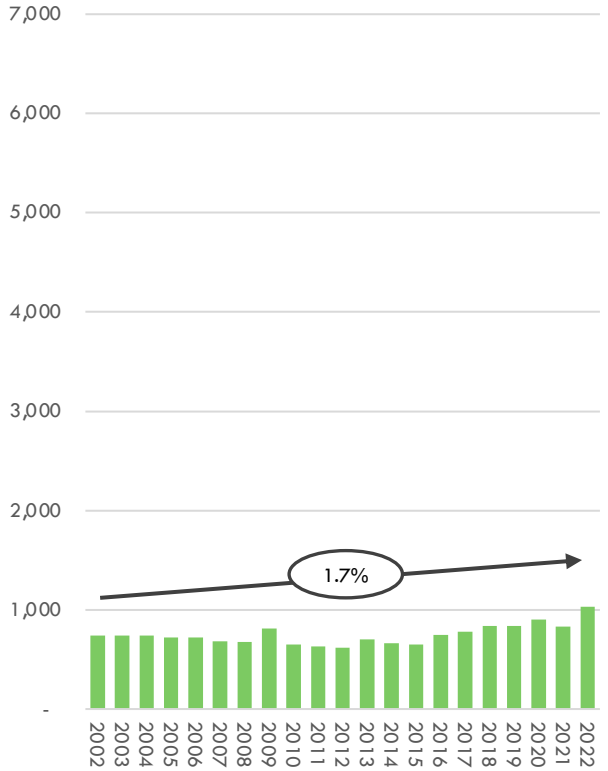
NUMBER OF EMPLOYEES BY SECTOR

Headcount; 2002-2022

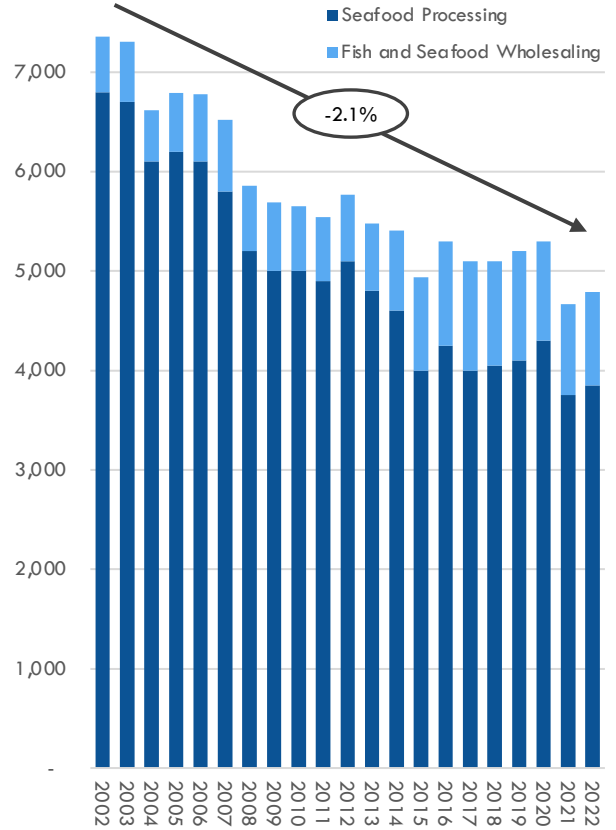
WILD CAPTURE



AQUACULTURE



PRIMARY PROCESSING

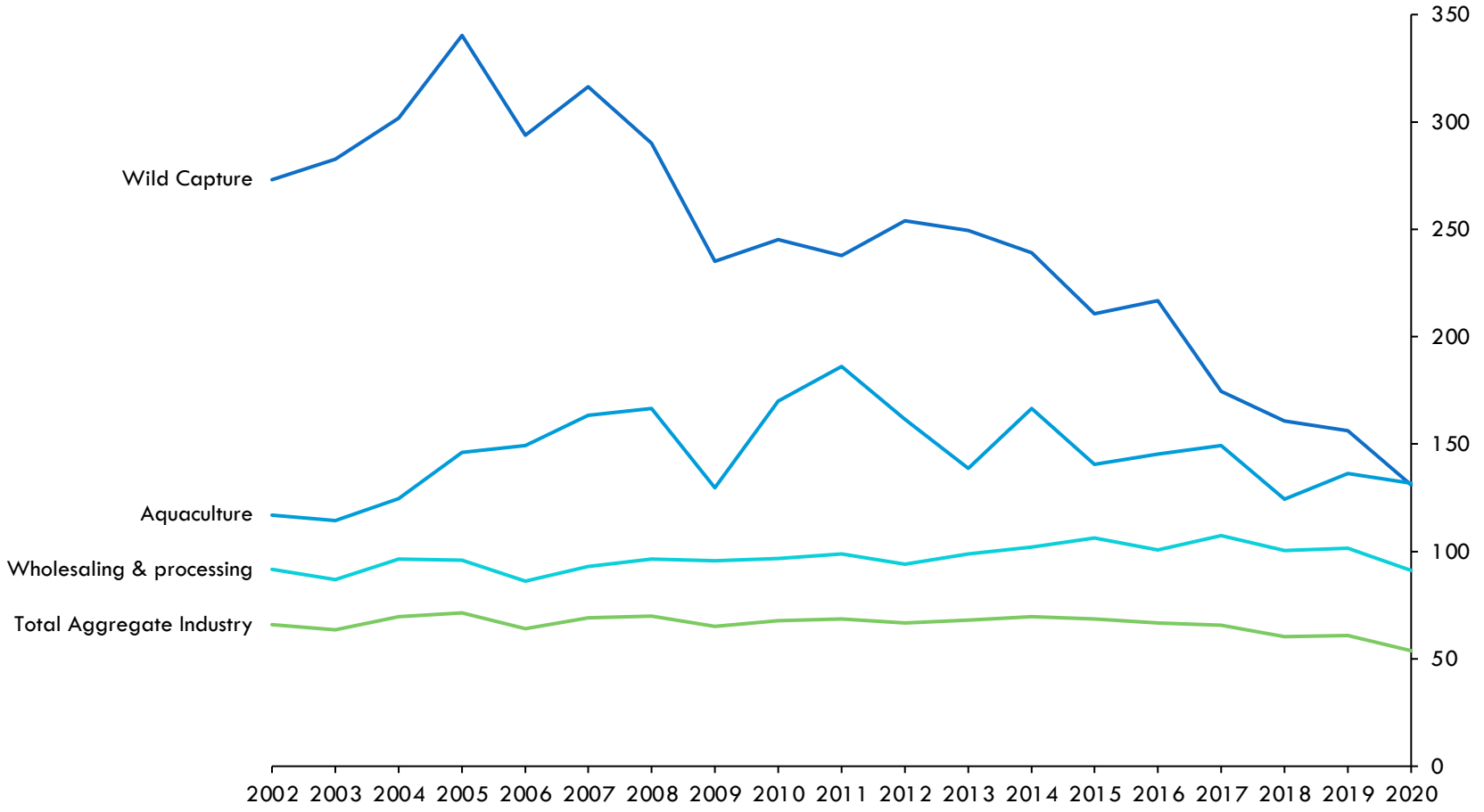


Source: StatisticsNZ (business demographics); Coriolis analysis

The industry is not increasing productivity; tonnes per employee is falling, suggesting further consolidation is likely going forward

TONNES PER EMPLOYEE BY SECTOR

Tonnes/headcount; 2002-2020 (latest available)



Source: StatisticsNZ (business demographics); UN FAO Fishstat database; Coriolis classification and analysis

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A scan of marine bioactives production and branding was conducted to assess which products were the market leaders

PRESENCE OF PRODUCT IN RANGE (COUNT)

LARGE

GREENSHELL MUSSELS (24)

Extractors/Processors (8)
Brands (16)

MEDIUM

MARINE COLLAGEN (15)

Extractors/Processors (6)
Brands (9)

FISH OIL (15)

Extractors/Processors (3)
Brands (12)

SMALL - OTHER MARINE PRODUCTS

KRILL OIL (9)	SHARK CARTILAGE (6)	SHARK OIL / SQUALENE (5)	ABALONE OIL/ POWDER (5)	OYSTER OIL/ POWDER (5)	FISH CALCIUM (3)
E (2) B (7)	E (2) B (4)	E (1) B (4)	E (2) B (3)	E (2) B (3)	E (2) B (1)

EMERGING

ALGAE
SEA CUCUMBER

**Presence of, not volumes; count of companies manufacturing and producing product, brands (specialists and generalists) selling products; Total 9 processors/extractors and 15 brands; See charts in Appendix for detail*

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New Zealand is a secondary mussel producer where growth has stalled

Mussels are a large family of bivalves; "blue" (Mytilus) and "green" (Pena) are the major aquaculture families

Mussels are produced globally from both wild capture and aquaculture

- Blue mussels dominate wild collection of mussels and wild collection is centered in Europe and the Americas
- Mussel aquaculture is centered in China, Chile and Europe
- New Zealand accounts for 4% of global mussel aquaculture

Mussel production is growing through large expansions in aquaculture in China and Chile

- Global mussel production is growing, driven by growing aquaculture production; wild capture continues to drift down
- Declines in global wild mussel capture have come from overfishing, particularly in Europe and SE Asia
- Global production of mussels in aquaculture is growing strongly driven by China and Chile; New Zealand production "going nowhere"
- It is quite clear that the plateau in New Zealand mussel production is a domestic issue when New Zealand is compared with Chile that has continued to grow
- Mussel aquaculture is well developed in China, Chile and Spain; New Zealand is a larger second tier producer

The global mussel market had a "farmgate"/dockside value of $3.0b in 2021; the industry was hit hard by COVID, with value falling by a third

NOTE: This is a text based summary; please see pages elsewhere in this section for the specific sources for any claims or numbers given here

Mussels are a large family of bivalves; "blue" (Mytilus) and "green" (Pena) are the major aquaculture families

"BLUE" (MYTILUS)

MYTILUS EDULIS
Blue mussel

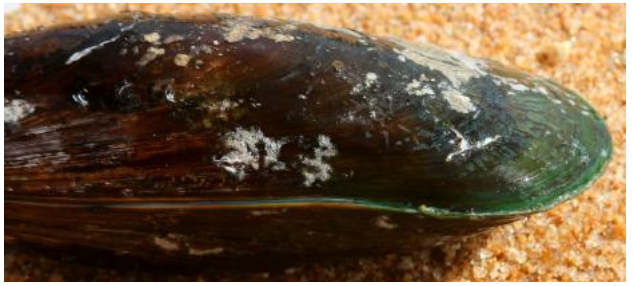
MYTILUS GALLOPROVINCIALIS
Mediterranean mussel

MYTILUS PLATENSIS
Chilean mussel

MYTILUS UNGUICULATUS/CORUSCUS
Korean mussel
Hard-shelled mussel

"GREEN" (PERNA)

PERNA VIRIDIS
Green mussel
Asian green mussel



PERNA CANALICULUS
New Zealand green-lipped mussel
New Zealand greenshell™ mussel
Kuku / Kutak

SELECT SPECIES

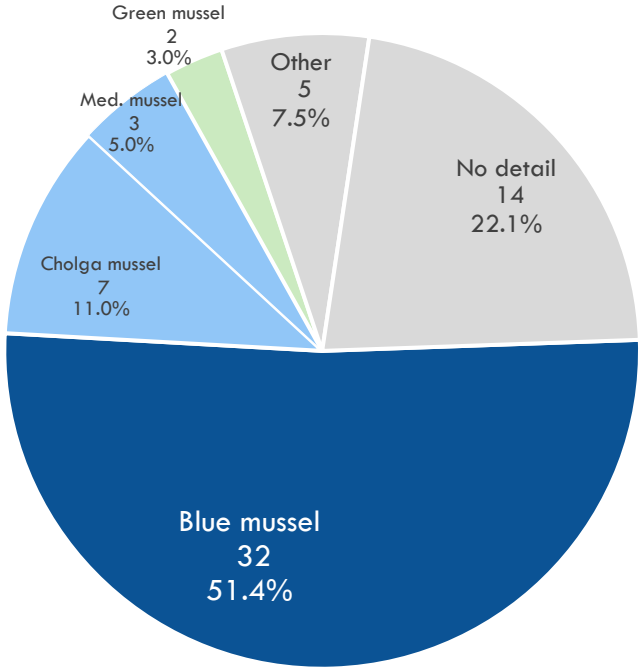
Note: Other minor members of the family not shown; Source: Fishbase; UN FAO Fishstat; Wikipedia; photo credit (CC-BY SA 3.0)

Blue mussels dominate wild capture; China and Chilean dominate aquaculture

GLOBAL MUSSEL PRODUCTION BY MAJOR TYPE: WILD VS. AQUACULTURE

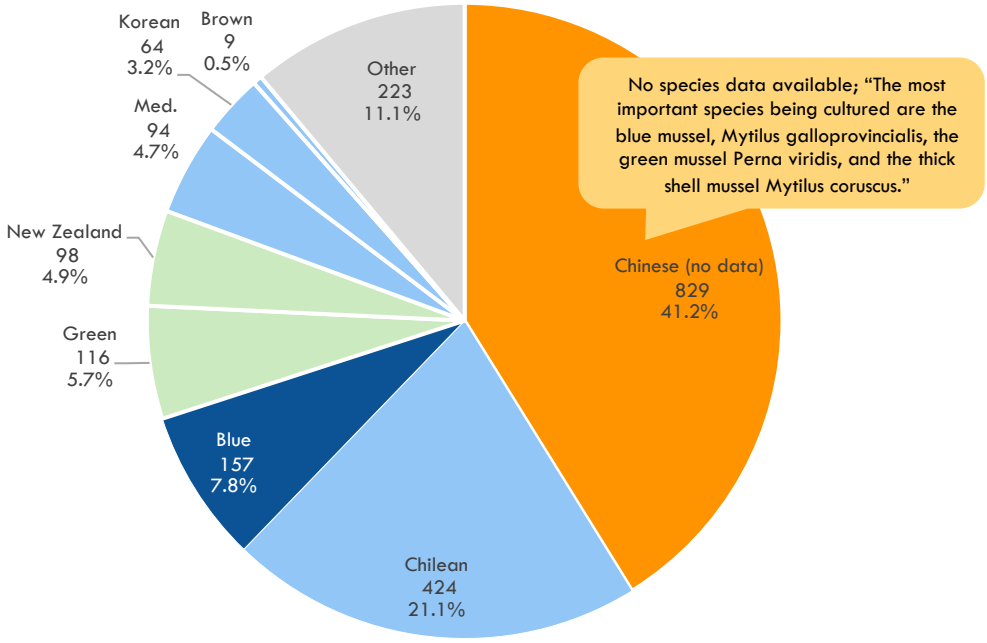
T; 000; live weight; 2021

WILD



TOTAL = 62kt

AQUACULTURE



TOTAL = 2,015kt

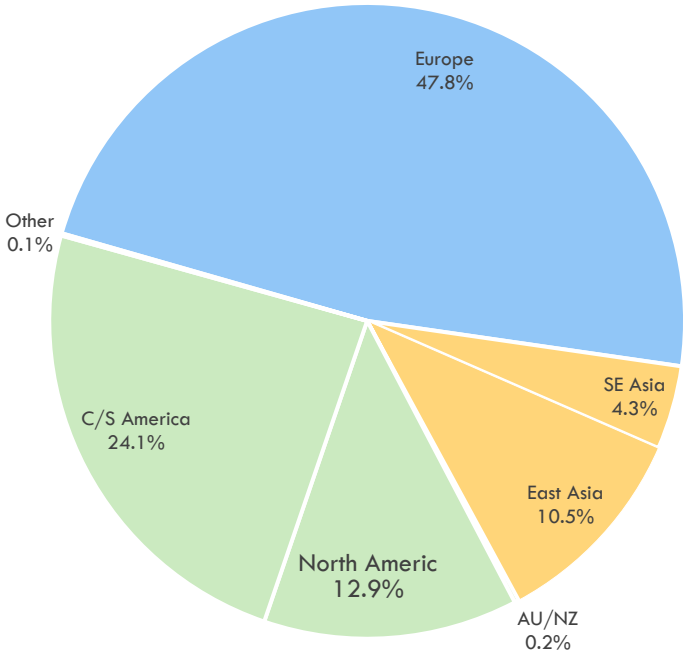
Other is unlisted species and NEI: Not Elsewhere Indicated (indicated another species or no further information); Source: FAO FishStat; Coriolis analysis

Wild mussel collection is centered in Europe and the Americas, where as aquaculture is centered in China, Chile and Europe

GLOBAL MUSSEL PRODUCTION BY REGION/COUNTRY: WILD VS. AQUACULTURE

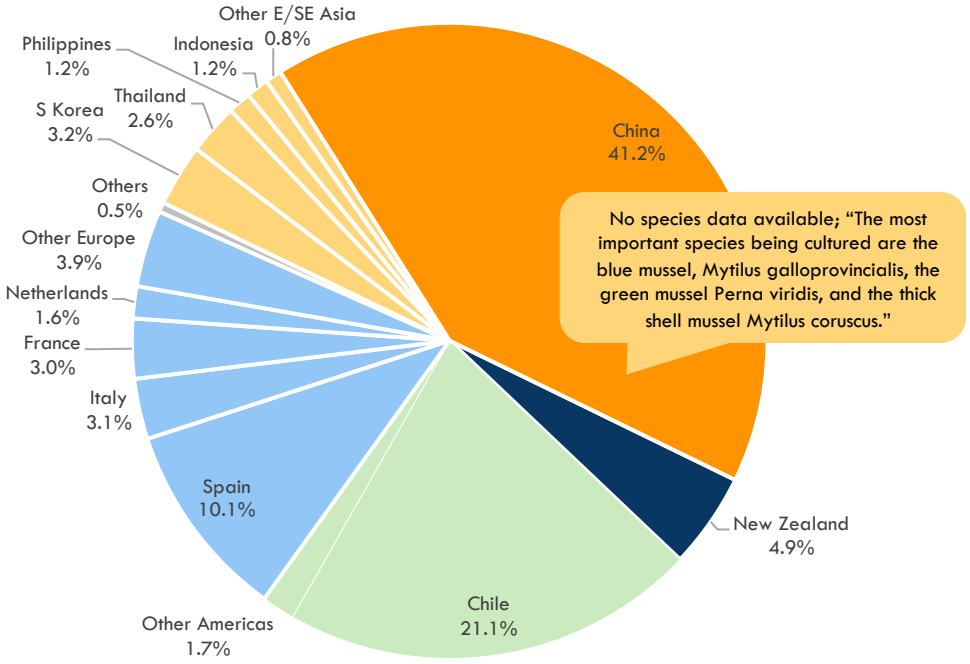
T; 000; live weight; 2021

WILD



TOTAL = 62kt

AQUACULTURE



TOTAL = 2,015kt

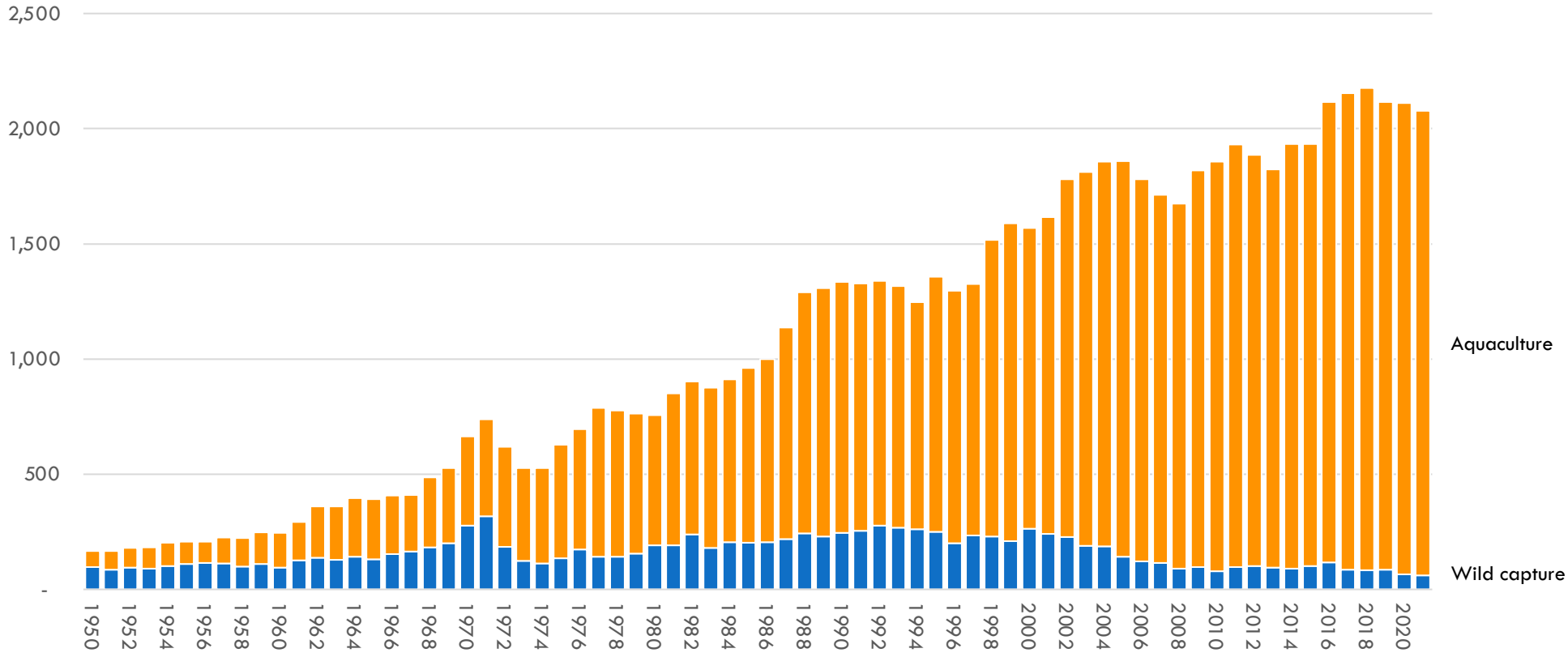
Source: FAO FishStat; Coriolis analysis

LARGE

Global mussel production is growing, driven by growing aquaculture production; wild capture continues to drift down

AGGREGATE GLOBAL MUSSEL PRODUCTION: WILD VS. AQUA

Tonnes; 000; live weight; 1950-2021

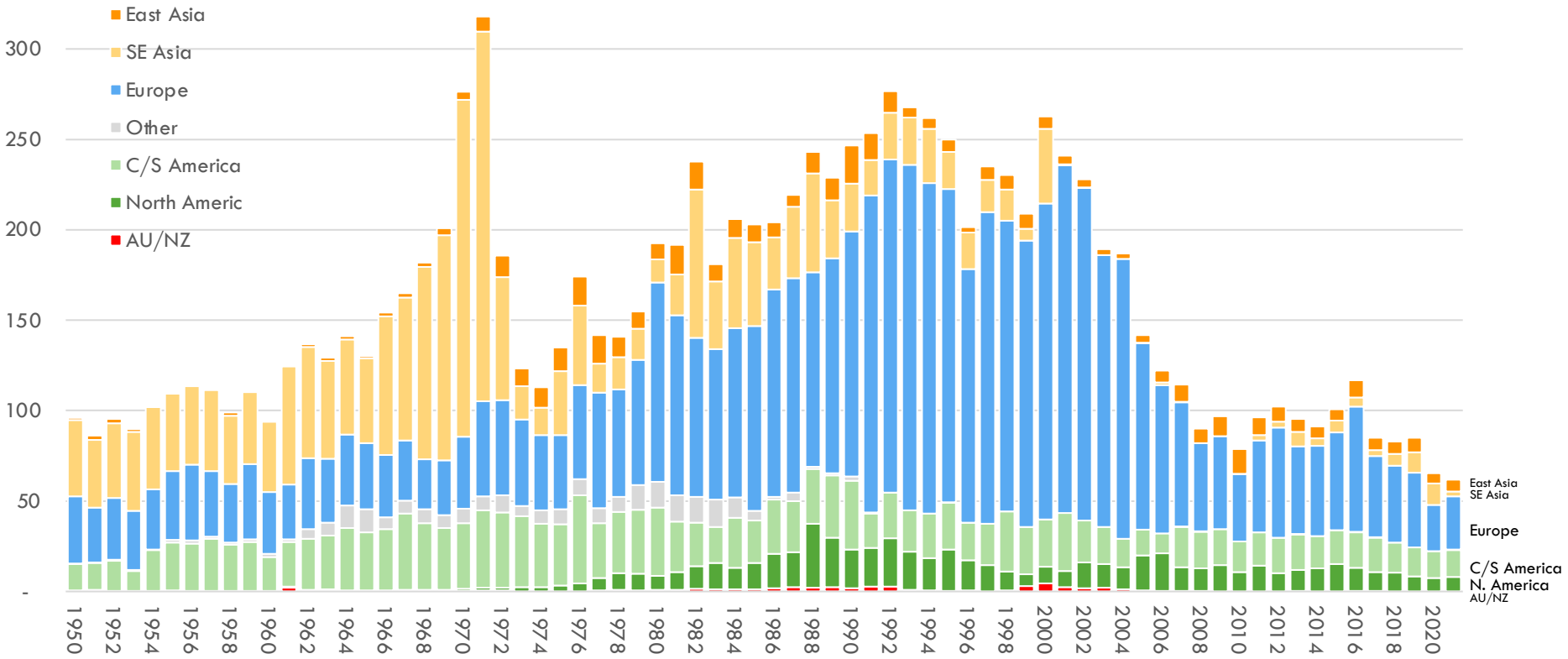


Source: FAO FishStat; Coriolis analysis

Declines in global wild mussel capture have come from overfishing, particularly in Europe and SE Asia

AGGREGATE GLOBAL MUSSEL WILD CAPTURE PRODUCTION

Tonnes; 000; 1950-2021

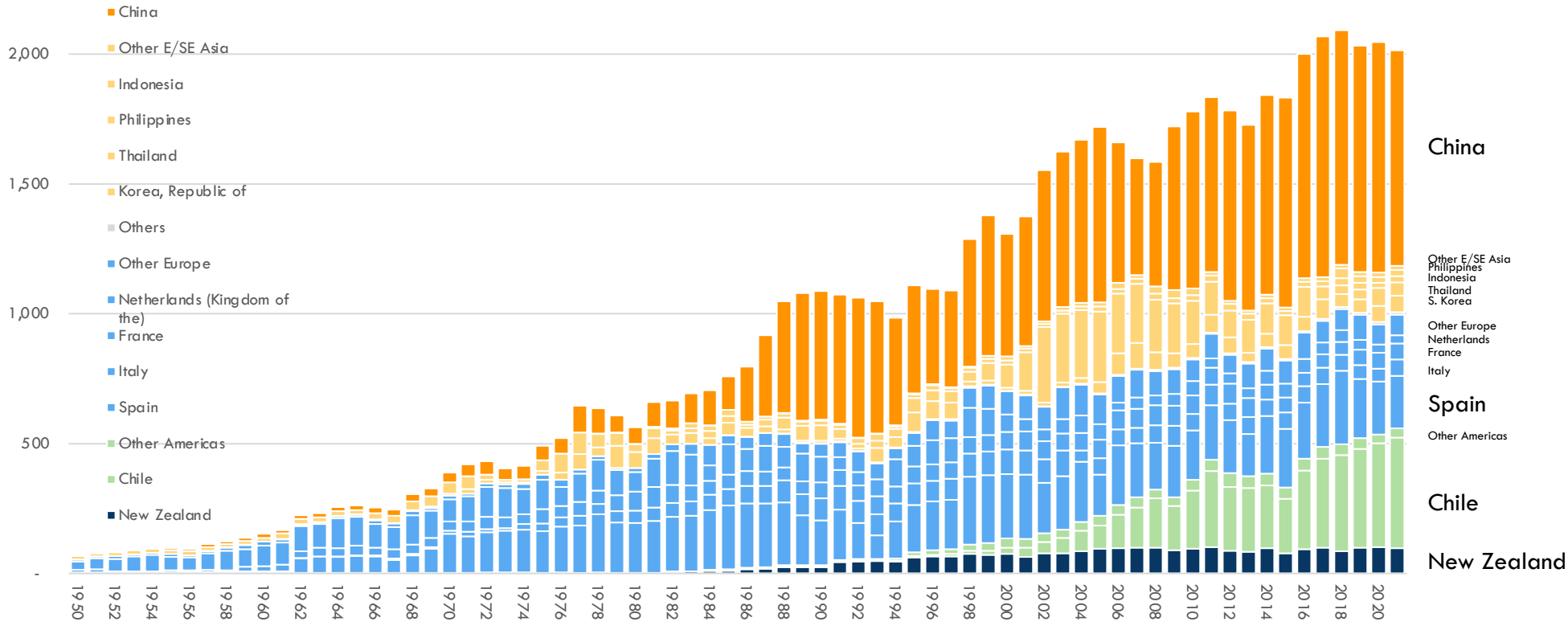


Source: FAO FishStat; Coriolis analysis

Global production of mussels in aquaculture is growing strongly driven by China and Chile; New Zealand production "going nowhere"

AGGREGATE GLOBAL MUSSEL AQUACULTURE PRODUCTION

Tonnes; 000; 1950-2021

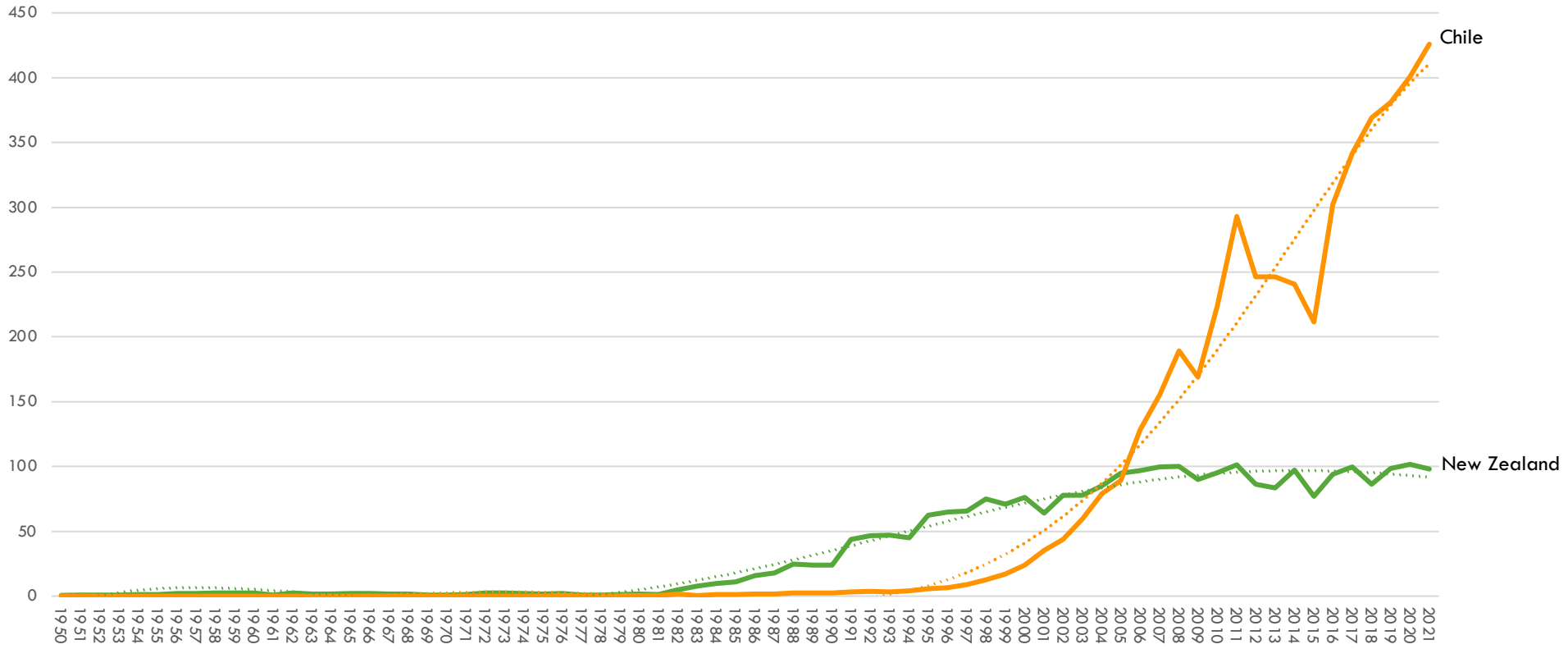


Source: FAO FishStat; Coriolis analysis

It is quite clear that the plateau in local mussel production is a domestic issue when New Zealand is compared with Chile that has continued to grow

AQUACULTURE MUSSEL PRODUCTION: NEW ZEALAND VS. CHILE

Tonnes, 000; Greenweight; 1950-2021



Source: UN FAO Fishstat; MPI; Coriolis analysis

Mussel aquaculture is well developed in China, Chile and Spain; New Zealand is a larger second tier producer

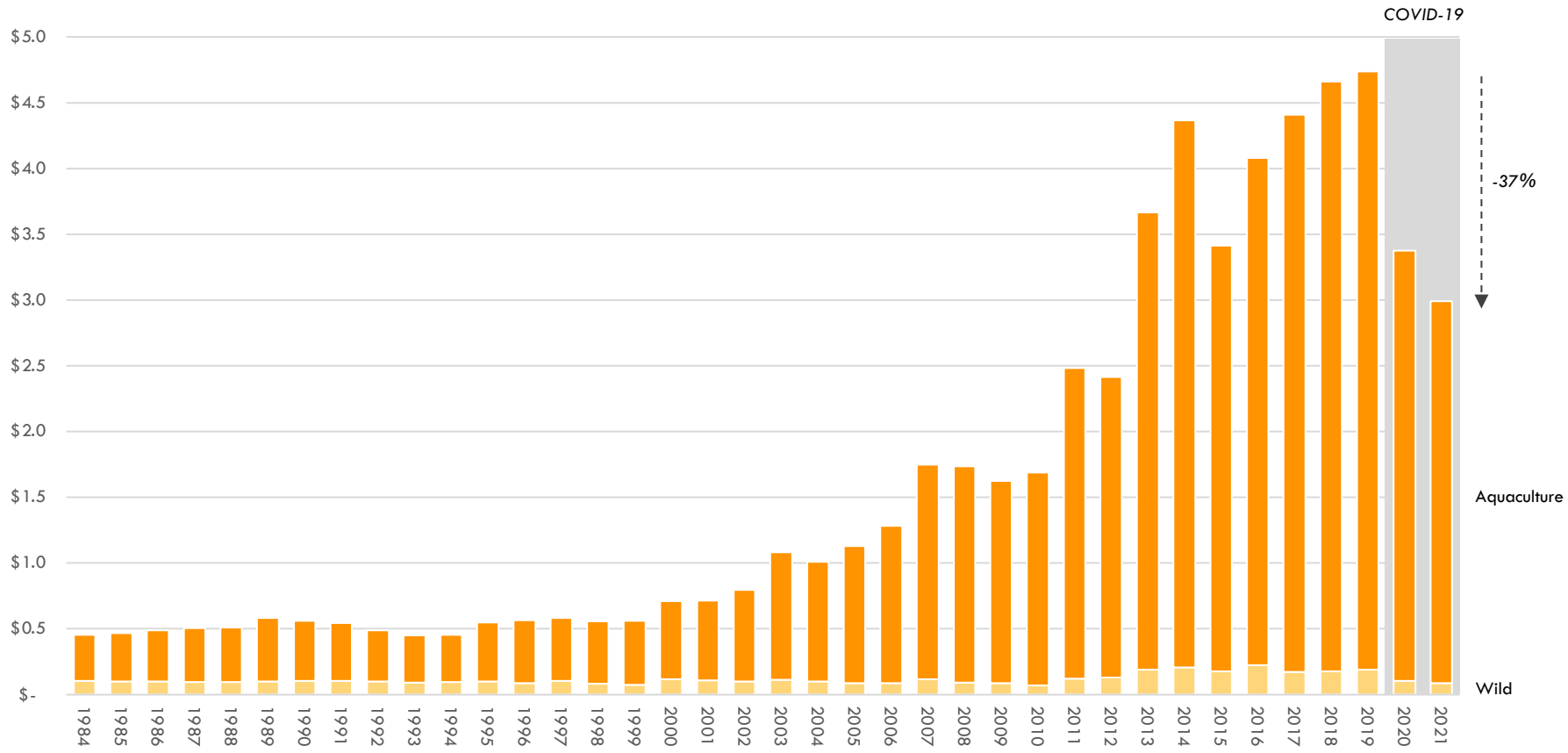
MAJOR	SECONDARY			TRIALS/EARLY STAGES
CHINA 829kt	NZ 98kt	ITALY 62kt	FRANCE 61kt	30 OTHER COUNTRIES
CHILE 426kt	S. KOREA 64kt	NETH. 33kt	THAILAND 52kt	FAILED
SPAIN 203kt	INDONESIA 23kt	PHILIPPINES 24kt	CANADA 23kt	16 COUNTRIES

Source: UN FAO Fishstat; Coriolis analysis

The global mussel market had a "farmgate"/dockside value of $3.0b in 2021; the industry was hit hard by COVID, with value falling by a third

GLOBAL MUSSEL VALUE BY PRODUCTION TYPE

US$; b; 1984-2021



Source: UN FAO Fishstat; UN Comtrade; Coriolis estimates, analysis and modelling

The New Zealand mussel industry is focused on adding value to existing volumes rather than adding new capacity

New Zealand has a large and mature mussel industry

- New Zealand mussel production appears to have plateaued in the 80-100kt range for the last twenty years
- The New Zealand mussel industry has a farmgate value of $627m and an export value of $300m; size of intermediate stages unclear at this point

New Zealand mussel products export are growing value on flat-to-declining volumes

- New Zealand mussel exports are achieving growing prices and growing total value on flat-to-declining volume (since the mid 2000s)
- In volume terms, export markets take predominantly frozen half shell, followed by live, frozen meat and frozen whole
- Prices are up for traditional mussel products, down for powders and very high for mussel oils
- In value terms, export markets take predominantly frozen half shell, followed by various whole mussel products and nutraceuticals (mussel oil and powder)

Drilling in on high value nutraceuticals, first mussel oil

- Overall, mussel oil value and volume have been trading in a band since 2016; the United States appears to be the most stable market
- Prices have converging across markets to around ~$2,000/kg for the past five years

Drilling in on high value nutraceuticals, second mussel powder

- Overall, mussel powder volumes and values were trending up through 2021; there has been a clear COVID impact in 2022
- Mussel powder export prices are trending flat-to-down across all markets; Japan stands out as a market that pays premium prices

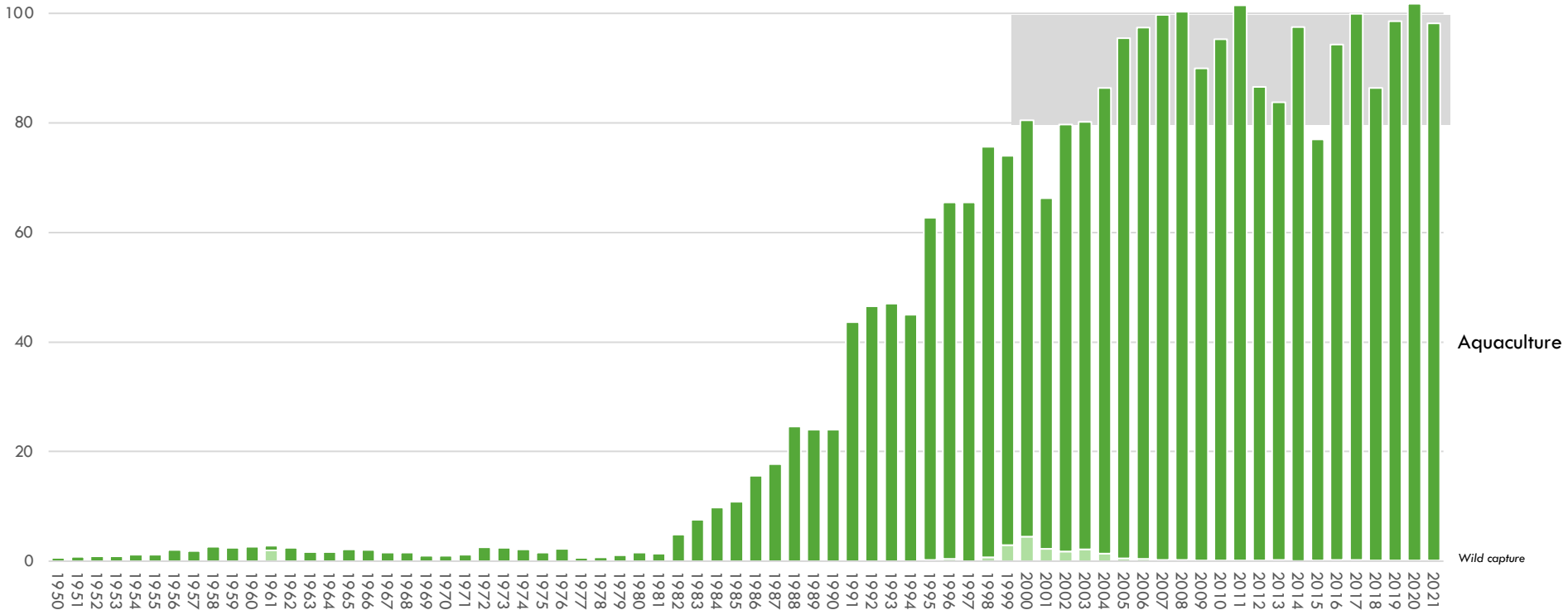
NOTE: This is a text based summary; please see pages elsewhere in this section for the specific sources for any claims or numbers given here

LARGE

New Zealand mussel production appears to have plateaued in the 80-100kt range for the last twenty years

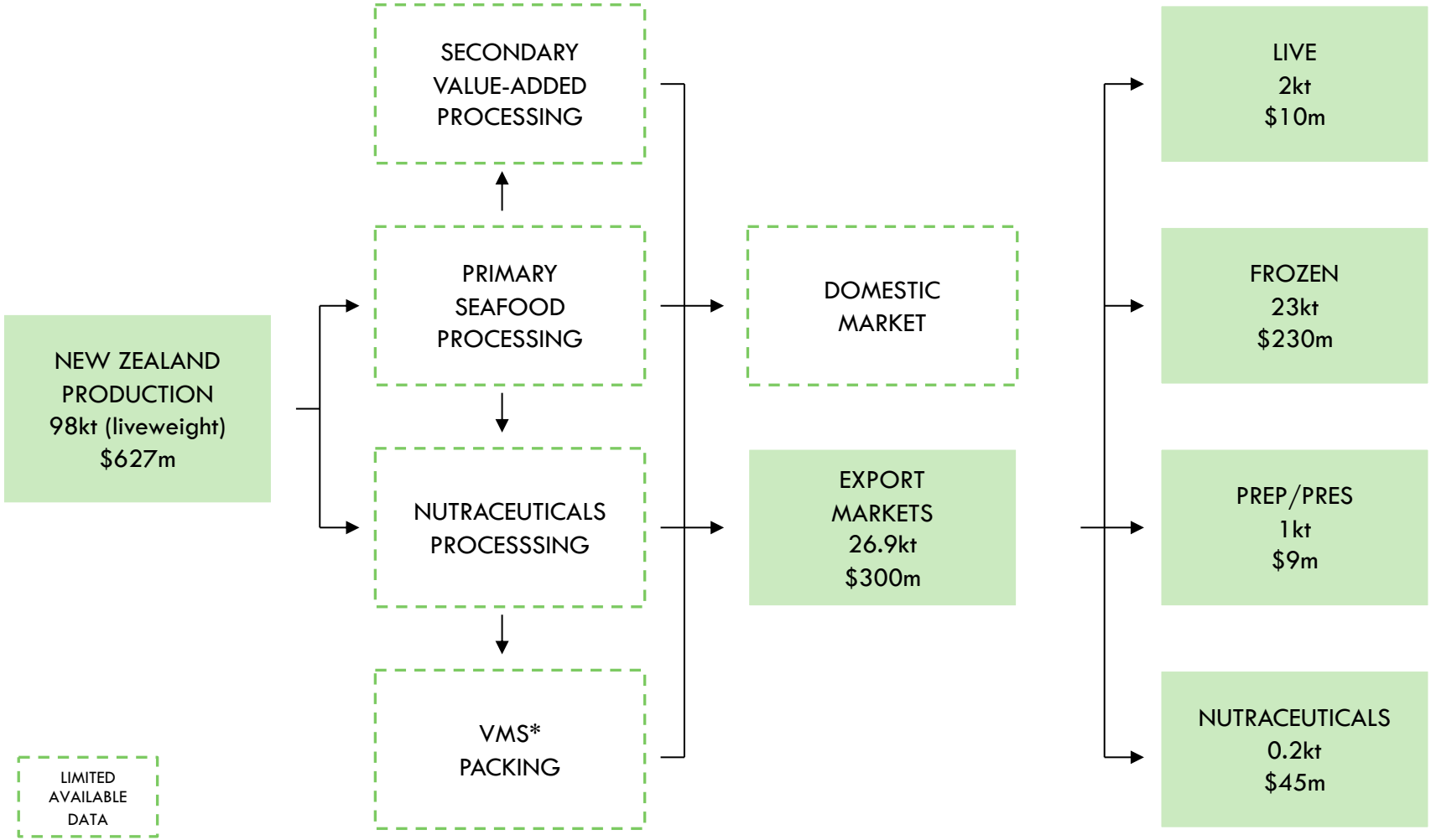
NEW ZEALAND MUSSEL PRODUCTION

Tonnes; 000; greenweight; 1950-2021



Source: UN FAO Fishstat; MPI; Coriolis analysis

The New Zealand mussel industry has a farmgate value of $627m and an export value of $300m; size of intermediate stages unclear



Note: not all exports shown (chart excludes other 0.2kt/$6m); Source: MPI; UN Fishstat; SNZ Infoshare; Coriolis analysis

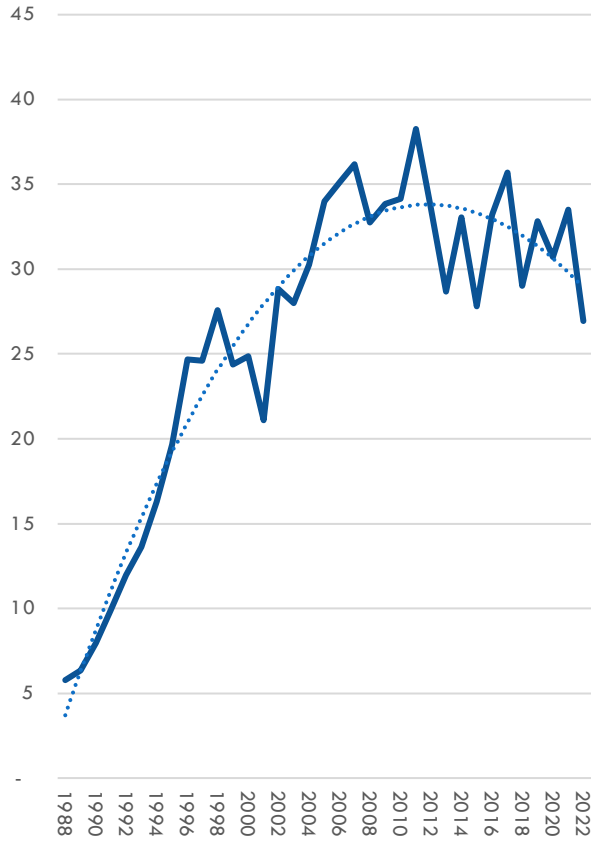
LARGE

New Zealand mussel exports are achieving growing prices and growing total value on flat-to-declining volume (since the mid 2000s)

MUSSEL EXPORTS (ALL FORMS)

EXPORT VOLUME

Tonnes; 000; 1988-2022

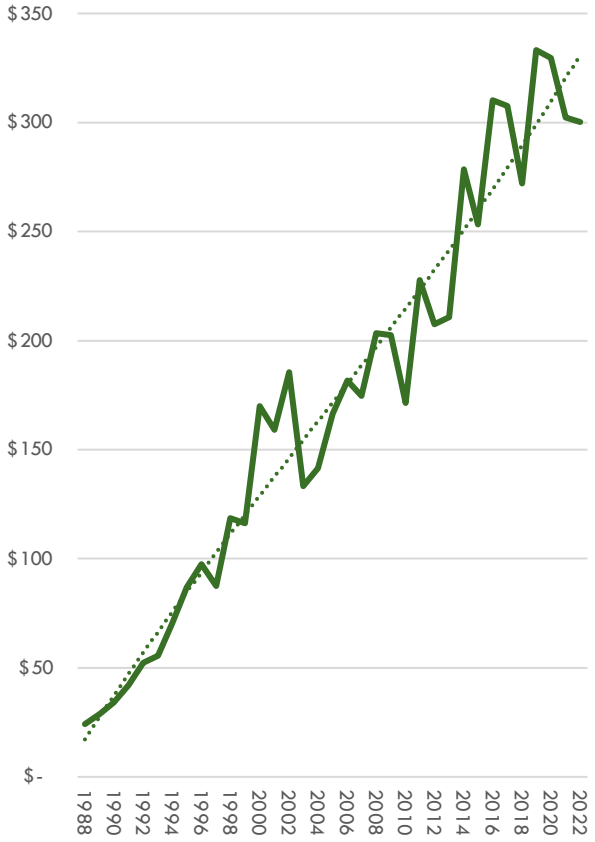


EXPORT PRICE

NZ$/kg; 1988-2022

EXPORT VALUE

NZ$; 000; 1988-2022



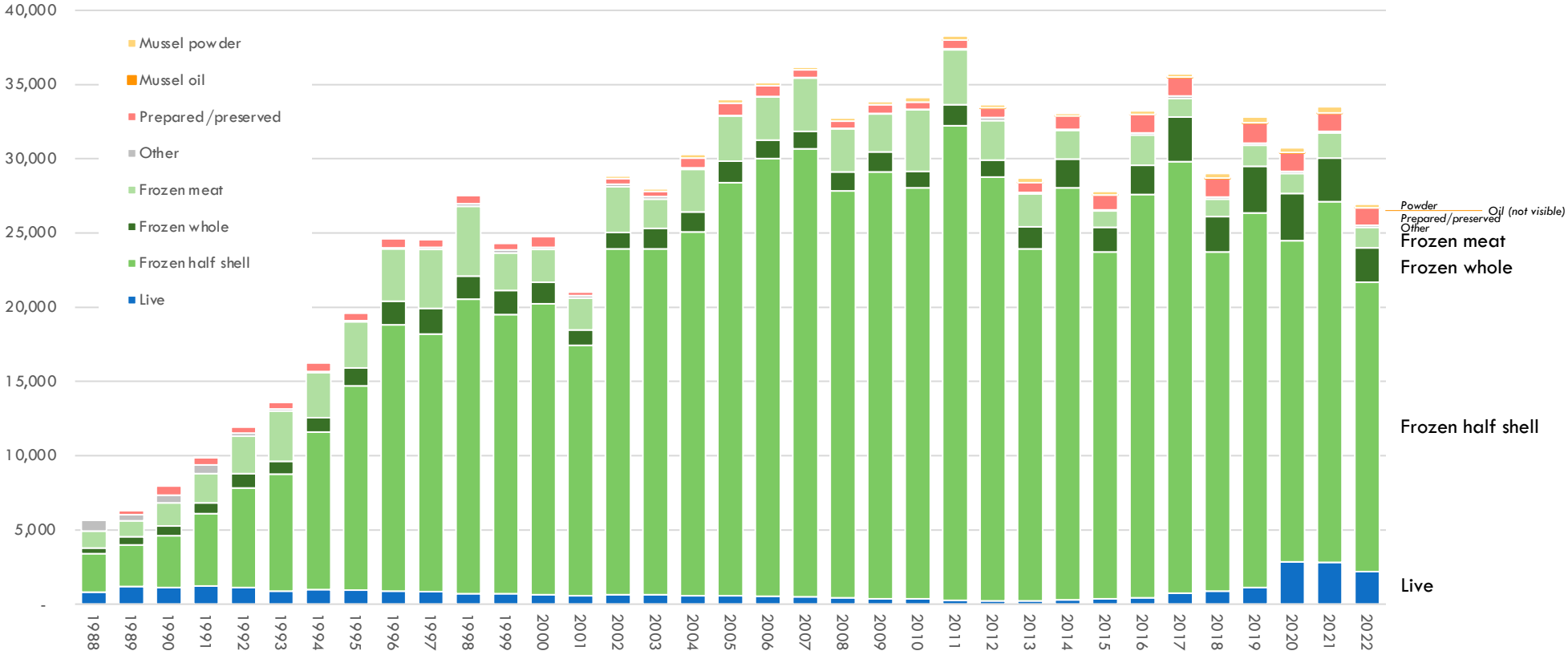
Source: SNZ Infoshare; Coriolis analysis

LARGE

In volume terms, export markets take predominantly frozen half shell, followed by live, frozen meat and frozen whole

NEW ZEALAND MUSSEL EXPORT VOLUME BY FORM

Tonnes; 1988-2022

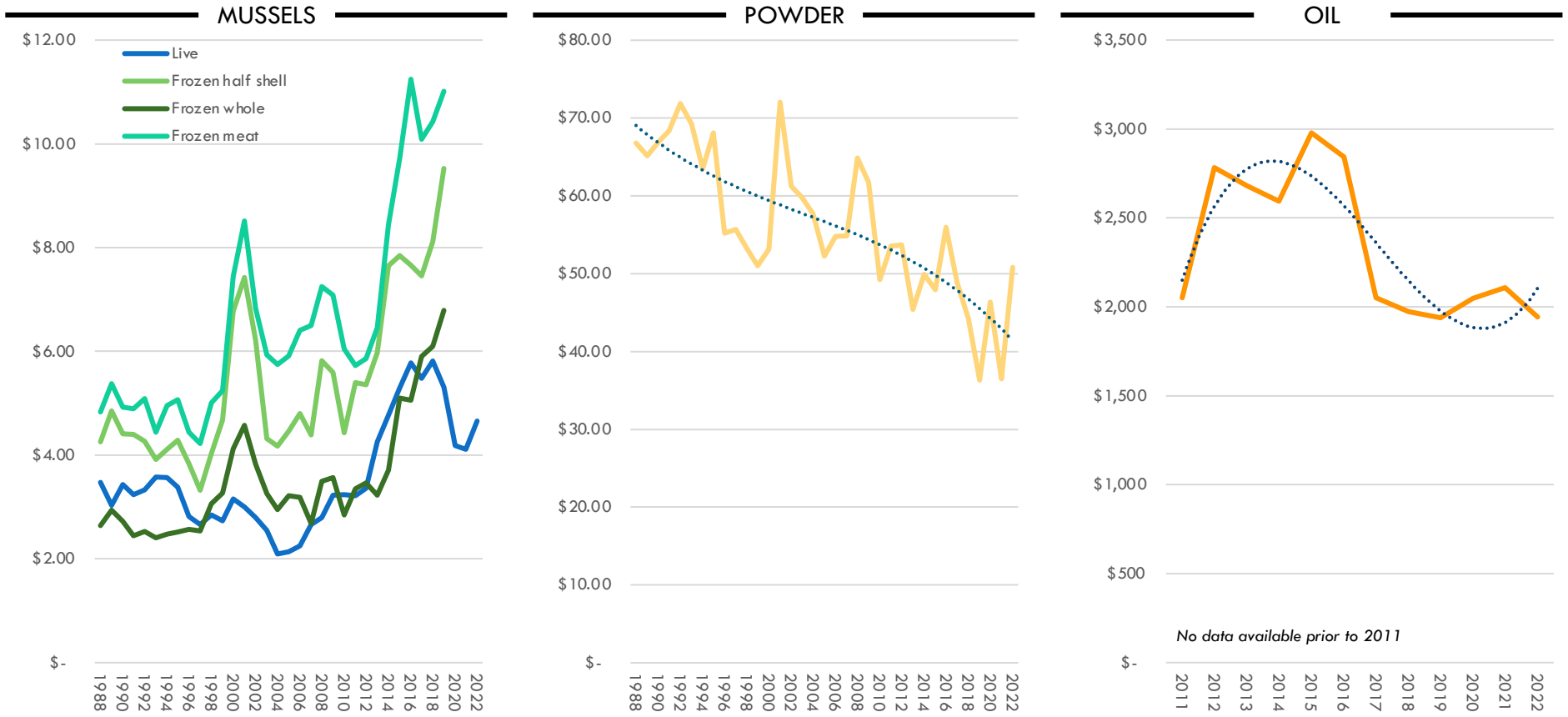


Source: SNZ Infoshare; Coriolis classification and analysis

Prices are up for traditional mussel products, down for powders and very high for mussel oils

NEW ZEALAND MUSSEL PRODUCTS AVERAGE EXPORT PRICES BY FORM

NZ$/kg; 1988-2022



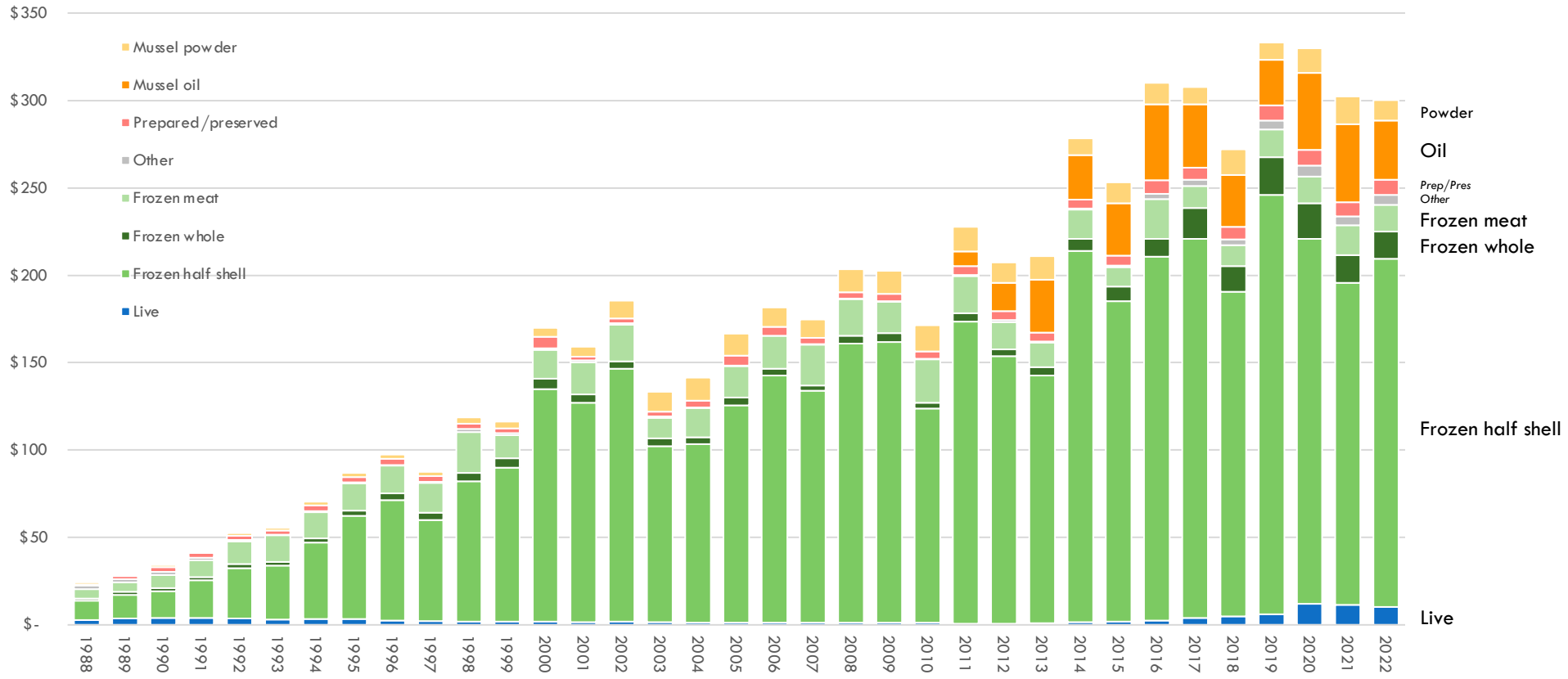
Source: SNZ Infoshare; Coriolis classification and analysis

LARGE

In value terms, export markets take predominantly frozen half shell, followed by various whole mussel products and nutraceuticals (mussel oil and powder)

NEW ZEALAND MUSSEL EXPORT VALUE BY FORM

NZ$; m; 1988-2022



Source: SNZ Infoshare; Coriolis classification and analysis

LARGE

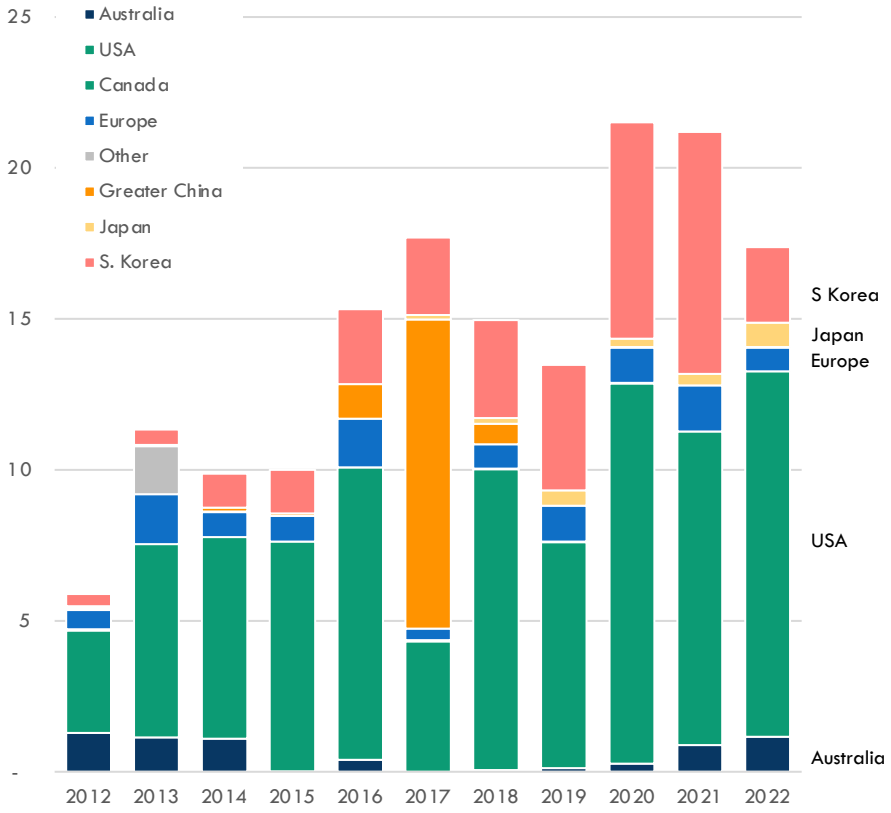
Drilling in on high value mussel marine extracts, first mussel oil

LIVE	FROZEN	PREP/PRES	OTHER	1 MUSSEL OIL	2 MUSSEL POWDER
	HALF SHELL			NZ 10 digit HS12 code 1603-00-0121 Extracts and juices; of crustaceans or molluscs, mussel oil	NZ 10 digit HS92 code 0307390021 Molluscs; mussels (Mytilus spp., Perna spp.), whether in shell or not, freeze-dried powder HS1605901939 Mollusc preparations; mussels, powder freeze-dried, in capsule form, packed other than in airtight cans or jars NZ 10 digit HS12 code 0307390023 Molluscs; mussels (Mytilus spp., Perna spp.), whether in shell or not, freeze-dried powder 1605539019 Mollusc preparations; mussels, powder freeze-dried in capsule form, packed other than in airtight cans or jars
	WHOLE				
	MEAT				

Overall, mussel oil value and volume have been trading in a band since 2016; the United States appears to be the most stable market

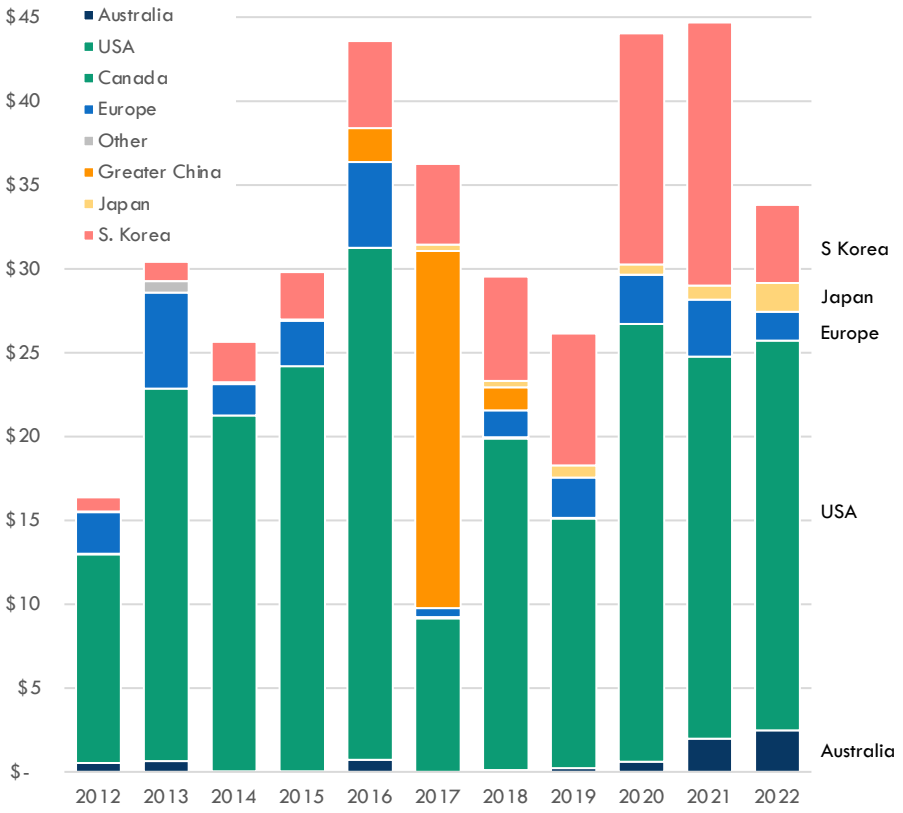
MUSSEL OIL EXPORTS: VOLUME

Tonnes; 2012-2022



MUSSEL OIL EXPORTS: VALUE

NZ$; m; 2012-2022

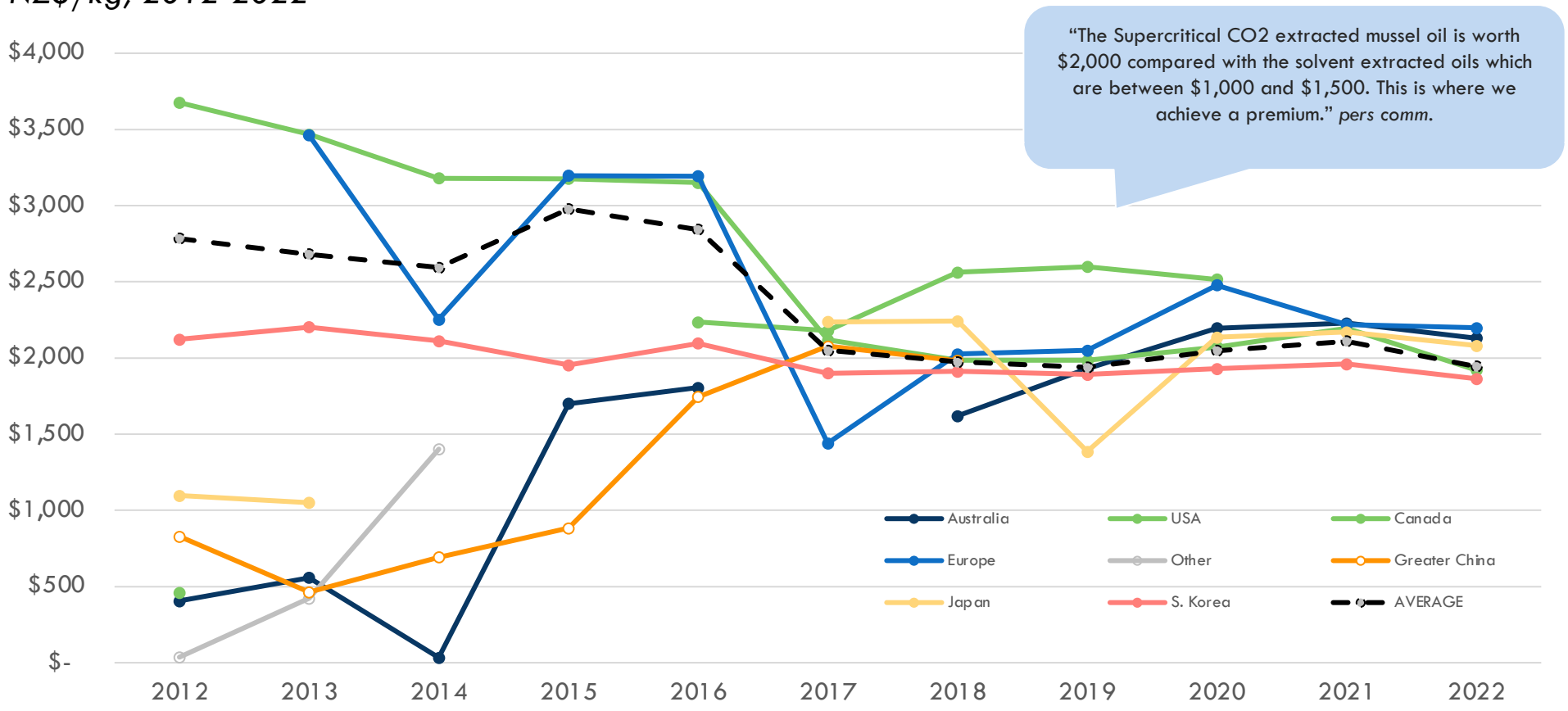


Source: SNZ Infoshare; Coriolis classification and analysis

Prices have converging across markets to around ~$2,000/kg for the past five years

NEW ZEALAND MUSSEL OIL: AVERAGE EXPORT PRICE BY MARKET

NZ$/kg; 2012-2022

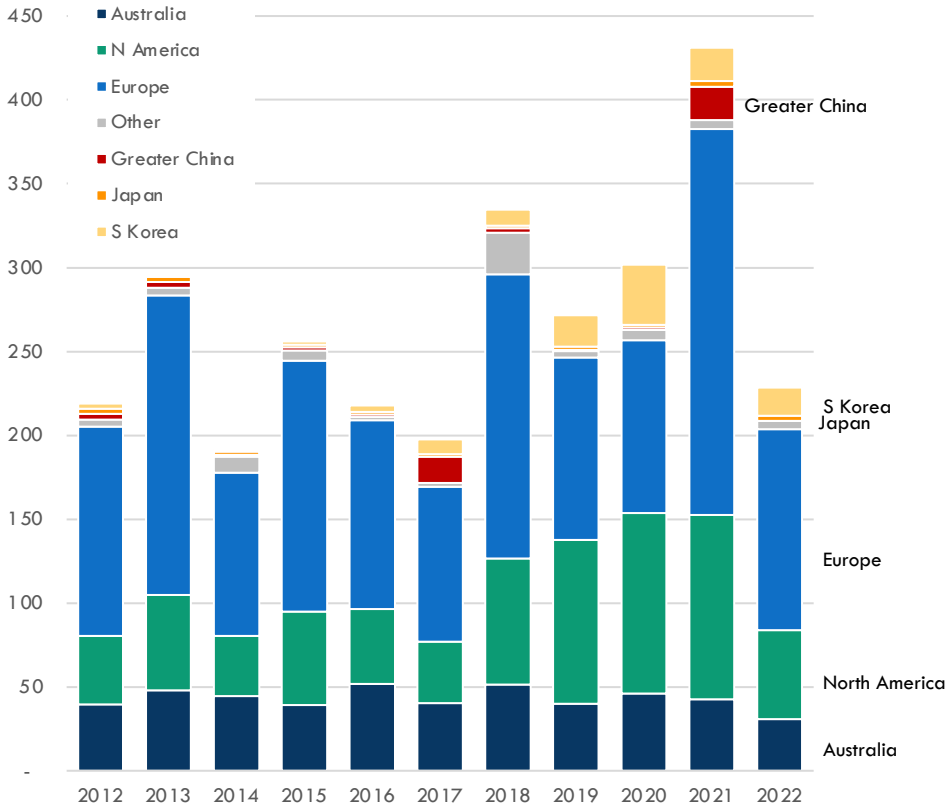


Source: SNZ Infoshare; Coriolis classification and analysis

Overall, mussel powder volumes and values were trending up through 2021; there has been a clear COVID impact in 2022

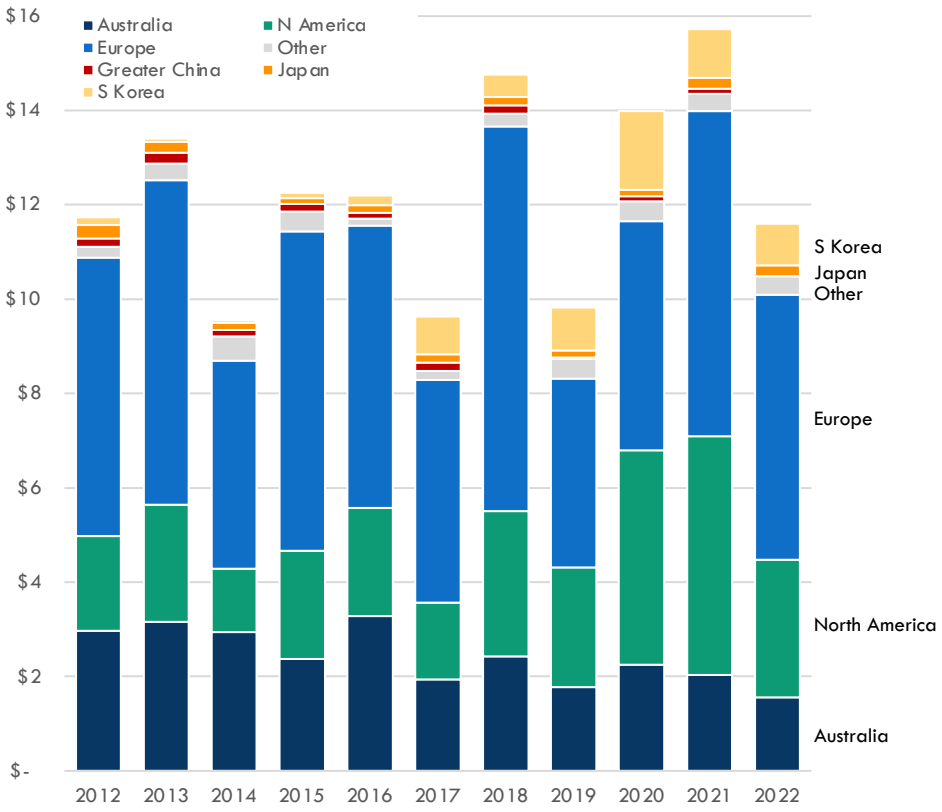
MUSSEL POWDER EXPORTS: VOLUME

Tonnes; 2012-2022



MUSSEL POWDER EXPORTS: VALUE

NZ$; m; 2012-2022

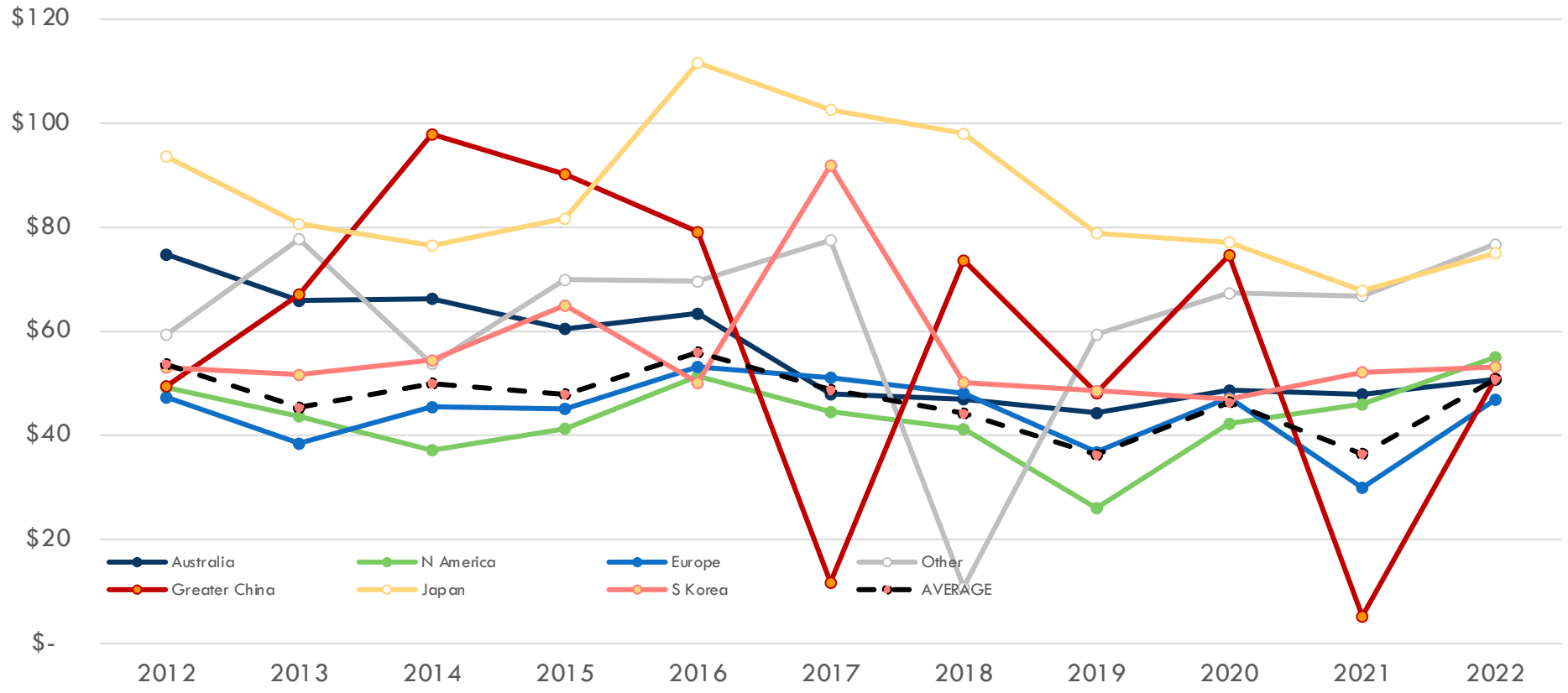


Source: SNZ Infoshare; Coriolis classification and analysis

Mussel powder export prices are trending flat-to-down across all markets; Japan stands out as a market that pays premium prices

NEW ZEALAND MUSSEL POWDER: AVERAGE EXPORT PRICE BY MARKET

NZ$/kg; 2012-2022



Source: SNZ Infoshare; Coriolis classification and analysis

Drilling in on high value nutraceuticals, second mussel powder

LIVE	FROZEN	PREP/PRES	OTHER	1 MUSSEL OIL	2 MUSSEL POWDER
	HALF SHELL			NZ 10 digit HS12 code 1603-00-0121 Extracts and juices; of crustaceans or molluscs, mussel oil	NZ 10 digit HS92 code 0307-39-0021 Molluscs; mussels (Mytilus spp., Perna spp.), whether in shell or not, freeze-dried powder HS1605-90-1939 Mollusc preparations; mussels, powder freeze-dried, in capsule form, packed other than in airtight cans or jars NZ 10 digit HS12 code 0307-39-0023 Molluscs; mussels (Mytilus spp., Perna spp.), whether in shell or not, freeze-dried powder 1605-53-9019 Mollusc preparations; mussels, powder freeze-dried in capsule form, packed other than in airtight cans or jars
	WHOLE				
	MEAT				

Green-lipped mussels are used primarily in three key ways: (1) as a meal , (2) in pet foods and (3) as a supplement for joint and cartilage support

- Green-lipped mussels are used in three very different ways across three distinct segments: human consumption, petfood ingredients and supplements; this research focuses on use as a bioactive extract

1. HUMAN CONSUMPTION: The majority of mussels are purchased as a shellfish (live, frozen or minimally processed)

2. PETFOOD: Green-lipped mussels are used as a petfood ingredient as a whole snack, an ingredient in a wet or dry meal, or as a supplement

3. SUPPLEMENTS: Greenshell mussel extracts have a range of recognised health-giving properties driving demand

- Numerous brands sell greenshell mussel powder

- Numerous brands now sell greenshell mussel oil; the product now comes in a range of concentrations (of the lipid fraction)

Green-lipped mussels are used in three very different ways across three distinct segments; this research focuses on use as a bioactive extract

1. HUMAN CONSUMPTION (as traditional shellfish)	2. PETFOOD INGREDIENTS	3. SUPPLEMENTS
- Eaten like most other shellfish in most forms depending on the occasion (fresh, frozen, processed) - Eaten both at home and in mid-market restaurants/cafes - Eaten for both taste and nutritional values	- Used as an ingredient in petfood and as a snack/treat for pets (cats, dogs) - Key characteristics is for nutritional value and for joint mobility and arthritis (in particular in older dogs)	- Used as a supplement for humans and pets - Taken in powder or pill/encapsulated form or as an oil - Primarily for joint mobility - Products backed by science

BIOACTIVE EXTRACT MARKET

LARGE

1. HUMAN CONSUMPTION: The majority of mussels are purchased as a shellfish (live, frozen or minimally processed) for human consumption

HOW ARE GREEN-LIPPED MUSSELS USED FOR HUMAN CONSUMPTION?

RESTAURANTS

*LIVE**

FROZEN HALF SHELL

AT HOME

LIVE

FROZEN

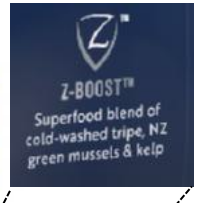
MARINATED

SMOKED

Source: Company websites; Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research; DALL:E

2. PETFOOD: Green-lipped mussels are used as a petfood ingredient as a whole snack, an ingredient in a wet or dry meal, or as a supplement

HOW ARE GREEN-LIPPED MUSSELS USED AS A PETFOOD INGREDIENT?



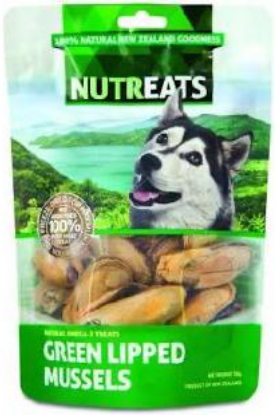


Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

3. SUPPLEMENTS: Greenshell mussel extracts have a range of recognised health-giving properties driving demand in particular joint health

"Greenshell Mussel Extract primary function is anti-inflammatory... it is a pure and natural source of Omega 3 oils from the sea, including EPA and DHA. Clinical research over many years supports the role of these essential fatty acids in providing **anti-inflammatory support**…. Research also suggests that some of the compounds found in Greenshell™ Mussels may help to support repair of **damaged joint cartilage** … Secondary function is **exercise and sport recovery -** perfect for supporting joints that may be feeling a little bit worse for wear."
https://aioranz.com

AIORA

Interest in the mussel's potential health benefits began in the early 1970s and stemmed from the observation that Māori people had a lower incidence of arthritis than people who lived inland It was later determined that the mussels were a rich source of anti-inflammatory omega-3 fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Furthermore, researchers have identified other types of fatty acids from the mussels. They may also possess anti-inflammatory effects by inhibiting enzymes and proteins that produce inflammation and pain. Similarly, green lipped-mussels contain chondroitin sulfate, a component of connective tissues like joints and bones that may reduce inflammation in the same way."
https://www.healthline.com/nutrition/green-lipped-mussel

healthline

"Research over the past twenty years has also identified a series of novel Omega 3 fatty acids in Greenshell mussel oil with significant **anti-inflammatory** activity. Pro-inflammatory compounds in the body known as eicosanoids play a key role in the inflammatory process, however the Omega 3 fatty acids found naturally in Greenshell mussels have been found to inhibit these inflammatory molecules. Pernatec is carefully processed to protect these PUFA's from oxidisation with typical total lipid levels of 10% of which 30% are Omega 3's…Supported by over 30 years of research additional biologically active components have been identified including **Glycosaminoglycans (GAG's) which are known to be important in joint health,** and a unique component known as phosphorylated glycogen which is also thought to contribute **anti-inflammatory activity."**
https://www.waitakibio.com/products/ingredients/greenshell-mussel/

WAITAKI BIOSCIENCES
A DIVISION OF PHARMAZEN LIMITED

"Perna canaliculus, the green-lipped mussel, is endemic to New Zealand. It is grown for aquaculture only in New Zealand, where it is trademarked as the greenshell™ mussel (GSM). Various therapeutics such as Lyprinol® are produced from GSM. When taken orally in whole powder or oil extract formats, GSM has been found to be beneficial for **pain relief, reducing inflammation** and ameliorating other debilitating symptoms associated with **inflammatory diseases** such as **rheumatoid arthritis (RA) and OA [osteoarthritis]** without causing the adverse side effects of NSAIDs*"
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8298224/

PMC PubMed Central®

**NSAID's = Non-steroidal anti-inflammatory drugs; Source: select articles; select websites; Coriolis analysis; NOTE: Matt Miller at the Cawthron Institute has published a review of scientific results from using GSM relating more recently to muscle recovery. https://www.researchgate.net/profile/Matthew-Miller-17*

LARGE

Numerous brands sell greenshell mussel powder

GREENSHELL MUSSEL POWDER

Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Numerous brands now sell greenshell mussel oil; the product now comes in a range of concentrations (of the lipid fraction)

GREENSHELL MUSSEL OIL

Image Credit: WikiMedia: CC ASA

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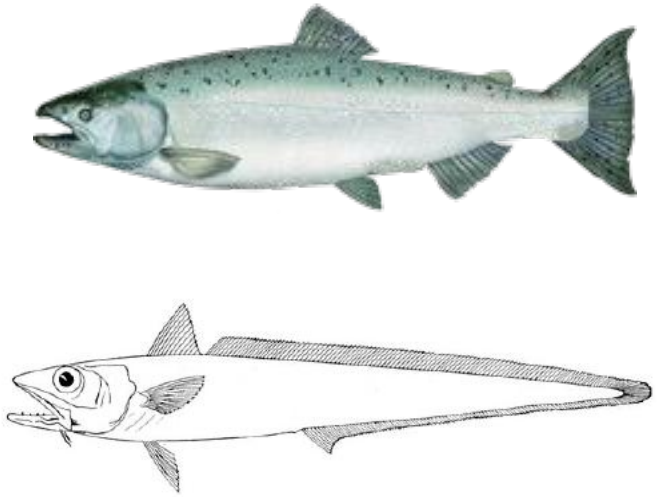
In New Zealand, fish oil is primarily a byproduct from rendering fish waste into "meal", producing at the same time an oil

FISH OIL



Fish oil and omega-3 are both sources of healthy fats, derived from salmon and other oily fish. Fish oil in NZ is sourced from salmon, hoki and other species. The organs and waste products especially liver are rendered to produce the oil.

OIL SUPPLEMENT

Image Credit: WikiMedia: Public Domain

Why fish oil? Fish oil is promoted as being high in omega-3, for which numerous health claims are made

Omega-3 fatty acids include eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA), both found primarily in oily cold-water fish such as tuna, salmon, and mackerel…**Omega-3 fatty acids** are a form of polyunsaturated fats, one of four basic types of fat that the body derives from food. (Cholesterol, saturated fat, and monounsaturated fat are the others.)… Omega-3 fatty acids have been shown to play a part in keeping **cholesterol levels low**, **stabilizing irregular heart beat** (arrhythmia), and **reducing blood pressure.** Researchers now believe that alpha-linolenic acid (ALA), one of the omega-3s, is particularly beneficial for protecting against heart and vessel disease, and for lowering cholesterol and triglyceride levels…**Reduce hypertension**…Improve **rheumatoid arthritis**, lupus, Raynaud's disease, and other autoimmune diseases…**Improve depression** and symptoms of other mental health problems… ”
https://www.greenhealth.co.nz/omega3.htm

GreenHealth.co.nz

Fish oil and omega-3 are both sources of healthy fats that can have many **health benefits.** Omega-3 fatty acids are a type of unsaturated fat that is essential for human health. They can be found in food sources such as fish, nuts, and seeds. On the other hand, fish oil is taken as a dietary supplement that contains omega-3 fatty acids. It is usually sourced from oily fish such as salmon, mackerel, and tuna… Fish oil is a source of eicosapentaenoic acid (EPA), which is an omega-3 fatty acid that offers a variety of health benefits. EPA is known to support heart health, cognitive function, and joint health. It also has anti-inflammatory properties, which can help manage conditions like arthritis. Fish oil supplements are a safe and effective way to get EPA into your diet.”
https://goldhealth.co.nz/products/fish-oil-omega-3-supplements/#read-more

GoldHealth
Do more. Live well for less.

“Fish oil is an excellent source of omega-3 fatty acids. Omega-3 fatty acids are essential for the proper development of the eyes, brain, and reproductive cells. They are also vital for heart and lung health, in addition to optimal functioning of the immune and endocrine systems.”
https://www.webmd.com/diet/health-benefits-fish-oil#:~:text=Fish%20oil%20is%20an%20excellent,the%20immune%20and%20endocrine%20systems.

NOURISH by WebMD

“Oily fish, for example mackerel, tuna, herring, and salmon, have especially high levels of omega-3.
Omega-3 is important for our brain throughout life, from early cognitive development in foetuses to learning and memory in adults. **Brain cells with high levels of omega-3 in their membranes are thought to be better at communicating with other cells,** an important process for brain function.”
https://www.alzheimers.org.uk

Alzheimer's Society

Source: select articles; select websites; Coriolis analysis

Why fish oil? In addition the global omega-3 industry is a very large and growing sector, currently over US$2b; NZ can take a niche position

"Global Omega-3 market is valued at **USD 2.15 Billion in 2022** and estimated to reach a value of USD 3.86 Billion by 2030 at a CAGR of 7.60% during the forecast period, 2022–2028. Omega 3 fatty acids *are a form of polyunsaturated Omega-3 fats."*

https://www.vantagemarketresearch.com/industry-report/omega3-market-1227#:~:text=Snapshot&text=Market%20Synopsis%3A,of%20polyunsaturated%20Omega%2D3%20fats

VANTAGE Market Research

"The global fish oil market size is to grow to **USD 3603 million by 2030 at a CAGR of 6% from the early figures of USD 2133 million in 2021**….The public and the medical community are becoming more aware of how important omega-3 fatty acids are, which has led to a big rise in fish oil consumption. Due to this, the companies are now adding concentrated EPA and DHA to their line of nutraceutical products. The growing need for EPA and DHA in human food has had a big effect on the fish oil market around the world."

https://straitsresearch.com/report/fish-oil-market

straits research

Source: select articles; select websites; *Coriolis analysis*

Numerous fish oil products are sold by New Zealand firms

FISH OIL

HOKI

HOKI

HOKI

SALMON

Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Antler Farms' New Zealand fish oil provides an excellent example of a product making clear, strong product claims

FISH OIL MARKETING

- NO HEAVY METALS
- NO CHEMICAL RESIDUE
- NO GMOS
- NO DAIRY
- NO GLUTEN
- NO SOY
- NO ARTIFICIAL ADDITIVES
- NO ARTIFICIAL FLAVORS
- NO ARTIFICIAL COLORS

Image Credit: Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research https://antlerfarms.com/products/wild-caught-new-zealand-fish-oil

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Marine collagen is made primarily from the skins, bones and scales of fish

MARINE COLLAGEN

Marine collagen is derived from fish scales, skin, swim bladders and bones.
Marine collagen peptides, also known as marine collagen hydrolysate, are broken down into an easily digestible form.

POWDER SUPPLEMENT

Image Credit: Sanford

There are five main types of collagen, of which two (Type I and II) are the primary focus of the marine sector

MARINE COLLAGEN TYPES

	MAIN TYPES	WHAT IS IT?	SOURCE
MARINE COLLAGEN	**TYPE I for skin elasticity**	- Makes up 90% of your body's collagen. Type I is densely packed and along with elastin provides structure to skin, bones, tendons and ligaments. - Associated with skin, hair and nail health.	- Marine collagen sourced primarily from fish scales and skin. - Hydrolysed type I collagen is broken down into peptide powder.
	TYPE II for joint health	- Type II collagen supports cartilage and joint health by supporting the immune health of joints. - Found in elastic cartilage, which provides joint support. Usually found in combination with proteoglycans (e.g. chondroitin sulfate). - Associated with joint health.	- Marine collagen Type II from shark cartilage (more readily available from beef) - Hydrolysed type II collagen broken down (via enzymatic hydrolysis) into peptides which are highly digestible and bioavailable proteins.

Photo credit (example products: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes)

Why marine collagen? Collagen is promoted as good for the skin and for joint health

"Marine collagen is claimed to **slow aging** and has **antioxidant** and **anti-inflammatory** effects on the body, but the evidence supporting these claims is still limited…Marine collagen has been suggested to slow the aging process, working on skin, hair, bones, and muscle mass…Collagen is an antioxidant, which means it works to neutralize free radicals in your body. Free radicals are unstable molecules that develop as a result of living in the world. For example, environmental pollution, industrial chemicals, smoke, and alcohol can all increase free radicals in your body, causing oxidative stress. Antioxidants prevent and neutralize free radicals, preventing them from affecting your skin or leading to disease."

https://healthnews.com/nutrition/vitamins-and-supplements/marine-collagen-health-benefits/#:~:text=Several%20studies%20have%20indicated%20that,acids%20necessary%20for%20wound%20healing.

healthnews

"Recently, development and research of nutraceuticals based on marine collagen peptides (MCPs) have been growing due to their high homology with human collagens, safety, bioavailability through gut, and numerous bioactivities… Skin properties (moisture, elasticity, sebum production, and biological age) and ultrasonic markers (epidermal/dermal thickness and acoustic density) were measured thrice (2 months before treatment and before and after cessation of 2-month oral intake). The supplementation remarkably improved **skin elasticity, sebum production, and dermal ultrasonic markers**."

PMC PubMed Central®

"Marine organisms harbor numerous bioactive substances that can be utilized in the pharmaceutical and cosmetic industries. Scientific research on various applications of collagen extracted from these organisms has become increasingly prevalent. Marine collagen can be used as a **biomaterial** because it is water soluble, metabolically compatible, and highly accessible. Upon review of the literature, it is evident that marine collagen is a versatile compound capable of healing skin injuries of varying severity, as well as delaying the natural human aging process."

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8780088/

PMC PubMed Central®

Collagen supplements help support various body systems, structures, and functions. **From heart health** to **bone health**, marine collagen promotes healthy **muscles, strong tendons, youthful skin, healthy gut lining, and improved joint pain.**

Collagen's many health benefits are attributed to it being the most abundant protein in the body. Found in tendons, ligaments, bones, organs, blood vessels, muscles, skin, and intestines, collagen plays an all-important role in many aspects of the human body. After water, collagen is the second most abundant substance in the body."

https://nz.iherb.com/blog/marine-collagen-health-benefits/1287

iHerb

Source: select articles; select websites; Coriolis analysis

A large and growing number of marine collagen products are made by New Zealand firms, with most being sourced from New Zealand waters

MARINE COLLAGEN

Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Marine collagen fibres using hoki skins has been developed into a skincare product that releases collagen and other products directly into the skin

MARINE COLLAGEN

NANOLAYR™

DERMA LAYR™

T-Coll™

DermaLayr is a pioneering transdermal delivery platform bringing the benefits of nanofibre technology to beauty and skincare.

The fastest non-invasive dermal delivery system in the world.

DermaLayr delivers collagen and active ingredients 1.8mm into the dermal skin layers in 15mins. Comparable only to invasive needle treatments.

Produced using a proprietary production method – Sonic Electrospinning Technology, DermaLayr is an ultra-thin non-woven web of kilometre long collagen nanofibres.

T-Coll™ is our own 100%, type 1 marine collagen sourced from New Zealand oceans.

https://www.nanolayr.com/product/dermalayr/ https://dermalayr.com

USED BY MULTIPLE COMPANIES

Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research
Source: Company website

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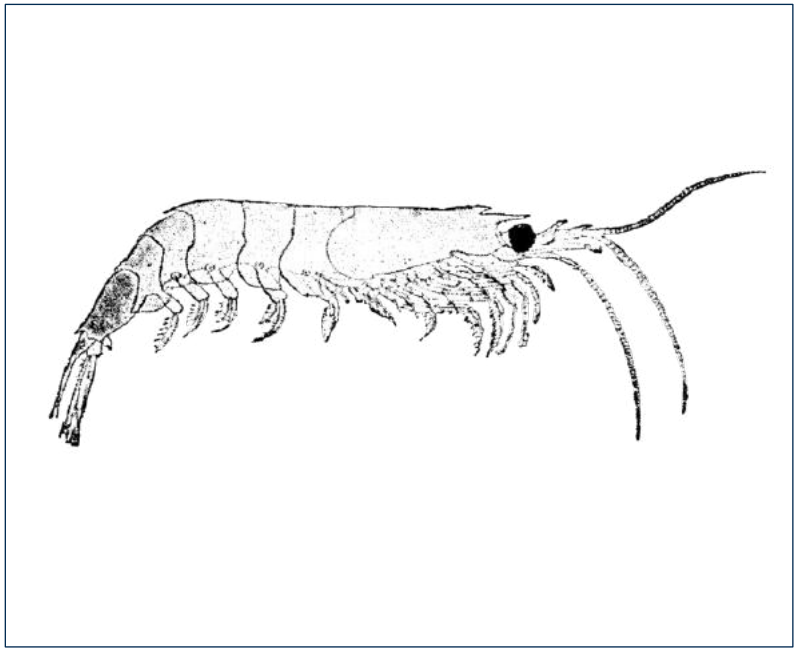
Beyond the 'top three' there are a wide range of other smaller or emerging marine bioactives

EXAMPLE: DEEP BLUE HEALTH PRODUCT RANGE BEYOND TOP 3

Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research
https://www.deepbluehealth.co.nz

Locally processed krill is sourced from the waters of Antarctica



Krill is caught in Antarctica and extracted locally (e.g. Pharmalink Extracts) by the supercritical carbon dioxide co-extraction process.

A lot of krill sold in NZ is imported and repacked

OIL SUPPLEMENT

Image Credit: WikiMedia: Public Domain

Why krill oil? Krill oil is promoted as being good for cardiovascular health, eye and liver health, and as having a range of other benefits

"Krill are a source of omega-3 fatty acids, which your body can only get from food or supplements. Omega-3s are a critical part of the membranes surrounding each of your cells. Omega-3s give your body energy and also serve important jobs in your heart, blood vessels, lungs, immune system, and endocrine system….Less inflammation, PMS symptom relief, cardiovascular health, reduced anxiety, decreased risk of colon cancer."
https://www.webmd.com/diet/health-benefits-krill-oil#:~:text=Research%20has%20shown%20that%20the,risk%20factors%20for%20heart%20disease.&text=One%20study%20has%20shown%20a,and%20reduced%20levels%20of%20anxiety

WebMD

"It is a rich source of the Omega-3s, DHA and EPA, bound to phospholipids, contains the natural antioxidant Astaxanthin and Choline. Krill Oil may provide benefits for **cardiovascular health, joint health, eye, liver and general health**... Our advanced extraction technology produces fresh oils with differing levels of phospholipids to meet your market needs. Phospholipids ≥ 40% w/w, EPA ≥ ,10% w/w, DHA ≥ 5% w/w…Sustainably harvested from the pristine waters of Antarctica…"
https://wanakabiomarine.com

WANAKA BIOMARINE

"Excellent **Source of Healthy Fats**, omega-3 fats EPA and DHA…Can Help Fight Inflammation. Omega-3 fatty acids like those found in krill oil have been shown to have important **anti-inflammatory** functions in the body…Omega-3 fats, and DHA and EPA specifically, are considered **heart healthy**…**Might Reduce Arthritis and Joint Pain**. Because krill oil seems to help reduce inflammation, it may also improve arthritis symptoms and joint pain, which often result from inflammation… **May Help Manage PMS Symptoms** In general, consuming omega-3 fats may help decrease pain and inflammation …May Help Manage PMS Symptoms. In general, consuming omega-3 fats may help decrease pain and inflammation…"
https://www.healthline.com/nutrition/krill-oil-benefits#TOC_TITLE_HDR_3

healthline

"Optiko is a premium Krill Oil specially selected because of its very high Phospholipid content. It contains 50% more Phospholipid than standard Krill oil. The resultant oil contains much higher levels of the valuable Omega 3 oils such as EPA and DHA. Because Astaxanthin is esterified to the Phospholipid it follows that the level of Astaxanthin is also higher in Optiko than standard krill oil."
https://biomer.com/optiko-krill-oil/

bio-mer

Source: select articles; select websites; Coriolis analysis

Krill oil is marketed by numerous New Zealand firms

PHARMALINK Extracts Limited
Nutraceutical innovation and manufacture

WANAKA BIOMARINE

Southern Ocean Krill Oil PL30

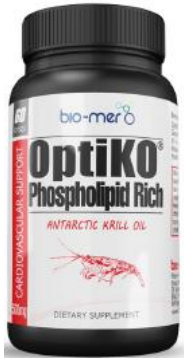
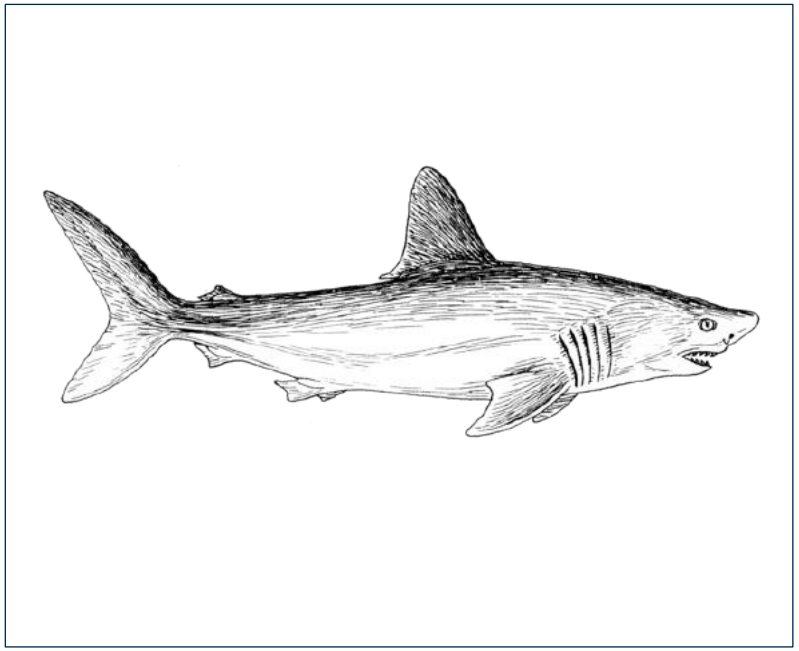


Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Shark is by-catch from the deep sea commercial fishing sector and shark liver oil, squalene and cartilage are all used as a nutraceutical ingredient

SHARK



Shark is a by-catch of the commercial fishing sector, squalene is found in the liver of deep sea sharks

OIL SUPPLEMENT
POWDER SUPPLEMENT

Image Credit: WikiMedia: Public Domain

Why shark squalene and liver oil? Shark live oil is promoted as a strong anti-oxidant that boosts immunity and is good for the skin

"**Squalene** is a natural compound obtained from the shark's liver…a powerful supplement for general health and **for maintaining healthy skin**…Squalene is a natural compound obtained from the shark's liver... Squalene in the human body is believed to carry oxygen to all cell tissues…Shark squalene has been referred to as the **'natural antioxidant'** or **'natural moisturiser'** which helps the skin get the nutrients that it needs. Shark Squalene is also a modulator of immunity to infections."

"Old fishing communities such as the Nordic and Japanese fishermen described Shark Liver Oil as the 'cure for all'. Modern scientists have been doing a lot of research to discover the health giving powers for this marine based supplement. Shark Liver Oil is one of the richest sources of alkylglycerols... Shark Liver Oil also contains squalamine and squalene that have antioxidant properties"
https://www.deepbluehealth.co.nz/

DEEP BLUE HEALTH

"Shark liver oil is used along with **usual cancer drugs** to treat leukemia and other cancers; to prevent radiation illness from cancer X-ray therapy; to prevent the common cold, flu, and swine flu; and to boost the body's immune system."
https://www.webmd.com/vitamins/ai/ingredientmono-956/shark-liver-oil#

WebMD

"Squalene appears to be critical for **reducing free radical oxidative damage to the skin.** Serum squalene originates partly from endogenous cholesterol synthesis and partly from dietary sources, especially in populations consuming large amounts of olive oil or shark liver…Truly one of nature's great emollients, squalene is quickly and efficiently absorbed deep into the skin, **restoring healthy suppleness and flexibility** without leaving an oily residue. New cosmetic emulsions with biomimetic molecules have been investigated using experimental designs."
https://www.mdpi.com/1420-3049/14/1/540

MDPI

"Shark liver oil (SLO) is the oil obtained from the livers of sharks, primarily Centrophorus squamosus, Cetorhinus maximus, and Squalus acanthias, or deep-sea shark, basking shark, and dogfish shark, respectively…Research on SLO attributes its multiple health benefits to its high alkylglycerol (AKG), squalene, and omega-3 polyunsaturated fatty acid (PUFA) content…May have **anticancer** properties… may boost your **immune system**… may improve **heart health.**"
https://www.healthline.com/nutrition/shark-liver-oil#benefits-uses
.

healthline

Source: select articles; select websites; Coriolis analysis

Shark liver oil and squalene are now well established and known product sold by a wide range of New Zealand firms

SHARK BIOACTIVES

Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Why shark cartilage? Cartilage is promoted as a good supply of chondroitin, marketed as good for joint health and pain

"Sourced from pristine New Zealand coastal waters, Deep Blue Health Shark Cartilage is rich in mucopolysaccharides and complex proteins to support joint mobility. The joints in our body are subjected to numerous stresses everyday, including running, walking and climbing stairs. Overtime cartilage between our joints can get worn away due to the demands being placed on our joints. The skeletal structure of a shark is made **of cartilage and it is rich in nutrients such as naturally occurring Chondroitin that are beneficial for human joints.** Deep Blue Health Shark Cartilage is freeze-dried to capture the nutrient composition present in it so that it can help with supporting joint mobility."
https://www.deepbluehealth.co.nz/products/shark-cartilage?variant=12099012067428

DEEP BLUE HEALTH

"Shark cartilage is the tissue that provides support for fins in sharks (Squalus acanthias). It mainly comes from sharks caught in the Pacific Ocean… People use shark cartilage for cancer, scaly itchy skin (psoriasis), osteoarthritis, and many other conditions, but there is no good scientific evidence supporting these uses."
https://www.webmd.com/vitamins/ai/ingredientmono-909/shark-cartilage

WebMD

"Shark cartilage has been successfully used in both animals and humans to **reduce pain in arthritis** and **improve mobility**.
Shark cartilage contains one or more substances which **inhibit the production of Angiogenin**, a substance responsible for the formation of new blood vessels. Cancer tumours cannot grow beyond about 2mm in size without the formation of new blood vessels to support new tumour growth.
Shark cartilage appears to be much more effective in **preventing new blood vessel development** than other cartilage sourced from mammals."
https://www.greenhealth.co.nz/sharkcartilage.htm

GreenHealth.co.nz

"Shark cartilage is one of the hottest and most controversial topics debated in medical circles today. Although its mode of action is accepted by established medical principles, the mechanism, or combination of elements responsible for triggering that action, remains a mystery.
Highly touted for its alleged cancer-fighting abilities (and currently under clinical trials by the Food and Drug Administration [FDA] on terminally ill cancer patients in new Jersey), this natural nontoxic substance is now becoming widely accepted as an effective means for treating less fatal degenerative diseases such as **osteoarthritis and rheumatoid arthritis**."
https://seapet.com/health-benefits/shark-cartilage-benefits/

sea pet

Source: select articles; select websites; Coriolis analysis

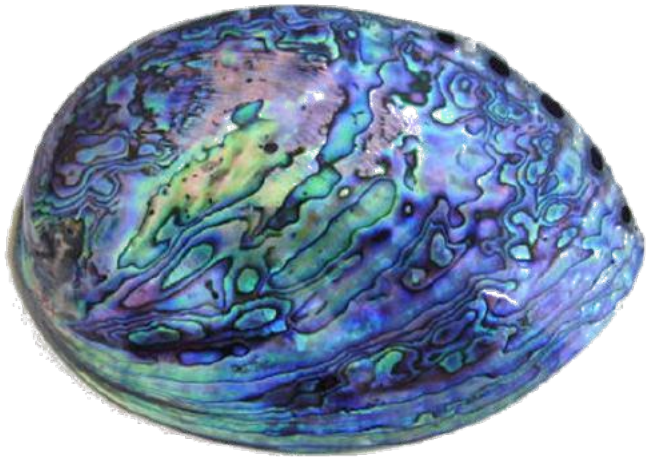
Shark cartilage is now a well established and known product sold by a wide range of New Zealand firms

SHARK CARTILAGE

Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Black foot abalone or pāua are a shellfish wild collected in New Zealand waters

ABALONE



Black foot Pāua is unique to New Zealand. Haliotis iris, common name pāua, blackfoot pāua or rainbow abalone, is a species of edible sea snail, a marine gastropod mollusc.

ABALONE POWDER SUPPLEMENT

Image Credit: WikiMedia: CC ASA 4.0 Joelnorman

Why abalone? Abalone is promoted as good for eye health, immunity health and as being a good supplier of essential minerals

"The meat of the Paua has also been considered good **for eye health.** Extremely rich in minerals, vitamins and proteins, Abalone is beneficial for maintaining general health and for supporting the liver… The abalone is an excellent source of minerals (Selenium, Phosphorous) Vitamins A, Vitamins B12, Vitamin E, Protein, Essential fatty acids and Glycosaminoglycans."
https://www.deepbluehealth.co.nz/

DEEP BLUE HEALTH™

"One of the standout nutrients in abalone is selenium. Selenium is an essential mineral that helps to **enhance our immune system.**
The mineral does this by activating various enzymes and proteins with antioxidant functions.
Per 100 grams, abalone contains 44.8 mcg of selenium, which is 64% of the daily value we should be getting."
https://www.nutritionadvance.com/what-is-abalone/

Nutrition ADVANCE

"Abalone, a marine gastropod, contains a variety of bioactive compounds with anti-oxidant, anti-thrombotic, anti-inflammatory, anti-microbial, and anti-cancer activities. For thousands of years different cultures have used abalone as a traditional functional food believing consumption provides health benefits. Abalone meat is one of the most precious commodities in Asian markets where it is considered a culinary delicacy. Recent research has revealed that abalone is composed of many vital moieties like polysaccharides, proteins, and fatty acids that **provide health benefits beyond basic nutrition.**"
https://pubmed.ncbi.nlm.nih.gov/26114550/

Food Science and Nutrition

"As a rich source of fatty acids such as **Omega-3 and Omega-9,** it promotes **healthy circulation and heart health.** It also contains a wide range of important minerals, including potassium, iron, sodium, magnesium, copper, zinc, selenium, and some vitamins, including vitamin A and B12.
All of these work together to help the body detox and improve liver health and eyesight." https://nutrinz.com/benefits-of-abalone/

nutri NZ new zealand

Source: select articles; select websites; Coriolis analysis

Abalone-based products sourced from New Zealand waters are branded and sold by several New Zealand firms

ABALONE POWDER

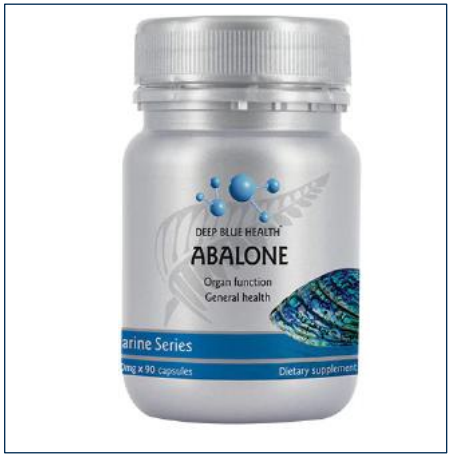


Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Pacific oysters were introduced to New Zealand and today they both grow in the wild and are farmed under aquaculture

OYSTERS

Pacific oysters *Crassostrea gigas* grow around the New Zealand's coastline and are also farmed in aquaculture operations across New Zealand

POWDER SUPPLEMENT

Image Credit: WikiMedia: CC ASA 3.0 David Monniaux

Why oysters? Oysters are promoted as being high in zinc and other micro nutrients, as well as supporting sex drive and a healthy immune system

"Oysters are nutritious and contain many vitamins and minerals that can provide health benefits. Some examples include:
Protein: Oysters are a high source of **protein** and are relatively low in calories, meaning they can help people feel fuller. Research suggests that higher-protein diets can help reduce obesity. Protein is present in every cell, while a sufficient intake is vital for keeping muscles, bones, and tissues healthy… Zinc, Vitamin B12, Omega-3 fatty acids, Iron, Magnesium…"
https://www.medicalnewstoday.com/articles/oysters

MEDICALNEWSTODAY

"Oysters are a good source of **essential minerals, especially zinc**, amino acids, omega-3 fatty acids, glycogen and taurine. With high contents of zinc and taurine, oysters **support nerve function, energy and the immune system.** Oysters are one of the richest source of zinc, which is crucial to your ability to make testosterone – the hormone responsible not just for **sex drive and vitality**, but also for keeping you confident and lean.
Zinc is one of the critical building blocks for a healthy immune system."
https://www.deepbluehealth.co.nz

DEEP BLUE HEALTH

"Provides naturally occurring vitamins, minerals, and nutrients for everyday health and wellbeing. The added zinc boosts the naturally occurring amounts present in oysters, for **reproductive and immune support**…a natural source of marine nutrients including zinc and taurine to support health and vitality. Extra zinc has been added for reproductive and immune support. Oyster naturally provides key nutrients essential for male vitality."
https://goodhealth.co.nz/product_range/oyster-plus/

goodhealth
NATURALLY NEW ZEALAND

"Oysters are low-calorie and high in micronutrients, making them a healthy food for many people. Many of the specific health benefits of oysters are tied to their abundant array of **micronutrients**…The impressive amount of vitamin B12 makes them a natural choice for keeping your **brain healthy**…Oysters are a rich source of **vitamin D, copper, zinc, and manganese.** These micronutrients, in combination with calcium, are thought to be key to slowing or even preventing bone loss in older women due to osteoporosis…"
https://www.webmd.com/diet/oysters-good-for-you

NOURISH by WebMD

Source: select articles; select websites; Coriolis analysis

Oyster extracts are sourced from both New Zealand aquaculture and wild caught sources and processed and branded by multiple firms

OYSTER POWDER

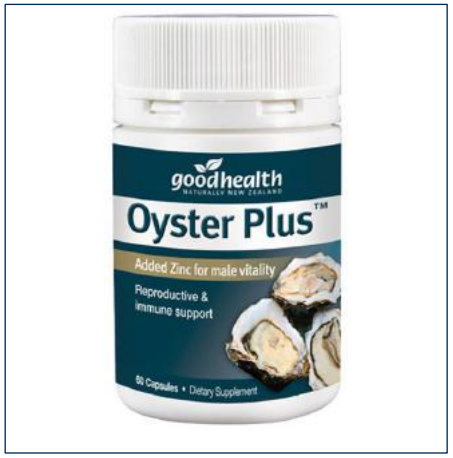
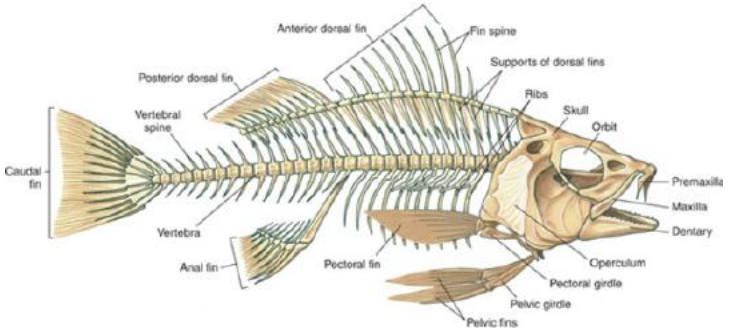


Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

Fish calcium is derived from bones of fish byproduct



Fish bone calcium is derived from the waste products of the fishing industry.
Contains calcium and phosphorus in the right ratio of approximately 2:1 to form hydroxyapatite, which is considered the most bioavailable form of calcium.

POWDER SUPPLEMENT

Image Credit: WikiMedia: CC ASA 4.0 Content from African Digital Schools Initiative (ADSI)

Why fish calcium? Fish calcium is promoted as a support for bone health

"Fish bone naturally contains calcium and phosphorus in the right ratio of approximately 2:1 to form hydroxyapatite, which is considered the most bioavailable form of calcium. Naturally occurring high levels of calcium (25.14%), phosphorus (12.75%) and marine collagen (14.2%), are retained. As well as many other naturally occurring minerals and trace elements, including iron, magnesium, selenium, and zinc. Calcium is an essential dietary mineral. It is present mainly in skeleton, which provides structural support for the body. **Calcium deficiency is known to lead to osteoporosis,** and is very common with an estimated 20% of the worldwide population being calcium deficient."

https://nutrizing.co.nz/product/calcium-phosphorus-collagen/

NUTRI ZING DIETARY SUPPLEMENTS

"New research ahs highlighted the positive effect of Biocare's collagenic bone powder ingredients in **sustaining bone health** which was published in the Biomedical Journal of Scientific and Technical Research…The company uses patent-protected hydrolysis technology to convert salmon byproducts into nutritional ingredients for the enhancement of human health…"

https://www.nutraingredients.com/Article/2022/05/25/Fish-bone-powder-six-times-more-absorbable-than-calcium-carbonate-study-says

NutraIngredients EUROPE

"Calcium (Ca) - fortified foods are likely to play an important role in helping the consumer achieve an adequate Ca intake, especially for persons with a low intake of dairy products. Fish bones have a high Ca content, and huge quantities of this raw material are available as a by-product from the fish industry."

https://nutritionandmetabolism.biomedcentral.com/articles/10.1186/1743-7075-7-61

BMC

"Effective calcium supplements support **bone health and function**…Our fishbone-derived calcium supplement:
- has high free elemental calcium which is easily absorbed by the body
- contains unique high-affinity calcium-binding peptides and phosphor-peptides that act as calcium fortifiers
- contains collagen, for bone strength and flexibility, hair and skin care
- contains vitamin K2 (MK-7); a vital ingredient, as this vitamin "directs" the calcium to the bone absorption and prevents arterial calcification. Vitamin D3, another essential vitamin to help absorption by bones... Ossomer® Calcium Supplement contains a new and completely natural, marine-derived ossein-microcrystalline hydroxyapatite compound (MCHC) extracted from fish bones... Several studies have shown that MCHC is only calcium supplement that will increase bone density."

https://biomer.com/ossomer-calcium-supplement/

bio-mer

Source: select articles; select websites; Coriolis analysis

Fish bone calcium is currently more of a specialist item not sold by the larger brands

FISH CALCIUM

Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

A range of other products are on the market, with all being sold in lower volumes

OTHER PRODUCTS

SEA CUCUMBER

Sea cucumbers are echinoderms from the class Holothuroidea. Sea cucumbers are found on the sea floor worldwide and abundant in the Pacific.

It is thought to stimulate **the immune system**

ALGAE OIL

Omega-3 Algae Oil high in DHA is a vegan option to support joint, cardiovascular and brain health.

Seadragon imports and refines algae oil and tuna oil

LING MAW COLLAGEN

Ling maw (dried air bladders) powder is sourced from New Zealand wild caught Ling; enzymatically hydrolysed from the collagen tissues; Hydroxyproline peptides support cells in the skin, joints and bones, and assist with collagen synthesis through cell activation and growth.*

SEAWEED

New Zealand Sea kelp is a natural source of vitamins A, B1, B2, C, D and E, as well as minerals including zinc, iodine, magnesium, iron, potassium, copper and calcium;
For: Boosting low energy levels related to thyroid health, supporting immunity

Image credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research
*Source: Wikipedia; company websites. *https://www.guytons.co.nz/*

Other products, such as sea urchins, red algae and marine toxins, are in discovery and trial stages

DISCOVERY

KINA – SEA URCHIN

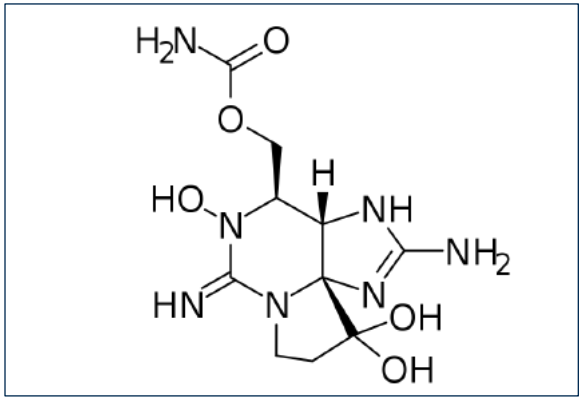
- Cawthron Institute, Hikurangi Bioactives and local hapu project researching bioactivity of kina
- Antioxidant, anti-inflammatory pigment properties
- Bioactive fatty acids in oils (omega-3)
- Low volumes of bioextract and difficult to extract

- Research with Massey Univ, Victoria Univ, Deakin, and Hokkaido Univ efficacy studies

RED ALGAE

- Protein isolated from NZ red algae species investigated as effective HIV/AIDS and SDARS-CoV treatment

- Waikato University



MARINE TOXIN

- Production of neosaxitoxin a toxin from the paralytic shellfish toxin family
- Pain treatment, local anaesthetic
- Stage 2 clinical trials

- Research with Cawthron Institute, medical researchers at Boston Children's Hospital (a Harvard Medical School teaching hospital) and Chilean biotech company Proteus

Image Credit: WikiMedia: CC ASA 2.5 Paul Moss Photographer Artist NZ; CC ASA 3.0; Public Domain; Source: Waikato University, Cawthron

There are significant opportunities to utilise more from New Zealand's key species, in this case hoki

POTENTIAL HOKI UTILISATION

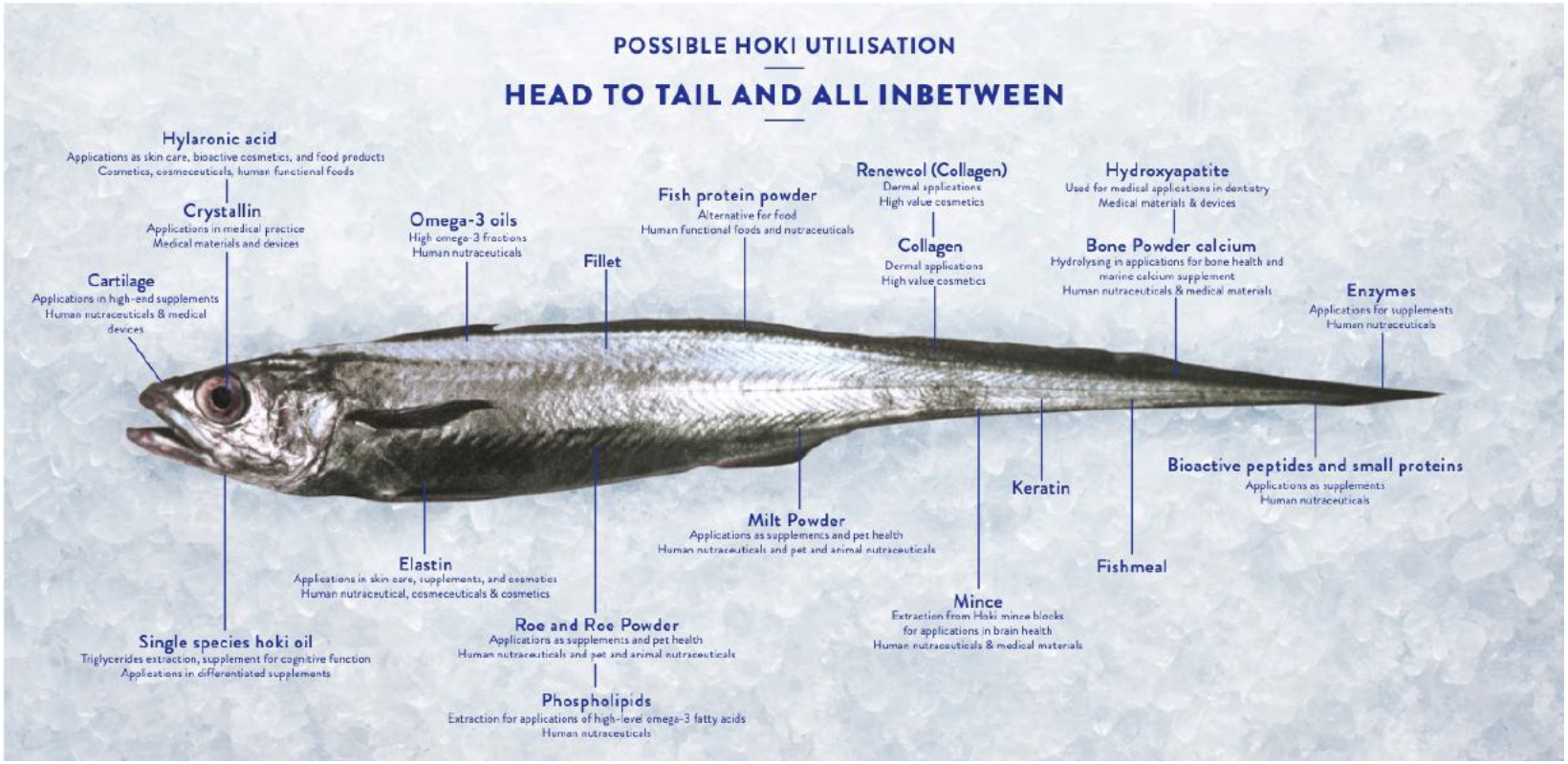


Image Credit: Sanford

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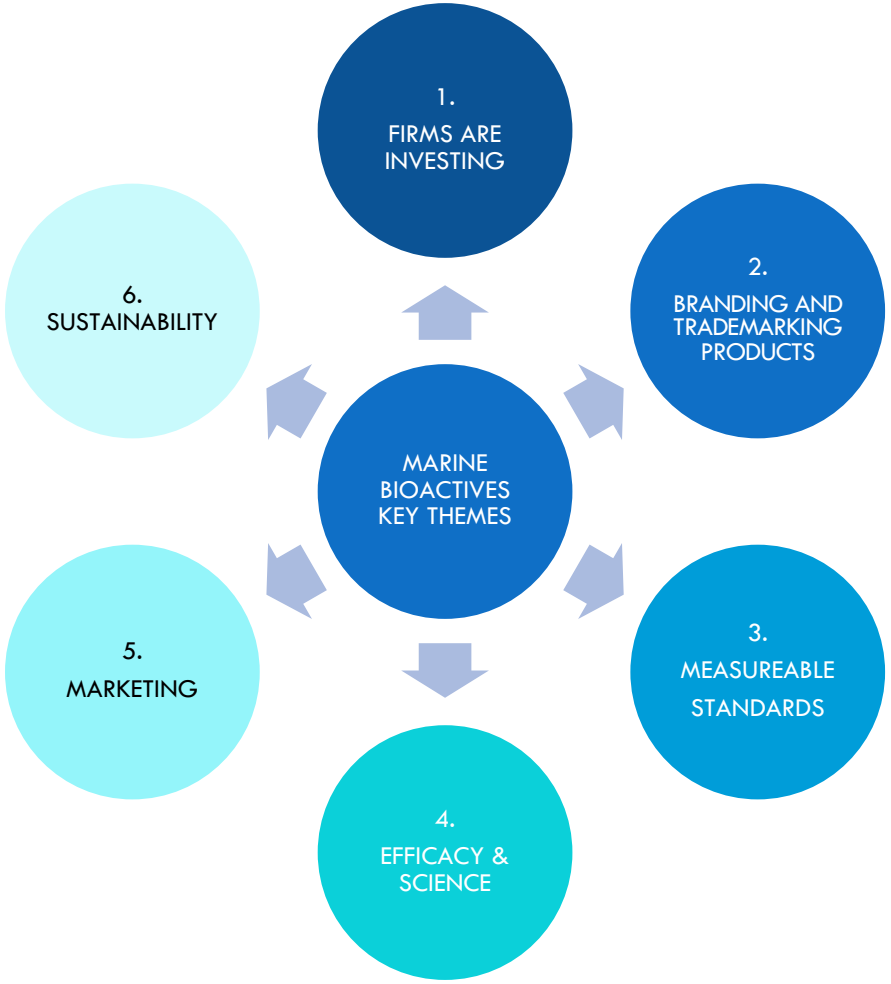
Six broad strategic themes are driving the growth of the New Zealand marine bioactives platform



First, firms are investing in scaling up marine extraction technologies and processing

SANFORD BIOACTIVES

$20m

INVESTMENT: MARINE COLLAGEN

- Sanford a leading publicly listed fishing and aquaculture company
- Sanford holds 20% of NZ fishing quota plus salmon and mussel aquaculture
- Invested $25m in a Marine Bioactives facility in Blenheim, opened 2022
- Extraction process to make high value greenshell mussel oil (up to 8 new spray driers), rooms for marine collagen extraction
- Innovation and adding value driving investment decision

PharmaZen
Good Health Healthy Future
WAITAKI BIOSCIENCES
A DIVISION OF PHARMAZEN LIMITED

$15m

FOCUS: SCALE & RANGE

- From 2006-2021 Pharmazen invested $15m in Waitaki Biosciences new plant, equipment and land to increase dryer capacity, solvent extraction plant (across full range, not just marine)
- First new factory costing $5.5m completed mid 2021 to house 3 large freeze driers and new extraction facilities and expanded marine collagen plant
- Additional freeze drier in 2022
- Ultimate capacity in excess of 100t/week in nutraceuticals ingredients

NEW ZEALAND COASTAL SEAFOODS

N/A

FOCUS: LING MAW COLLAGEN

- July 2022 "NZCS has successfully commercialised a new hydrolysed marine collagen powder for supply to the world's booming nutraceuticals market after development of a more efficient, less costly process for collagen extraction from Ling maw…Commercial production is about to commence."

Source: Select articles; Coriolis research and analysis

Firms are securing supply and investing across the chain from farms to processing

MacLab:

$20m+

INVESTMENT: PRODUCTION IN GSM

- Vertically integrated operation, investing in farms, harvesting, drying, research
- MacLab received consent for additional GSM aquaculture (1,000ha project finalised 2020)
- Invested in increasing production ($20m 2018-2020) including a new ship (the Vanguard) able to harvest 80t mussels/day
- Ongoing aquaculture research (e.g. Precision Aquaculture R&D Project (2022)
- Supplies dried GSM to Pharmalink Extracts

AROMA
RESEARCH REFINE RESTORE

N/A

FOCUS: GSM Supply Chain

- 2017 built new mussel powder processing factory in Havelock
- 2019 built new state of the art mussel harvester (Karaka)
- Acquired new farms in Banks Peninsula Canterbury
- 2020 Acquired Biolane mussel brand from Vitaco
- 2021 invested and installed new supercritical fluid extraction CO2 system (for GlycOmega™ oil)

FURTHER EXPANDING INTO BOTANICALS

- 2020 acquired NZ flower supplier Moffatt's Flowers (greenhouse operations)

Source: Select articles; Coriolis research and analysis

Firms across the supply chain are investing in marine collagen and marine extraction production

"The money gives us the chance to supercharge [production]…There is so much opportunity out of fish skins, scales and frames, all these things can be converted into marine collagen." *General manager Craig McIntosh, Waitaki Biosciences*
https://www.stuff.co.nz/business/123958927/14m-investment-in-pharmazen-nutraceuticals-nets-two-new-factories

WAITAKI BIOSCIENCES
A DIVISION OF PHARMAZEN LIMITED

"Advances in fish processing have enabled the development of by-products including collagen supplements and pet food made from fish bones, skin and liver. These premium fish products are exported to markets around the world." *Greg Summerton, article*
https://blog.bnz.co.nz/2022/01/gone-fishing

OKAINS BAY
LONGLINE FISHING

"Sanford has partnered with nanotechnology company, Revolution Fibres to transform sustainably caught fish into nanofiber facemasks, which can reduce wrinkles by more than 30%. The fish is hoki which we sustainably catch before extracting pure collagen from the skins, a part of the fish that might otherwise be considered low value. This collagen is then transformed into a nanofiber cloth by Revolution Fibres which has perfected the techniques for creating skin-penetrating collagen masks." article 2018
https://www.sanford.co.nz/newsroom/from-fish-to-face-sanford-ventures-into-marine-nano-tech-and-sustainable-skincare/

SANFORD

"Sanford, has opened a new $20m marine extracts plant in Blenheim,, with the hopes of investing in the under-appreciated marine products… We already make it, we already sell it, it is very popular. Our new bioactives centre introduces new tech and equipment which gives us a change to double and eventually quadruple our output." Andrew Stanley, General Manager for Innovation, Sanford
https://businessdesk.co.nz/article/markets/sanford-opens-new-20m-blenheim-plant

SANFORD

Source: select articles; select websites; Coriolis analysis

Local investment is occurring across the supply chain from major seafood companies to access supply, extraction technology and brands

EXAMPLE INVESTMENTS BY LOCAL FIRMS

INVESTOR	FIRM	DETAILS
Talley's	MacLab	- Talley's Group a leading seafood company in NZ 'invested' 5% in MacLab in 2019 as part of a MOU (MacLab leading producer and processor of GSM)
Talley's	CFARMX NEW ZEALAND	- Talleys acquired CFARMX NZ, while CFARMX LTD stays in founders ownership, this provides Talleys with access to high value extractions and processing of GSM, hoki and ling into powders, oils, collagens and peptides
Talley's	KONO	- May 2023 Talley's acquires Kono Seafood operations from Wakatu Incorp. includes 3 mussel production operations employing 298 staff - Increases Talley's supply of GSM
SANFORD	ENZAQ MUSSEL LIFE FROM THE SEA	- Sanford acquired Enzaq mussels in 2017. Enzaq nutraceutical firm manufacture and export GSM powder. - Acquisition provided Enzaq with a supply of mussels and Sanford with a facility to dry and extract mussel powder (high value extract)
SANFORD	NANOLAYR RevolutionFibres	- 2018 Sanford partners with Revolution Fibres (Nanofibre) to produce the hoki skin based nanofiber for the cosmetics sector - Adds value to hoki skin
SANFORD	two islands	- Sanford leading NZ seafood company invested in Two Islands (50% ownership) - Health and supplements company with a growing collagen beauty range - Allows Sanford to supply marine collagen to a high value brand, adding value to seafood and marine waste streams
PharmaZen Good Health Healthy Future	WAITAKI BIOSCIENCES A DIVISION OF PHARMAZEN LIMITED	- PharmaZen acquired Waitaki Biosciences in 2002 - PharmaZen publicly listed on the NZ Unlisted Securities exchange - Allows Waitaki Biosciences to ramp up production of high value extracts and drying

Source: various company websites; interviews; articles; Coriolis analysis and classifications

Aroma acquired Biolane, the original GSM product from VitaCo in 2020

INVESTMENTS IN BRANDS

DETAILS

- Acquired Biolane from VitaCo June 2020, including the IP around production processes
- Biolane was the first GSM on the market 45 years ago
- Aroma is a vertically integrated mussel farm, production and processing facility across three locations, working with GLM for 30 years
- VitaCo use Biolane in Healtheries Seatone, NutraLife Musseltone and many others

Source: various company websites; interviews; articles; Coriolis analysis and classifications

Acquisitions and investments are occurring from firms outside NZ, reflecting the global appetite for investing in the NZ health and wellness sector

EXAMPLE INVESTMENTS BY INTERNATIONAL FIRMS

ACQUIRER	INVESTMENT	DETAILS
R&T AUSTRALIA 1992	RMF nutraceuticals	- R&T Australia is a specialist raw material products firm supplying vitamins and chemicals to pharmaceutical contract manufacturers - Invested in RMF nutraceuticals gaining supply of NZ-based extracts and compounds - https://www.rtaustralia.com
PHARMALINK INTERNATIONAL LIMITED	PHARMALINK Extracts Limited Nutraceutical innovation and manufacture	- Pharmalink international based in HK is a publicly held nutraceutical company - Owns Pharmalink Extracts based in Nelson; specialises in omega extraction (greenshell mussels supplied by MacLabs) - https://pharmalinkinternational.com
CIBUS	PharmaZen Good Health Healthy Future; WAITAKI BIOSCIENCES A DIVISION OF PHARMAZEN LIMITED	- 2021, Cibus Fund (UK) a major agri-technology fund took a 13.8% stake (for A$14m) in Pharmazen (Waitaki Biosciences), this allowed for the expansion of two new factories at Rolleston, Christchurch - https://www.cibusfund.com
AKER BIOMARINE	WANAKA BIOMARINE; Southern Ocean Krill Oil PL30	- Aker Biomarine (Norway) specialist in krill oil, established Wanaka Biomarine in 2019 and use new source of krill oil from Pharmalink Extracts (Nelson) - https://www.akerbiomarine.com

Source: various company websites; interviews; articles; Coriolis analysis and classifications

Private Equity and Capital Funds are investing in the sector

INVESTMENTS BY LOCAL FIRMS

INVESTOR	TARGET	DETAILS	MOTIVATION
CCA CAPITAL	BePURE	- NZ Private Equity firm, Director Jenkins - 41% ownership in BePure nutritional and nutraceutical health company - ~$8m revenue (2019)	- Strong growth category
Movac	NANOLAYR	- Movac Fund owns 22% of NanoLayr (portfolio of NZ iconic, high tech firms), allows for ongoing R&D and marekting - https://www.movac.co.nz	- High tech, high value product, in line portfolio
BEYOND Capital Management Ltd	Oceanfit	- Beyond Capital LP (80%) (Beyond Capital Management owned by Diamond Wheel out of the Virgin Islands) and F4 Holdings (20%) own OceantFit a brand of supplements and health products - http://www.beyondcapitalnz.com/project/natural-nutrition/	- High value consumer brand in line with core competencies

Source: various company websites; interviews; articles; Coriolis analysis and classifications

In addition, large global firms are also investing in the wider New Zealand based nutraceutical, health and wellness brands

EXAMPLE INVESTMENTS BY LOCAL FIRMS

ACQUIRER	TARGET	DETAILS
中生联合 SINOLIFE UNITED	goodhealth NATURALLY NEW ZEALAND	- 2015 Sinolife acquired 100% ownership of Good Health from local owners via Shanghai Weiyi Investment and Management - Nanjing Sinolife United is a manufacturer of nutritional supplements serving clients in China - http://www.zs-united.com/en/
SPH 上海医药 SHANGHAI PHARMA	vitaco	- Vitaco was acquired in 2016 by Shangahi Pharma (60% for $141m) and Primavera Capital (40%-$98m) US$239m - https://www.sphchina.com/index/
春華 Primavera	vitaco	- https://www.primavera-capital.com
Nestlé	GO healthy NEW ZEALAND HEALTH MANUFACTURING	- 2022 Nestle Health Science acquires The Better Health Company (Go Healthy and Egmont Honey brands) and New Zealand Health Manufacturing from CDH Investments (China Diamond Holdings, Singapore) - Strategic fit to complement global portfolio of active lifestyle and health & wellness nutrition brands - "accelerate growth in the region through the manufacturing facility in Auckland which will enable us to bring new products to local markets faster." Nestlé Health Science's Head - https://www.nestle.co.nz/

Source: various company websites; interviews; articles; Coriolis analysis and classifications

Second, firms are branding and trademarking specific types and formulations of marine bioactives

TRADE MARKED BIOACTIVES

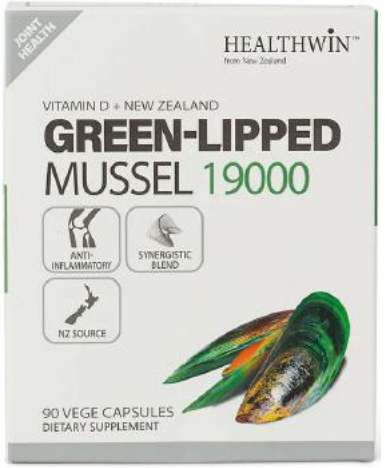
AROMA	bio-mer	WAITAKI BIOSCIENCES	SEADRAGON	SANFORD BIOACTIVES
Abalone Powder: ABA-Active™ Oyster Powder: OystaZIN® Fish Cartilage: FCP-Active™ GLM Powder: GlycOmega™ PLUS Fish Cartilage: BIO-Active™ GLM Oil: GlycOmega™ OIL Marine Collagen Powder (Type II): RevitaCOL™	Calcium (from hoki): OSSOMER® GLM Oil: TRIPERNOL®	GLM Powder: PernaTec GREENSHELL MUSSEL POWDER GLM Oil: PernaTec GREENSHELL MUSSEL OIL EXTRACT	NZ Hoki Oil: O3-mega^{20} Tuna Oil: O3-mega^{35} Algal Oil: DHA-mega^{50}	GSM Powder: PERNAULTRA™ GSM Oil: PERNAGOLD™ Marine Collagen (Type I): RENEWCOL™

Note: Waitaki Biosciences manufacture Pernatec but it is owned by NZ Superfood and Co. Ltd Source: company websites

Third, the industry is rallying around measurable standards for concentration (and in doing so, 'taking a page out of the manuka honey playbook')

EXAMPLE: FOUR LEVELS OF POTENCY

10,000mg fresh=80mg oil
80mg/100caps
0.8mg/cap



35,000mg fresh=280mg oil
280mg/60caps
4.7mg/cap

HEALTHWIN™
from New Zealand

Source: https://healthwin.co.nz/collections/mussel-products; NOTE These numbers do not represent the bioactive concentrations or type of bioactive just the ratio of actual concentration

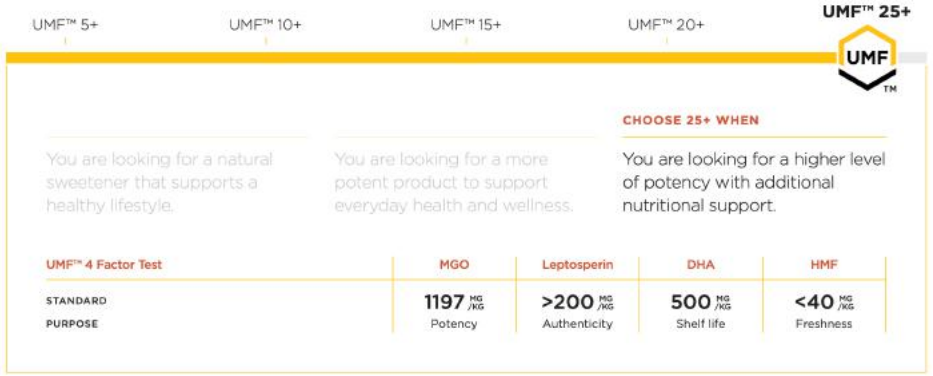
The greenshell mussel industry is in the process of developing a quality assurance standard for greenshell mussel powder

NEW GREENSHELL MUSSEL POWDER STANDARDS

"The industry is in the process of developing a quality assurance mark. The quality standard will differentiate greenshell mussel powders. All products within the standard will have a guaranteed lipid content. This is similar to the manuka honey UMF grades and wagyu grades… The mark will ensure our products are authentic and maintain our quality reputation." *Aquaculture NZ*

Aquaculture New Zealand

UMF HONEY EXAMPLE MODEL



The UMF™ Four Factor Quality Assurance Test independently certifies the quality factors that matter and summarises them in a single figure. It validates Potency, Authenticity, Freshness, and Purity of honest mānuka honey and verifies the genuine UMF™ rating of each batch." https://www.umf.org.nz/

Source: Interview; https://www.umf.org.nz/unique-manuka-factor/

Fourth, firms are seeking to demonstrate efficacy through stronger science

"MacLab has since invested millions of dollars into science and research proving the anti-inflammatory benefits of greenshell mussels for both humans and animals…There's been more than 30 years of research funded by MacLab at the Royal Melbourne Institute of Technology…" MacLab

MacLab:

"Ling maw is consumed as a soup or stew in Chinese cuisine and the company has engaged clinicals research organisation RDC Clinicals to validate it's benefits on gut and digestive health based on Traditional Chinese Medicine concepts...There's a lot of claims on different types of collagen on the market, very few are backed up by science. Hence the clinical trials that we will be conducting very soon to support marketing material." *Peter Fletcher, New Zealand Coastal seafoods (NZCS), article in Nutraingredients Asia, Dec 2022*

NEW ZEALAND COASTAL SEAFOODS

"We are currently working on a new and significant initiative. The development involves Greenshell Mussel (GSM) – Fucoidan product. Fucoidan is extracted from seaweed (Undaria pinnatifida). Combining Fucoidan with GSM's bioactive compounds. We will scientifically validate its health benefits relating to anti-inflammatory properties, immune stimulation, and glycaemic control in people with pre-diabetes or experiencing joint pain. The research team is led by a group of health specialists from Auckland University of Technology, the University of Auckland, and a food science expert from the National University of Singapore."
http://www.beyondcapitalnz.com/project/natural-nutrition/

BEYOND
Capital Management Ltd

"The United Fisheries fish bone powder (MCHC) had a significant effect on bone cells in the lab, stimulating osteoblast mineralistion. This indicates a potential positive effect on bone cell function. The fish bone powder MCHC had a significant positive effect on osteoblast mineralistion. This means that the powders stimulated the bone-making osteoblast cells to produce more bone mineral, although it should be notes that this effect was small. The powders did not inhibit and were therebefore not toxic to this bone formation process in this model." – Research by Massey University

NUTRI ZING
DIETARY SUPPLEMENTS

NOTE: Matt Miller at the Cawthron Institute has published a review of scientific results from using GSM relating more recently to muscle recovery. https://www.researchgate.net/profile/Matthew-Miller-17
Source: select articles; select websites; company websites; Coriolis analysis

Universities across New Zealand are researching marine bioactives and supporting firms researching bioactives

EXAMPLE MARINE PRODUCTS

UNIVERSITY OF AUCKLAND School of Biological Sciences	MASSEY UNIVERSITY Marine Biology	UNIVERSITY OF CANTERBIRY Marine Chemistry Group Marine Ecology Research Group
UNIVERSITY OF OTAGO Hawkin's Lab in the Department of Chemistry *(marine anti-cancer compounds)*	UNIVERSITY OF WAIKATO Environmental Research Institute Coastal Marine group in the School of Science *(sea sponge compound for cancer treatment)*	AUCKLAND UNIVERSITY OF TECHNOLOGY Health Sciences

Photo credit (example products: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes)

New Zealand's Crown Research Institutes and similar are researching marine bioactives

CAWTHRON

- NZ largest independent science organisation based in Nelson
- Works closely with private sector to develop customised analytical solutions to support product development and to validate nutritional content.
- Algae and Bioactives centre focus on realising the potential of marine bioactive resources, expertise in the isolation, characterisation, extraction, cultivation and modification of bioactive compounds.
- https://www.cawthron.org.nz/

Plant & Food™ Research
Rangahau Ahumāra Kai

- Plant and Food Research is a Crown Research Institute
- Seafood Division looks at breeding, aquaculture and aquaculture systems, production, consumer research, health and nutrition, food and ingredients formulation, total utilisation of products and food safety
- Cyber-Marine programme aimed at achieving 100% utilisation and maximised value for all wild and harvested seafood (MBIE funded)
- https://www.plantandfood.com/

CallaghanInnovation

- Callaghan Innovation is "New Zealand's Innovation agency providing a range of innovation, R&D services."
- Experts in Supercritical CO2 extraction (used for mussel oil) and services around marine lipids (pilot scale extractor)
- www.callaghaninnovation.govt.nz

NIWA
Taihoro Nukurangi

- NIWA The National Institute of Water and Atmospheric Research is a Crown Research Institute
- Research into potential of Nutraceuticals from seafood products
- Fisheries and seafood research
- https://niwa.co.nz

Finally, firms are delivering and marketing their sustainability

"Greg Summerton's dedication to using the sustainable methods of fishing… Its state-of-the-art longliner Kawatea runs on a mix of renewable biodiesel fuel, while advances in fish processing have enabled the development of by-products…A decade ago, to reduce his carbon footprint, Summerton purchased a 2225-hectare high-country farm in the Kaikoura Ranges with the aim of regenerating the native bush and planting millions of trees to sequester carbon."
https://blog.bnz.co.nz/2022/01/gone-fishing

OKAINS BAY
LONGLINE FISHING

"Consumers worldwide are increasingly demanding high-quality and sustainably sourced products, and there's a particular focus on the sustainable use of marine resources. As a business that has sustainability as its core, NZCS prides itself on reducing waste…Ling 100% wild caught under New Zealand's world leading, sustainable Quota Management System. The hydrolysis process involves less chemical input and less energy compared with traditional processes for land animal collagen extraction, meaning that it has high yields and is 'cleaner and greener'."
https://www.miragenews.com/new-zealand-company-develops-unique-technology-823200/

NEW ZEALAND
COASTAL SEAFOODS

"BIODIESEL The Kawatea runs on a blend of sustainable, renewable biodiesel fuel, made from used canola oil. Biodiesel greatly reduces C02 particulate emissions by up to 50% compared to normal diesel. Along with outstanding environmental credentials, biodiesel is also much safer and easier to store…. CARBON NEUTRAL- Waikene Station joined the Okains Bay Seafood group in 2010. The property is a 5,500-acre high country station and is a unique carbon farm where native New Zealand trees are supported to regenerate…. ZERO WASTE Through constant improvement and innovation in the way fish are processed the business aims to use every part of the fish. The business has developed a range of products, including pet food supplements that enable the full potential of each fish to be realised."
https://www.okainsbayseafood.co.nz/the-kawatea

OKAINS BAY
LONGLINE FISHING

Source: select articles; select websites; Coriolis analysis

As an example, firms that source New Zealand marine collagen products focus on selling the pristine nature of the environment and sustainable sourcing

MARINE COLLAGEN

nutriNZ New Zealand

"NutriNZ Marine Collagen is sustainably sourced hydrolysed Marine Collagen from the **pristine coastal waters of New Zealand**. It is naturally composed of the same 20 types of amino acids that are found in the body, helping it provide support from the inside out to nourish, hydrate and restore healthy tissue, skin, hair and nails.
https://nutrinz.com/product/marine-collagen/

DEEP BLUE HEALTH™

"Our marine collagen is sourced from the by-product of Elephant fish and Hoki fish living in the **pristine waters of the New Zealand** coast… Collagen can come from many sources, but Marine Collagen is a vegetarian option and is free from heavy metal contamination. It is a natural bi-product of the New Zealand fishing industry and is a renewable resource which is sustainably harvested."
https://www.deepbluehealth.co.nz

Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research

It is important that all sectors and segments of the industry are sustainable and ethical

WILD CATCH MANAGEMENT FRAMEWORK

Ministry for Primary Industries
Manatū Ahu Matua

QUOTA MANAGEMENT SYSTEM

Most of the fish species (98) that are important to New Zealand's commercial, recreational, and customary fishers are managed under the Quota Management System (QMS). For species managed under the QMS, there's an annual limit of how much can be caught.

Marine Stewardship Council

MARINE STEWARDSHIP COUNCIL

In New Zealand 8 species are certified to MSC standards (50% of all catch)

AQUACULTURE SUSTAINABLE MANAGEMENT FRAMEWORK

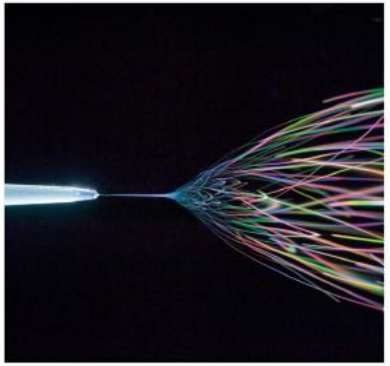
Source: A+ Aquaculture New Zealand; http://www.aplusaquaculture.nz

The industry is supported by a number of government and research programs and funds covering topics across these themes

SELECT: MARINE REPORTS, PROGRAMS & FUNDS

Draft Fisheries Industry Transformation Plan

Mahere Takahuritanga Ahumahi Hao Ika



https://www.mpi.govt.nz/consultations/draft-fisheries-industry-transformation-plan

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

National SCIENCE Challenges — SUSTAINABLE SEAS
Ko ngā moana whakauka

Our research

During 2014–2023 we have funded 75 research projects, bringing together around 250 ecologists, biophysical scientists, social scientists, economists, and experts in mātauranga Māori and policy from across Aotearoa New Zealand. In 2022–2024 we are weaving together the findings from all this mahi.

Innovation Fund

This has funded 23 innovative research projects in partnership with enterprise and business organisations, that will help build a blue economy in Aotearoa New Zealand.

This fund supports small, short-term projects up to a value of $250k for 2 years, and focuses on new approaches, capability, research and researchers/research partnerships. Project partners provide additional co-funding or funding in-kind. The fund is closed to new applications, all funding has been allocated.

We define 'blue economy' as being comprised of marine activities that generate economic value and contribute positively to ecological, cultural and social well-being.

https://www.sustainableseaschallenge.co.nz

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Endeavour Fund

The Endeavour Fund plays a unique role in the science system through an open, contestable process with a focus on both research excellence and a broad range of impacts.

https://www.mbie.govt.nz/science-and-technology/science-and-innovation/funding-information-and-opportunities/investment-funds/endeavour-fund/success-stories/

Ministry for Primary Industries
Manatū Ahu Matua

SFF Futures projects: seafood and aquatic

The projects are listed according to their start dates.
The latest project is at the top.

16 Seafood & Aquaculture projects funded

https://www.mpi.govt.nz/funding-rural-support/sustainable-food-fibre-futures/current-sff-futures-projects/sff-futures-projects-seafood-and-aquatic/

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The marine bioactive sector is a part of the wider circular system, in particular adding value to generically rendered fish carcasses

WHAT ARE THE OPPORTUNITIES TO BUILD A MORE CIRCULAR BIOMARINE SECTOR?

Using sustainable aquaculture and fishing
Aquaculture spp. low carbon footprint*
Potential for alternative fuels in vehicles, barges
On-boat rendering industry uses all products (no 'waste')

Recyclable/biodegradable packaging, production materials
Efficient production
Collaboration with other marine activities to increase scale of inputs
Circular design elements

Encouraging recycling/composting of packaging
Mussel shells returned to ocean to regenerate new mussel beds
Mussel shells as construction material

Modern plant and equipment
Renewable energy use
Co-located with ingredients suppliers
Efficient use of resource – no 'waste'
Developing high value bioactives from full carcass and skins

No obvious opportunities

Reduced distribution distances with optimised route management
Potential for alternative sources of energy in distribution
Bioactives light weight vs live fish

Rendered fish byproduct used as animal feed

* *vs alternative protein meat species. Image credit: European Parliament*

Plant and Food Research and University of Waikato have a number of programs working towards the goal of supporting marine products in being more circular and optimising use of the whole resource

"We need to think of a fish as being more than food, **valuing the whole organism** and what it contains. Of course there are fillets, shellfish, stocks and flavourings but marine organisms also contain a **wealth of compounds** including bioactives for body, skin and hair and large polymers for biomaterials. This creates huge potential to **add value to our fisheries** without catching more fish…New Zealand is already producing some marine nutraceuticals and biomaterials, but there's so much opportunity to do more. We're **working towards using everything, optimising value, reducing energy and water use, and making exciting new products** that will give us an edge in our export markets."

Dr Sue Marshall, Plant and Food Research

Plant & Food™ Research
Rangahau Ahumāra Kai

"Professor of engineering Kim Pickering and her team are researching ways to create building products out of waste materials in an effort to stamp out carbon emissions in the construction industry. Every year construction industry waste accounts for half of what enters landfills, and 20 per cent of the country's greenhouse gas emissions…Āmiomio Aotearoa aims to change that. The project is part of an $11 million government funded initiative to find ways to move businesses closer to a circular economy."
https://www.stuff.co.nz/business/126478346/mussel-shell-house-cladding-could-help-cut-landfill-waste-by-half--researchers-say

Stuff Āmiomio Aotearoa THE UNIVERSITY OF WAIKATO Te Whare Wānanga o Waikato

Source: Plant and Food Research; select articles

NanoLayr is an example of a firm combining the principles of the circular economy by using a low value product to produce a high value cosmeceutical

"Sanford has partnered with nanotechnology company, Revolution Fibres to **transform sustainably caught fish into nanofiber facemasks,** which can reduce wrinkles by more than 30%. The fish is hoki which we sustainably catch before **extracting pure collagen from the skins, a part of the fish that might otherwise be considered low value.**"

Sanford release, Nov 2018
https://www.sanford.co.nz/

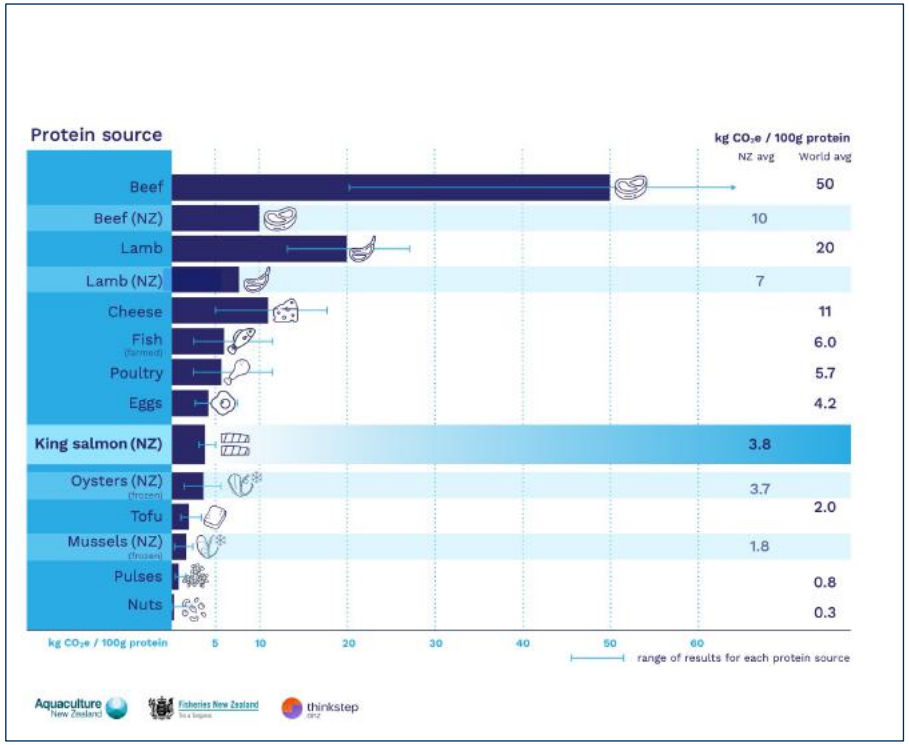
"T-Coll™ is our own 100%, type 1 marine collagen sourced from New Zealand oceans. Our proprietary novel batch production uses a gentle bioprocess method that enables us to treat our marine collagen with the utmost care, allowing us to preserve this sustainably sourced marine collagen in its purest, native form."

https://dermalayr.com/formulations/

Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research
Source: Company websites

Recent research highlighted the relatively low environmental impact of New Zealand aquaculture relative to alternative proteins

CARBON FOOTPRINT OF DIFFERENT PROTEINS



NOTE: Oysters and mussels come from thinkstep-anz (2021). Beef and Lamb NZ (2022), converted to per 100g protein. The other nutritional proteins come from global production data from Poore and Nemecek (2018). All products are shown using a system boundary that spans from farming to retail (NZ salmon this is domestic retail). Does not included further processing into bioactives.

RECOMMENDATIONS TO REDUCE CARBON FOOTPRINT SHELLFISH

- *Efficient vehicle use (barges and truck) and convert them to run on **low-carbon renewable energy** sources*
- *Switch from burning fossil fuels for thermal energy in processing facilities to **low-carbon renewable energy** sources, such as biomass or electric boilers*
- *Further analyse **plastic use** in the industry, especially for ocean-contact plastics*
- *Seek ways to reuse **production waste**, particularly organic waste*
- *Reduce the amount of **packaging** used and/or use reusable packaging*
- *Encourage air cargo operators to explore **low-carbon fuel alternatives***
- ***Increase the share of the domestic** and regional live product markets, as air freighting fresh product over long distances has a large carbon footprint*
- ***Expand the frozen export** market, as exporting frozen product in cargo ships has a low carbon footprint, even over long distances…"*

RECOMMENDATIONS TO REDUCE CARBON FOOTPRINT - SALMON

- *Source **low impact feed***
- *Improve **feed conversion ratio***
- ***Lower mortality***
- ***Reduce transport by air***

Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes; transformative, criticism, comment, scholarship & research
Source: Thinkstep anz funded by Aquaculture NZ & Fisheries NZ: LCA of NZ Mussels and Oysters 2021 and LCA of King Salmon 2023; https://www.aquaculture.org.nz

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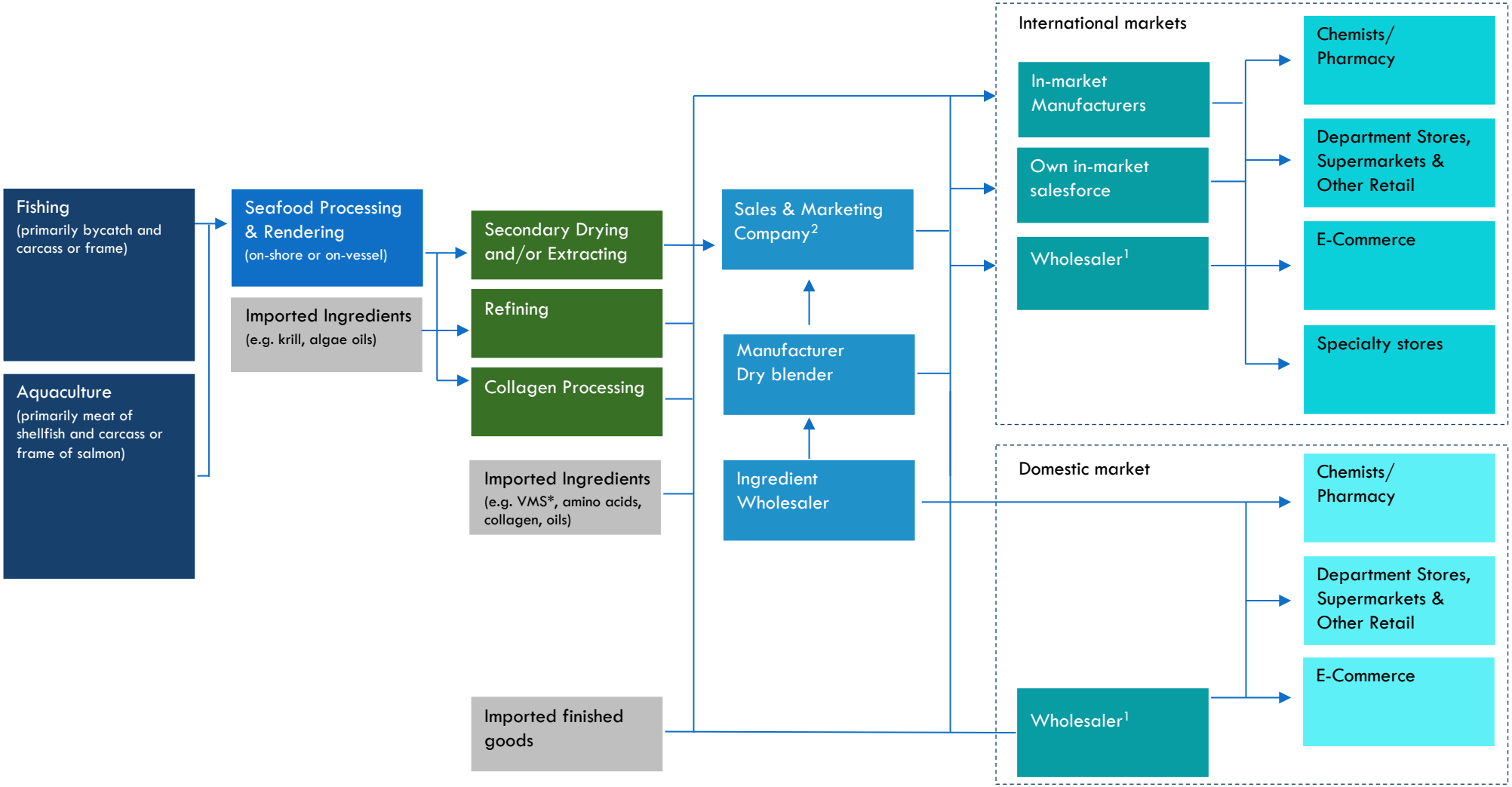
New Zealand has a successful marine bioactives sector built on the back of a sustainably managed wild capture seafood and aquaculture industry

NEW ZEALAND MARINE BIOACTIVES PLATFORM: SWOT ANALYSIS

STRENGTHS	WEAKNESSES
- Clean water and generally healthy aquatic environment - Unsubsidised industry - Early introduction of quota management system prevented collapse of stocks - Regularly ranked in top three sustainable regions - Efficient, modern fishing industry with large boats, in particular deep sea freezer trawlers - Stable, long-term ownership in place across most major firms - Only country farming green lipped mussels (Perna canaliculus); others farm a different green shelled species (perna viridis, etc.) or blue mussels (mytilus sp.) - Limited presence of disease in aquaculture species - Unique access to some bio-secure markets (particularly Australia & Japan) - Parts of domestic industry protected from imports by biosecurity measures - History and experience in development of high-tech processing solutions, particularly in the dairy industry, that is leveraged in the marine sector	- Most EEZ space low productivity deep water - Relatively small producer on a global scale - Most industry wild capture growth metrics negative; wild catch volume has fallen since 1998 leading to reduced throughput; 'sustainable' catch regularly revised downward - Supply fluctuates year-to-year with availability of wild capture fish - Numerous regulatory challenges to aquaculture growth - Bioactives firms primarily small-scale with limited access to capital relative to global leaders - Competing users of coastal space for aquaculture (e.g. holiday houses) - High and growing levels of industry regulation; semi-regular emergence of all new regulatory frameworks that are claimed will fix the challenges of the old framework - No competitive advantage around aquaculture feed production due to low scale - Lack of market integration, not capturing most in-market value (most margin in market) - Limited in-market knowledge
OPPORTUNITIES	**ISSUES/THREATS/RISKS**
- Consumer perceptions of health benefits of marine bioactives - Further targeted scientific research into species in New Zealand waters - Ongoing investment in new processing and extraction facilities - Large amounts of fish body currently going to meal and waste - Optimising by-catch in particular when in high volumes - Growing interest by some more wealthy consumers in Western markets for eco-labelling and environmental certification (driven by retailers) - Growing middle class in China and SE Asia - Ongoing removal of trade barriers and negotiation of new free trade agreements	- New regulations of wider nutraceuticals sector suppressing innovation - New Zealand's wild capture continues to decline while aquaculture stall continues - Other countries "catching up" on sustainability (e.g. Argentina) - Low cost competitors in low wage/low regulation/higher productivity warm waters - Chile continues achieving massive growth in mussels; shifts more strongly to bioactives - Growing industry professionalism and food safety standards in China - NIMBY (not in my back yard) attitudes limiting industry activity - Single issue special interest groups driving domestic regulatory agenda - Global warming and climate change impacts fisheries

The New Zealand marine bioactives industry has a diverse supply chain that delivers ingredients and finished products to worldwide



** Vitamins, Minerals and Supplements' 1. There may be one or more layers of wholesaling, depending on product or market; some wholesale functions may be captive inside manufacturers or retailers; 2. Brand and sales company using third party manufacturing and distribution; Source: Coriolis*

The New Zealand marine bioactives sector is supported by a large, robust seafood industry with strong capabilities in place across the total supply chain

NEW ZEALAND CAPABILITIES DRIVEN SUPPLY CHAIN: SEAFOOD

SELECT FIRMS

AQUACULTURE GENETICS

Salmon Smolt NZ Ltd · Clearwater Salmon Hatchery · CAWTHRON · spatNZ

FUEL & LUBRICANTS

GO Fuel · Mobil · bp · CLIPPER OIL

EQUIPMENT/SUPPLIES

MESH Industries Group · fresh by design · AKVA GROUP · SEAFISH Systems · Southshore Marine Ltd. · COOKES a BRIDON-BEKAERT Ropes Group Brand · DEEPDROP COMMERCIAL · SMART MARINE · BURNSCO · TENOB · CR EQUIPMENT · STORMLINE · Discount Fishing Supplies The Saltwater Specialists

FEED IMPORTERS

BigNutrition · BioMar · SKRETTING

AREA

4.4m sqkm water
15,134km coast
~7,700ha aquaculture

PEOPLE IN SHEEP FARMING*

1,030 aquaculture
2,593 fishing/capture
4,790 processing/wholesaling

AQUACULTURE

New Zealand King Salmon · Mt COOK alpine salmon · KONO · SANFORD · MOANA NEW ZEALAND · Talley's · OPC · North Island Mussels Ltd · Te Ohu Kaimoana · AKAROA SALMON · UNITED · SEALORD · Clevedon Coast OYSTERS · Kaipara Oysters · HIGH COUNTRY SALMON

FISHING/PROCESSING

Talley's · SANFORD · SEALORD · UNITED · NGĀI TAHU SEAFOOD · Te Ohu Kaimoana · MOANA NEW ZEALAND · Solander OCEAN TO PLATE · VELA FISHING LTD · Independent · Takitimu SEAFOODS · CLOUDY BAY CLAMS · pauaco · Ngati Porou Seafoods Group · PelcoNZ · WF WESTFLEET SEAFOODS EST 1979 · FIORDLAND LOBSTER COMPANY · Echinoderm Ltd · OKAINS BAY LONGLINE FISHING

BIOACTIVES

MacLab · SANFORD BIOACTIVES · SEADRAGON THE WORLD'S BEST BRAINFOOD · WAITAKI BIOSCIENCES · Genesis Bio-Lab · Anagenix · Alaron · CFARMX NEW ZEALAND · GO Healthy · SEPEREX NUTRITIONALS · PHARMALINK Extracts Limited · bio-mer · NANOLAYR · vitaco · RMF nutraceuticals · AROMA · ORGANIC BIOACTIVES

PET FOOD

Nestlé Good Food, Good Life · PURINA · Heinz · Chunky · rpf · Bpf · Natural Pet Food Group · ZIWI · TU MEKE FRIEND · zealandia · Natural · NRG+

SHIPPING

MAERSK LINE · HAMBURG SÜD · msc · CMA CGM · Hapag-Lloyd · EVERGREEN · COSCO SHIPPING · YANG MING

LOGISTICS

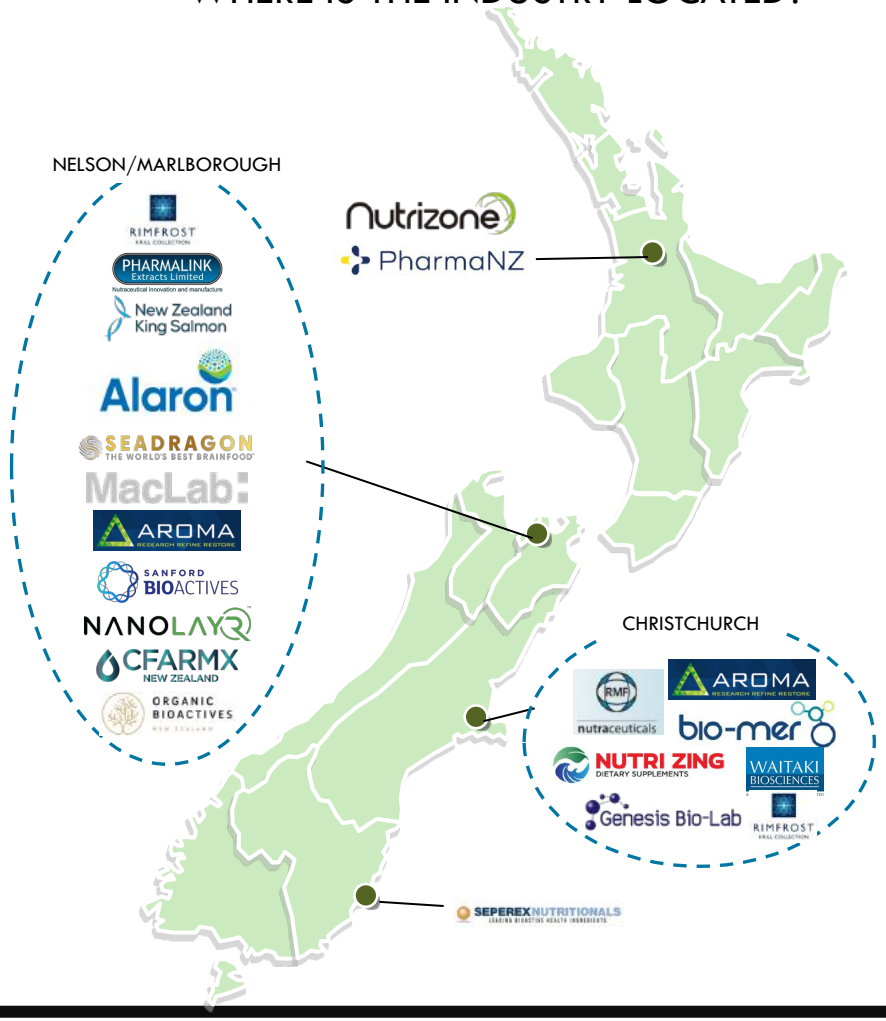
Move Freight · MAINFREIGHT

INDUSTRY ORGANISATION

Seafood New Zealand · deepwater group · Aquaculture New Zealand · ANZSA · PĀUA INDUSTRY COUNCIL · mfa Marine Farming Association · CoroMFA · FISHERIES INSHORE NEW ZEALAND · NZ Fish Fed · New Zealand Salmon Farmers Association Inc.

New Zealand's marine bioactive processors and extractors are primarily located in two clear clusters in Nelson and Christchurch.

WHERE IS THE INDUSTRY LOCATED?



SELECT FIRMS
Not a complete list

NOTE: Select Firms only

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Marine Bioactives firms profiled in this section

FIRMS PROFILED

NANOLAYR	ORGANIC BIOACTIVES NEW ZEALAND	WAITAKI BIOSCIENCES A DIVISION OF PHARMAZEN LIMITED ALORA	SANFORD BIOACTIVES	AROMA RESEARCH REFINE RESTORE
Genesis Bio-Lab	GMP Alaron	SEADRAGON THE WORLD'S BEST BRAINFOOD	HIKURANGI BIOACTIVES	RMF nutraceuticals
PHARMALINK Extracts Limited Nutraceutical innovation and manufacture	MacLab	bio-mer	PharmaNZ	Nutrizone
NEW ZEALAND COASTAL SEAFOODS	new zealand extracts limited	DRY FOOD NEW ZEALAND	OKAINS BAY LONGLINE FISHING	CFARMX NEW ZEALAND Talley's
New Zealand King Salmon OMEGA PLUS+ THE SALMON SUPERFOOD	WANAKA BIOMARINE Southern Ocean Krill Oil PL30	RIMFROST KRILL COLLECTION		

INGREDIENTS

NANOLAYR (was Revolutionfibres Nanofibre Technology	ORGANIC BIOACTIVES	WAITAKI BIO-SCIENCES / PHARMAZEN	SANFORD
Iain Hosie **Co-Founder, Director**	**Andrea Taimana,** **Director, CSO and Co-founder**		**Peter Riede** **CEO**
DESCRIPTION: Sanford partnership with RevolutionFibres to product collagen brand Activlayr. 2021 changed to NanoLayr, (brand: DermaLayr) use electronspinning technology to produce nanofibres	DESCRIPTION: Cosmetics science and wholesaling organisation specialising in R&D, cosmetics chemistry and pharmacology, utilising NZ unique botanicals such as seaweed, mamaku and other botanicals using water-based extraction technology TPTXtraction.	DESCRIPTION: "Innovative developer, manufacturer and marketer of science based, natural nutritional ingredients." Ingredient supplier, contract dryer, plus own brands of ingredients (CassiPure, PhenAciv, PernaTec, CollaMex…), plus own brand of retail products Aiora	DESCRIPTION: Major fishing company in New Zealand (harvesting 109k GWT), wild catch, salmon and mussels. Sanford Bioactives division created to extract additional value from harvest
KEY PRODUCTS: collagen nanofibre repairs and rejuvenates skin – mask and mist products	KEY PRODUCTS: OceanDerMX, Natrue and Cosmos certified range	KEY PRODUCTS: Freeze-dried glands, organs, fruit (black currants, kiwi fruit) greenshell mussel oil & powder, shark cartilage	KEY PRODUCTS: Fishing products, aquaculture, value added products
OWNERSHIP: Private: NZ: Movac Fund (22%) Chillaxing (9%), GRC Sinogreen nominees (9%), Others	OWNERSHIP: Private: NZ: Organic Bioactives Holdings: Taimana (34%), Wong (HK) (21%), Astrolab (11%), Vulinovich (9%), others	OWNERSHIP: Private: NZ	OWNERSHIP: Private: NZ Ngai Tahu Investments (20%), ASB Nominees (10%), Masfen Securities (8%), many others
COMPANY NUMBER: 2198121	COMPANY NUMBER: 7645216	COMPANY NUMBER: 1168773	COMPANY NUMBER: 40963
ADDRESS: 59 Mahunga Drive, Mangere Bridge, Auckland, 2022	ADDRESS: Tasman Building, 16-22 Anzac Avenue, Level 1, Suite B	ADDRESS: 3 Desi Place, Hillsborough, Christchurch	ADDRESS: 22 Jellicoe Street, Freemans Bay, Auckland
PHONE: +64 9-622 0068	PHONE: +64 21 224 6992	PHONE: +64 3 337 6096	PHONE: +64 9 379 4720
WEBSITE: https://www.nanolayr.com https://www.activ-layr.eu	WEBSITE: https://organicbioactives.com	WEBSITE: https://www.waitakibio.com/ https://pharmazen.co.nz; https://aioranz.com	WEBSITE: https://www.sanford.co.nz https://sanfordbioactives.co.nz
YEAR FORMED: 2009	YEAR FORMED: 2019	YEAR FORMED: 2001	YEAR FORMED: 1904
STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A
REVENUE: N/A	REVENUE: N/A	REVENUE: $24.6m (2022)	REVENUE: $532m
COMPANY HIGHLIGHTS: New product 100% NZ marine hydrolysed collagen from hoki skins. 2021 changed names to Nanolayr	COMPANY HIGHLIGHTS: Directors based in France, NZ, HK, 2022 Best Ingredient supplier. 2022 Introduces OceanDerMX line and invests in R&D. Partnering with global ingredient distributors 2020 wins L'Oreal innovation runway competition Approached by $28b USA retail to supply ingredients.	COMPANY HIGHLIGHTS: Acquired by PharmaZen in 2002; between 2006-2008 invested $15m; 1800m2 manufacturing; drying capacity 4700kg, 100t/wk drying capacity. Significant investment in new drying capacity two new 2,000 kg FD's	COMPANY HIGHLIGHTS: 2017 Acquired Enzac nutraceutical company and 2022 scaled up capabilities in marine extracts, opened $20m Bioactives Centre in Blenheim (Marine Collagen extraction among other extractions).

^ *Coriolis estimate*

INGREDIENTS

AROMA NZ LTD	GENESIS BIOLABORATORY	ALARON PRODUCTS	SEADRAGON
Ben Winters **Managing Director**	**Stephen Parsons** **Managing Director**	**Claire Quin** **General Manager**	**Mark Stewart** **Director, Owner**
DESCRIPTION: Vertically integrated mussel farms and mussel production and processing – including freeze-drying. Process NZKS freeze dry pet food; Three factories in CHCH and investing in new processing in mussel facility in Marlborough	DESCRIPTION: Contract manufacturing – full service sourcing material, freeze-drying, milling, packing; medium sized facility producing bioactives, nutraceuticals, pharmaceutical products; Current capacity but no facilities for specialist mixing.	DESCRIPTION: Manufacture and contract pack supplements, medicines and therapeutic goods; source, store, dry, mill, blend. Various sized machines, large processor.	DESCRIPTION: Processor of Omega oils into marine bioactive compounds and is committed to, and recognised for, the quality and purity of our products. Ingredients supplier, plus own branded Seadragon products
KEY PRODUCTS: Green-lipped mussel extracts; green-lipped mussel powder & oil, MCHA calcium powder, marine collagen, oyster powder, fish cartilage powder, abalone powder, freeze-dried meat products and dog treats,	KEY PRODUCTS: Glands, organs, marine collagen, greenshell mussel powder, fucoidan powder, seasonal fruit, petfood	KEY PRODUCTS: Freeze dry: honey, fruits, vege, algae, plant material, Greenshell mussels and other marine products (capsules, tablets, blending)	KEY PRODUCTS: DHA omega-3 oils from (algae, tuna, NZ hoki), powders for supplements, food ingredients
OWNERSHIP: Private: NZ 90% (Winters, John Rundle, John Creighton) 10% (Winters)	OWNERSHIP: Private: NZ Stephen Parsons 50%, Adrienne Parsons 50%	OWNERSHIP: Private: NZ Edwards 57%,, Geiger 19.8%, Wests, Williams 10%, Maitai Trust and Williams 10%	OWNERSHIP: Private: NZ Sheldon Ltd (Masthed via Pescado Holdings, Mark Stewart)
COMPANY NUMBER: 126871	COMPANY NUMBER: 670089	COMPANY NUMBER: 612891	COMPANY NUMBER: 310577
ADDRESS: 12 Senior Place, Bromley, Christchurch, Canterbury	ADDRESS: 4 Michelle Road, Middleton, Christchurch	ADDRESS: 13 Bolt Road, Tahunanui, Nelson	ADDRESS: 12 Nayland Road, Stoke, Nelson
PHONE: +64 3 389 9005	PHONE: +64 3 338 3552	PHONE: +64 3 548 5875	PHONE: +64 3 547 0336
WEBSITE: www.aromanz.com	WEBSITE: http://genesisbiolab.co.nz / https://evas.co.nz/	WEBSITE: https://www.alaron.co.nz	WEBSITE: https://www.seadragon.co.nz
YEAR FORMED: 1962	YEAR FORMED: 1995	YEAR FORMED: 1993	YEAR FORMED: 1986
STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A
REVENUE: N/A	REVENUE: N/A	REVENUE: N/A	REVENUE: N/A
COMPANY HIGHLIGHTS: Processes include: freeze drying, flash drying, vacuum drum drying and supercritical fluid extraction; Aroma acquired the Biolane™ Green-lipped mussel brand from Vitaco June 2020; Supercritical extraction installed in 2021	COMPANY HIGHLIGHTS: Developed Eva's brand of smoothies and supplements	COMPANY HIGHLIGHTS:	COMPANY HIGHLIGHTS: Refinery commissioned 2016, capacity of 5,000t omega-3 oil per year 2019 Talley's retrofitting vessels to obtain fit for human consumption hoki oil

^ *Coriolis estimate*

INGREDIENTS

CFARMX NZ LTD/TALLEYS	HIKURANGI BIOACTIVES / NEW ZEALAND NUTRACEUTICALS LIMITED	RMF NUTRACEUTICALS	PHARMALINK EXTRACTS
Nick McMillan , Ben Forrest **Founding Directors**	**Manu Caddie** **Director**	**Roman Sulovsky** **Director**	**Grant Wilson** **General Manager**
DESCRIPTION: Initial extraction of blueshell mussels (bycatch) into pet ingredients, extended into greenshell mussels products, ling and hoki products	DESCRIPTION: economic development Trust. R&D firm and investor in various enterprises across hemp, cannabis, kanuka oil, marine bioactives etc.	DESCRIPTION: Supplies innovative and high-quality raw materials to some of the largest end-users and contract manufacturers in the Pharmaceutical and Nutraceutical industries worldwide.	DESCRIPTION: Production and extraction of high value natural products. Operate a large multi-purpose extraction plant with four 850L extraction vessels; powders, liquids, blending, packing, R&D plus pilot facilities; extracting bio-actives
KEY PRODUCTS: GSM oil, peptides and powder, blue mussel products, marine collagen peptides, ling maw powder	KEY PRODUCTS: Kanuka oils, new species bioactives research	KEY PRODUCTS: Marine products, (AquaNutraceuticals), animal and plant products	KEY PRODUCTS: powder and liquid bioactives; mussel, krill oil
OWNERSHIP: Private: NZ 100% Talleys Cfarmx Ltd (6483813) owned by McMillan, Forrest and McLeannan	OWNERSHIP: Private: NZ JV Hikurangi Enterprises Limited and New Zealand Nutraceuticals Limited	OWNERSHIP: Private: AU R&T Australia Pty Ltd	OWNERSHIP: Private: HK Pharmalink International
COMPANY NUMBER: 8195588	COMPANY NUMBER: 5850827	COMPANY NUMBER: 5495503	COMPANY NUMBER: 4639259
ADDRESS: 1 Ward Street, Motueka, Nelson	ADDRESS: Ruatoria, East Coast	ADDRESS: 24 Byron Street, Sydenham, Christchurch	ADDRESS: 379 Appleby Highway, RD 1 Richmond
PHONE: +64 9 212 3881	PHONE: +64 274 202 957	PHONE: +64 3 365 8811	PHONE: +64 3 544 5610
WEBSITE: https://cfarmx.co.nz/	WEBSITE: https://hikurangibioactives.co.nz https://hikurangi.enterprises	WEBSITE: http://www.rmfnutraceuticals.co.nz	WEBSITE: https://www.pharmalinkextracts.com
YEAR FORMED: 2021	YEAR FORMED: 2016	YEAR FORMED: 1996/2014	YEAR FORMED: 2013
STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A
REVENUE: N/A	REVENUE: N/A	REVENUE: N/A	REVENUE: $46.7m (2022)
COMPANY HIGHLIGHTS: Use enzymatic hydrolysis to produce a stable liquid. Partnership with Talleys to use GSM and other marine ingredients to create functional. Ramping up extraction process and just acquired Kono GSM operations	COMPANY HIGHLIGHTS: Kina Bioactives Project with Cawthron and local hapu	COMPANY HIGHLIGHTS: R&T Australia acquired RMF in Feb 2023	COMPANY HIGHLIGHTS: Directors across AU, HK, NZ and Philippines; 2022 amalgamated with Richmond Management Services; Partnership with Pharma Health NZ to produce 'Lyprinol'; Use supercritical extraction for high value oils; Wanaka Biomarine sell their krill oil

^ *Coriolis estimate*

INGREDIENTS

MACLAB (NZ) LTD	BIO-MER	NUTRIZONE	PHARMA NZ
Scott Gillanders **CEO**	**Joe Cave** **General Manager**	**Seoksu Yun** **Owner**	**Peter Lehrke** **Director**
DESCRIPTION: Vertically integrated green-lipped mussel extract company producing nutraceuticals and supplying Pharmalink to process into oils Lyprinol and Antinol. Leader in oil research.	DESCRIPTION: Processor and contract freeze-drying, extraction and blending; specialising in marine extracts for human and pet health products based in Christchurch; supplying retail ready or bulk ingredients	DESCRIPTION: Contract manufacturing services ranging from powder blending, encapsulating, tableting & packaging services (tins, sachets, blisters). Contract manufacture and own brand Healthwin and Imanuka	DESCRIPTION: Contract manufacturing facility, covers a 2,500m2 footprint with a cleanroom area of 350m2; produces over 500 tonnes of powder blend products, 10 million tablets, and 70 million hard-shell capsules annually
KEY PRODUCTS: Green-lipped mussel powder, Oils	KEY PRODUCTS: Powder, whole, encapsulated forms of: calcium supplements, krill oil, Hoki, brain health products, green-lipped mussel supplements, pet health products	KEY PRODUCTS: Honey products, Colostrum, oil capsules, Marine collagen (non-NZ), Green lipped mussel granules	KEY PRODUCTS: powders, capsules,
OWNERSHIP: Private: NZ (Broadbent 95%), Talleys (5%)	OWNERSHIP: Private: NZ Cave	OWNERSHIP: Private: NZ Yun	OWNERSHIP: Private: NZ Lehrke
COMPANY NUMBER: 6131569	COMPANY NUMBER: 171281	COMPANY NUMBER: 5175241	COMPANY NUMBER: 7075980
ADDRESS: 11 Merton Place, Annesbrook, Nelson	ADDRESS: 38 Sonter Road, Christchurch	ADDRESS: 12 Cape Hill Road, Pukekohe, Auckland	ADDRESS: 18 Lincoln Street, Frankton, Hamilton,
PHONE: +64 3 548 6288	PHONE: +64 3 348 9871	PHONE: +64 9 265 1000	PHONE: +64 7 974 9248
WEBSITE: https://www.maclab.co.nz	WEBSITE: www.biomer.com	WEBSITE: https://www.nutrizone.co.nz	WEBSITE: https://pharmanz.com
YEAR FORMED: 1973/2016	YEAR FORMED: 2005	YEAR FORMED: 2014	YEAR FORMED: 2018
STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A
REVENUE: N/A	REVENUE: N/A	REVENUE: N/A	REVENUE: N/A
COMPANY HIGHLIGHTS: Founding partner in Moananui a collaboration of organisations formed to improve ocean health and sustainably develop the blue economy in NZ. Talleys invested 5% in 2019. Consent for 1000 ha marine farm (finalised 2020) Founding member of NZ Seaweed Association Invested $20m (2018-2020) to increase production; including Vanguard a ship able to harvest 80t mussels /day; ongoing aquaculture research e.g. Precision Aquaculture R&D Project (2022)	COMPANY HIGHLIGHTS: Produce ingredients and branded marine products	COMPANY HIGHLIGHTS: End of 2022 soft gel encapsulation service, honey blending service. 2019 achieved MPI RMP certification; 2019 sachet machine; 2018 Honey packing service; 2015 Set up blending, encapsulation and tableting machines; 2014 founded	COMPANY HIGHLIGHTS: Contract manufacturing facility opened 2019

^ *Coriolis estimate*

INGREDIENTS

NEW ZEALAND COASTAL SEAFOODS LTD.	NEW ZEALAND EXTRACTS LTD	DRY FOOD NZ LTD	OKAINS BAY SEAFOOD
Peter Chai **Managing Director**	**Michael Turner** **Director**	**Jeremy Harris** **General Manager**	**Greg Summerton** **Founder**
DESCRIPTION: producer of premium seafood products and nutraceutical marine ingredients.	DESCRIPTION: Manufacture 100% natural water soluble bioactive biofunctional ingredients from NZ grown fruits & plants (often by products), into liquid, powder or encapsulated range, based in Blenheim	DESCRIPTION: Nutraceutical and functional food manufacturer; purpose-built manufacturing facility to dry, mill, extract and pack	DESCRIPTION: Seafood company based out of Christchurch
KEY PRODUCTS: Ling Maw (branded and bulk), nutraceutical ingredients	KEY PRODUCTS: Grape seed extract, kiwifruit extract, **marine gel**, blackcurrant and boysenberry extract	KEY PRODUCTS: Dried fish , fin fish oil, mussel oil, fish powder, mussel powder, hoki roe powder, marine collagen powder	KEY PRODUCTS: long line fish species (10), marine collagen
OWNERSHIP: Public: NZ	OWNERSHIP: Private: Japan Ohsawa Holdings Ltd	OWNERSHIP: Private: NZ Masthead Ltd (Mark Stewart)	OWNERSHIP: Private: NZ
COMPANY NUMBER: 6159969	COMPANY NUMBER: 4889039	COMPANY NUMBER: 8119136	COMPANY NUMBER:
ADDRESS: 7 Bolt Place Harewood, Christchurch	ADDRESS: 6 Kendrick Road, Riverlands, Blenheim 7242, Marlborough,	ADDRESS: 7 Fielder Close, Riverlands, Blenheim	ADDRESS:
PHONE: +64 3 338 9996	PHONE: +64 21 398 559	PHONE: +64 21 461 953	PHONE: +64
WEBSITE: https://nzcs.co	WEBSITE: https://www.nzextracts.com	WEBSITE: https://www.dryfoodnz.com	WEBSITE: https://www.okainsbayseafood.co.nz
YEAR FORMED: 2016	YEAR FORMED: 2014	YEAR FORMED: 2020	YEAR FORMED:
STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A
REVENUE: N/A	REVENUE: N/A	REVENUE: N/A	REVENUE: N/A
COMPANY HIGHLIGHTS:	COMPANY HIGHLIGHTS: Previously named Tuatara Natural Products (until 2014); Marine gel is a raw skincare ingredient made from Wakame, *Undaria pinnatifida* use the whole kelp to extract bioactives	COMPANY HIGHLIGHTS: Recent investment	COMPANY HIGHLIGHTS: 2022 developed a collagen product from byproducts in conjunction with Plant and Food

^ *Coriolis estimate*

INGREDIENTS

NEW ZEALAND KING SALMON

Graeme Tregidga
Acting CEO

DESCRIPTION: Leading salmon aquaculture producer in NZ under brands Ora King and Regal, includes petfood operations under the Omega Plus brand; ~6,000 MT harvest in FY2023

KEY PRODUCTS: Salmon products (fresh, frozen, processed), Petfood ingredients, including fish oil

OWNERSHIP: Mix: NZX, and others
Oregon Group (40%), Virgin Islands; NZ share market (14%), China Resources NG Fund, HK, (10%), others

COMPANY NUMBER: 2161790

ADDRESS: 17 Bullen Street, Tahunanui, Nelson

PHONE: +64 3 548 5714

WEBSITE: https://www.kingsalmon.co.nz

YEAR FORMED: 2008

STAFF EMPLOYED: N/A

REVENUE: $167m

COMPANY HIGHLIGHTS: Recent approval for deep sea Ocean aquaculture, struggling with consents and location in Marlborough Sounds

WANAKA BIOMARINE

Ian Chant
General Manager (Aker AU)

DESCRIPTION: Krill oil supplier sourcing Antarctic Krill that is processed by Pharmalink and branded by Southern Ocean Krill Oil (Wanaka Biomarine)

KEY PRODUCTS: Krill Oil

OWNERSHIP: Private: Norway
Aker Biomarine Antarctic AS

COMPANY NUMBER: 7224893

ADDRESS: 287-293 Durham Street Level 1, Awly Building, Christchurch

PHONE: N/A

WEBSITE: https://wanakabiomarine.com
https://www.akerbiomarine.com

YEAR FORMED: 2019

STAFF EMPLOYED: N/A

REVENUE: N/A

COMPANY HIGHLIGHTS: Aker Biomarine established Wanaka Biomarine in 2019 and use new source of krill oil from Pharmalink Extracts (Nelson)

^ *Coriolis estimate*

Marine Bioactives brands profiled in this section

IDENTIFIED FIRMS PROFILED

vitaco

GO healthy

goodhealth NATURALLY NEW ZEALAND

OCEAN&GREEN™ Nourished by Nature

PETER JOHN

NUTRI ZING DIETARY SUPPLEMENTS

UBbIO™ SINCE 1988

DEEP BLUE HEALTH™

nutri NZ new zealand

TURNER new zealand

IDENTIFIED FIRMS NOT PROFILED

GreenHealth.co.nz

KiwiCorp Enzergen

ANTLER FARMS® Your Body Will Thank You

LYPRINOL®

nzpurehealth New Zealand

Mills Bay® MUSSELS

HealthUP

vh. | VITA HUB

Everyday Health

HEALTHWIN™ from New Zealand

BRANDS

VITACO GROUP	THE BETTER HEALTH COMPANY LIMITED	NUTRI ZING/UNITED FISHERIES	UB BIO 2005 LTD
John Stanton **General Manager (NZ)**	**Scott Johnson** **Group CEO**	**Andre Kotzikas** **Director**	**Youn Soo Lee** **Managign Director**
DESCRIPTION: Vitaco is Australlasias leading nutrition manufacturer with market share dominating Vitamin, Sports and Health brands. Brands: Healtheries, Musashi, Balance, Aussie Bodies, NutraLife and Inc Sports	DESCRIPTION: Vitamins and supplements manufacturer; based in Wellington; subsidiary New Zealand Health Manufacturing Limited (NZHM), specialists in in softgell, hardshell, tablet and powdered health products, based in Auckland; Go Healthy Australia business unit	DESCRIPTION: Frozen and fresh fish, mussels, oysters, fish fertilisers, nutraceutical products Company; producing supplements for humans and pets	DESCRIPTION: New Zealand deer velvet processing and health foods manufacturer. Products cover human and pet use; export to China, Korea, Australia, the USA, Canada and European countries.
KEY PRODUCTS: Vitamins, Supplements, Health Foods, Sports and Health products	KEY PRODUCTS: Honey, V,M&S	KEY PRODUCTS: Fish products, Dietary supplements: fish bone, fish cartilage, GSM powder; Fish fertiliser under brand Bio Marinus	KEY PRODUCTS: Bio-active deer velvet, freeze-dried green lipped mussel, other nutritional supplements (shark cartilage, berries, kiwifruit etc.) for human and pet.
OWNERSHIP: Public: HK/CN SSEW: 01607; SEHK: 2607 Shanghai Pharmaceuticals Holding Co via Zeus Two Holding Co	OWNERSHIP: Public: Switzerland Nestle via Ora New Zealand	OWNERSHIP: Private: NZ Kotzikas Family	OWNERSHIP: Private: NZ Youn
COMPANY NUMBER: 1885808	COMPANY NUMBER: 5220401	COMPANY NUMBER: 126455	COMPANY NUMBER: 1607184
ADDRESS: 4 Kordel Place, East Tamaki, Auckland	ADDRESS: 88 Montgomerie Road, Mangere, Auckland	ADDRESS: 50 - 58 Parkhouse Road, Christchurch	ADDRESS: 4 March Place, Belfast, Christchurch
PHONE: N/A	PHONE: +64 4 891 0184	PHONE: +64 3 343 0587	PHONE: +64 3 323 8398
WEBSITE: https://vitacohealth.com	WEBSITE: www.gohealthy.co.nz	WEBSITE: https://nutrizing.co.nz	WEBSITE: www.ubbio.com
YEAR FORMED: 1904/2006	YEAR FORMED: 2008/2014	YEAR FORMED: 1953	YEAR FORMED: 1988/2005
STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A	STAFF EMPLOYED: 180 (total business)	STAFF EMPLOYED: 20
REVENUE: $187.3m ('22; NZ)	REVENUE: $126.2 (FY22) Ora	REVENUE: $70-90m (total business)	REVENUE: N/A
COMPANY HIGHLIGHTS: 2015 – Acquired Musashi; 2015 – Listed on AS X; 2020 – Built purpose-built DC in Auckland; Aroma acquired the Biolane™ Green-lipped mussel brand from Vitaco June 2020	COMPANY HIGHLIGHTS: own 50% Egmont Honey Nestle acquired The Better Health Co (via Ora NZ)	COMPANY HIGHLIGHTS: Started with fish bone cartilage, utilising fish waste from manufacturing facility in CHCH; Research by Massey University	COMPANY HIGHLIGHTS:

^ *Coriolis estimate*

BRANDS

MAGMEG LTD/NUTRINZ	GOOD HEALTH	NEW ZEALAND SOUTHERN PACIFIC SEAWEED COMPANY	ALL NZ TRADING LIMITED
Bruno Beuchel **General Manager**	**Wing Wang** **General Manager**	**Daneen Morgan** **Founder**	**Heo** **Director**
DESCRIPTION: Nutraceuticals firm based on flagship colostrum products, shipping to 70 countries	DESCRIPTION: Manufacturer and wholesaler of nutraceutical and health foods. Over 350 products; sold into pharmacies, health stores, duty free channels	DESCRIPTION: Produce supplement and skin-care range based on nutrient-rich New Zealand ocean products. Sourcing collagen from NZ - NZ Natural RevitaCOL Marine Collagen	DESCRIPTION: Supplements and nutraceuticals brand made in New Zealand and sold primarily into China
KEY PRODUCTS: Nutraceuticals: dairy, marine, bee based, sheep placenta, deer velvet products etc.	KEY PRODUCTS: Beauty (marine collagen powders), Bee Products, Colostrum & Milk, Weight management, Superfoods, Dairy nutritionals Health products (deer based), Nutritional oils	KEY PRODUCTS: Skincare, Collagen and seaweed powders	KEY PRODUCTS: Mussel oil, bee products, ovine, cow and deer products
OWNERSHIP: Private: NZ Beuchels	OWNERSHIP: Public: CN Nanjing Sinolife United (XHKG:03332) via Shanghai Weiyi Investment & Management Limited Company	OWNERSHIP: Private: NZ Morgan	OWNERSHIP: Private: NZ Heo (33%), Kim (22%), Kim (33%)
COMPANY NUMBER:1018399	COMPANY NUMBER: 1545099	COMPANY NUMBER: 6334207	COMPANY NUMBER: 8214115
ADDRESS: Tauranga Central	ADDRESS: 265 Albany Highway, Albany, Auckland	ADDRESS: Christchurch, 8014	ADDRESS: Unit 7, 7 Henry Rose Place, Albany, Auckland
PHONE: +64 7 552 4877	PHONE: +64 9 448 0160	PHONE: +64 22 429 0597	PHONE: +649 880 4620
WEBSITE: https://nutrinz.com/	WEBSITE: https://goodhealth.co.nz	WEBSITE: https://www.oceangreenorganics.com	WEBSITE: http://peterandjohn.co.nz/
YEAR FORMED: 2000	YEAR FORMED: 1987/2004	YEAR FORMED: 2017	YEAR FORMED: 2001
STAFF EMPLOYED: N/A	STAFF EMPLOYED: 100	STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A
REVENUE: N/A	REVENUE: $37.5m (FY21)	REVENUE: N/A	REVENUE: N/A
COMPANY HIGHLIGHTS:	COMPANY HIGHLIGHTS: 2015 Sinolife acquired 100% ownership of Good Health from local owners via Shanghai Weiyi Investment and Management	COMPANY HIGHLIGHTS:	COMPANY HIGHLIGHTS: Mussel oil supplied by Waitaki Biosciences (Pernatec), SuperBa Krill not from NZ Co.

^ *Coriolis estimate*

BRANDS

DEEP BLUE HEALTH	TURNER NEW ZEALAND
Tony Lawton **Director**	**Noel Turner** **Director**
DESCRIPTION: Deep Blue Health is an innovative, premium natural health supplement producer. Distributing to 15 countries. Also owns NZPureHealth brand; Partnering with New Zealand Health Manufacturing, an award winning dietary supplement manufacturer.	DESCRIPTION: New Zealand firm exporting food and supplements
KEY PRODUCTS: Supplements and nutraceuticals company using products from mussels, sea cucumbers, oysters, fish, sharks, krill, abalone, bees, deer	KEY PRODUCTS: Seafood, lamb, mussels, supplements (manuka oil, mussel oil others)
OWNERSHIP: Private: NZ Lawtons	OWNERSHIP: Private: NZ Turner
COMPANY NUMBER: 1976753	COMPANY NUMBER: 536050
ADDRESS: 36C Apollo Drive, Albany, Auckland	ADDRESS: N/A
PHONE: +64 9 444 2886	PHONE: N/A
WEBSITE: https://www.deepbluehealth.co.nz/	WEBSITE: https://www.turnernewzealand.co.nz/
YEAR FORMED: 2004/2007	YEAR FORMED: 1992
STAFF EMPLOYED: N/A	STAFF EMPLOYED: N/A
REVENUE: N/A	REVENUE: N/A
COMPANY HIGHLIGHTS:	COMPANY HIGHLIGHTS: Sourcing NZ products but based in the USA

^ *Coriolis estimate*

CONTRACT MANUFACTURERS

NEW ZEALAND HEALTH MANUFACTURING	GMP PHARMACEUTICALS
	Bin Yang **Director**
DESCRIPTION: One of the leading contract manufactures in nutraceutical and supplements	DESCRIPTION: End to end service for health food and pharmaceuticals
KEY PRODUCTS: Produce, pills, caps, powders, blisters	KEY PRODUCTS: Dairy products, Goat products, Bee products, Plant and herbs, seafood and marine products, specialty oils (omega 3 Fish oil and flaxseed oil)
OWNERSHIP: Private: NZ	OWNERSHIP: Private: AU Infinity Pacific Holdings
COMPANY NUMBER: 4768259	COMPANY NUMBER: 1151040
ADDRESS: 7 Pavilion Drive, Mangere, Auckland	ADDRESS: 12 Averton Place, East Tamaki, Auckland
PHONE: +64 9 275 7511	PHONE: +64 9 272 1111
WEBSITE: https://www.nzhm.co.nz	WEBSITE: https://gmp.com.au
YEAR FORMED: 2013	YEAR FORMED: 2001
STAFF EMPLOYED: 180	STAFF EMPLOYED: N/A
REVENUE: $126.2 (FY22) Ora	REVENUE: N/A
COMPANY HIGHLIGHTS: Nestle acquired NZHM as alongside Go Healthy and Egmont Honey in 2022 (pending approval), from CDH Investments and the founding shareholders	COMPANY HIGHLIGHTS: 2019 Shifted head quarters to Australia; still manufacturing at two sites in NZ; own GMD Dairy and GMP Nutrition

^ *Coriolis estimate*

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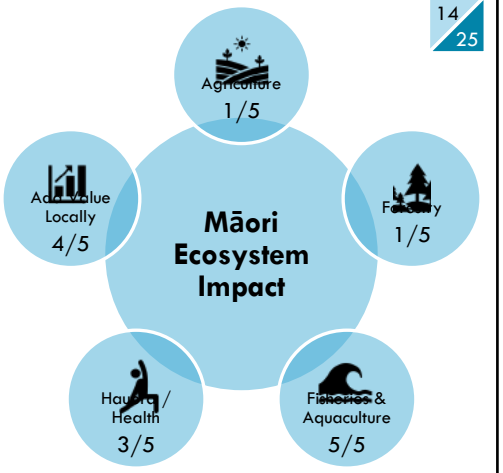
APPENDIX 01: Marine Bioactives

HOW BIG IS THE MĀORI ECOSYSTEM IMPACT?

14/25



WHAT WOULD MĀORI LEADERS SAY?

LANDOWNERS	IWI RŪNANGA / PARENT GROUPS
"Some of us have quota/ marine space to diversify from land and welcome this development."	"The fishing sector has produced economic returns for our Iwi, hapū and marae. Any shift in returns has a significant impact on our community."
INVESTMENT GROUPS	**FISHERIES/MARINE AQUACULTURE**
"We are heavily weighted in this sector. Should we invest in optimising the return from these assets or manage portfolio risk by investing elsewhere?"	"Extracting more value out of the bycatch and maximizing return from the actual catch – utilising every part of the fish is a potential game changer."
NATIONAL BODIES	**MĀORI BUSINESS IN THIS SECTOR**
"We fought for and secured rights in the fishing and aquaculture industry. We are all deeply invested in maximising the return from these assets."	"We emphasise provenance, sustainable practices and indigenous connection to differentiate ourselves."

MĀORI SECTOR SCORECARD

23.5/32

CONNECTIVITY?	☆☆☆
Can we build new or utilize existing international connections for expanding markets?	
TREATY ASSET?	☆☆☆☆
Does this platform have a connection to a Treaty asset or is there a Treaty perspective/position?	
JOBS?	☆☆☆
Will this platform have an employment impact, particularly for rural communities?	
OUR ECONOMY?	☆☆☆
How much of an impact will this platform make on our rural economies / communities?	
TAIAO?	☆☆☆
Will this improve our environment? Is there a regenerative or circular economy opportunity?	
MĀTAURANGA?	☆½
Can we bring insights from Mātauranga Māori to this platform to create value?	
BRAND MĀORI	☆☆
Can we wrap this in a package? Can we bring something to this with no cultural IP issues?	
LEVERAGE?	☆☆☆☆
Any advantage to leverage Māori assets or in utilise Māori / indigenous in the platform?	

DOES THIS CROSS INVESTMENT THRESHOLDS FOR MĀORI CAPITAL?

15/20

WILL IT GENERATE HIGH YIELDS/RETURNS?	☆☆☆
CAN IT SUPPORT OUR BALANCE SHEET?	☆☆☆½
DO WE HAVE COLLECTIVE LEVERAGE?	☆☆☆½
IS IT POTENTIALLY TRANSFORMATIVE?	☆☆☆
IS THE RISK MANAGEABLE?	☆☆

SPECIFICALLY FOR MĀORI, DO THE OPPORTUNITIES OUTWEIGH THE RISKS?

8/10

OPPORTUNITIES	RISKS
• Three key aspects resonate for Māori: 1. Strong seafood connections – Māori presence significant in industry 2. Unique bioactives and other nature-derived ingredients allow for significant value-add 3. Opportunity to create strong brands embracing Māori narrative with provenance and sustainability claims • Ability for a coordinated collective industry response from Māori. Aligned interests from connected parties. • There are wider opportunities to supply into the biopharmacy, biocosmetics and sports nutrition sectors and grow the utility of the underlying bioactives.	• Although some clear industry wins (greenshell mussel/ lipid) the sector hasn't converted into a replacement export receipt earner despite the interest over many decades. • Key issues exist around the capability in Aotearoa to develop and grow export-ready consumer businesses into global markets. • If this opportunity is embraced the Māori economy (as a whole) is even more invested into the marine aquaculture/fishing sector. Concentrated investment is put at risk if an adverse sector issue arises e.g. ingredient contamination or toxicity, change of market sentiment re sustainability etc.

OVERALL ATTRACTIVENESS (out of 100)

70

TUIA GROUP

TUIA GROUP POINT-OF-VIEW

- This opportunity is likely to receive high engagement within the Māori community. Primarily through the importance of commercial fishing returns to Iwi and the ongoing need to maximise these returns.
- Although a relationship to the sea and marine life played a huge role in Te Ao Māori through mātauranga Māori, tikanga, pūrakau, taonga, and other cultural practices the issue of traditional knowledge / intellectual property rights in respect of marine bioactives is not likely to be as potentially problematic to industry development as it might be with natural land-derived bioactives and nutraceuticals.
- The broad ability to leverage off significant Māori interests and networks in commercial fishing and marine aquaculture is the key rationale for this opportunity getting the Overall Attractiveness rating of 60.5. The direct ownership of quota, the growing marine aquaculture expertise of Iwi in regions like Bay of Plenty and Te Tauihu / Top of the South Island, the ability to directly influence two of the largest players in the sector (Moana and Sealord) as well as connections to other large participants like Sandford and industry processers like Maclab means there is a potential for a strong Māori coordinated response unlike many other industries.
- New product development is a different type of skillset and expertise that the industry has not traditionally had. It's a huge opex cost inside the larger seafood and aquaculture companies to create a product development team and invest in the R & D required to support that team. The huge cost, the level of risk and the potential lack of capability in Aotearoa to build a consumer-facing brand in this sector might lead some to simply wait and adopt the Coca Cola approach of simply acquiring the successful products and folding them into the portfolio. This strategy risks losing out to overseas acquirers who can write a bigger cheque.
- To boost innovation and help manage the cost barrier a similar approach to the New Zealand Food Innovation Network innovation hubs could be adopted with marine bioactives. This might enable innovation while seeking to manage costs of new product development.
- For the right proposition(s) a Māori collective investment platform could enable "scale" investment alongside expert co-investors into this opportunity.

Glossary	
te ao Māori	The Māori world experience including language, culture, economy etc. as distinct from broader mainstream New Zealand
taiao	The natural environment.
mātauranga	Māori knowledge - the body of knowledge originating from Māori, including the Māori world view and perspectives, Māori creativity and cultural practices/knowhow.
tikanga	Practice, activity
pūrakau	Ancient legends, stories
taonga	Treasures
hapū	Sub-tribe, extended families
marae	Traditional gathering places/complexes
rongoā	remedy, medicine, drug, cure, medication, tonic

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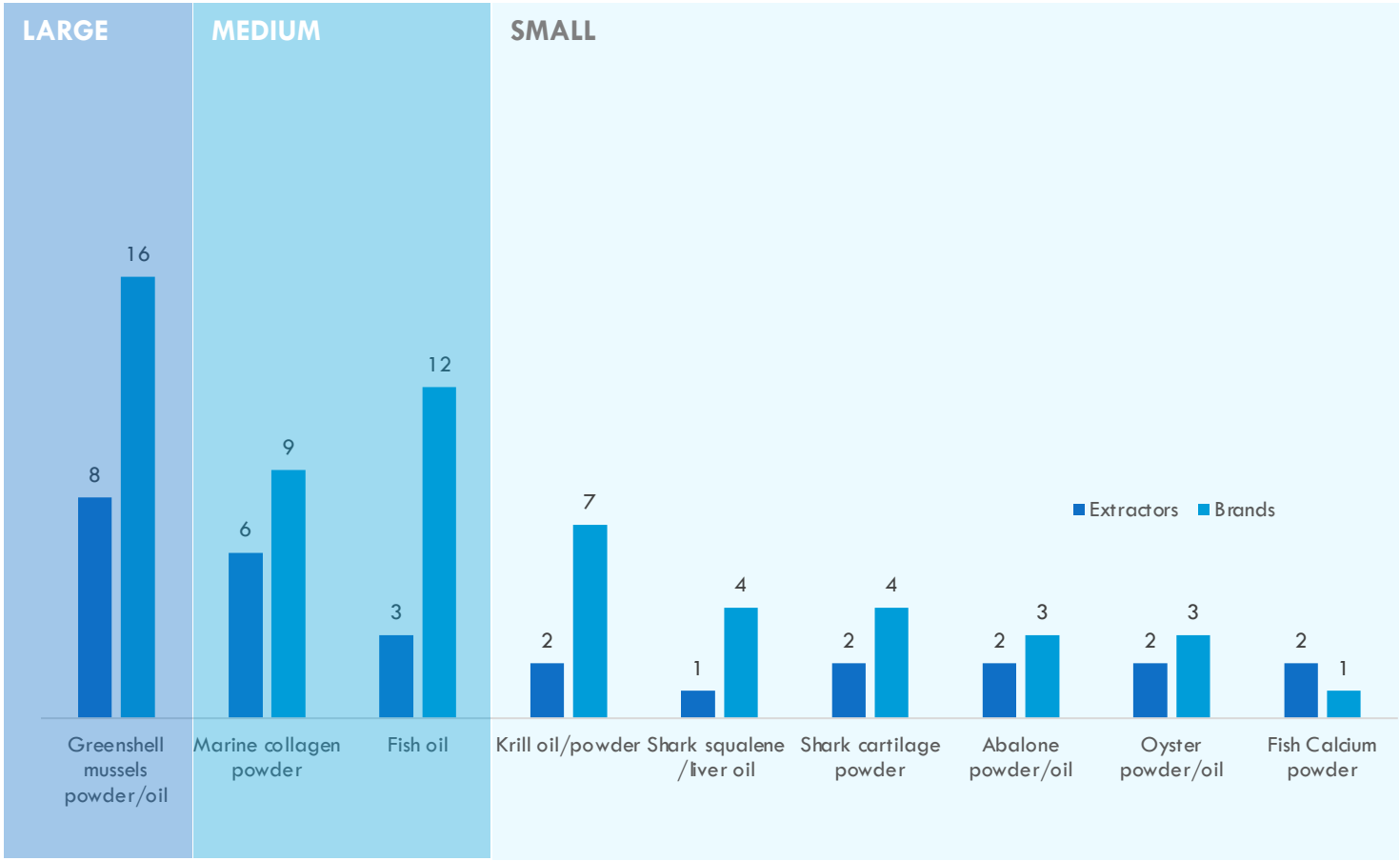
APPENDIX 02: *A production and brand scan assessment* shows GSM, marine collagen and fish oil are the most popular products made and sold into retail*

PRESENCE OF PRODUCT IN RANGE (COUNT)



**Presence of, not volumes; count of companies manufacturing and producing product, brands (specialists and generalists) selling products; See charts following for more detail; Total 9 processors/extractors and 15 brands*

GSM powder and oil are the most popular product to extract and sell

NZ COMPANIES MARINE RANGE

		MARINE /EXTRACTION SPECIALISTS									UNIQUE NZ PRODUCT FOCUSED SELLERS					
		NUTRI ZING	SANFORD BIOACTIVES	SEADRAGON	CFARMX NEW ZEALAND	AROMA	Alaron	nutraceuticals	WAITAKI BIOSCIENCES	bio-mer	DEEP BLUE HEALTH	UBBIO	PETER JOHN	GreenHealth.co.nz	nutri NZ	ANTLER FARMS
GSM oil	10		X		X	X		X	X	X	X		X	X		X
GSM powder	12	X	X		X	X	X[1]	X	X		X	X	X	X	X	
Fish oil-hoki	3			X				X								X
Fish oil-tuna	1			X												
Fish oil	1													X		
Collagen-marine	5					X		X			X[2]			X	X	
Collagen-hoki	3		X		X					X						
Collagen-ling	1				X											
Shark-squalene*	3							X			X			X		
Shark cartilage	4	X						X			X			X		
Fish calcium	3	X								X[3]			X			
Fish cartilage	1					X										
Abalone pwdr.	4					X		X			X				X	
Oyster pwdr/oil	3					X		X			X					
Sea cucumber	2							X			X					
Krill oil/powder	7							X		X	X		X	X	X	X
Algae	3			X			X	X								

**and or Shark liver oil; 1. Alaron contract manufacturers (few products listed online); 2. Elephant fish and hoki byproduct; 3. Specifies hoki calcium*

Large VM&S firms supply the basic range of fish oil, marine collagen and GSM powder and beyond GSM do not state the source

MAJOR VM&S# MARINE PRODUCT RANGE

VITAMIN, MINERAL AND SUPPLEMENTS BRANDS

		Healtheries	NUTRALIFE	GO	goodhealth	SANDERSON	Clinicians	BLACKMORES	red seal	Swisse ^
GSM oil	2	BIOLANE	BIOLANE	X	X					
GSM powder	4	X	X	X	X	X				
Fish oil-hoki	0									
Fish oil-tuna	1			X[1]						
Fish oil	7	X[1]	X[2]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]
Collagen-marine	6	X	X	X[1]	X[3]	X[1]	X		X[1]	X
Collagen-hoki	0									
Collagen-ling	0									
Shark-squalene*	2			X[1]	X					
Shark cartilage	2			X	X					
Fish calcium	0									
Fish cartilage	0									
Abalone pwdr.	1				X					
Oyster pwdr/oil	2			X	X					
Sea cucumber	0									
Krill oil/powder	2			X[1]	X	X				
Algae	0									

*#Vitamins, Minerals & Supplements; *and or Shark liver oil; ^Swisse NZ range sold in Chemist Warehouse; 1. No source stated; 2. Fish oil packed in AU; 3. France*

APPENDIX 03: *A broad range of organisations support the New Zealand marine bioactives industry, either directly or indirectly*

Numerous fishing and aquaculture industry organisations exist. Some take a strong interest in marine bioactives, others less so.

Aquaculture New Zealand	Natural Health Products NZ	FGC New Zealand Food & Grocery Council	New Zealand Food Innovation Network
- A national peak industry organisation representing the aquaculture sector in New Zealand - Strong role in mussel bioactives coordination and advocacy - Funding via membership fees - www.aquaculture.org.nz	- A national industry organisation representing the natural products, functional foods, complementary medicines, cosmeceuticals, and nutraceuticals industries. - Funding via membership fees - www.naturalhealthproducts.nz	- Represents the manufacturers and suppliers behind New Zealand's food, beverage, grocery and FMCG brands - Funding via membership fees - www.fgc.org.nz	- Business development advice and access to science and research facilities across five locations - Funding government and user pays - www.foodinnovationnetwork.co.nz
Aquaculture producers	Natural Health Support & Advocacy	Wider FMCG Manufacturer Support & Advocacy	Science, Product Development and Advisory

Source: Coriolis from industry websites

APPENDIX 04: *GLOSSARY OF TERMS*

A$/AUD	Australian dollar
ABS	Absolute change
ANZSIC	AU/NZ Standard Industry Classification
AU	Australia
Australasia	Australia and New Zealand
b	Billion
CAGR	Compound Annual Growth Rate
CN	China
CRI	Crown Research Institute
E Asia	East Asia
FAO	Food and Agriculture Organisation of the United Nations
FY	Financial year (of firm in question)
HK	Hong Kong
JV	Joint venture
kt	Kilotonne (one thousand tonnes)
m	Million
n/a	Not available/not applicable
N. America	North America (USA, Canada)
Nec/nes	Not elsewhere classified/not elsewhere specified
NZ	New Zealand
NZ$/NZD	New Zealand dollar
R&D	Research and Development
S Asia	South Asia (Indian Subcontinent)
SE Asia	South East Asia
S.H	Southern Hemisphere
T or t	Tonne (one thousand kilograms)
US/USA	United States of America
US$/USD	United States dollar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