

# A life cycle assessment of NZ mussels and oysters

October 2021

To understand the sustainability of farmed New Zealand Greenshell Mussels and Pacific Oysters, Aquaculture New Zealand and the Ministry for Primary Industries asked environmental consultancy thinkstep-anz to carry out a Life Cycle Assessment (LCA) study.

## Summary

01. New Zealand mussels and oysters have among the lowest carbon footprints of all animal protein
02. The carbon footprints involved in producing shellfish and tofu are comparable
03. Exporting live products using air freight significantly increases their carbon footprint
04. There are opportunities to further reduce the carbon footprint of New Zealand mussels and oysters

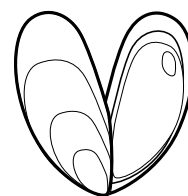
## We compared the carbon footprint of NZ-farmed shellfish and other dietary proteins

We first assessed the carbon footprint of farmed mussels and oysters over their entire life cycles. This enables the aquaculture industry to identify where they need to focus their efforts in reducing their impact.

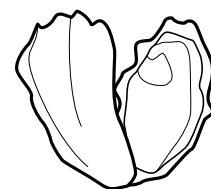
In the second part of our study, we put our findings into context by comparing the impact of producing the shellfish to other popular dietary proteins.

In the third part of our study, we assessed the impact of exporting live products.

In the fourth part, we looked at ways to further reduce the carbon footprint of New Zealand mussels and oysters.



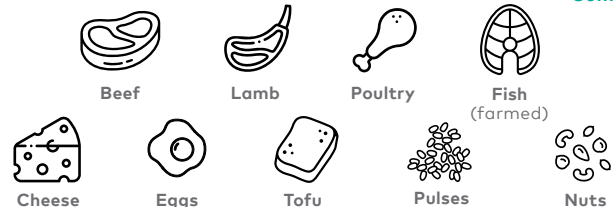
**New Zealand Greenshell Mussels**  
(*Perna canaliculus*)



**Pacific Oysters**  
(*Crassostrea gigas* / *Magallana gigas*)

PART 01  
LCA

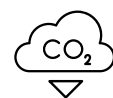
Protein comparison products



PART 02  
Comparison



PART 03  
Export  
impact



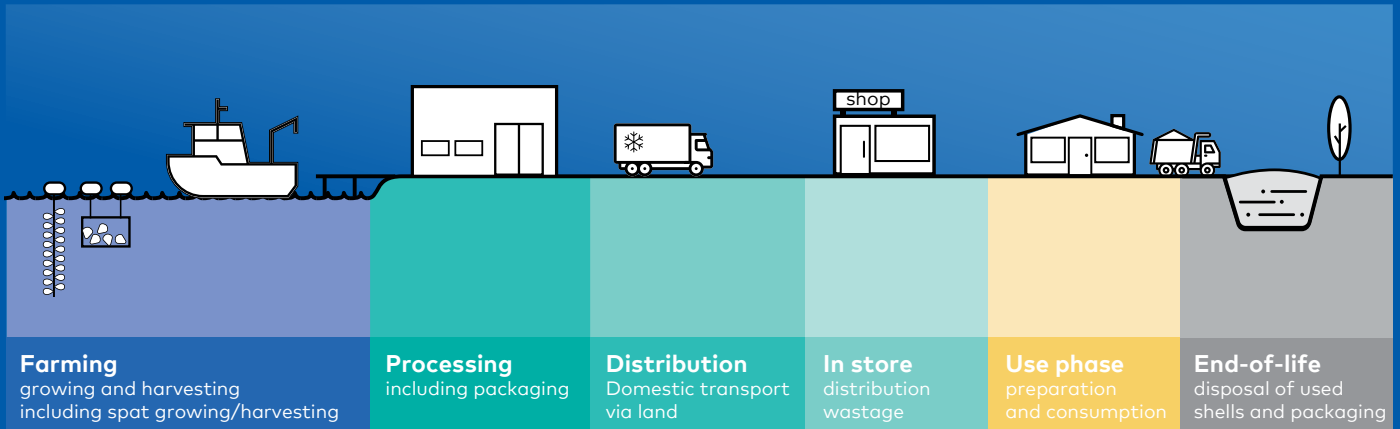
PART 04  
Reduction  
pathways

# We assessed the carbon footprint of the farmed shellfish over their entire life cycle

This study follows ISO 14044:2006 and ISO 14067:2018 and has undergone a critical review by three independent experts.

Our analysis included the carbon footprint of shellfish farming, harvesting, processing, packaging, chilled distribution to domestic retail, preparing, consumption, and disposal of used shells and packaging.

Full domestic life cycle - production to disposal



## NZ mussels and oysters have among the lowest carbon footprints of all animal proteins

We found the impact of these shellfish (from the farming stage to the domestic retail stage) is lower than producing all other forms of animal proteins we considered. This includes protein from land animals, farmed fish, and farmed crustaceans.

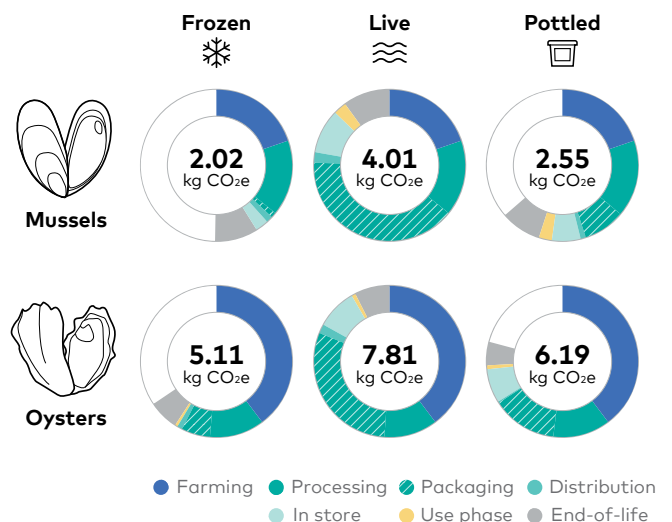
Mussels and oysters are nutritionally rich, high in protein, and can be grown without the need for manufactured feeds. The shellfish get all they need to develop by extracting oxygen and food (phytoplankton) directly from the water column through filter-feeding.

## Different shellfish products have different carbon footprints

The carbon footprint across the entire life cycle of mussels and oysters depends on the type of product they become – frozen half shell, live, or potted meat. This is because:

- different packaging is used for each product (live and potted products require more packaging)
- supply chains vary in their rate of wastage (frozen products produce little waste)

The higher carbon footprint per kilogram of oyster meat is because individual oysters contain less meat relative to the amount of shell than mussels.



# The carbon footprint of New Zealand shellfish is comparable to tofu on the global market



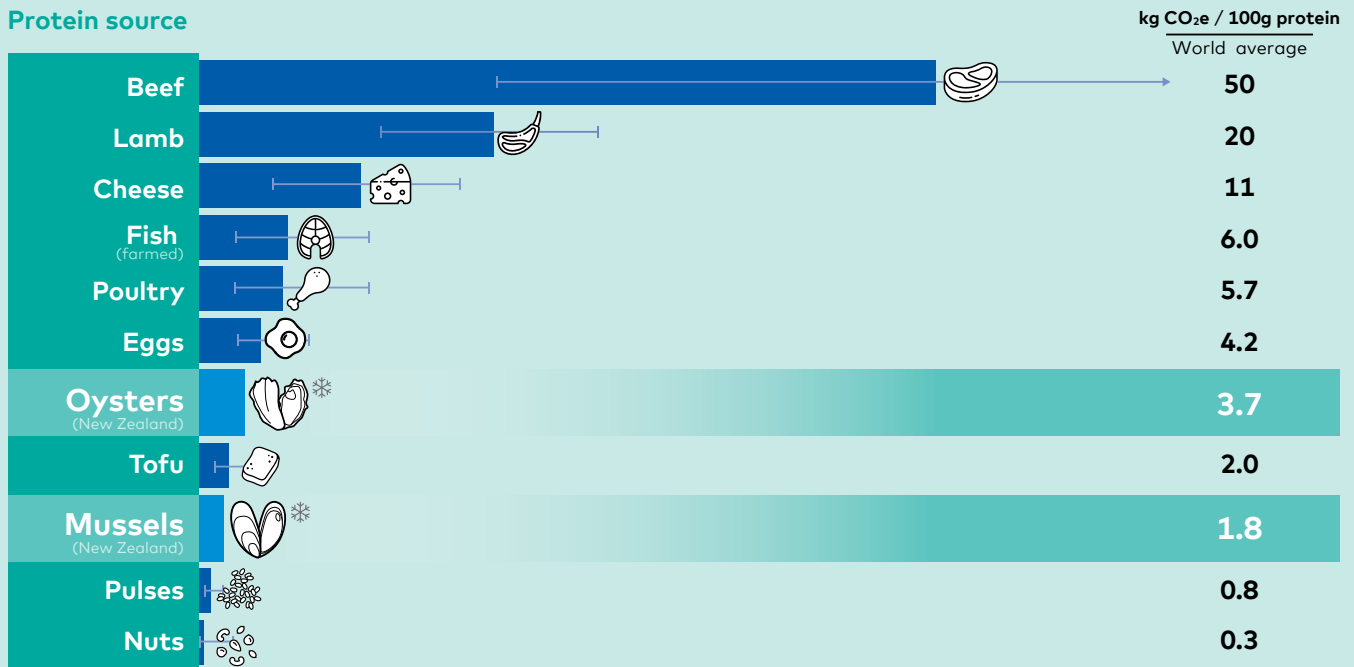
We considered farming, processing, and distribution to domestic retail for our dietary proteins comparison.



We compared the carbon footprint of producing mussels and oysters to producing other protein types. We focused on the farming to retail stages of farmed shellfish because of the large number of variables after production (international distribution, consumers' cooking preferences, and the disposal at end-of-life).

We referred to the work of Poore and Nemecek (2018) who assessed the relative carbon footprint of producing popular animal, plant, and dairy proteins. This 'cradle to domestic retail' analysis involved comparing the carbon footprint of producing 100 grams of mussels or oysters protein to producing the equivalent amount of a range of dietary proteins.

Carbon footprints of different dietary proteins on the global market – production to retail only (in kg CO<sub>2</sub>e / 100g protein)



— range of results for each protein source

This chart shows global production data. For proteins other than mussels and oysters, it does not necessarily reflect New Zealand conditions. Frozen half-shell products have been chosen because they are the most common product exported from New Zealand.

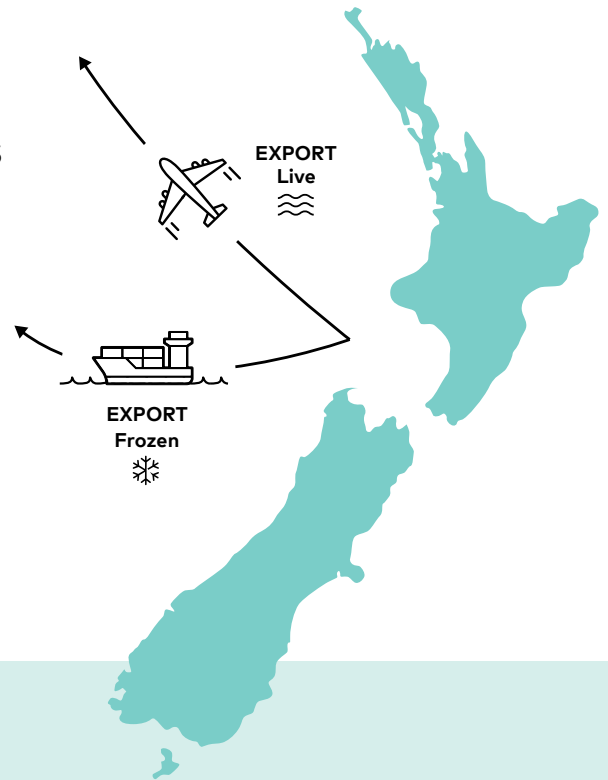
PART 03 – Export impact

## Transporting product to export markets adds to the carbon footprint

Most shellfish exported from New Zealand are sent as frozen product by sea freight. This adds a relatively small amount to the total carbon footprint.

Where live shellfish are exported by air freight, this accounts for more than 70% of the overall carbon footprint. In 2019, 3% of mussel exports and 30% of oyster exports were exported by air.

When other proteins are exported, their footprint increases for the same reasons. Farmed shellfish continue to compare well.

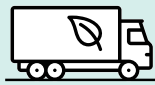


PART 04 – Reduction pathways

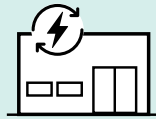
## Improving practices could further reduce the carbon footprint of New Zealand mussels and oysters



**Improve packaging** through reducing and reusing when possible



**Switch to green fleet** which runs on low-carbon renewable energy sources



**Increase green energy** to run processing facilities on low-carbon renewable energy sources



**Research plastic use** - especially the ones that are in contact with the ocean



**Reduce waste** through avoiding landfill and finding circular solutions for organic waste



**Focus on high value** products that can be sea freighted, while limiting air freight

This Life Cycle Assessment (LCA) study was co-funded by Fisheries New Zealand and Aquaculture New Zealand



**Fisheries New Zealand**  
Tini a Tangaroa

**Aquaculture**  
New Zealand



### About Aquaculture NZ

Aquaculture New Zealand is the voice of Aotearoa New Zealand's aquaculture industry, representing the interests of the three main species grown in New Zealand: Greenshell mussels, king salmon, pacific oysters.

Our aquaculture industry is dedicated to sustainably producing the world's best seafood. We are continually looking to strengthen our green credentials and lead the way in reducing our environmental footprint.

<https://www.aquaculture.org.nz/>  
<http://www.aplusaquaculture.nz/>

### About thinkstep-anz

At thinkstep-anz, we are passionate about enabling organisations to succeed sustainably.

We underpin sustainability initiatives with facts and figures to contribute quantifiable business value. Our clients value our ambition to tailor solutions to their specific needs, no matter how large or small.

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