Discussion Paper on Seafood Labelling

Fisheries Research and Development Corporation

Project 2020-093

All food sold in Australia must comply with the Food Standards Code. Food label claims are subject to Australian Consumer Law, prohibiting false, misleading or deceptive behaviour.

Australian seafood consumers face existing risks and confusion regarding species, nomenclature, and product misrepresentation.

The imminent launch of cellular meat and seafood, now being debated globally by producers and regulators, will offer new benefits to consumers. But there are risks. If the Australian seafood industry mishandles these challenges, we will compound existing product misrepresentation and seafood fraud. A Senate Committee is currently assessing the risks and options across meat and seafood consumer products.

This discussion paper updates the issues, challenges and relevant laws, to suggest options and risks going forward. It is a living document which attempts to reflect a very dynamic food labelling environment. This report is to be used as a first version working document, with further updates to occur every 12-18 months.

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(*FRDC Project 2020-093: Discussion Papers on seafood traceability and labelling (Part B: Labelling*)

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Front Cover image source: (Hallman & Hallman-II, 2020)

GLOSSARY

ACCC	Australian Competition and Consumer Commission
ACNF	Australian Committee for Novel Foods
AFMA	Australian Fisheries Management Authority
AFNS	Australian Fish Names Standard
ALGA	Australian Local Government Association
ASC	Aquaculture Stewardship Council
ASF	African swine fever
ANZ	Australia and New Zealand
CAF	Legislative and Governance Forum on Consumer Affairs
CCFL	Codex Committee on Food Labelling
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLG	Common Language Group, a seafood industry panel established by the FRDC
CMO	Common Organisation of the Markets Regulation of the EU
COAG	Council of Australian Governments
CoOL	Country of Origin labelling
Codex	Codex Alimentarius
Cwth	Commonwealth Government of Australia – or Cth
DAWE	Commonwealth Department of Agriculture, Water and Environment
Developed Countries	Albania, Andorra, Armenia, Australia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, European Union (all current European states except the UK), Faroe Islands, Georgia, Iceland, Israel, Japan, Kazakhstan, Kyrgyzstan, Monaco, Montenegro, New Zealand, Norway, Republic of Moldova, Republic of North Macedonia, Russian Federation, San Marino, Serbia, Serbia and Montenegro, South Africa, Switzerland, Tajikistan, Turkmenistan, Ukraine, United Kingdom, United States, Uzbekistan (OECD-FAO, 2021, p. 15).
DIIS	Department of Industry, Science, Energy and Resources of the Australian government previously titled Department of Industry, Innovation and Science
FAO	Food and Agricultural Organisation of the United Nations
FCC	Federal Communications Commission
FFWCRC	Fight Food Waste Cooperative Research Centre
FMI	Food Marketing Institute of the USA
AFNC	Australian Fish Names Committee (FNC) of the FRDC
FRA	Inter-governmental Food Regulation Agreement between Australia and New Zealand
FRDC	Fisheries Research and Development Corporation
FRSC	Food Regulation Standing Committee
FSANZ	Food Standards Australia and New Zealand
FSSAI	Food Safety and Standards Authority of India
GAP	Good agriculture practices
GFSI	Global Food Safety Initiative
GHG	Greenhouse gas
GMO	Genetically modified organism
GSSI	Global Sustainable Seafood Initiative
GSUDT	General Standard on the Use of Dairy Terms
HACCP	Hazard analysis and critical control point
IGA	Intentional genomic alteration, a recent clarification to GMO products
ISFR	Implementation Subcommittee for Food Regulation
IVM	In-vitro meat

LCA	Life cycle assessment, identifies, quantifies and evaluates the environmental impacts (inputs and outputs) of a product, service or activity, from cradle to grave. That is, the environmental impacts of all phases of the product's life are assessed, from the time materials are extracted through manufacture, transportation, storage, use, recovery, reuse and disposal. (Global Development Resource Centre, 2021)
MLA	Meat and Livestock Australia, an industry owned R&D and Marketing company
MSC	Marine Stewardship Council
NMI	National Measurement Institute
PPP	Primary production and processing
RMAC	Red Meat Advisory Council, a federation of Australian red meat and livestock national employer associations and commodity representative organisations
RTE	Ready to eat
SFA	Singapore Food Agency
TACC	Total Allowable Commercial Catch
TBT	Technical barriers to trade
UNSW	University of New South Wales
USDA	USA Department of Agriculture
USFDA	USA Food and Drug Administration
WHO	World Health Organisation
WTO	World Trade Organisation

1. PURPOSE OF SEAFOOD LABELLING

Seafood[1] is many highly perishable aquatic species landed from diverse production sources in multiple formats.

Markets bring order to this supply chaos, granting consumers transparent choice based on source, specification, availability, quality, and price. Labels pervade this seafood chain - no other protein faces such complexity.

Discussion about seafood labels is not straight-forward. Domestic issues are anchored in dynamic, complex global and local trade. Country of origin, traceability, fish names and jurisdictional variances compound issues.

Labels serve multiple masters. Producers, manufacturers, marketers and regulators all use food labels to give consumers transparent and informed choices. Suppliers offer labels to differentiate their unique product offer, by brand, ahead of competitors. But regulators mandate labels where suppliers have no financial incentive to provide accurate information, or where they will potentially make false claims. Regulators require labels to be clear and to inform consumers about food purchase choices, quality, composition, benefits and risks.

Globalisation of trade, travel, and technology is driving up living standards for millions of people. Consumers can see and buy food products globally, now. Their preferences and prejudices change constantly, updated in-person or on-line, and funded from increased per capita consumer wealth. But food production technologies are creating new food competitors, including meat, dairy and seafood products that will soon be produced in factories, not on farms. Food nomenclature and what goes on a food label is a current global war zone.

Human health science builds capability and safety daily, but catastrophic food risks persist globally and in Australia. Food labels seek to reduce disease and health risks, and to personalise warnings wherever possible.

Labels are fundamental to improving consumers' awareness, risk management and purchase choices. They are the final critical food-integrity step in the complex chain of trust from producer to consumer. They convey information regarding:

- Specification - product name and description, size, weight, barcode,
- Source - who produced or manufactured, how, where, and contact details,
- Composition - ingredients, nutrition, omega-3, health ratings,
- Safety - allergens, warnings (contains bones, nuts, etc) or hot to taste (chilli rating),
- Use, care and preparation - consumption, temperature, storage, reuse, waste disposal,
- Authenticity - misrepresentation, or fraud,
- Expiry - "best before" date, "use by" date, or consign to waste,
- Provenance - linking quality to geographic origins and traditions, and
- Ethical supply - animal welfare, sustainable production, social license and certifications.

Technology is also driving down the delivered price of information on food labels. It is a key driver boosting consumer awareness. Tomorrow's smart food labels will be more complex, both on products and in the cloud.

Food labels also save money by reducing public health costs. Changes in upstream producer competition and risk result in pressure (direct or indirect) to improve label outcomes and reduce consumer costs downstream.

As markets are very dynamic it is not surprising that the law related to food labelling is always in transition[2], occasionally predicting, mostly catching up to local and traded market realities and emerging consumer risks.

This paper summarises today's seafood labelling for Australian consumers. It identifies trends and challengers that our producers, supply chain leaders and seafood markets need to better understand to inform their decisions over the coming decade.

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[1] FSANZ Definition – Seafood is all aquatic vertebrates or aquatic invertebrates intended for human consumption, but excluding amphibians, mammals, reptiles and aquatic plants in any form, including whole fish, or part thereof, in raw or cooked form, or as a fish product.

[2] For example, in 1994 Government amended the Trade Practices Act re Country of Origin Labelling. Legislation implemented on 1st July 2016 is now monitored by the national competition regulator. *Report of the Working Group on Country-of-Origin Labelling of Consumer Products*, May 1993.

Recommendations

The following actions are recommended for the Australian Seafood Industry based on the conclusions drawn from this Discussion Paper.

Seafood Labelling Risks		Recommended Actions / RD&E	
Policy Impact 	1. Global policy exposure to label change 2. Being wedged by domestic regulations 3. The Food Code / FSANZ	SIA	1. Engage directly with key agencies responsible for seafood labelling regarding emerging label policy developments - DAWE, ACCC, FSANZ 2. Maintain dialogue with relevant Primary Industry organisations, in particular: Meat and Livestock Australia/RMAC — labelling of beef, lamb, mutton, goat Australian Pork Limited — labelling of pork, ham, bacon and pig meats Australian Chicken Meat Federation/Agrifutures — labelling of poultry meats Dairy Australia — labelling of dairy foods
		FRDC	1. Establish FSANZ-SIA-FRDC Seafood Label Working Group to track existing and potential label impacts 2. Monitor food label regulation movements in US, EU, Japan, China, India, Israel, Singapore, etc
Trade Impact 	4. Synthetic seafood trade impact growth	SIA/FRDC	1. Identify seafood products and supply chains exposed to domestic, export and import changes 2. Document related baseline trade metrics (volume, value, FTEs, etc) for products and chains 3. Groundtruth these metrics with key industry, chain partners and trade agencies 4. Investigate Point of Sale label technologies/QR codes) with capability to boost chain resilience, enable and/or leverage end-to-end traceability
Industry Awareness and Strategy	5. Apathy re domestic seafood labelling 6. Lack of Fisheries and Aquaculture awareness of label risk 7. Lack of seafood chain impact data 8. Loss of our Competitive Advantage	FRDC	1. Scope out competitive strategy scenarios due to label evolution over next 1-5 years 2. Document the key Operating, Financial, and Economic data and do economic impact metrics for fishers, chains, markets, communities 3. Seek/build opportunities for each scenario that will differentiate and leverage Competitive Advantage - fresh, wild, nutritious, sustainable, etc 4. Identify development opportunities in new synthetic seafood technologies under strategic scenarios 5. Summarise Seafood Industry exposure, scenarios, impacts, opportunities due to label evolution
		SIA	1. Deliver Communications Strategy - forums/roadshows to raise awareness and engage industry, retail/Food Service, agencies, NGOs.

2. SUMMARY and CONCLUSIONS

A. Global trends reflecting change

1. Big Picture

Our great grandparents probably grew or prepared much of their family's food, whereas today we are more reliant on processors, retailers, and foodservice. Trust in what and from where we eat is increasingly anchored to food labels.

Food can now be cultured and manufactured in factories, unshackled from garden plots, fisheries, farms, and feedlots. We are at the start of a major shift in global food production and flows. Technology now enables meat[3] and seafood production from five sources:

1. Hunting, wild harvest and capture fisheries,
2. Agriculture and aquaculture,
3. Plant-based meat (PBM) substitutes that have been developed since the 1990s,
4. Cellular agriculture - the production of animal-based products outside the animal from cell cultures of animal stem cells, and
5. Precision fermentation of microorganisms, a variant on cell culturing.

Regardless of the source and supply pathway, consumers' awareness and trust in products is critical to market choice and uptake. Food labelling is the key to that door, in both a regulatory and a voluntary branding sense.

2. Real fish V Synthetic meat and seafood

Two points are evident regarding change in consumer meat and seafood products:

- For existing meat and seafood products - there are no significant trends in technologies and processes that suggest product changes. Minor changes are around improvements in packaging and presentation directed at the end consumer (rather than bulk fish in a box) – a few niche products and value added – but no new products.
- For new and emerging meat and seafood substitute and replacement products – there are substantial changes emerging related to technologies and processes that will create new food products. Opportunities for labelling and branding for these products and their mimicking and substitution of traditional products, are the subject of current strident global debate.

In Australia, a small open advanced economy, we typically adopt or adapt and align with European and north American food technologies and regulatory trade regimes. Increasingly we track international food standards (such as GFSI benchmark production standards), and market trends in Asian markets.

Australia's competitive advantages in food production face challenges. The potential long-term impacts from new food sources (especially cellular meat) are great, but not necessarily all adverse. The entry of cellular commodity foods may hasten and incentivise Australian farmers and fishers to further differentiate our best-practice natural food systems in global consumer markets. This is also the conclusion reached by the Australian Farm Institute in 2020:

> *Protein producers should be proactive in differentiating their products, particularly in promotion of health or environmental benefits, rather than reactive against a competitor's perceived threat.*
>
> *Traditional animal protein will likely continue to dominate the market to 2030, due to factors such as the rising demand in Asian countries and customer familiarity with existing products. As such, the continued*

[3] This Paper defines "meat" and "seafood" in the Definitions Appendix. Meat does not include seafood.

and/or expanded production of quality protein from whole foods such as lean meat, poultry, eggs, legumes and dairy products presents an opportunity for Australian agriculture.

B. Summary of issues for seafood

In October 2021 it is too early to draw considered conclusions regarding the detailed impact of cellular seafood in competitive consumer markets, globally or locally. The literature confirms that the scale of global investment into plant-based and cellular seafood has been negligible compared to the scale and scope of investment into beef, poultry and other meats.

This initial discussion of triple bottom line issues therefore reflects change across all meat sectors.

1. Triple Bottom Line

Social Issues

Health increasingly drives food consumers' motivation. They have progressed from an economic focus (1980s) to a locally grown, content (cholesterol, calories, chemical additives, and sugar) focus (2000s), to a self-care strategy focus today. Shoppers and consumers in advanced economies increasingly view foods as "medicine for their body", focussing on cardiovascular health, weight loss, energy, brain function, digestive health, and emotional wellness, and sleep behaviour.

However, these drivers play out differently by demographics and age group. Boomers, Matures and Millennials have differing priorities and capabilities. Boomers (born from 1946-64) and Matures (born 1964-early 1980s) are more likely to check labels, ingredients and use-by dates. Millennials (born from early 1980s to late 1990s) advocate organics, private brands, smart labels, transparency, and "free-from" unhealthy ingredients.

Consumers' trust is critical to market penetration. They increasingly require transparency, both for ingredients within packages and information about sourcing, animal welfare, and other factors that go beyond ingredients. They trust their primary retailer as a health ally. And they also trust guidance from health professionals and dietitians.

But consumers get overloaded and confused as they navigate toward healthier foods. They struggle to understand and then prioritise ingredients, macronutrients, holistic eating, gut health, brain health, ethical sourcing, animal welfare, etc. Manufacturers have tried to ease the way with often spurious package claims on "clean[4] labels" and subsequently towards "clear labels". The top clean label claims in the USA (2019) included, "All natural/100% natural", "Made with real ingredients", "No added sugar", "Organic" and "No-additives or preservatives". Consumer trust in food labels is under threat.

Vague or poorly targeted labels on consumer foods result in trust deficits and excess waste of food. The use of "Use by" or "Best before" dates are being reviewed and refined in many markets, and in the design of smart labels.

Plant-based meats (PBMs) are increasingly trusted as mainstream food products in global retail and food service markets. These products continue their transition (since the 1990s) from niche markets to mainstream markets, on the back of consumers' desire for food to be both medicinal and ethical. Product pricing and margins reflect this transition from niche to mainstream food commodity.

New technologies applied to cellular meats and seafood will enable designer foods that more accurately and pervasively target consumer's preferences. This has clear and significant implications for branding and labelling, both mandatory and voluntary. Consumer trust levels in these emerging cellular products is currently low, fuelling the debate about trespassing on or adoption of existing trusted food terminology (e.g., meat, roast, milk, burger, steak, butter, etc).

The literature (including US consumer surveys) suggests that public and consumer acceptance of cellular meat food products (also insect-based and seaweed protein foods) will take some decades to manifest as significant

[4] There is no definition of "clean" food label, but it is a product using as few ingredients as possible, and those ingredients are items consumers recognise as wholesome. Fresh, real and less processed are the key words. Professional marketers discourage use of the "clean" food label due to its confusion. By contrast a "clear" food label is one that defines the ingredients in detail on the pack or via signage at point of sale.

market share. Initially, cellular meat products will find viable niche food markets among activist consumers seeking "clean" (no contaminants) "slaughter-free" meat. But their growth in share of mainstream consumer commodity markets is difficult to forecast. Industrial (e.g., pet and animal feeds) markets for cellular meat products may see first-mover uptake of these products soon after their regulatory approval. Cats and dogs aren't ethical consumers, but some of their owners may be.

Product names and nomenclature adopted by retailers are fundamental to the consumer uptake rate and viability of cellular meats. If trusted traditional meat and dairy terms (e.g., sirloin, bacon, prosciutto, cheese, butter, etc) are approved for consumer use on "novel" foods, their rate of market adoption will be much quicker. This is the core issue driving the current strident global debate regarding the legal use of traditional food nomenclature.

Economic Issues

Global agriculture and fisheries will face increased resource scarcity in the future to sustainably supply the growing human and livestock demand for protein. Both animal and plant production will need to increase productivity to overcome this challenge. The utilisation of technology and breeding techniques which enable the production of more protein with fewer resources will be vital in ensuring environmental stewardship and global food security.

The mid-long term (>10 years) economics for cellular meat look likely to be cheaper and more sustainable (use less water and land, and create lower GHG emissions) than conventional agriculture or fishing, and even lower than global aquaculture.

But, as with any new technology and related consumer products, it may take some years before technologies are refined and delivered, and mainstream consumers become aware of, trust, and accept these manufactured meat products. Cost of production will be important, but not the only purchase criteria for consumers.

Today, these new food technologies and market opportunities are attracting strong capital investments from global agribusiness (e.g., Cargill, Seamark, Thai Union). Their long-term assessments of regulatory regimes and forecast economic returns from new meat replacement foods are obviously better than inhouse investment hurdle rates.

Further, it is clear in the literature and from domestic ministerial comments (October 2020) that the traditional suppliers (farmers and fishers) of meat and seafood will not passively accept new competitors trespassing on and leveraging their existing terminology for economic gain.

Environmental Issues

Consumers now expect both a sustainable environment and ethical production, to which they grant their social license. Increasingly, the public expect they will realise social value from the licenses they grant to producers.

Meat and Livestock Australia notes that the scarcity (and hence increasing opportunity cost) of land, water and feed combined with limiting environmental factors will require that animal agriculture limits herd numbers while increasing productivity to produce sustainably. Drought, and the subsequent increase in feed cost, are already forcing Australian producers to decrease the national herd size.

Shoppers have strong opinions about food labels, health, and transparency. They are embracing "free-from" products with simpler ingredients lists. They are moving along a path that is somewhere between "clean label" and "clear label." Plant-based meats are growing faster than other food trends.

Plant-based meat substitutes and cellular meat products claim a number of environmental benefits:

- Reduced resource demand (less land, soil and water than traditional production),
- Improved environmental sustainability (reduced GHG emissions),
- Enhanced animal welfare - slaughter-free, and
- Reduced waste (e.g., from abattoirs and seafood processing plants). However modern food processors have already developed technologies that translate most waste streams into co-product streams.

Cellular meat products will likely also claim to offer:

- Reduced energy demand (both in production and logistics to markets), and

- More efficient calorific conversion (compared to dry weight grain for example). The energy conversion rate for cellular meat (i.e., beef) is around four times more efficient than traditional meat from grain. There is no public data available on the seafood conversion rate.

Cellular food risks are yet to be tested but the literature notes consumer confusion (subject to regulatory and labelling employed), and potential risks from unknown allergens.

Globally, seafood arises from very diverse production systems. But review of the drivers for change in existing food labels suggests that many seafood production pathways will be more environmentally sustainable and market competitive against other meat and synthetic foods.

Table 1 summarises the status of the various meat and dairy food issues and their animal sources.

2. Seafood Specific Issues

The rise of plant-based seafood replacement products has been impacting global seafood consumer markets for 5-10 years, albeit in a limited way.

But the unique and attractive sensory appeal of seafood (e.g., smell of fresh fish) in fish mongers and fresh retail outlets, compared to red meat retail, has blunted the competitiveness of plant-based seafood replacement products.

Processed packaged seafood is more exposed to competition from plant-based substitutes masquerading as fish and often positioned on the shelf next to seafood. US consumer research confirms that Boomers and Mature shoppers are far more likely than Millennials to distinguish a processed food brand and forward-facing packaging, and flip labels to read fine print. Australia is a relatively large importer on processed and packaged seafood.

Existing Seafood Issues

Australia's seafood industry has custom-built regulatory food standards embedded into a national food regulatory system. Legislation is harmonised under Model Food Provisions across jurisdictions. Seafood labelling is fundamental to optimising the value of benefits derived by consumers from their seafood purchases.

From industry consultations and desk research, this paper has identified the following seafood labelling issues.

- *The Australian Fish Names Standard (AFNS) is voluntary.* Confusion and consumer concern exist in domestic markets around the mislabelling of seafood products. Standardising and promotion of fish names has resolved some confusion. But industry continues to use obsolete names, on claims that consumers will not change existing names. This mindset discounts the authenticity of product and standards, and the transparency of consumer's choices. Examples include Sea Perch v Orange Roughy; Pacific Dory v Basa; Flake for many shark species; and Snapper (there are many species).
- *Voluntary adoption of the Fish Names Standard fosters and compounds market and trading breaches.* Non-compliance promotes seafood label confusion, product misrepresentation, and traceability[5] and recall failures. Voluntary fish names also lead to complaints about fish or seafood products. As the AFNS is not mandated in the Australian Food Standards Code, responsibility for a complaint falls between the relevant state Department of Health and the Federal Department of Consumer Affairs. Mandating fish names would resolve this anomaly.
- *Truth in labelling including CoOL (Country of Origin Labelling) and Fish Names.* CoOL related issues are not resolvable through fish names (e.g., attempting to quarantine "Barramundi" for Australian product only).

[5] FRDC has commissioned a separate *Discussion Paper on Seafood Traceability* (FRDC Project 2020-093) currently being undertaken by Ms Meaghan Dodd.

Table 1. Comparison of Seafood to Other Foods

	A. Genetic Modification / Intentional Genetic Modification (IGA)	B. Plant-based Meat / Seafood Substitutes[#]	C. Cellular Meats	D. Consumer and Regulatory Nomenclature and Food Terminology
1. Beef, Lamb	Meat technology being developed. Products not yet approved in any markets.	Technology established in 1990s, Food products approved in Australian and global markets. Food products on sale in global and Australian retail and food service outlets.	Production technology exists. Food products not yet approved in global markets. Australian regulators currently assessing policy options.	• Key words ("meat") used in markets by plant-based products • Cellular meat terminology being debated and developed • USFDA and USDA currently assessing use of terminology for non-meat products • In Oct. 2020 EU Parliament approved limited use of "meat" terminology for non-meat food products
2. Pork	USFDA IGA approval in Dec. 2020 for *GalSafe*™ pigs to be human food and human therapeutics. Not yet approved for Australian markets.		Production technology exists. Food products not yet approved in global markets. Australian regulators currently assessing policy options.	• Key words ("pork", "bacon", "prosciutto" etc) used in markets by plant-based products • Cellular meat terminology being debated and developed • USFDA and USDA currently assessing use of meat terminology for non-meat products • In Oct. 2020 EU Parliament approved limited use of "meat" terminology for non-meat food products
3. Poultry	Meat technology being developed. Products not yet approved in any markets.		Production technology exists. Food products approved in Singapore (Dec. 2020), but not yet approved in other global markets. Australian regulators currently assessing policy options.	• Key words being used in markets by plant-based products • Cellular meat terminology being debated and developed • USFDA and USDA currently assessing use of meat terminology for non-meat products • In Oct. 2020 EU Parliament approved limited use of "meat" terminology for non-meat food products • In Dec. 2020 the Singapore Government approved limited use of a cellular cultured "chicken nugget" product for sale in 2021
4. Seafood	USFDA approved *AquAdvantage*™ Atlantic Salmon in 1989. Products approved in US market. Seafood products on sale in USA.		Production technology exists. Food products not yet approved in global markets. Crustacean research projects underway (e.g., University of the Sunshine Coast).	• Key words being used in markets by plant-based products (e.g., Surimi and "seafood extenders" approved in all markets. Existing labels include "Toona", "Fishless tuna", "Vegan shrimp", and "Fishless filets". (This paper refers to both "filet" and "fillet" meaning a strip of boneless meat. Fillet is the more general term, while filet is usually reserved for French cuisine and in the names of French-derived dishes such as filet mignon. Some cellular meat brands use "filet" in an attempt to differentiate their products.) • Cellular seafood technology and terminology being debated and developed
5. Dairy	Dairy livestock technology exists. Products approved in some markets.		n/a	• Key words being used in markets by plant-based products – ongoing debate • In late 2020 EU Parliament restricted use of "dairy" terminology for non-dairy food products. India proposes to outlaw "dairy" terminology for non-dairy foods.

Colour Key: Green =Technology exists, Regulators approved, and Products on sale, in whole or part; Grey = Partial approvals and sales; Yellow = No approvals or sales to date.

[#]Note: FSANZ specifically excludes "Seafood" from the regulatory definition "Meat".

- *No label verification*. Apart from export supply chains (where it is mandated), there is no review or checking of fish names along seafood supply chains or in markets. Self-regulation is not effective and product fraud continues to occur. Some processors and manufacturers are motivated to walk a fine line between optimising their marketing strategies and misleading or deceptive conduct. The only indicator of non-compliance is customer complaints.
- *Brand V Species Tension*. There is ongoing tension for packaged seafoods. For example, the name listed in the ingredients and the species (e.g., Hiramasa King Fish V Yellow Tail Kingfish), and the catch name of the product compared to the brand name (e.g., a company trademarked "Kariba Bream" for Tilapia). Product labels and other branding on the same pack could be misleading. One unique example approved by the fish names process is imported branded "South American Flathead", which is not a flathead species[6]).
- *Frozen seafood has a negative market stigma*. Industry should invest to remove this incorrect expectation that frozen seafood is low quality or risky. Clear labelling is the first step to building confidence in frozen seafood.
- *Lack of regulatory consistency and enforcement across jurisdictions*. Australia's Model Food Regulations are Standard driven and not clearly articulated and uniformly enforced.
- *Lack of jurisdictional harmonisation* of food regulation at the primary production and processing stages[7].
- *Market pressure*. Australian fishery regulators, unlike in the EU and USA, have not faced pressure to protect their markets from IUU (Illegal, unreported and unregulated) fishing, and therefore have not institutionalised traceability from fishery-to-consumer as a feasible policy tool (Garcia, 2019, p. 2). In general, across all down-stream seafood regulations, this recent report suggests Australia is not yet ready to adopt EU level seafood labelling standards.

Emerging Seafood Issues

The following emerging issues will compound the existing failures and shortcomings identified above:

- *Global cellar meat technologies are regulatory issues highly relevant to consumers today*. Decades of seafood label development will be directly and significantly impacted by labelling choices that industry and regulators (overseas and in Australia) agree in coming months.
- *Global and domestic seafood supply growth is currently fuelled by aquaculture systems*. By volume, consumption is increasingly concentrated to a few species. Cellular aquaculture will likely target the same species for the same reasons (economic, cultural cuisines, brand recognition). Clear labelling for aquaculture will be critical to regulatory outcomes, product differentiation and less consumer confusion.
- *Seafood demand is growing faster than other meat proteins*. Aquaculture's global technologies and scale will keep commodity seafood prices low. To avoid this economic price trap, sustainable wild catch seafood must differentiate itself in consumer markets. But plant-based (possibly) and cellular (definitely) seafood will launch new products that are very price competitive. There will be increasing opportunities for wild catch products in high-end and niche segments.
- As aquaculture matures and cellular seafood advances, all groups of *producers will invest heavily down-stream to differentiate* their products and consumer offers – capture, farmed, plant-based, and cellular. This will increase consumers' demand for accurate seafood labels. This demand can only be met by clear common legislative frameworks and labelling.
- *Low-cost cellular seafood* will initially attract both consumer and industrial commodity markets at very competitive prices. It will also create (potentially jointly with insect-based proteins) new low-cost industrial aquaculture inputs/animal feeds on a global supply scale.

[6] Pers comm. Industry advice..

[7] As noted in 2009 by the Productivity Commission, in Performance Benchmarking of Australian and New Zealand Business Regulation: Food Safety, p167.

- *Cellular seafood product labelling and nomenclature will be product specific.* For example, consumers of tuna will want comprehensive labels they can access immediately, and can understand and trust to inform their choices about tuna products:
    - Capture: exists as fresh, frozen, canned
    - Farmed: exists as fresh, frozen
    - Plant-based: exists *inter alia* as "Toona",
    - Cellular: being developed as fresh tuna flesh by BlueNalu Inc. but not yet approved for sale.
- *Voluntary V Mandatory.* To date Australian food regulators have resisted pressure to mandate the fish names standard. Will cellular seafood encourage Australian regulators to mandate this Standard? Will, and if so, how will the Standard be applied to plant-based and cellular seafood products and substitutes?
- Rising cellular seafood market share over the long term will force third party certifiers (MSC, ASC, Certified Organic, etc.) to consider offering *certification services for cellular seafood producers*. The impact of this move is unknown but will likely be patchy. Current 3rd party certification costs are often beyond the commercial scope of operators in medium to small fisheries, and so impacts may vary by fishery and enterprise scale.

Australian packaged seafood (imports and local supply) will be one of the first seafood sectors to experience competition from global introduction of cellular seafood. These new products will likely enter mainstream markets as new complementary seafood-substitutes from existing seafood suppliers. For example, Thai Union (a global seafood major) recently become an investor in BlueNalu Inc., a cellular seafood start-up business based in San Diego, USA.

Seafood Regulation

Food regulations regarding meat replacement products and cellular meats are currently being reviewed by an estimated 40 countries. The following references and observations are therefore as current as possible as at the date of this paper.

Food regulations in Australia are clearly defined through legislation, consumer law, harmonised Model Food Provisions, and in national standards managed by Food Standards Australia and New Zealand (FSANZ), the ACCC and the FRDC.

Existing shortcomings of the current food labelling laws include:

- Lack of formal recognition and mandating of Fish Names and Plant Names Standards,
- Lack of linkage between safety, labelling and Country of-Origin Labelling rules, leading to consumer confusion or fraud,
- Lack of consistency between and within jurisdictional agencies regarding the way regulation is applied,
- Lack of clarity over enforcement - jurisdictional authority,
- Outdated food standards, although this is in transition (note the transfer of CoOL from FSANZ to ACCC),
- Lack of review of fish names along seafood supply chains or in markets. Self-regulation of the AFNS (for example) is not effective and product fraud continues to occur, and
- Unresolved tension and misrepresentation for some packaged seafood between the name listed in the ingredients and the catch name of the product or the brand name.

Food regulators worldwide are now struggling to define, review, agree and establish clear regulatory frameworks for new meat replacement foods, many of which are currently classed by regulations as "Novel Foods".

In Australia:

- Two DAWE Working Groups have developed and submitted (Mar-June 2021) Policy and Issues Papers for both Plant-based Foods and "Synthetic" Foods to Minister Littleproud. These papers are currently under review with no advice as to when a response will be provided.
- On 15 June 2021 the Rural and Regional Affairs and Transport Legislation Committee of the Australian Senate commenced an inquiry into *Definitions of meat and other animal products*. The committee will present its report by the end of February 2022.

3. Conclusion

The transition to a broader range of meat, seafood and dairy food substitutes needs to be considered, concise, and clear. Otherwise, food label fraudsters will be motivated and enabled to grow, market and misrepresent meat and seafood products to consumers.

The proposed through-chain use of testing (DNA, trace elements, stable isotopes in plants and animals, nanotechnologies) will increasingly be relied on to authenticate product nomenclature (e.g., meat, bacon, seafood, tuna, sirloin, prosciutto, etc) integrity and provenance. DNA tracking linked to food or seafood labels is an emerging technology not yet undertaken in Australia.

Food science, responding to dynamic consumer preferences, will continue to identify and create nutraceutical health benefits for key customer niches (e.g., allergen-free cellular meat, high omega 3 seafood) that will increase niche market prices and margins. Cellular meat producers will be able to dial-up a range of nutraceutical attributes to target a prescribed niche consumer market segment. This prospect will become far more pervasive than it is under existing traditional agribusiness and seafood supply chain and regulatory environments.

One likely scenario would see consumers' concerns regarding food rise above levels recently documented in USA surveys. Such an outcome would increase the need for "clear" food regulations and for labels to be comprehensive and immediately available to consumers, both at point of sale and in the online information "cloud".

Regulators will confirm brand nomenclature that is acceptable for existing and emerging seafood products. Marketers will then amend the voluntary advice on labels to ensure compliance while optimising their market competitiveness.

Today, only one synthetic meat product (chicken nuggets in Singapore) has been approved by regulators, so how and when real consumers will buy cellular meat or seafood is largely an open question.

Over the long-term (~10-15 years) plant-based and cellular manufactured meat will achieve scale and lower price points, thereby pushing conventional meat into the premium end of the market. Cellular will become the dominant supplier of bulk, commodity meat in consumer markets and activist niche markets. In that case beef mince and pet food will come from cellular meat factories, while prime steak and sirloin roasts will come from farmed cattle.

A similar example for seafood will see commodity white meat fish fillets or fish cakes come from cellular seafood factories, and premium tuna steaks or fresh live mud crab come from aquaculture or wildcatch. Conventional aquaculture and wild catch products will become relatively more expensive (e.g., to cover the costs of supply chain waste, process yield loss, etc) as the palatability and versatility of manufactured meats improves. But there is some way to go before that is either possible or achieved.

C. Differences in Australian jurisdictions

1. Model Food Regulations

All Australian jurisdictions have adopted and use national Model Food Regulations. However, there is significant variability between jurisdictions as to compliance management and emphasis.

FSANZ has no power to enforce compliance with the model regulations, so industry must rely on state agencies and the ACCC to regulate labelling.

Reviews (2015) found a lack of articulation of over-arching principles to guide policy and cross- jurisdictional implementation consistent with Best Practices. The relative complexity of seafood product (compared to other foods) chains and markets makes accurate and compliant seafood labelling a far greater challenge.

2. Fish Names

Some domestic seafood[8] labels will be inaccurate until compliance with the Australian Fish Names Standard (AFNS) is firstly, included in the Food Standards Code, and then secondly, included in all state legislation consistently as a regulatory requirement. And from that point on the AFNS will need to be regulated nationally and in each jurisdiction.

Supply chain members who use common, outdated, inaccurate fish names should be held accountable. But tightening of regulations will be difficult in complex seafood chains where "low trust" pervades consumers and the broader industry culture.

There is also an anomaly related to fish names usage between Australian exporters and importers of fish and fish products. Exporters must use the Australian fish names list per the Standard as part of their ExDoc system. However, importers of fish and fish products do not have the same requirements. The Imported Food Inspection Scheme refers to the Food Standards Code. The AFNS is not mandated in the Food Standards Code, and therefore the use of the AFNS cannot be enforced at the import border. Fish that is in the box may not necessarily match what is written on the outside of the box.

Any move to mandate and harmonise the AFNS across jurisdictions will need to be supported by a comprehensive strategy to build public and consumer awareness, expand chain and market review and testing procedures, and report poor regulation and non-compliance.

3. Country of Origin

Country of Origin laws were first established by the Australian Government in the 1990s to ensure consumers had access to a product origin information. In June 2006 the Australian Government introduced regulations that require seafood sold to the Australian public to be clearly labelled with its country of origin. This regulation was only binding on retailers of fresh food – foodservice venues selling fish for immediate consumption including restaurants, clubs, bars, and fish and chip shops were exempt from this Country of Origin Label (CoOL) requirement.

State and territory governments can introduce regulation to improve consumer access to seafood origin information in the food service sector. In 2008 the NT Government introduced a licence condition requiring imported seafood prepared for immediate consumption to be labelled as "imported". This seafood labelling requirement applies to restaurants and other dining venues (cafés, bistros, hotels, motels, fish and chip shops, delicatessens, and supermarkets). In 2016 the NSW Government announced measures to support the New South Wales seafood industry by promoting its locally sourced products all the way through to diners' menus. Consultation across industry is underway.

In 2016 the Australian Government introduced the Country of Origin Labelling Information Standard specifically designed to address consumer information asymmetry unique to retail purchases of food. Seafood foodservice outlets continued to be exempt from mandatory adoption of CoOL labelling as the new regulations were found to be not suited to foodservice and would impose significant costs if mandated. Foodservice consumers (compared to retail consumers) have less dependency on labels for addressing information asymmetry as foodservice consumption and production takes place together (e.g., in a restaurant), and interested consumers are able to enquire about origin information with wait staff, chefs, cooks, and proprietors directly responsible for preparing meals, sourcing ingredients and delivering customer service. The new 2016 standard and related

[8] Pers comm. Lisa McKenzie DAWE 16 Feb 2021

regulatory reforms became mandatory on 1 July 2018. On that date regulation of the new Standard moved from FSANZ to the ACCC and to the Legislative and Governance Forum on Consumer Affairs (consisting of all state and territory governments).

CoOL continues to be a very active area for debate and policy development. In December 2020 the Senate Standing Committees on Rural Affairs and Transport recommended "the exemption regarding country of origin labelling under standard 1.2.11 of the Australian New Zealand Food Standards Code for cooked or preprepared seafood sold by the foodservice sector be removed, subject to a transition period of no more than twelve months.[9]

The Australian Government will undertake a review of the 2016 reforms in 2021 (DIIS, July 2020).

4. Labelling Along Chains and in Markets

Consultation with leaders in the seafood industry and agencies has identified a number of ad hoc inconsistences in seafood labelling[10], between regions and between jurisdictions. But there is no apparent trend or consistency in these variances.

D. Australian capacity for food substitutes

1. Australian Food Labelling Framework

Australia has established a consumer food labelling framework at the core of the Food Regulation System.

This system has two streams:

- Australian Consumer Law regulated by the ACCC. The relevant regulations relate to the Country of Origin Labelling Information Standard 2016, introduced on 1 July 2016 and became mandatory for all retail seafood from 1 July 2018. The Food Standards Code (see next point) was also amended on that later date to remove country of origin labelling requirements from FSANZ and transfer them to the Legislative and Governance Forum on Consumer Affairs (CAF), consisting of Australian government, state and territory ministers.
- The Australian Food Standards Code (The Code). Food Policy is directed by an Australian - New Zealand Ministerial Forum, led by Food Regulation Standing Committee, and managed by FSANZ (an agency within the Australian Government's Health portfolio). FSANZ develops standards that comprise The Code, currently comprising around 70 standards. Once standards are agreed by the Ministerial Forum they are included in The Code and published by FSANZ. Labelling is specifically established as Standard 1.2 within The Code (see Appendix 1). State and Territory jurisdictions adopt and adapt relevant standards in their legislation under national Model Food Provisions. Local Government Authorities (shire and regional councils) enable on-the-ground implementation of The Code.

2. Labelling of Food Substitutes

Australian food regulations have established a clear requirement to manage food labelling for food substitutes including "Novel Foods", as per The Code:

Table 2 below presents a more detailed review of the extent to which regulatory definitions apply to plant based and cellular products.[11]

Food Standard 1.2.2-2: Name of food

For the labelling provisions, the name of a food is:

[9] This Senate Committee recommendation followed a 2014 recommendation by the Rural and Regional Affairs and Transport References Committee, that recommended the same action (Rural and Regional Affairs and Transport References Committee, 2014)

[10] FRDC has commissioned a separate *Discussion Paper on Seafood Traceability* (FRDC Project 2020-093) currently being undertaken by Ms Meaghan Dodd.

[11] This table has been complied by Ridge Partners from available sources. Expert legal and regulatory advice is required to inform the reader's decisions related to products and regulatory definitions. Also refer to the Definitions summary at the end of this Discussion Paper.

a) if the food has a prescribed name—the prescribed name; and

b) otherwise—a name or description:

(i) sufficient to indicate the true nature of the food; and

(ii) that includes any additional words this Code requires to be included in the name of food.

Table 2. Existing Food Code's ability to deal with the Emerging Issues

CURRENT FOOD CODE	NEW PRODUCT IMPACTS
Standard 1.1.2-3 DEFINITIONS *Fish* means a cold-blooded aquatic vertebrate or aquatic invertebrate including shellfish, but not including amphibians or reptiles.	**Plant-based** seafood will not fall within the existing definition of *Fish*. **Cellar** seafood is derived from DNA of the defined aquatic species and will fall within the existing definition of *Fish*.
Standard 1.5.1 NOVEL FOODS Novel Foods are non-traditional foods that require FSANZ assessment to establish their safety before they are added to the food supply. Novel Foods are assessed by the Advisory Committee on Novel Foods. The Terms of Reference for the ACNF are: 1. Consider enquiries in relation to potential Novel Foods. 2. Make recommendations (to FSANZ) in response to enquiries re potential Novel Foods. The recommendations should contain the following advice: a) Whether the food in the enquiry should be considered a 'non-traditional food' in accordance with the definition in Standard 1.5.1. b) Whether an assessment of public health and safety considerations should be required for the food that is the subject of the enquiry to confirm that there is a reasonable certainty that no harm will result from the intended use of the food and to decide whether any risk management strategies are warranted to ensure the safe use of the food. c) Whether the enquirer should make an application to FSANZ to amend The Code in order to undertake an assessment of public health and safety. Possible categories of Novel Foods are issued by FSANZ. Categories of Novel Foods may include but are not limited to plants or animals and their components, plant or animal extracts, herbs, including extracts, dietary macro-components, single chemical entities, microorganisms, including probiotics, foods produced from new sources, or by a process not previously applied to food.	**Plant-based** seafood will fall within the existing definition of *Novel Foods*. **Cellular** seafood will fall within the existing definition of *Novel Foods*.
Standard 2.2.1 – MEAT and MEAT PRODUCTS *Meat* means whole or part of the carcass of a buffalo, camel, cattle, deer, goat, hare, pig, poultry, rabbit, or sheep, slaughtered other than in a wild state, but excludes: (a) The whole or part of the carcass of any other animal unless permitted for human consumption under a law of a State, Territory or New Zealand; or (b) Fish, avian eggs, or foetuses or part of foetuses.	**Plant-based or cellular-meats** will not fall within the existing definition of meat as they are not from a slaughtered animal carcass. **Seafood** does not fall within the existing definition of *Meat* or meat product.
Standard 2.2.3 FISH and FISH PRODUCTS 2.2.3-2 Definitions: *Fish* means a cold-blooded aquatic vertebrate or aquatic invertebrate including shellfish, but not including amphibians or reptiles. *Meat* defined by FSANZ does not include "seafood". *Seafood* means all aquatic vertebrates and aquatic invertebrates intended for human consumption, but excluding amphibians, mammals, reptiles, and aquatic plants.	**Plant-based** seafood will not fall within the existing definition of *Fish* or *Seafood*. **Cellar** seafood is derived from DNA of the defined aquatic species and will fall within the existing definition of *Fish*. **Cellular** seafood is derived from *Fish* for human consumption and may fall within the existing definition of *Seafood*.
Standard 2.2.3-3 Labelling of formed or joined fish For the labelling provisions, for a food that consists of raw fish that has been formed or joined in the semblance of a cut or fillet of fish using a binding system without the application of heat, whether coated or not, the following information is required: a) Declaration that the food is either formed or joined, b) In conjunction with that declaration, cooking instructions that would result in microbiological safety of the food being achieved.	**Plant-based** seafood will not fall within the existing definition of *Fish,* raw, joined or otherwise. **Cellar** seafood is derived from the DNA of the defined aquatic species, and if joined in semblance of a cut or fillet will fall within the existing definition of *Fish*. **Cellular** seafood is derived from *Fish* for human consumption, and if joined in semblance of a cut or fillet may fall within the existing definition of *Seafood*.

Food Standard 1.1.2-8 Novel Foods

The catch-all name of Novel Foods has been established in major markets (including Australia, EU, USA) as an initial regulatory guideline for food products and food substitutes from emerging technologies.

In The Code *Novel Food* means:

> A non-traditional food that requires an assessment of the public health and safety considerations having regard to:
>
> a) the potential for adverse effects in humans; or
>
> b) the composition or structure of the food; or
>
> c) the process by which the food has been prepared; or
>
> d) the source from which it is derived; or
>
> e) patterns and levels of consumption of the food; or
>
> f) any other relevant matters.

While the term Novel Foods does "catch" all emerging food technologies and their product offerings, it is not a long-term regulatory descriptor. Novel Foods is a transition regulation regime that relies on robust contemporary food regulations and labelling laws. "Meat" (specifically excluding seafood) must come from the carcass (i.e., dead body) of a prescribed species of animal. However, "seafood" is not meat, and must come from aquatic species defined as "fish", for human consumption. This definition is under review by the Senate Rural and Regional Affairs and Transport Legislation Committee, with a report due by the end of February 2022.

New cellular meat products do not come from the carcass of an animal, but from animal DNA processed in a fermentation vessel. It is not clear if or how the current food regulations under The Code can adequately and equitably label cellular meat and seafood as revealed in Table 2.

3. Capacity to authenticate food substitutes

Product authentication is increasingly critical to food integrity. Integrity testing technologies (e.g., DNA, trace elements, stable isotopes, nanotechnologies) are currently applied to:

Plant Products

These testing technologies could readily be applied to plant-based meat substitutes. Plant-based meat and milk products have been in consumer markets for ~30 years.

Meat and Dairy Products.

These testing technologies are increasingly robust across fresh and processed foods and could readily be applied to "cellular meats" as that material is drawn directly from real animal stem cells.

Seafood Products

These testing technologies are currently used to confirm the spatial harvest authenticity provenance of seafood (e.g., Australian wild abalone exported to Asian markets).

Industrial Aquatic Products

These testing technologies are currently used to confirm the spatial harvest authenticity and provenance of pearls (i.e., marine or manufactured). Pearl meat, a seafood coproduct from industrial aquatic production can be authenticated in the same way as other seafood.

4. Capacity to regulate exports

For export seafood, compliance with the Fish Names Standard is mandatory to ensure truth in labelling for Australia's export consumers. The present Food Code and Australian Fish Names Standard require an export fish to be a fish for export purposes, and a fish product is required to contain a majority of fish, with a few minor exceptions. However, food label complications arise in at least two areas:

Alignment with Large Overseas Importers

As a global seafood supplier, Australian producers must deal with larger global trading partners, where labelling complexities arise depending on the trade partner's import legislation. Under existing domestic legislation, there is the ability to certify seafood product that Australia might not identify for export, but the importing country does identify, as a fish or fish product (i.e., the EU).

For example, composite food product requirements can call for certification of any amount at all of dairy ingredient mixed in with fish ingredients (e.g., a dairy based fish dip). The result is that if another import country decides that some cells in a dish are a fish and there is some clear link to fish DNA, Australian regulators can potentially use the expanded application of the legislation to impose a system upon the processors that is the equivalent of the system required to export fish. But the regulatory ruling is less clear if the fish ingredient in the dip is from a plant-based seafood or cellular seafood source.

Value Added Seafood Substitutes

Value added export fish products have always been problematic, especially highly processed fish substitute products like surimi, and crumbed formed fish products and fish cakes.

The source of the problem is these products are not species-specific and manufacturers change the input aquatic animal species content seasonally to optimise their sales margins. These products are just "fish products" and not marketed or valued because of the species used to manufacture them.

Regulations[12], require them to be comprised of fish (not plants) for the most part and be made out of fish. Legislation mandates that a label must be correct and not deceptively misrepresent these content details.

E. Can The Code deal with these issues?

1. What the Literature Suggests

The literature confirms that global and local regulators are currently trying to determine and prescribe names for many emerging plant-based meat foods and cellular meat products. Plant-based meat substitutes are already using some meat and dairy terminologies that are globally inconsistent (e.g., dairy products in the EU and India) and is under review across major global markets. Plant-based meat products are expanding quickly beyond their vegan market heritage.

Cellular meat will be manufactured based on new technologies (both *in vitro,* and precision fermentation), and forthcoming process improvements. As at February 2021 supply chain and market nomenclature for cellular meat (including seafood) has not yet been confirmed in any major global economy.

In the world leading USA market, the USDA and USFDA are currently engaging consumers and industry bodies to negotiate and firm up supply chain regulatory demarcations. Cellular seafood is under the jurisdiction of the USFDA, while regulation for all other cellular and traditional meats is shared between USFDA and USDA, depending on the stage of the supply chain.

In Europe, the EU Parliament has made an initial pronouncement (Oct 2020) that rejected a motion that would have banned meatless food products from having names associated with meat. Producers of meatless foodstuffs will be allowed to continue calling them "sausages" and "burgers" if they desire. By contrast, the EU requires non-dairy foods to avoid referring to "milk" or "cheese" in their descriptions.

France has stated (late 2020) a firm position at odds with these EU pronouncements. And the UK, now out of the European Union, is looking to establish independent trade agreements including with Australia. Clearly there is some way to go yet before legislative clarity emerges regarding cellular meat and seafood in Europe.

In general, Australian industry experts believe there will be a resolution of nomenclature and regulatory jurisdiction in the next 12 months, and new plant-based meat and cellular-meat products will then enter domestic consumer markets. Product authenticity and supply chain integrity testing to support these new products, is not yet being discussed in the literature.

[12] Pers comm. DAWE staff 16 Feb 2021

2. FSANZ' View

In February 2021, FSANZ stated (3 Feb. 2021)[13]: *"The Food Regulation System in Australia and New Zealand is equipped to deal with new types of foods, including foods produced by new technologies."*

Further, the agency noted there are currently no permissions granted or requirements in the Food Standards Code for cell-based meats. FSANZ is aware of emerging cell-based meats, but (at that time) has no application seeking approval.

The fundamental issues here rest on the regulatory creation of some "prescribed names" (as noted above and below in Standard 1.2.2-2) for plant-based meat and cellular meat products as defined by the current standard.

Food Standard 1.2.2-2: Name of food.
For the labelling provisions, the name of a food is:

(a) if the food has a prescribed name—the prescribed name; and

(b) otherwise—a name or description:

(i) sufficient to indicate the true nature of the food; and

(ii) that includes any additional words this Code requires to be included in the name of food.

FSANZ notes that the creation of prescribed names would also mean that existing meat and seafood product names were 'ring fenced' or reserved for use by the traditional producers of those food products.

The literature reviewed in the paper demonstrates that proprietary use of existing market terminology is at the core of the debate now raging across Europe and the USA, and the subject of domestic DAWE Working Group deliberations and a Senate Enquiry. The definition of "Meat" and related labelling matters is currently under review by the Senate Rural and Regional Affairs and Transport Legislation Committee (report due in early 2022).

FSANZ notes (Feb. 2021) that cell-based meats would be captured within existing standards in The Code and require pre-market approval. Depending on the composition of cell-based meats, these standards may include those for:

- Novel Foods,
- Processing aids,
- Food additives,
- Foods produced using gene technology,
- Vitamins and minerals,
- Labelling that indicates the true food nature,
- Definition of cell-based meat, and
- Food Safety requirements.

However, the FRSC noted (FRSC, 2019, p. 5) it is unclear how cellular meat food substitutes would be captured under The Code. Cellular meat and meat products are developed via fermentation outside the animal and not "from the carcass of an animal". Cellular meat products for human consumption (some cellular meat products are being designed as pet foods by start-up companies in the US) may not fall within the definition of meat under *Standard 2.2.1 – meat and meat products*, which stipulates that meat is from the carcass of an animal.

Importantly, meat and seafood diverge at this point. "Fish" is specifically excluded from the definition of "meat" by FSANZ (see Definitions 2. Meat). "Fish means a cold-blooded aquatic vertebrate or invertebrate in any form (excluding mammals, amphibians, reptiles, and aquatic plants). "Seafood" therefore is "fish" for human consumption and is not sourced from the "carcass of a prescribed animal." Expert legal and regulatory advice is clearly required here to clarify the potential for encroachment on existing fish and seafood terms by emerging food substitutes (i.e., plant-based, cellular or fermented).

[13] www.foodstandards.gov.au/consumer/generalissues/Pages/Cell-based-meat.aspx

As noted above Table 2 developed by this paper, summarises key definitions according to The Code as currently written. The table concludes that:

1. Plant-based meat substitutes and cellular meat products both fall within the definition of *Novel Foods,*
2. Plant-based meat substitute products are *neither Fish nor Seafood*,
3. *Meat* must come from the carcass of an animal,
4. Cellular meat is created directly from the DNA of an animal but is not drawn *from the carcass of an animal*. Labelling of cellular meat may therefore be problematic.
5. *Seafood* is specifically excluded from the definition of meat. Seafood is *fish* (aquatic animals of specified groups) when specifically used for human consumption, and
6. Cellular seafood is directly created from the DNA of a *fish* and may fall within the *seafood* definition.

3. Red Meat Industry

Australia has a large and expanding world competitive red meat (cattle and sheep[14]) and livestock industry (MLA, 2021) with total turnover of $72.5 billion employing 434,000 people. Red meat sales in 2018-19 were 89% higher than 2013–14 levels, driven by increasing demand for high quality protein in global markets.

National industry research organisation Meat and Livestock Australia, notes (MLA, 2021) that consumers need to understand that plant-based foods are not nutritional substitutes nor replacements for red meat in a balanced diet. Current branding of plant-based meat products focuses on their functional role as an alternative protein choice – it does not inform consumers of nutritional variances between animal and plant foods, important to a nutritionally adequate diet in line with Australian Dietary Guidelines.

The industry cites recent research regarding new food metabolites (van Vliet, et al., 2021). This study found large differences between farmed grass-fed meat and plant-based meat in metabolites within various nutrient classes (e.g., amino acids, dipeptides, vitamins, phenols, tocopherols, and fatty acids) with physiological, anti-inflammatory, and/or immunomodulatory roles. The paper concludes that these products should not be viewed as truly nutritionally interchangeable but could be viewed as complementary in providing nutrients for human food.

According to the Red Meat Advisory Council (RMAC), the Australian red meat and livestock industry position for minimum regulated standards is to prohibit:

- The use of plant protein descriptors that contain any reference to animal flesh or products made predominately from animal flesh, including but not limited to meat, chicken, beef, goat and lamb,
- The use of livestock images on plant protein packaging or marketing materials.

RMAC cites the use of standards as the best way for regulatory protection of meat branding and labelling.

3. Conclusion

Food substitutes from emerging technologies, including cellular meats, will likely enter global markets in 2022. Singapore is the only country to approve sale of this product to date (Dec 2020).

Based on the issues considered and assessed here:

1. Country of Origin Labelling and Australian Fish Names remain a work-in-progress for the seafood industry. Anomalies persist across supply chains and jurisdictions. The transfer of the regulatory powers for Country of Origin Labelling from FSANZ to the ACCC in July 2018 will broaden the regulatory focus related to the new CoOL standard away from food safety toward disclosure of products under consumer law.
2. The existing Food Standards Code is not able to deal clearly with all of the labelling issues potentially arising from emerging meat and seafood substitute products.

[14] https://www.mla.com.au/prices-markets/Trends-analysis/fast-facts/

3. Seafood labelling under the existing Code may result in misleading or deceptive conduct that is not compliant with the Australian Food Regulatory System and will attract an ACCC response.
4. Plant-based seafood products will not fall within the existing FSANZ definition of *Fish*, nor *Seafood*, but will fall within the definition of *Novel Foods*.
5. Cellular seafood will fall within the existing definition of *Fish*, *Seafood* and *Novel Foods* as it is from the DNA or defined species of aquatic animals used for human consumption.
6. Plant-based and cellular seafood will add a new layer of complexity to the national and regional seafood labelling system that is already demonstrably failing consumers in many ways identified in this paper. Australian Seafood labelling systems need to better deal with existing labelling issues and failures, as well as preparing for the emerging issues of seafood substitutes. Failure to align seafood labels and regulations with new and emerging food technologies will compound existing misleading and deceptive behaviours.
7. The latest food science and nutritional research suggests that existing food labels may present misleading nutritional information to consumers. From a human nutrition metabolite perspective, traditional meat products and plant-based substitutes should not be presented or viewed as interchangeable substitutes but may be complementary within Australian Dietary Guidelines.

3. PROTEIN DEVELOPMENT PATHWAYS

A. Context

The Role of Food Labels

The role of food labels is to improve consumers' awareness, risk management and purchase choices. Food labels are the final critical food-integrity step in the complex chain of trust from producer to consumer.

Food labels convey information regarding:

- Specification - product name and description, size, weight, barcode,
- Source - who produced or manufactured, how, where, and contact details,
- Composition - ingredients, nutrition, omega-3, health ratings,
- Safety - allergens, warnings (contains bones, nuts, etc) or hot to taste (chilli rating),
- Use, care and preparation - consumption, temperature, storage, reuse, waste disposal,
- Authenticity - misrepresentation, or fraud,
- Expiry - "best before" date, "use by" date, or consign to waste,
- Provenance - linking quality to geographic origins and traditions, and
- Ethical supply - animal welfare, sustainable production, social license and certifications, etc.

Labels seek to regulate risks arising from consuming a food, at two levels: direct and indirect. Labels *directly* reduce food risks for consumers by:

- Preventing food borne illnesses,
- Preventing foreign objects and contaminants, and
- Minimising physical harm from chemicals.

All other risks are *indirect* and encompass a large, very diverse and expanding portfolio of issues. The following discussion summarises these issues.

Drivers for Food Label Changes

Global and local changes in food labelling are being driven by many complex and interrelated factors. The following discussion summarises these drivers, with emphasis on the Australian context.

Global Population and Demographics

Global consumer demand for meat[15] and seafood protein is increasing. The world population (7.6 Bn in 2018) is forecast to reach 10 billion by 2050. Demand for protein is expected to grow by 70% over the next 30 years as the global population increases (Springer, 2021).

Global meat consumption is rising 3% per year. But rising meat demand does not easily nor directly translate into production forecasts for meat and seafood producers, be it beef, pork, mutton, lamb, goat meat, poultry, wild or farmed seafood, or other sources.

[15] This Paper defines "meat" and "seafood" in the Definitions Appendix. Meat does not include seafood.

Livestock, used as human food, consume nearly half (46%) of the currently available plant harvest worldwide (ATKearney, 2019). This plant feed supply to animals and then onto humans, is manifest in complex environmental, social and climatic drivers that influence production systems directly and consumers' choices indirectly.

Wealthy people eat more meat, both as fresh and processed food. The key factors affecting the level and type of meat consumption are demographics, urbanisation, incomes, prices, tradition, religious beliefs, cultural norms, and environmental, ethical/animal welfare and health concerns.

Wealthy consumers are also far more fussy regarding their indirect drivers for meat product purchases. But income growth will drive up per capita meat consumption far more for low-income consumers than it will for high-income consumers. At high incomes, meat consumption is largely saturated and limited by other factors such as environmental, and ethical/animal welfare and health concerns (OECD-FAO, 2021, p. 171).

In 2018-20 meat consumers in Developed Countries[16] consumed 86 kg on average retail weight per capita per year (OECD-FAO, 2021), a rate more than double that in Developing Countries.

Table 3. Forecast Global Meat and Seafood Consumption 2020-2030

Meat and Seafood Consumption Kg per capita per year	**2018-20** Avg/Year	**2030 Forecast** Avg/Year
Meat		
Developed Countries	86	88
Developing Countries	33	35
Seafood		
World	21	21
Africa	10	10
Latin America	10	11
Asia excl China	18	18
Europe	21	21
North America	23	24
Oceania	27	27
China	39	45

The OECD-FAO finds that the same high-income trend bias is less clear for global seafood consumption. China, a Developing Country which is also the largest producer and consumer of seafood, is forecast to experience a very high (15%) growth in seafood consumption over the decade to 2030. This growth rate is much higher than the regional averages across the rest of the world. (OECD-FAO, 2021, p. 197).

The OECD-FAO also notes "that dietary preferences for lower meat consumption (e.g., vegetarian or vegan diets) or for alternative protein sources (e.g., cultured and plant-based protein substitute for meat) are assumed to expand slowly and to be adopted by a small part of population concentrated mainly in high income countries, and therefore hardly affect meat consumption over the next decade. Nevertheless, while the competition from substitutes will increase, consumer choice will continue to be influenced by the nutritional content in meat as compared to protein substitutes".

Technology for Food Production and Labelling

High and rising consumer demand is motivating new investments and technologies to both reengineer efficiencies (e.g., in food fermentation) from existing food production systems, and also to create new meat and seafood protein production processes that potentially offer a step change to improved product design, resource sustainability, and consumer benefits.

[16] Refer to Glossary for list of Developed Countries

In the next decade traditional meat farmers, and seafood fishers and farmers, will see new non-traditional alternative meat competitors launching meat and seafood replacement products in their food and industrial feed markets. Food branding, labelling, and regulation is already becoming increasingly complex and contested. Complexity and competition will escalate further in the next 2-5 years.

The new meat and seafood replacement products will enter a very dynamic environment driven by multiple global and local technologies, and consumer market preferences. This is a challenge for existing food regulators responsible for trade, consumer safety, and related food label issues.

New product pathways are emerging and will join existing meat production pathways. Within five years there will likely be five meat, seafood and dairy production pathways:

1. Exiting hunting and wild harvest sectors, including capture fisheries,
2. Existing farmed agriculture and aquaculture (including ranching),
3. Existing plant-based meat substitute production that was initially developed in the 1990s and has a growing market presence,
4. Cellular agriculture – an emerging technology that produces animal-based products outside the animal from cell cultures of animal stem cells, and
5. Precision fermentation of microorganisms, a longer-term variant on cell culturing. The emerging scope and scale of this variant is very uncertain.

Technology also drives consumer awareness. Advanced information technologies, advanced portable personal mobile devices, and the internet all enable large gains in the storage, access and point-of-sale presentation of product information to consumers. Virtually any information, accurate or spurious, can be delivered instantly on cloud-based QR (Quick Response) codes and labels to consumers about to make dietary choices.

Advanced technology access is driving greater awareness which in turn is also driving consumers' expectations higher.

Environmental Costs of Food

A 2018 paper (Hilborn, Banobi, Hall, Pucylowski, & Walsworth, 2018) identifies the relationship between the environment and food production as one of the primary global conversations underway now.

Given that the most control an individual has over their environmental impact on the planet is through diet, it follows that those consumers will seek to make more informed dietary and purchase choices. This issue is therefore a primary driver for change in food labelling (Mossler, A closer look at the environmental costs of food , 2018).

The paper states that agriculture currently uses 38% of the world's land and accounts for over 90% of freshwater use. Farming and food production has been, and continues to be, the largest driver of habitat and biodiversity loss on the planet.

Life Cycle Assessments of animal proteins used as food, has quantified four kinds of environmental impacts that may find their way onto food labels:

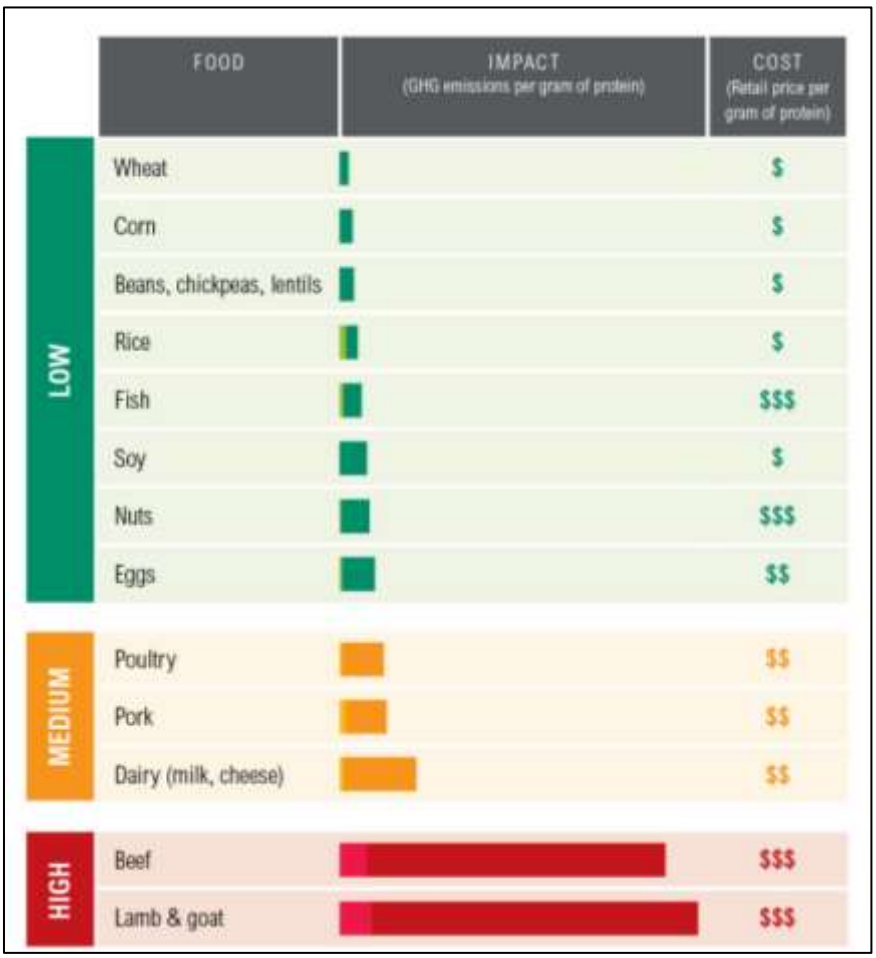
1. Electricity/energy use,
2. Greenhouse gas (GHG) emissions,
3. Potential for nutrient run-off that impacts water quality, and
4. Potential to cause air pollution.

The paper concludes that:

- All food production has environmental costs, which differ greatly between types of animal protein,
- Most of the environmental costs derive from fertiliser used in feed production, fuel for fishing boats, and circulation of water in aquaculture, and

- The lowest impact forms of animal protein come from species that feed naturally in the ocean and that can be harvested with low fuel requirements.

Table 4. GHGs and Protein Cost Scorecard for Selected Foods



A more recent paper (World Resources Institute, 2021) presents (Table 4) research related to the GHG impacts from a range of food production systems.

Beef, lamb and goat meat have the greatest GHG impact on the global environment because they are ruminant animals relying on methane-generating bacteria in their gut to break down food. GHGs are emitted mostly from the front end of the animal.

For non-ruminant pigs and poultry, feed needs to be grown, harvested, processed, and shipped to farms, all contributing to emissions.

Wild-caught fish feed and grow on their own and have the lowest emissions among animal proteins. Commercial wildcatch fishing emissions mostly come from boat fuel burned, so the carbon impact of seafood depends on the species being caught (e.g., prawns and lobster have higher carbon emissions because trawl and trap boats have to constantly stop and start to place/collect nets and pots).

A 2014 study (Scarborough, et al., 2014) concluded that fish-eaters (who consumed no other meat) have nearly the same emissions profile of strict vegetarians, differing by about 1%. Vegans are the least impactful eaters.

Well managed wild-caught fish foods also offer consumers three other key advantages over land-based food:

1. They require negligible land space to operate,
2. They have minimal impact (via pollution, diversion, contamination, and use scarcity) on freshwater rivers and lakes, and,
3. They have negligible impact on extinction of species.

Aquaculture also offers environmental benefits compared to ruminant livestock farming, but it is species specific. For example, farmed kelp, mollusc and bivalve aquaculture absorbs excess nutrients that are harmful to ecosystems, producing the least amount of air pollution. Small capture fisheries and salmon aquaculture are close behind. And these species are grown close to shore so there is minimal transport fuel consumption. But farmed catfish/pangasius production has a large negative impact (similar to beef production) on the environment through energy used, emissions of GHGs, eutrophication potential, and acidification potential. (Hilborn, Banobi, Hall, Pucylowski, & Walsworth, 2018).

Emissions from plant-based proteins are directly related to their protein density. Food needs to be harvested, packaged, and shipped - all creating GHGs - meaning denser foods provide more protein for their weight. There is more protein in a pound of fish than in a pound of nuts, thus GHG emissions per gram of fish protein is lower.

A further paper in 2019 (Mossler, The climate change impacts of nutrition, 2019) referenced Life Cycle Analysis research undertaken in Sweden (Elinor Hallström of Research Institutes of Sweden, 2019) related to local wild-caught seafood species. Seafood species best to eat for both good health and minimal climate impact include European Sprat, Atlantic Mackerel, Atlantic Herring, Pink Salmon, and Alaskan Pollock. Seafood that are poorest choices, providing relatively little nutrition, but incurring high GHG costs include farmed Catfish, Norway Lobster, Northern Prawn, and Scallops.

Climate Change Impact

Many start-up companies[17] are looking to build a business making synthetic foods that mimic and compete with traditional wild harvests or farmed animals or plants. At the core of their motivation is the belief, *inter alia*, that consumers will increasingly favour food production systems that resolve or mitigate climate change impacts, reduce carbon creation and release, and reduce greenhouse gas emissions. Reducing emissions is the most compelling case for a plant-based diet.

Hilborn et al (Hilborn, Banobi, Hall, Pucylowski, & Walsworth, 2018) measured GHG emissions per unit of protein production for livestock, fisheries and aquaculture (Table 5). Seafood species are very diverse, represented at the lowest GHGs and at the highest levels.

Table 5. GHG Emissions per Animal Source

GHG Emissions per Animal Source	GHG
Capture Small Pelagic	0.16
Capture Whitefish	0.3
Aquaculture Molluscs	0.37
Impossible Burger – based on PBMs	0.62
Aquaculture Salmon	0.63
Capture Large Pelagic	0.64
Livestock Chicken	0.88
Livestock Pork	1.3
Aquaculture Carp	1.89
Capture Prawn	1.93
Capture Invertebrate	2.68
Aquaculture Tilapia	3.00
Aquaculture Prawn	4.82
Livestock Beef	5.92
Aquaculture Catfish	8.61

It should be noted in Table 5 that the *Impossible Burger 2.0* (a plant-based product) is a processed grain/pulse manufactured product[18], whereas the seafood products are all listed at their unprocessed product emissions and would need to be frozen, filleted, canned, or handled in some way to change from raw form into market form, adding more GHG emissions along the way. The *Impossible Burger* would therefore likely have a lower GHG level when in the hands of the consumer.

Some aquaculture species and beef are unquestionably the worst offenders is GHG emissions, reinforced broadly by the findings of the Swedish study in 2019 (noted in the previous section).

Nutrition

Debate continues as to the comparative benefits for human health from Plant Based meats V meat V seafood. Vegetarian diets are associated with healthy lifestyles in western society, but the debate about dietary benefits of plant-based meat substitutes, are far from a consensus. (Cheney, 2021).

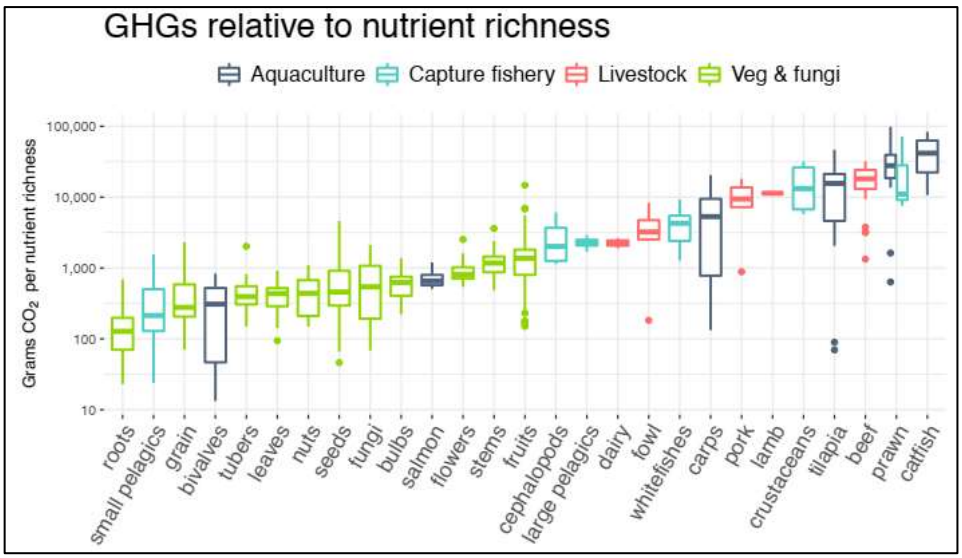
[17] A sample of these are listed in (Cheney, 2021) and include Good Catch, Alpha Foods, Ocean Hugger Foods, Prime Roots, New Wave Foods, Beyond Meat, Impossible Foods, and BlueNalu.

[18] The ingredients in an Impossible Burger are: Water, Soy Protein Concentrate, Coconut Oil, Sunflower Oil, Natural Flavours, 2% or less of: Potato Protein, Methylcellulose, Yeast Extract, Cultured Dextrose, Food Starch Modified, Soy Leghemoglobin, Salt, Soy Protein Isolate, Mixed Tocopherols (Vitamin E), Zinc Gluconate, Thiamine Hydrochloride (Vitamin B1), Sodium Ascorbate (Vitamin C), Niacin, Pyridoxine Hydrochloride (Vitamin B6), Riboflavin (Vitamin B2), Vitamin B12. https://faq.impossiblefoods.com/hc/en-us/articles/360018937494-What-are-the-ingredients-

Leading US industry figure, John Mackey, CEO of Whole Foods Inc. has criticised the "highly processed" nature of PBMs meaning they are less healthy. Some dietitians (Cheney, 2021), have determined that PBMs be consumed as a dietary meat substitute, not a vegetable replacement.

Compared with ground beef on standard nutritional metrics, the *Impossible Burger 2.0* is very similar to red meat but has more saturated fat. The Cheney paper referenced a comparison (drawn from FDA.gov; Impossible Foods.com; and USDA 2018) of calories, total fat, carbohydrates and protein between ground beef, *Impossible Burger 2.0*, and eight common seafood species. The *Impossible Burger 2.0* had 2 grams of saturated fat per one ounce, while only ground beef (1.5 g), Atlantic Salmon (0.67 g) and Tilapia (0.33 g) registered any saturated fat at all from the other species. Ground beef for this comparison contained 15% fat. Seafood is more nutritious than PBMs.

Cheney also referenced a 2019 study (Koehn, 2019) that found "the lowest environmental impact and most nutrient rich foods were vegetable food groups like grains, tubers, roots, seeds, as well as small pelagic fish in wild capture production and bivalves in aquaculture production." His summary conclusions are drawn from Figure 1 (note the y-axis is on a logarithmic scale).



Cheney states "it is not possible to estimate precisely where *Impossible Burger 2.0*, or any other PBM products might fall on this chart without more comprehensive data, but a fair estimate would assume PBMs would be near cephalopods and large pelagic species (roughly 10% of beef's GHG relative to nutrient richness)".

Figure 1. GHG emissions V Food Nutrient Richness

Plant production to support PBMs requires land use, water use, agricultural runoff, and therefore must be associated with varying degrees of opportunity costs that are rarely associated with responsibly managed wild capture fisheries.

Ethical Treatment of Animals

Reducing animal deaths and minimising animal cruelty has long been the ethical foundation for many vegetarians and proponents of sustainable food production. Free range chickens, cage-free breeding sows, and "Animal Welfare Certified" are commonplace on food packaging these days.

There are complex origins for most of our daily plant foods as found by Professor Mike Archer, University of NSW in 2011[19]. Australian cattle are primarily (98%) raised on natural grasslands that require minimal, if any, degradation to the natural habitat resulting in zero additional animal deaths by ploughing or clear-cutting. Archer determined that on average, one cattle death produced 45 kg of edible protein, so about 2.2 deaths required to produce 100 kg of edible protein via Australian grazing systems. By comparison Archer estimated that 55 sentient animal deaths (snakes, birds, mice, etc) occurred from ground clearing and ploughing for 100 kg of usable plant protein, though these measurements were far from definitive. This suggests broadacre farm agriculture results in 25 times as many deaths as grass fed beef.

Recent US research (Fischer & Lamey, 2018) concluded that "traditional veganism could potentially be implicated in more animal deaths than a diet that contains free-range beef and other carefully chosen meats."

[19] https://sustainablefisheries-uw.org/ethics-impact-and-nutrition-plant-based-meat

Many fisheries would compare unfavourably when measuring human rights violations. Distant water fishing fleets facilitate some of the worst cases of forced labour on earth, and the nature of those supply chains makes those atrocities extremely difficult to remedy. But the mission of reducing sentient animal deaths is very different. In that analysis, seafood compares very favourably to plants, as does grass fed free-range beef.

These few references confirm that many viewpoints are needed to achieve a balanced view of food system ethics.

B. Plant-based Meat

A significant portion of the literature suggests efficiency gains for conventional meat production are approaching their resource limits – water, land, etc. This leads to the conclusion that the economics of meat substitutes will likely become more competitive. Social acceptance of the type and rate of natural resource consumption in meat production is attracting increasing public scrutiny.

1. Meat

Plant-based meat replacement products[20] manufactured from plant mycoproteins are currently the biggest direct competitors to traditional (i.e., farmed) meat. Made from plants and plant-based proteins, these products are produced to mimic, look and taste like traditional meat, despite containing no animal cells. Plant-based meats are made in food factories and manufacturing facilities like other every-day foods.

Market demand for plant-based meat replacements is strong. Total store plant-based meat alternative sales in the USA were $760 million in 2019, up 11.8% for the year (US Annual Meat Conference 2020). They are mostly an occasional choice driven by perceived health benefits, being a good source of protein, "just something different" for progressive consumers, and offering environmental sustainability benefits.

These products have been widely available to consumers, including in the USA, Europe and Australia for at least 30 years. They include ground beef such as Quorn™ mince[21] (made by a UK company from edible fungus), meat-free sausages and nuggets, and beetroot burgers.

Other products released in 2021 in ASDA, a large UK supermarket group, include "bacon style rashers" free from meat, egg and dairy[22]. Product names use meat nomenclature.

Blended plant-based meat items, such as mushroom burgers, have a higher and greater cross-population appeal, and can be a bridge to health and social benefits some consumers look for, while keeping real meat on the plate (an objective of traditional producers).

Research by The Economist[23] newspaper notes that plant-based milk (including from almond, oat and hemp sources) now accounts for about 15% of retail milk sales in America and 8% in Britain.

2. Plant-based Seafood

Plant-based seafood is commonplace in global seafood retail outlets.

In late 2018 UK chain Sainsbury's added "fishless filets" to its seafood range from Canadian processor Gardein. In early 2019 it offered Sophie's Kitchen

[20] www.foodstandards.gov.au/ consumer/generalissues/ quorn/Pages/default.aspx
[21] Image sourced from FSANZ
[22] www.thegrocer.co.uk/own-label/range-preview-asda-veganuary-2021/651970.article?itm_source=Bibblio&itm_campaign=optimised_end_article
[23] www.economist.com/international/2019/10/12/plant-based-meat-could-create-a-radically-different-food-chain

brand vegan prawns and "Plant-based Toona", citing an 82% increase in customers searching vegan products online[24].

Australian supermarkets also currently offer these products for sale but in a limited range.

C. Cellular Meat

1. Meat

Cellular meat is created outside the animal from animal stem cells, or from genetically modified organisms.

Production (for beef, lamb, pork, poultry) involves new technologies that directly produce only the parts of animals consumers prefer to eat (e.g., fillet steak), rather than creating the whole animal.

"Cultured" meat (FRSC, 2019, p. 5) emerged in a laboratory[25] in 2013 and into consumer markets in London later that year (Verbeke, et al., 2015). In 2020 cellular meat has many names variously called *in vitro* meat, IVM, lab-based, lab-grown cultured, slaughter-free, artificial, synthetic, clean, fake, schmeat, animal-free, cruelty-free, cellular, cell-based, cell-cultured, cultivated, meat 2.0, pure meat, safe meat, and craft meat.

The conversion rate of grain in dry weight to conventional meat (for cattle, pigs, or poultry) with similar calorific value per kilogram is around 15% over these meat types. The comparable conversion rate for cellular meat is more than four times higher according to a respected global consultancy firm (ATKearney, 2019, p. 13). That study forecasts 35% of global meat consumption will be cellular meat by around 2040. The US National Academies of Sciences forecast cellular meat products would enter consumer markets by 2022[26]

There are currently no cultured meat products commercially available in Australia and only one globally (in Singapore). The Australia Farm Institute (AFI, 2020 February) notes that while production costs per kilogram for cultured meat have significantly reduced in the past 18 months, it is still not a commercially viable product at retail scale. Once cultured meat is available to consumers, it is likely to primarily substitute for cheaper mince-based products rather than the array of different cuts and products available to consumers of animal-sourced meat. Issues of scalability, adverse health impacts, and unknown consumer acceptance are potential obstacles for companies producing cultured meat.

2. GMO and Cellular Seafood

In 1989 the USFDA determined that genetically modified *AquAdvantage*™ Salmon be approved for commercial sale to seafood consumers. The agency said this salmon product meets the statutory requirements for safety and effectiveness. The salmon are safe to eat, safe for the fish itself, and they meet the sponsor's claim about faster growth[27]. *AquAdvantage*™ Salmon has been genetically engineered to reach a growth marker more rapidly than its non-genetically engineered farm-raised Atlantic salmon counterpart.

The USFDA determined there were no significant potential environmental impacts from this approval. The USDA's Agricultural Marketing Service regulates the labelling of human food from genetically engineered salmon, including *AquAdvantage*™ Salmon, under a National Bioengineered Food Disclosure Standard issued

[24] www.thegrocer.co.uk/new-product-development/sainsburys-adds-sophies-kitchen-vegan-prawns-to-plant-based-lineup/575376.article
[25] Dr. Mark Post of Maastricht University, Netherlands, proved meat could be cultured as a meat hamburger in 2013, at a cost of roughly AUD$400,000. His enterprise, Mosa Meats, plans to have cellular meat in commercial production by 2021.
[26] National Academies of Sciences, Engineering, and Medicine. 2017. Preparing for Future Products of Biotechnology. Washington, D.C. The National Academies Press. doi: https://doi.org/10.17226/24605.
[27] www.fda.gov/animal-veterinary/animals-intentional-genomic-alterations/aquadvantage-salmon-fact-sheet

on December 20, 2018. As with all foods, a producer/manufacturer/marketer may include voluntary information in labelling, provided the information is truthful and not misleading.

But cellular seafood production and regulation has been slow to advance since its initial approval by the USFDA in 2015. There is limited literature available on marine cell cultures and related development pathways (Rubio, Datar, Stachura, Kaplan, & Krueger, 2019). Most available research has been based on finfish and commercialisation is centred on species suitable for aquaculture, and therefore the focus is to optimise financial investment returns. There is very little cellular seafood research underway or published for crustaceans and even less for molluscs.

Approaches to cell-based seafood production range from large scale cell cultivation (e.g., masses of seafood-relevant cells for processed seafoods like surimi) to three-dimensional tissue cultivation in structured products more akin to fillets (Rubio, Datar, Stachura, Kaplan, & Krueger, 2019, p. 9). These authors see two main advantages to cellular seafood, apart from environmental considerations:

- Elimination of production of inedible excess tissues (bones, skin, shells, scales) that are often discarded,
- Shorter cycle time: cell cultures take weeks to generate functional seafoods, compared to AquaBounty[28] Salmon (18 months) or normal aquaculture Salmon (36 months).

3. Pros and Cons

A number of advantages and disadvantages for cellular meats in general, have been collated from a range[29] of sources listed in this paper. Given the uncertainty regarding the consumer demand and technology capability, these points are only advisory in nature.

Benefits of Cellular Meat

- Less land use and soil depletion,
- Less water use to grow crops, and rear and slaughter animals,
- Fewer greenhouse gases emitted from animals,
- Improved welfare for slaughter animals,
- Less energy use to convert inputs to food,
- Shorter cycle time - cell cultures require weeks to generate seafood; farming takes months,
- Less prone to biological risk or animal disease,
- No likelihood of faecal contamination,
- Could be healthier, with less undesirable fats,
- Farmers will be less reliant on climate for yield, and
- Less food waste from processing.

Challenges for Cellular Meat

- Cost of labour, facilities and production are unknown, but currently relatively high,
- Cell cultures are easily contaminated or killed,
- Consumer perceptions are as yet untested,
- Regulatory uncertainty and delays,
- Taste: meat gets much of its flavour from blood and muscle, and researchers do not yet know what components of blood give meat flavour,

[28] US firm AquaBounty Technologies developed and sold the first genetically modified salmon in 2017

[29] Including University of Alberta, https://www.ualberta.ca/agriculture-life-environment-sciences/alesnews/2018/november/cellular-meat

- Metabolite research suggests that plant based meat substitutes lack many of the nutritional classes (e.g., amino acids, dipeptides, vitamins, phenols, tocopherols, and fatty acids) required for physiological, anti-inflammatory, and/or immunomodulatory roles currently found in meat, and
- Reliable edible "scaffolds" on which meat cultures can grow are yet to be developed.

In 2020 an Australian study funded by AgriFutures (AFI, 2020 February, p. 61) concluded that non-traditional protein sources (cellular meat, algae, seaweed, insects) have several sustainability, technological and institutional factors affecting their feasibility as suitable protein alternatives.

Specifically, the production of cultured meat and algae proteins are mainly in the research and development stage and not available for purchase by consumers. Current insect protein production is small-scale and labour intensive.

The report found that while consumers appear willing to try them, market interest in insects and cultured meat appears to be low. The potential future of cultured meat, algae and insects is not yet clear due to issues related to consumers' acceptability, technological challenges and regulations.

D. Precision Fermentation

Precision fermentation of microorganisms, a variant on cell culturing Precision Fermentation (RethinkX, 2019 Sept) is the final emerging food technology identified in this paper.

This technology is a variant of cellular meat, that employs fermentation of microorganisms. The process maps and instructs selected micro-organisms to produce complex organic meat molecules. It is not yet widely discussed in the literature[30].

E. Conclusion

Consultation with industry and review of the literature reveal two trends related to consumer meat and seafood products:

1. For existing meat production and processing - there are no significant trends in technologies that suggest changes in consumer products.
2. For new and emerging meat substitute and replacement products - there are substantial changes emerging related to technologies and processes that are driving new food products.

[30] Precision Fermentation combines fermentation plus precision biology. The process allows production to program micro-organisms to produce almost any complex organic molecule.

4. LAW RELATED TO SEAFOOD LABELLING

A. Australian Seafood Labelling Snapshot

The following figure illustrates how seafood labelling supports the Australian food system to achieve safe food.

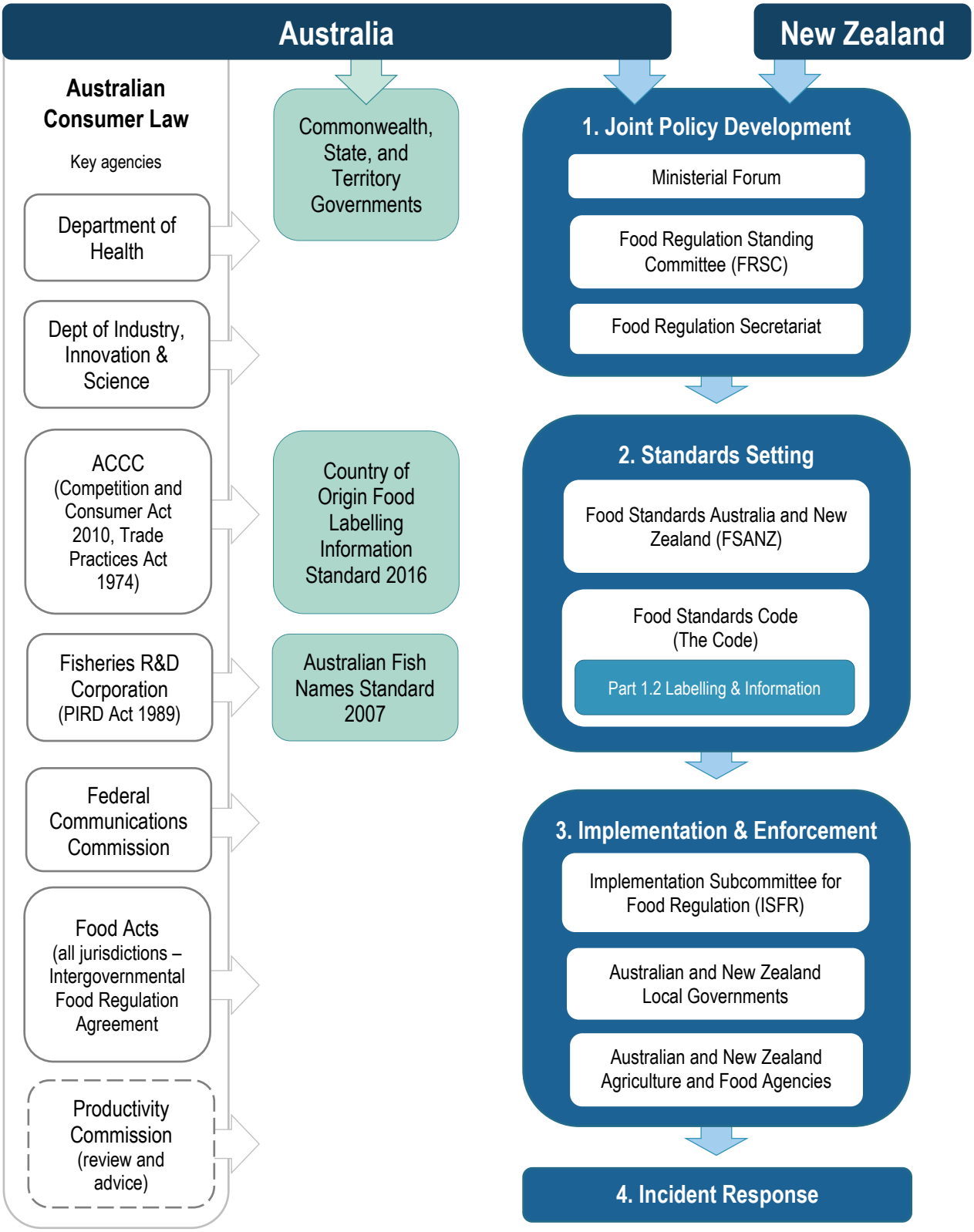


Figure 2. How the Australian Seafood Labelling System Operates

B. Australian Consumer Law

The Australian Consumer Law is a national law that aims to protect consumers and ensure fair trading and competition in Australia. As a general rule, all product packaging and labelling must comply with Australian Consumer Law.

It is the responsibility of the supplier of the food (this includes manufacturers, distributors, importers and retailers) to ensure that food labels are compliant with all relevant regulations before selling the food. If food businesses are unsure whether their food complies with the relevant regulations, they should engage the services of an experienced lawyer or food regulatory consultant.

There are two fundamental rules of advertising and selling that the Australian Consumer Law imposes on all businesses. You must not:

1. Engage in conduct that misleads or deceives, or is likely to mislead or deceive your customers, or
2. Make false or misleading claims or statements.

There is no strict legal definition of "misleading or deceptive behaviour". Applying common sense will often determine whether conduct is in breach of these rules. The ACCC is the primary arbiter.

Misleading and deceptive conduct may include:

- Statements or claims that you make on your product labels, and
- Information that you withhold or remain silent about.

The Australian Consumer Law is promulgated across Australian jurisdictions and extends to New Zealand to underpin the Australia New Zealand Food Standards Code. Both nations have undertaken extensive individual and joint assessments of food regulatory approaches over many years.

In parallel the National Reform Agenda of the Council of Australian Governments (COAG) focuses on reducing the regulatory burden imposed by the three levels of government. COAG confirmed that effective regulation is essential to ensure markets operate efficiently and fairly, to protect consumers and the environment and to enforce corporate governance standards. However, the benefits from regulation must not be outweighed by the costs imposed and there should be no unnecessary compliance costs[31].

Food importers must also comply with Australian labelling laws.

The following discussion relates to regulation of food labelling. It draws from two primary websites[32] (Food Regulation, and FSANZ) and presents a summary of information relevant to understanding seafood labelling in Australia.

C. Australian Food Regulators

1. Joint Regulatory System

The Australia and New Zealand joint food regulation system is made up of the laws, policies, standards and processes that we use to make sure our food is safe to eat. Refer to Figure 2 above, and Table 6 below.

Food regulators[33] conduct activities in the following areas:

- Generating compliance,
- Monitoring and assessing compliance, and
- Responding to non-compliance.

[31] Productivity Commission 2009, *Performance benchmarking of Aust. and NZ Business Regulation: Food Safety*, Research Report, Canberra.
[32] www.foodregulation.gov.au/internet /fr/publishing.nsf/Content/Home and www.foodstandards.gov.au/Pages/default.aspx
[33] Refer to www.foodregulation.gov.au /internet/fr/publishing.nsf/Content/Home

Food regulators are undertaking activities in support of all three areas on a continual basis and in an inter-connected manner. Food regulators conduct activities to generate and monitor compliance focussing on different topics or priorities as issues arise.

The joint food regulation system[34] is a strong system, based on scientific evidence and expertise, that protects the health and safety of consumers. It is a complex system that involves all levels of the Australian and New Zealand governments. Different roles are met by local, state and national government, and international obligations are respected.

The rigorous system reflects the many businesses and stakeholders in the food supply chain, providing a firm platform on which our food industries can operate, and enables choice for consumers. Table 6 summarises the jurisdictions, agencies, and legislation relevant to food labelling.

2. Policy development

Joint Regulatory System

Australian Governments and agencies develop food policy for Australia, often advised by specialist organisations such as the Productivity Commission. But the Joint Food Regulatory System between Australia and New Zealand is the primary regulator.

Joint Ministerial Forum

Food policy in Australia and New Zealand is cooperatively made by the Australia and New Zealand Ministerial Forum on Food Regulation. The Ministerial Forum Members are the decision makers in the system. The Forum signs off on all food standards and can also request that a draft standard be developed, reviewed, amended or rejected.

Forum membership is designed to reflect the whole-of-food chain approach to food regulation. Members include a Minister from New Zealand, Ministers from the Australian Government, Health Ministers from Australian jurisdictions, Ministers from related portfolios (Primary Industries, Consumer Affairs) where nominated, and the Australian Local Government Association as an observer.

The Forum has two distinct roles as a decision maker. It must carry out its responsibilities as outlined above, and is required to be the system arbitrator. To do this, the Forum must balance food regulation in the bi-national interest with potentially competing views from consumers, from industry and from itself.

The Chair of the Forum is a Health Minister responsible for the *Food Standards Australia and New Zealand (FSANZ) Act (1991)*. The Forum is required to meet face-to-face at least once every calendar year.

Food Regulation Standing Committee

The Forum is supported by the Food Regulation Standing Committee (FRSC), a sub-committee that provides policy advice to the Forum. Members of this committee include government department and agency heads responsible for food regulation in each jurisdiction.

Food Regulation Secretariat

The Food Regulation Secretariat provides secretariat services to the Forum and its sub-committees.

Local Government

Local Governments regulate all food businesses not specifically regulated by other agencies. Local Councils also assist Departments of Health with food recalls and food sampling activities and respond to complaints about food safety relating to local businesses selling food in their jurisdictions.

3. Making Food Standards

The ACCC, FSANZ and the FRDC (since 2013) are accredited Standard Development Organisations. All three bodies develop and sets food standards which support or are part of food law in Australia and New Zealand.

[34] www.foodregulation.gov.au/internet/fr /publishing.nsf/ Content/system-overview-1

Table 6. Australian Food Regulation – Jurisdictions, Legislation and Bodies

Jurisdictions	Agencies	Primary Seafood Legislation	Notes
Australia	• Department of Health • Department of Industry, Science, Energy and Resources • Department of Agriculture, Water and Environment • Department of Foreign Affairs and Trade • State, Territory and Local Government Agencies • Food Safety Australia and New Zealand • Australian Fisheries Management Authority (AFMA) • Australian Competition & Consumer Commission (ACCC) • Federal Communications Commission • Productivity Commission • National Measurement Institute (NMI)	• *Competition and Consumer Act 2010 (Cwth)* • *Food Standards Australia and New Zealand Act 1991* • Food Standards Australia and New Zealand Regulation 1994 • Joint Food Standards Treaty (Aust.& New Zealand) • Food Regulation Agreement – Australian jurisdictions • *Imported Food Control Act 1992* • Trans-Tasman Mutual Recognition Agreement • Food Standards Code (Australia and New Zealand) • *Biosecurity Act 2015* • *Fisheries Management Act 1991* • *Trade Practices Act 1974 (Cwth)* • *National Measurement Act 1960 (Cwth)* • *Primary Industries R&D Act 1989 (Cwth)* • Country of Origin Food Labelling Information Standard 2016	• Oversight by Australian and New Zealand Ministerial Forum on Food Regulation. In Australia, all jurisdictions party to Inter-Governmental Food Regulation Agreement. Forum supported by Food Regulation Standing Committee. Implementation by Subcommittee for Food Regulation. Administered by Food Regulation Secretariat – based at Australian Dept of Health. • Imported Foods are regulated by the DAWE • Australian local government councils (~550) monitor and enforce Australia regulations • All food legally sold in Australia may be sold in New Zealand, and vice versa • New Zealand can opt out of any standard in the Food Standards Code • ACCC monitors and regulates competition and consumer law • NMI is the national authority on measurement including for all labelled foods • Country of Origin labelling requirements for food, and label design tools
ACT	• ACT Health – Health Protection Service	*Food Act 2001* *Biosecurity Act 2015* *Fisheries Act 1994*	
NSW	• NSW Food Authority • Dept of Primary Industries - Fisheries	*Food Act 2003* *Biosecurity Act 2015* *Fisheries Management Act 1994*	
NT	• Dept of Health • Dept of Primary Industry and Resources	*Food Act 2004* *Biological Control Act 1986* *Fisheries Act 1988*	
QLD	• Queensland Health • Dept of Agriculture and Fisheries • Safe Food Queensland	*Food Act 2006* *Food Production (Safety) Act 2000* *Biosecurity Act 2014* *Fisheries Act 1994*	
SA	• SA Health • Dept of Primary Industries and Regions	*Food Act 2001* *Biosecurity Act – under development* *Fisheries Management Act 2007*	
TAS	• Dept of Health and Human Services • Dept of Primary Industries, Parks, Water and Environment	*Food Act 2003* *Biosecurity Act 2019* *Fishing (Licence Ownership and Interest) Registration Act 2001* *Inland Fisheries Act 1995*	
VIC	• Dept of Health and Human Services • Fisheries Authority • Food Safety Victoria	*Food Act 1984* *Biological Control Act 1996* *Fisheries Act 1995* *Seafood Safety Act 2003*	
WA	• Health Dept of WA • WA Dept of Agriculture and Food • WA Dept of Fisheries	*Food Act 2008* *Biosecurity and Agriculture Management Act 2007* *Aquatic Resources Management Act 2016*	

Sources: www.foodstandards.gov.au; Productivity Commission Report Dec. 2009 Performance Benchmark of Aust. and NZ Business Regulation: Food Safety; agency websites

ACCC

The ACCC is Australia's peak consumer protection and competition agency. It is a regulatory commission (i.e., statutory government authority) of the Australian Government, under the Treasury.

In 2016 the ACCC introduced the Country of Origin Labelling Information Standard 2016. The ACCC regulates this standard under the *Competition and Consumer Act 2010*. This standard became mandatory for prescribed food supply chain participants (excluding foodservices) on 1 July 2018.

The Standard applies to most food offered for retail sale in Australia if it is:

- In a package
- Unpackaged seafood, particular meats, fruit and vegetables, nuts, spices, herbs, fungi, legumes, seeds or a mix of these foods, or
- Fresh fruit and vegetables in transparent packaging.

The Standard does not apply to food that is:

- Otherwise unpackaged (for example, unpackaged cheese, pastries or sandwiches),
- Only intended for export to overseas markets,
- Sold by restaurants, canteens, schools, caterers, self-catering institutions, prisons, hospitals, medical institutions and at fund-raising events (for example, a cake stall at a school fete),
- Made and packaged on the same premises where it is sold (for example, bread in a bakery),
- Delivered and packaged ready for consumption, as ordered by the consumer (for example, home delivered pizza),
- For special medical purposes, or
- Not for human consumption (for example, pet food).

Businesses may voluntarily choose to provide country of origin information for food that is exempt from the Standard, provided it is not false or misleading. However, if a business wishes to use the kangaroo logo (see Figure 3) or the bar chart on food products to be sold in Australia, they will be required to comply with the Standard regarding the use of those graphics.

FSANZ

FSANZ is part of the Australian Government's Health portfolio. FSANZ develops standards that regulate the use of ingredients, processing aids, colourings, additives, vitamins and minerals that are covered under the Australian and New Zealand Food Standards Code. The Ministerial Forum considers the standards developed by FSANZ, and once agreed, they are included in The Code.

The Code covers some foods (e.g., dairy, meat and beverages) as well as standards developed by new technologies such as genetically modified foods. The Code currently contains around 70 standards.

FSANZ is also responsible for some labelling requirements on packaged and unpackaged food (e.g., specific mandatory warnings or advisory labels). The organisation develops Australia-only food standards to address food safety issues, including requirements for primary production.

FSANZ is responsible for publication of the current version of all food standards.

The regulation of Country of Origin Labelling was transferred from FSANZ (under the Food Standards Code) to the ACCC on 1 July 2018.

FRDC

The steps to develop an Australian Fish Names Standard commenced in the mid 1980's, boosted in 1999 with the formation of the Fish Names Committee. At that time there were approximately 3,000 edible fish species and 10,000 different names.

Seafood Services Australia was accredited as a Standards Development Organisation in 2006 to develop Australian Standards in the seafood industry. This organisation had one accredited Australian Standard, the Australian Fish Names Standard AS 5300. In July 2013 this organisation ceased to exist, its role taken over by the FRDC and industry.

FRDC immediately become accredited as a Standards Development Organisation, ensuring that the Australian Fish Names Standard development continued. The Australian Fish Names Standard now includes agreed names for over 600 commercially important domestic and imported species of fish, and over 5,000 other domestic and imported finfish. The process of assigning these agreed names drew on the expertise of several of the world's best fisheries taxonomists and other key stakeholders. The FRDC has given autonomy to the Fish Names Committee for the development and maintenance of this Standard which is underpinned by rigorous policies and procedures that have been developed by Standards Australia and the FRDC[35].

Observance of this standard is voluntary for all seafood entities in Australia. The standard is referenced by FSANZ, but not mandated by either FSANZ or the ACCC.

4. Implementing and Enforcing

Australian, State and Territory Governments and the New Zealand Government (and relevant agencies) implement, monitor and enforce food laws (including for CoOL and the Food Standards Code) through their own Food Acts and standards, Labelling Acts and standards, and other food related legislation.

The Australian Department of Agriculture and Water Resources enforces these laws at Australian borders in relation to imported food.

Authorities in Australia and New Zealand work closely together to implement food laws consistently. This is done by the Implementation Subcommittee for Food Regulation (ISFR). To assist consumers and industry to pursue food enquiries and complaints, the ISFR has established the "Home Jurisdiction Rule" whereby regulation applies in the state or territory in which a food business is based or, in the case of a national chain, where the home company's head office is located. The home jurisdiction is responsible for investigating legislative breaches, responses to complaints, and undertaking compliance or enforcement actions.

The ISFR also develops protocols and procedures to implement and enforce food standards.

FSANZ data for the decade ending 2016 shows 608 food recalls were undertaken, with 44 (7%) being for fish and fish products (DIIS, June 2017). Of those 44 recalls, 17 recalls (38%) were imported products and 27 recalls (62%) were domestic products. One of the 17 recalls for imported products was a trade level recall which may have impacted the foodservice sector. More than half of the recalls for domestically produced fish and fish products were at the trade level, meaning they were likely sold via the foodservice sector.

The FSANZ data for 2011-2020 shows 763 food recalls, 14% of which were at trade level. The incidence of recalls related to labelling is ~2% as shown in the table.

Table 7. Food Recalls by Year and Classification 2011-20

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Undeclared allergen	24	18	16	27	39	33	35	46	32	51	321
Microbial contamination	13	25	12	26	12	21	9	20	30	27	195
Foreign matter	16	11	7	14	7	7	9	16	5	11	103
Other	4	2	3	4	6	3	10	8	12	10	62
Biotoxin	4	1	2	3	15	5	4	2	3	2	41
Chemical/ contaminant	5	2	0	1	0	1	1	2	4	6	22
Labelling	1	1	2	1	2	2	1	6	1	2	19
Total	67	60	42	76	81	72	69	100	87	109	763

[35] FRDC Project 2015-210 FRDC resource: Australian Fish Names Standard (AS5300), Final Report, A. Snow, June 2019

5. Incident or Emergency Response

Australian, State and Territory Governments and the New Zealand Government agencies are the first points of contact for managing food recalls, incidents or food safety emergencies, and complaint management.

Responses related to food safety are managed at two levels:

Identification of a Food Problem

Problem identification is managed by Health Departments in all jurisdictions, by:

- Epidemiologists who focus on foodborne illness surveillance,
- Ozfoodnet - a government funded health network to enhance the surveillance of foodborne diseases in Australia,
- Food sampling, and
- Information gathering and sharing.

Investigation of a Food Problem

Investigation brings experts together to find out why people are getting sick from food, via:

- Epidemiological interviews to assess common cause and exposure,
- Environmental traceback information gathered from businesses and supply partners (farmers, fishers, processors, restaurants, etc) to identify the source of the problem,
- Laboratory testing of clinical samples to pinpoint the specific microorganism causing illness, and
- Sampling and testing food samples or production environments.

Every Australian seafood enterprise must have a food recall plan in place as required by The Code. It is then up to the individual enterprise to comply with the standard and manage any recall of product.

D. Other Regulatory Bodies

A number of other organisations and agencies are responsible for regulations that include the food industry.

1. COAG

On 3 November 2000, the Council of Australian Governments (COAG) comprising the Australian Government and all state and territory governments, signed an Inter-Governmental Food Regulation Agreement (FRA) agreeing to a new food regulatory system. The FRA has been updated several times since 2000.

2. ACCC

The Australian Competition and Consumer Commission (ACCC) is a federal body that monitors and regulates industry competition and consumer law, to protect and strengthen market processes.

Regarding seafood labelling, the Commission is particularly focussed on monitoring and prosecuting misleading and deceptive conduct. It is illegal for a business to engage in conduct that misleads or deceives or is likely to mislead or deceive consumers or other businesses. This law applies even if a defendant did not intend to mislead or deceive anyone, or no one has suffered any loss or damage as a result of your conduct[36].

In 2016 the Australian Government introduced significant reforms to the existing food origin labelling framework. The ACCC's central role in these reforms relates to release of a Country of Origin (CoOL) Food Labelling Information Standard, which commenced 1 July 2016. The new Information Standard[37] sought to balance consumer information needs and regulatory costs to businesses, with a focus on improving existing origin labelling rules, rather than extending the rules. The new standard introduced new labels, a selection of which are illustrated in Figure 3.

[36] www.accc.gov.au/publications/advertising-selling/advertising-and-selling-guide
[37] Fact Sheet published by ACCC. Country of origin food labelling. April 2019

Figure 3. Various Country of Origin Retail Label Examples

3. Federal Communications Commission

The Federal Communications Commission (FCC) occasionally receives complaints from consumers about broadcast advertising. These complaints concern a wide variety of issues, including[38]:

- The nature of the products being advertised,
- The timing of certain advertisements,
- Commercials believed to be indecent or in poor taste, and
- False and misleading advertisements.

4. Productivity Commission

The Productivity Commission (PC) is a federal body reporting to the Australian Government on industry and market productivity and performance, including from time to time, fisheries and aquaculture and food labelling.

Recent PC reports include *Food Safety 2009*; and *Country of Origin Labelling*, and *Fish Names*, both in 2016. Regarding matters related to food labelling, the Commission concluded as follows:

Food Safety Report 2009

Across the Australian jurisdiction, there is far less regulatory harmonisation at the primary production and processing (PPP) end of the food chain:

- There is no model food safety legislation covering PPP,
- Progress in developing national PPP standards has been slow, and
- Significant differences in the interpretation and implementation of PPP standards persist in jurisdictions.

Marine Fisheries and Aquaculture Report 2016

1. Some industry participants requested that the Australian Government mandate Australian Fish Name Standards (AS 5300-2015) — a voluntary standard introduced in 2007 that specifies the prescribed fish name for fish sold to consumers or for wholesale, export and import. Making the standard mandatory would require agreement across all jurisdictions on all names, a costly and difficult exercise. As current arrangements do not appear to be having significant negative impacts on consumers or businesses that would outweigh the cost of a mandated standard, the standard should remain voluntary.
2. The Commission is satisfied that the current food safety system applying to both domestic and imported seafood provides sufficient protections, including for imported seafood.
3. Third-party certification may provide immediate additional assurance to consumers that seafood is sustainably caught — albeit for a price — and, to the extent that it overcomes misperceptions as to sustainability of catch, is likely to promote greater overall consumption than would otherwise occur. Ultimately, whether or not to pursue third-party certification should rest with individual fisheries as they

[38] www.fcc.gov/consumers/guides/complaints-about-broadcast-advertising

are best placed to judge the benefits of certification (of which most, if not all, are private in nature) and the costs associated with gaining and maintaining this certification.

4. The most significant issue raised by participants relating to downstream processes was a desire that mandatory country-of-origin labelling requirements be extended to seafood sold for immediate consumption in restaurants, clubs, hotels and takeaways. Consumer health and safety interests would not be enhanced by such a policy change, and there are practical impediments to implementation. If such arrangements are desired to better meet consumer preferences, industry should apply them voluntarily.

5. National Measurement Institute

The National Measurement Institute (NMI) is the Australian Government's national authority on measurement. Consistency and certainty in measurement supports fair and open competition, a capacity embedded in food labelling for consumer markets.

In 2019-20 the NMI tested 78,290 lines of packaged goods[39], of which 1.6% were found to contain less product than stated on the label. For the tested lines, label weight variances by packaged goods product types included:

- Fuel (solid) – 5.4% of 537 food lines,
- **Seafood (frozen) – 4.3% of 676 food lines,**
- Meat (processed) – 4.2% of 1,811 lines,
- Meat (fresh) – 3.5% of 15,311 lines,
- Beverages (incl. alcohol) – 3.4% of 1,058 lines,
- Confectionery/snacks – 2.4% of 3,398 lines, and
- Fruit & vegetables (fresh) – 2.4% of 7,563 packaged lines.

The NMI reported that the types of Trader enterprises with a greater incidence of non-compliance requiring more serious enforcement action in 2019–20 included:

- Licensed Premises,
- Fuel Retail,
- Meat Retail,
- Supermarkets,
- Importers,
- Fruit and vegetables Retail,
- Hardware, and
- **Seafood Retail.**

As detailed in Table 8, NMI's initial audits of food enterprises indicate 50% of Seafood Retailers were non-compliant with food measurements in 2019-20. Follow-up audits confirmed that 54 seafood retailers (34%) continued to be non-compliant with food laws after their second audit. Seven (13%) of these retailers were non-compliant for seafood labelling (per Table 9). Labelling is one of four breach conditions identified in audits. It comprises around 14% of all breaches in the most recent data year that attracted an initial warning letter from NMI regulators.

[39] National Measurement Institute 2020, *Trade measurement compliance in 2019-20*, p7

Table 8. Non-compliance in Seafood Labelling for Seafood Retailers

	Initial Audits	Non- compliant	Follow-up audits	Non-compliant	Warning letters	Infringement notices
2017–18	191	101 (53%)	92	20 (22%)	5	0
2018–19	116	53 (46%)	48	6 (13%)	5	1 ($1,050)
2019–20	158	79 (50%)	54	21 (39%)	21	4 ($5,250)

Table 9. Seafood Retail Breaches by Enforcement Action 2019-20

	Inaccurate measuring instrument	Packaged goods (short measure)	Packaged goods (labelling)	Trading practices
Warning letter	7	9	7	26
Infringement notice	0	0	0	5

E. Labelling of Traded Seafood

Food labelling laws differ around the world. Businesses that are exporting or importing seafood for sale in Australia need to ensure that these foods comply with Australian labelling regulations before presenting the food products for sale to Australian consumers.

1. World Trade Organisation

The World Trade Organization (WTO) is the only global international organisation dealing with the rules of trade between nations.

At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations and ratified in their parliaments. The goal is to ensure that trade flows as smoothly, predictably and freely as possible to better informed consumers.

Non-Tariff Measures (NTMs)

International trade in products and services (including any related to food) are increasingly complex. Labelling of foods products and services is a core objective of effective global trade.

Non-tariff measures are generally defined as policy measures other than ordinary customs tariffs, that can potentially have an economic effect on current international trade in goods, changing quantities traded, or prices or both (UN Conference on Trade and Development, 2019). This definition is broad and covers various forms of non-tariff measures.

- Sanitary and Phytosanitary Measures are applied to protect human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; to protect human life from plant or animal-borne diseases; to protect animal or plant life from pests, diseases, or disease-causing organisms; to prevent or limit other damage to a country from the entry, establishment or spread of pests; and to protect biodiversity. These include measures taken to protect the health of fish, wild fauna, forests and wild flora.

  An example of food labelling under this measure is a mandatory label specifying storage conditions at 5°C maximum, or a label indicating potentially dangerous ingredients such as allergens, for example, "contains honey not suitable for infants under one year of age".

- Technical Barriers to Trade (TBT) Measures relate to product characteristics such as technical specifications and quality requirements; related processes and production methods; and measures such as labelling and packaging in relation to environmental protection, consumer safety and national security.

Included in TBTs are measures regulating the kind, colour and size of printing on packages and labels and defining the information that should be provided to the consumer. Labelling is any written, electronic, or graphic communication on the packaging or on a separate but associated label, or on the product itself. It may include requirements concerning the official language to be used, as well as technical information on the product, such as voltage, components, instructions on use, and safety and security advice.

Example of TBTs include mandatory labels on refrigerators indicating size, weight and level of electricity consumption, or labelling of certified organic products, or labelling chocolate that must contain at least 30% cocoa.

A recent Australian report (Fitzgerald & Colquhoun, 2018, p. 15) identified TBTs related to seafood trade to China, including inconsistent application of import requirements, testing procedures, documentation and labelling requirements from port to port. Inconsistencies in the application of Chinese import requirements lead to additional compliance costs for Australian exporters and delays in customs clearance.

The WTO's Technical Barriers to Trade Agreement[40] aims to ensure that technical regulations, standards, and conformity assessment procedures are non-discriminatory and do not create unnecessary obstacles to trade. At the same time, it recognises WTO members' rights to implement measures to achieve legitimate policy objectives, such as the protection of human health and safety, or protection of the environment. Through its transparency provisions, it also aims to create a predictable trading environment.

2. World Health Organisation

The WHO works worldwide to promote health, keep the world safe, and serve the vulnerable. It is currently leading global initiatives to manage the Covid-19 pandemic.

Product labelling is an issue managed by the WHO typically from a health trade dispute perspective. A recent example is the WHO decision to support Australia's ban on the use of logos, colours, brand images and promotional information on tobacco products and packaging, other than brand and product names in a standardised colour and font. In 2018 a WHO dispute settlement panel decided[41] that Australia's policy (declared in 2012) on plain packaging is consistent with WTO law. The ruling clears another legal hurdle thrown up in the tobacco industry's efforts to block tobacco control and is likely to accelerate implementation of plain packaging around the globe.

INFOSAN

In 2004 the WHO/FAO established INFOSAN (International Food Safety Authorities Network) to facilitate rapid exchange of information across borders and between members and prevent foodborne illness. Increasing interconnection of the global food supply raises risks posed by unsafe foods, and the mitigation role played by information exchange and product labelling.

INFOSAN was involved in 162 events during the 2018/2019 (World Health Organization and Food and Agriculture Organization, 2020). The food categories most commonly involved in these events were milk and dairy products (23), fish and other seafood products (19), snacks, desserts and other foods (15) and meat and meat products (14).

3. Codex Committee on Food Labelling

The Codex Alimentarius (Codex) is the international food standards compendium, a collection of internationally adopted food standards and related texts presented in a uniform manner. These food standards and related texts aim at protecting consumers' health and ensuring fair practices in the food trade.

Australia is a member of The Codex Committee on Food Labelling (CCFL), managed by the DAWE. This committee drafts provisions on labelling of foods and endorses draft provisions on labelling. It also studies

[40] www.wto.org/english/tratop_e/tbt_e/tbt_e.htm
[41] www.who.int/news/item/27-06-2018-world-trade-organization-panel-rejects-claims-concerning-tobacco-plain-packaging-in-australia

labelling issues assigned to it by its leadership group and it studies issues related to food advertising including claims and misleading descriptions.

Standards relating to food labelling that have been endorsed and adopted into the international food code include standards on[42]:

- Use of the Term Halal,
- General Standard for the Labelling of Food Additives when sold as such,
- Labelling of and claims for Pre-packaged Foods for Special Dietary Use,
- Labelling of and claims for Foods for Special Medical Purposes,
- Production, Processing, Labelling and Marketing of Organically Produced Foods,
- Packing Media (Composition and Labelling), and
- Guidelines for Nutritional and Health Claims.

The DAWE also manages the International Food Standards program (IFS)[43] that contributes to government-to-government negotiations on international food standards and maintains and develops international market access arrangement for food and beverage industries. This program draws on and integrates global trade and health labelling matters from WTO, WHO and Codex.

In 1999 the Codex adopted the Codex General Standard on the Use of Dairy Terms (GSUDT) in order to protect consumers from being confused or misled by the use of dairy terms on non-dairy products, to ensure the correct use of dairy terms intended for milk and milk products, and to ensure fair practices in the food trade.

The GSUDT does provide exceptional permissions for the use of dairy terms on non-dairy foods whose nature is clear from traditional usage or when the term is used to describe a characteristic quality of non-milk products (e.g., peanut butter, coconut milk, cow peas, cocoa butter). Such use is dependent on avoiding any erroneous impression that the non-milk product is milk, a milk product or a composite milk product (FRSC, 2019, p. 12).

4. Seafood Certification Organisations

Many third-party seafood certification organisations have entered global seafood markets over the last 30 years. These organisations (often "green" or not-for-profit entities) offer commercial certification labels for consumer product chains, typically from natural resources commodity industries such as seafood, and forest products.

They offer fishers, farmers, processors, supply chain partners, retailers, and food service outlets (in store or online) a commercial certification to a performance standard, and related product label (or ecolabel) confirming that a fishery's performance has been independently assessed relative to that standard. They seek to differentiate supply chains and related products to consumers and potentially increase sales volumes and prices.

In Australia the Marine Stewardship Council (MSC) has become the dominant third-party certifier/eco-labeller for Australian fisheries. MSC claims its wild-capture fisheries certification and ecolabelling program meets best practice requirements set by both the FAO, ISEAL (International Social and Environmental Accreditation and Labelling Alliance), and GSSI (Global Sustainable Seafood Initiative). Other 3rd party certifier organisations include the Aquaculture Stewardship Council (ASC), Global GAP (Good Agricultural Practices), Seachoice, Sustainable Fisheries Partnership, and other proprietary supermarket systems.

The Friends of the Sea[44] certification organisation announced that it will soon begin certifying plant-based seafood products under a new program.

These organisations charge aquatic resource owners and users a fee to independently assess and authenticate a fishery to a science based sustainable fishery standard.

[42] www.agriculture.gov.au/ag-farm-food/food/codex/committees/labelling
[43] www.wto.org/english/tratop_e/tbt_e/tbt_e.htm
[44] www.gfi.org/blog-friend-of-the-sea-certification

5. NATIONAL SEAFOOD STANDARDS

A. National Food Standards Code

The national Food Standards Code (The Code) comprises an authoritative register and portfolio of all relevant food standards.

The related Australian legislative instruments are the *Food Standards Australia New Zealand Act 1991 (Cth)*, and *Legislation Act 2003 (Cth)*.

The Trans-Tasman Mutual Recognition Agreement is a treaty between Australia and New Zealand that gives effect to joint funding, and New Zealand's participation in the system and further specifies the role of FSANZ in relation to New Zealand. This agreement was signed in 1995 and has been updated several times since then.

The agreement requires that FSANZ and the New Zealand Minister for Food Safety conclude a funding and performance agreement annually. This agreement details the services FSANZ is to provide and includes quarterly performance reporting, details of New Zealand's contribution and the payment schedule.

Appendix 2 illustrates the Australian Food Regulatory System, drawing on research undertaken by the Productivity Commission (Productivity Commission, 2009).

1. Label Required

Standard 1.2.1 in The Code defines when a food for sale is required to bear a label or have other information provided with it and sets out the information that is to be provided.

Information that must be included on all food labels, includes the:

- Name and/or description of the food. The food name must be either a prescribed name, or a name or description that is sufficient to indicate the true nature of the food, and that it be included on the label.
- Identification of the 'lot' number,
- Name and Australian address of the supplier,
- List of ingredients,
- Date mark,
- Nutrition information panel,
- Country of origin, and
- Warning and advisory statements (e.g., allergens or intolerances).

The Food Standards Code also includes specific labelling and information requirements that apply to certain foods only, and what nutritional and health claims can be made about certain foods.

2. Novel Foods

Australian and other economies have "catch-all" definitions of Novel Foods in their respective food regulations. Regulators in these economies generally anchor their definition in the same base criteria, being a food that:

- Is new to consumers,
- Is created due to recent innovation,
- Has undertaken a major change, or
- Comes from a genetic plant, animal or microorganism modification.

An application to a regulator seeking product approval or amendment will then be assessed, including its status as a Novel Food.

The Food Standards Code currently states (at Part 1.5.1 Novel Foods):

1. In The Code "Novel Food" means non-traditional food that requires an assessment of the public health and safety considerations having regard to the:
   a. Potential for adverse effects in humans; or
   b. Composition or structure of the food; or
   c. Process by which the food has been prepared; or
   d. Source from which it is derived; or
   e. Patterns and levels of food consumption; or
   f. Any other relevant matters.

   Possible categories of Novel Foods are described in guidelines issued by FSANZ, including, but not limited to, the following:

   - Plants or animals and their components,
   - Plant or animal extracts,
   - Herbs, including extracts,
   - Dietary macro-components,
   - Single chemical entities,
   - Microorganisms, including probiotics, and
   - Foods produced from new sources, or by a process not previously applied to food.

   Non-traditional food means:

   a. A food that does not have a history of human consumption in Australia or New Zealand, or
   b. A substance derived from a food, where that substance does not have a history of human consumption in Australia or New Zealand other than as a component of that food; or
   c. Any other substance, where that substance, or the source from which it is derived, does not have a history of human consumption as a food in Australia or New Zealand.

2. The presence of a food in a food for special medical purposes or the use of a food as a food for special medical purposes does not constitute a history of human consumption in Australia or New Zealand in relation to that food for the purposes of this section.

B. Food Standards Australia & New Zealand

Under an inter-Governmental Agreement (1991) between the Commonwealth and states and territories, the states and territories adopt, without variation, Australian food standards once they have been gazetted.

Most packaged foods are required to have a label with important information to help consumers make informed choices about what they eat. The information required varies depending on the food.

Certain information about foods that are unlabelled (e.g., fresh fruit and vegetables, or food that is purchased from where it is made such as cafes, bakeries or takeaway shops) may still need to be provided. This information is usually displayed with the food.

FSANZ is responsible for developing and maintaining The Code, which includes standards for food labelling. These standards are enforced by the Australian states and territories.

The Code includes the general labelling and information requirements that are relevant to all foods and sets out which requirements apply in different situations (for example food for retail sale, food for catering purposes, or an intra-company transfer). The Code also includes specific labelling and information requirements that apply to certain food products only.

In addition to the Food Standards Code, all representations made about food are subject to fair trading laws and food laws in Australia which prohibit false, misleading or deceptive representations.

C. Australian Fish Names Standard

Australia has over 5000 native species of finfish, crustaceans and molluscs. Around 600 of these are commercially important, and many others support recreational activities such as fishing and diving (FRDC, 2014). The Standard[45] (AS 5300-2019) defines the common marketing names to be used through the supply chain for all fish and seafood in Australia.

Fish become seafood when commercially harvested and then join a supply chain to downstream food consumers. The scientific name of every fish species harvested and sold in this way is therefore a fundamental part of the seafood, but not necessarily the attached product label.

Seafood consumption surveys demonstrated that one of the main concerns from consumers when purchasing seafood was a lack of confidence that they were getting what they paid for[46]. The Australian Fish Names Standard was developed in 2007 to address this market failure.

For the purpose of the standard, fish is defined as," any aquatic vertebrate or invertebrate (excluding mammals and amphibians) in any form, including whole fish, or part thereof, in raw or cooked form, or as a fish product".

The purpose of the standard is:

- Improved monitoring and stock assessment enhance the sustainability of fisheries resources,
- Increased efficiency in seafood marketing improves consumer confidence and industry profitability,
- Improved accuracy in trade descriptions enables consumers to make better informed choices when purchasing seafood and reduces the potential for misleading and deceptive conduct,
- Seafood related public health incidents and food safety risks can be more efficiently managed through improved labelling and species identification, and
- Marketability and consumer acceptability of species are enhanced through the use of standard fish names.

Creation of the Fish Names Standard means that it is now a requirement for retailers displaying the Approved Fish Names logo to label seafood with the Australian approved fish name (as used in the standard). While the standard has been established and is voluntarily applied it is not yet a mandated legal requirement for all seafood outlets and food labels. Until the standard name can be enforced, misnamed or unnamed fish will continue to discount the integrity of product information available to consumers.

FRDC has delegated authority to the development and ongoing maintenance of the Australian Fish Names Standard (AFNS) to the FRDC Fish Names Committee (FNC), an expertise-based group that accepts and considers applications to amend the Australian Fish Names Standard through the addition or amendment to names already in the standard. The Committee applies rigorous procedures endorsed by the FRDC and Standards Australia in considering proposed amendments to the standard.

One recent example where a market failure was addressed was through the addition of the name "flake" to the AFNS. Previously, the use of the name flake was completely unregulated and applied to the flesh of any shark species. In 2014, the FNC determined that the name flake could only be used for the flesh of the two species, *Mustelus antarcticus & Mustelus lenticulatus* which are commonly known as Gummy Shark and the imported species Rig. It should be noted that the name applies to the flesh of the animal only, the species is still referred to as Gummy Shark or Rig.

At present, adherence to the Australian Fish Names Standards is not mandatory, although it is referenced in Standard 2.2.3 – Fish and Fish Products of the Food Standards Code. The Fish Names Committee has advocated at every chance that adherence should be mandatory.

However, while the use of standard fish names is not mandated, you cannot call a fish something it is not and that is where the role of the ACCC is important to seafood integrity. The Commission can and will investigate complaints where it is of a substantial nature and where naming is deliberate, mainly from a corporate

[45] www.fishnames.com.au
[46] personal communications with Alan Snow, Fish Names Committee, FRDC

standpoint (e.g., importing a fish species accurately and then further down the supply chain this same product deliberately mislabelling as something different).

It then comes to the state and territory jurisdictions, where there is some variation in responsibility for regulation and action. For example, the NSW Food Authority can and does investigate complaints. In Queensland, complaints can be taken to Queensland Health, the agency responsible for labelling although they do not specifically reference the Australian Fish Names Standard. Table 10 lists some relevant comments from industry regarding these labelling matters.

Table 10. Sample of Comments from Seafood Industry re Label Issues

Seafood Activity	Mandated Label Data	Comment
1. Catcher	• Species, • Where caught/harvested, • Traceability information	
2. Wet fish counter	Usually, • CoOL information, • Species	Species is often wrong or using old names. Problems occur when a brand is introduced, e.g., Crystal Bay Prawns for Banana Prawns
3. Fish and Chip shops	Should use proper name but often do not.	e.g., Pacific Dory for Basa; or Sea Perch for Orange Roughy
4. Food Service/ Restaurants	Some are quite accurate, but many just adopt an attractive fish or seafood name	Common problem in pubs and clubs is "Flathead and Chips" which is actually South American Flathead (In this case this terminology has been endorsed by the Fish Names Committee.)
5. Packaged product	There are strict guidelines (https://www.industry.gov.au/regulations-and-standards/selling-seafood) that must be followed but tensions arise between the brand or product name and the actual ingredients or species	e.g., A common product is Crumbed Flathead Fillets. The ingredients list is correct and calls it South American Flathead or *Percophis brasiliensis*

D. Jurisdictions and The Code

Seafood labelling under the national Food Standards Code is managed by jurisdictions. The following brief discussion of the NSW and Victorian systems serves to illustrate the scale and scope (but not detail) of systems employed by Australian states and territories.

1. NSW Food Authority

The Food Authority[47] is a state government statutory authority responsible for food safety and regulation for industry, local government and consumers. Legislation includes:

- *Fair Trading Act 1987 (NSW),*
- *NSW Food Act 2003*,
- Australian & New Zealand Food Standards Code, and
- NSW Food Regulation 2015.

Key Regulations are:

- Food Regulation 2015 sets minimum food safety requirements for food industry sectors that have been identified as higher risk: seafood, shellfish, meat, dairy, plant products, egg and vulnerable persons.

[47] www.foodauthority.nsw.gov.au/search?q=seafood+labelling

- Businesses in these industries are subject to Food Safety Schemes because of their higher risk "priority" classification. Under each scheme licence categories specify the types of activities each business is licensed to perform (e.g., opening oysters, raw milk transport). Licensing is used to ensure that a business has the capacity to produce safe food before it is supplied to the market.
- Businesses that need to hold a licence with the Food Authority include:
    - Seafood - businesses that handle and wholesale seafood excluding shellfish,
    - Shellfish - businesses that cultivate, harvest or depurate shellfish,
    - Eggs, dairy, meat, plant products, and food service to vulnerable persons in hospitals and aged care facilities, and
    - Transporters - businesses that transport any of the foods above.
- Businesses that need to hold a Food Authority licence include seafood processing businesses and seafood transport vehicles involved in:
    - Handling fin fish, crustacea or cephalopods after they are taken or caught, whether the handling occurs on board a vessel or otherwise,
    - The processing of seafood, including skinning, gilling, gutting, filleting, shucking, cooking, smoking, preserving and canning,
    - Packaging seafood,
    - Storing,
    - Wholesale, and
    - Transporting, except from retail premises to the consumer or in a vehicle from which the seafood will be sold by retail.

Seafood Processing means all activities, procedures and hygiene controls used in the sale of fresh or ready-to-eat (RTE) seafood products (being aquatic vertebrates such as fish or aquatic invertebrates such as crustaceans or their products) for human consumption. This includes:

- Receipt,
- Processing, including skinning, gilling, gutting, filleting, shucking, cooking, smoking, preserving or canning,
- Storing,
- Dispatching, and
- Transporting, except from retail premises to the consumer, or in a vehicle from which the seafood will be sold by retail.

Seafood Processors must label products according to the national Food Standards Code.

2. Victoria Food Authority

Figure 4 and following discussion illustrates the linkages to national and jurisdictional regulatory arrangements for food labelling, using Victoria as an example[48]. Not all state and territories implement the national food labelling system in the same way. Detailed discussion of these variations is beyond the scope to this seafood labelling paper[49].

Food standards in Victoria are implemented by Victorian food safety regulators. A Memorandum of Understanding operates between Victorian food regulators. Signatories are Dept of Health and Human Services; Dept of Jobs, Precincts and Regions; Dairy Food Safety Victoria; PrimeSafe; and the Municipal Assn of Victoria.

[48] www.agriculture.vic.gov.au/biosecurity/food-safety/victorias-food-safety-regulatory-framework

[49] refer to Model Food Act discussion in Productivity Commission Report Food Safety 2009, pp78-80.

The Food Regulators Forum comprises senior representatives of these organisations.

The Food Regulators Forum promotes regulatory coordination and alignment within the state.

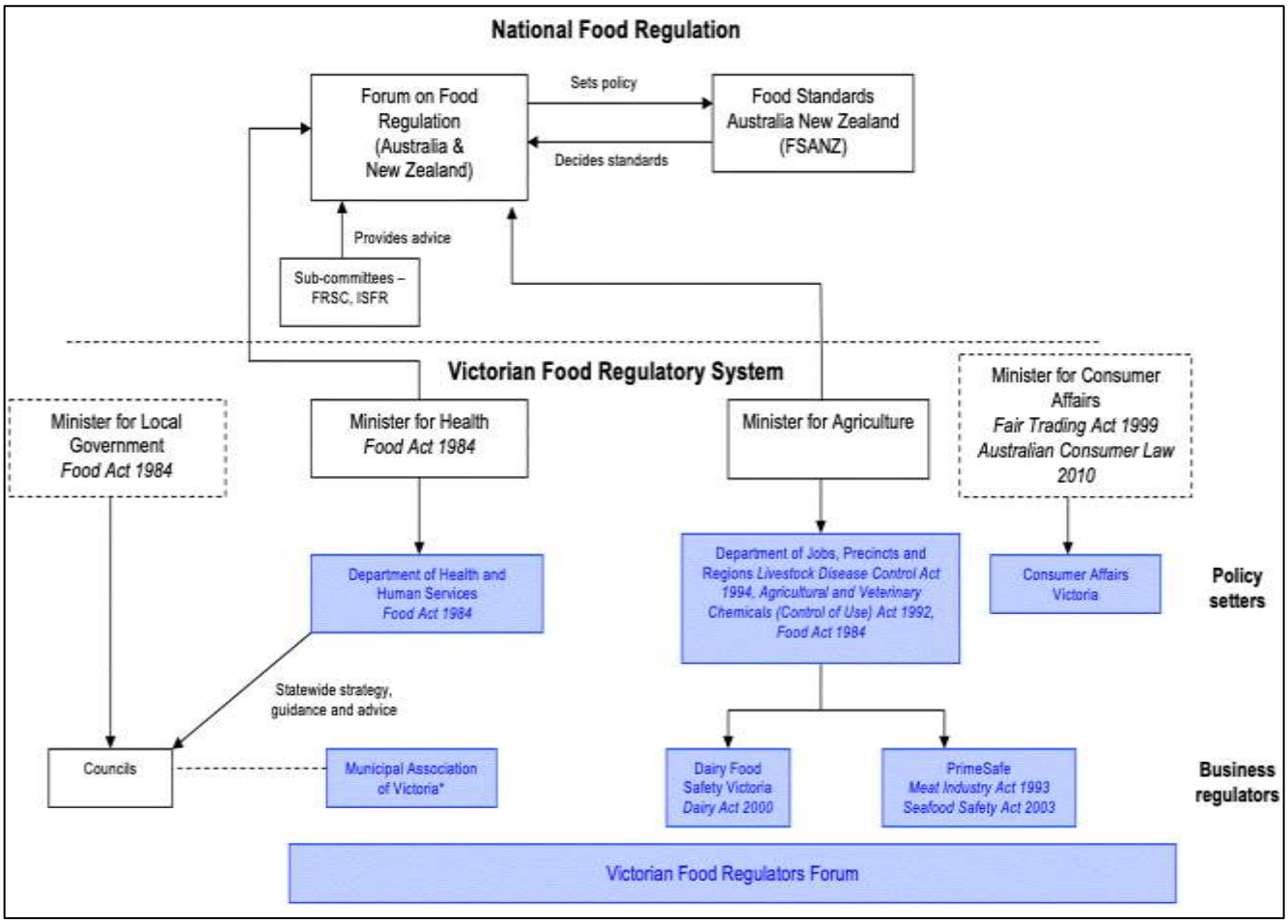


Figure 4. Victorian Food Regulation Framework

PrimeSafe

PrimeSafe regulates the safety of Victorian meat, poultry and seafood under the *Meat Industry Act 1993* and the *Seafood Safety Act 2003*, reporting to the Minister for Agriculture. Its functions include control and review of Standards for construction and hygiene at meat and seafood processing facilities through a licensing and inspection system and audited quality assurance programs.

Facilities licensed by PrimeSafe under the Meat Industry Act include:

- Abattoirs and knackeries,
- Processors, and
- Retail outlets (other than supermarkets).

Facilities licensed under the Act include:

- Seafood producers and harvesters,
- Wholesalers,
- Processors, and
- Retailers.

E. Country of Origin Labelling

The Australian Government established mandatory country of origin labelling (CoOL) in the **1990s** to ensure consumer access to a products origin information (DIIS, June 2017, p. 25).

In **June 2006** the federal government introduced regulations that require seafood sold to the Australian public to be clearly labelled with its country of origin (National Seafood Industry Alliance Inc.). This requirement was introduced to ensure the Australian consumer be accurately informed about the origin of the seafood. This regulation is only binding on retailers of fresh food - venues selling fish for immediate consumption including restaurants, clubs, bars, and even fish and chip shops are exempt from this Country of Origin Label requirement.

Country of origin labelling requirements vary considerably depending on the category of food (FRDC, 2014, p. 3) and the jurisdiction.

1. Fish and fish products for retail sale – packaged:
    - Label requires a statement on the package that identifies where the food was made or produced, or
    - Label requires a statement on the package that identifies the country where the food was made, manufactured or packaged for retail sale, and
    - To the effect that the food is constituted from ingredients imported into that country or from local and imported ingredients as the case may be.
2. Fish and fish products for retail sale unpackaged:

    A label is required on or in connection with the display of the food:
    - Identifying the country or countries of origin of the food, or
    - Containing a statement indicating that the foods are a mix of local foods or imported foods or both.
3. Fish and fish products for export and import:

    Australian exporters of fish and fish products must use the Australian fish names list as part of their ExDoc system. This means exporters are compliant with the Australian Fish Names Standard (AFNS).

    Importers of fish and fish products however do not have the same requirements. The Imported Food Inspection Scheme refers to the Food Standards Code. The AFNS is not mandated in the Food Standards Code, and therefore the use of the AFNS cannot be enforced at the import border. Fish that is in the box may not necessarily match what is written on the outside of the box.

    There is a clear anomaly evident between exported fish and fish products and imported fish and fish products relevant to their country of origin.
4. Jurisdictional anomalies:

    While retailers are required by law to state the country of origin for all pre-packaged or unpackaged fish and fish products, the food service sector is not bound by the same rules. This food service sector includes restaurants, clubs, cafés, takeaway food etc. The FRDC noted (FRDC, 2014, p. 10) that this exemption creates a void in providing information to the consumer.

    State and territory governments are able to introduce regulation to improve consumer access to seafood origin information in the food service sector.

In **2008** the Northern Territory Government introduced a licence condition requiring imported seafood prepared for immediate consumption to be labelled as "imported". This seafood labelling requirement applies to ~77,000 restaurants and other dining venues (café's, bistros, hotels, motels, fish and chip shops, delicatessens, and supermarkets). Where mixed seafood dishes are advertised for sale, if any of the seafood products are not harvested in Australia, they must be identified as "contains imported seafood products". This regulation is based on the premise that, by default, unlabelled seafood is Australian origin, reflecting consumers' expectations that they were purchasing locally caught fish.

In **2014** the Rural and Regional and Transport References Committee of the Senate tabled its finding regarding *Current requirements for labelling of seafood and seafood products*. The Committee recommended that the exemption regarding country of origin labelling under Standard 1.2.11 of the Australia New Zealand Food Standards Code for cooked or pre-prepared seafood sold by the food services sector be removed, subject to a transition period of no more than 12 months (Rural and Regional Affairs and Transport References Committee, 2014).

Research in December **2015** (DIIS, 2015) consulted with Australian consumers and tabled a CoOL impact statement. The report noted the "current country of origin framework for food allows businesses to make a range of claims about their products so long as they are truthful and are not misleading". However:

- Consumers find some of the current country of origin labels confusing,
- The framework does not require businesses to provide information on the proportion of Australian ingredients in a product, which consumers identify as a key piece of information, and
- For business, the costs of interpreting and complying with the current framework can be burdensome, and its requirements confusing.

The independent consumer research (Colmar Brunton, 2015, p. 45) undertaken for that report "found that being able to identify the country of origin of food was important or very important for 74% of respondents. The research also demonstrated that country of origin is a more important factor for some food products than others:

- Very important for fresh fruit, vegetables and nuts; meat, poultry and seafood; eggs and dairy; and deli and cured meats,
- Important for fruit and vegetable juices; canned/packaged/frozen ready to eat meals; canned/dried/frozen fruit, vegetables and nuts; and baked goods,
- Somewhat important for meal bases; dressing and sauces; breakfast cereals and muesli bars; cooking ingredients; rice, noodles and pasta; and jams and spreads, and
- Relatively unimportant for biscuits and snack food, bottled water, seasoning, confectionary, alcohol, sports drinks and soft drinks."

The report concluded that:

> "The current country of origin labelling framework for food is confusing, can be burdensome for business, and does not necessarily provide consumers with the information they most want—the proportion of Australian ingredients in their food.
>
> The proposed Commonwealth Government response is to revise the current country of origin labelling framework."

In **2016** the New South Wales government announced measures to support the New South Wales seafood industry by promoting its locally sourced products all the way through to diner's menus. Further detail on this New South Wales government approach is under consultation.

In **2016** the Australian Government introduced reforms to origin labelling specifically designed to address consumer information asymmetry unique to retail purchases of food.

A **2017** review paper (DIIS, June 2017, p. 16) concluded "This same origin labelling is unlikely to be appropriate in foodservice, since consumers are less dependent on labels for product information and foodservice businesses deal with day-to-day variability in food preparation."

Under the 2016 reforms the government maintained the long-standing exclusion of the food service sector from mandatory origin labelling. The government observed the new labelling requirements for retail were not suited to foodservice and would impose significant costs (DIIS, November 2017, p. 8) if implemented and mandated. This view is based on the observation that foodservice consumers (compared to retail consumers) have less dependency on labels for addressing information asymmetry. Where foodservice consumption and production takes place together (e.g., in a restaurant) interested consumers are able to enquire about origin information with wait staff, chefs, cooks, and proprietors directly responsible for preparing meals, sourcing ingredients and delivering customer service.

The government review paper also noted:

> "Evidence suggests concerns about origin misperceptions are mainly confined to low-cost foodservice segments and affect only a small percentage of Australia's total edible seafood production. Based on price comparisons, Australian seafood appears to compete more directly with higher-priced protein (e.g., lamb, beef) than with imported seafood, while low-cost imported seafood appears to compete more directly with lower-priced proteins (e.g., chicken, mince)" and,
>
> "Research indicates origin information is important to consumers, but not the most important factor in consumer decision-making. Other important factors valued by consumers include freshness, species, price, and region".

These 2016 reforms became mandatory on 1 July **2018**.

Enforcing and policing correct species and origin labelling

In **2012** the FRDC established the Common Language Group (CLG) to help resolve confusion among a range of stakeholders (producers, wholesalers, retailers) about seafood language. The CLG completed a range of consultations/surveys with industry, NGOs, major retailers, fisheries managers and Indigenous fishers. In its submission (FRDC Common Language Group, 2014) to the seafood labelling review by the Senate Standing Committee on Rural and Regional Affairs and Transport, the committee noted that current seafood labelling requirements under the FSANZ and ACCC fall into two broad categories: country of origin labelling and species labelling. The CLG recommended:

- Country of origin laws applicable to seafood be maintained and strengthened,
- Country of origin laws applicable to seafood be extended to apply in the restaurant and foodservice sectors, and
- It be made a legal requirement for food labels on seafood to carry the standard fish name in accordance with the Australian Fish Names Standard.

The voluntary nature of the Fish Names Standard also leads to complaints about imported fish or seafood products. As the AFNS is not mandated in the Australian Food Standards Code responsibility for a complaint falls between the state Department of Health (custodian of the Food standards code in the relevant jurisdiction) and the Federal Department of Consumer Affairs. The FRDC notes that if fish names were mandated in the relevant standard of the Food Standards Code this anomaly would be addressed (FRDC, 2014, p. 4).

Under Australian Consumer Law, foodservice businesses who choose to make origin claims, must not be false or misleading. If a foodservice business is silent on origin, consumers can always ask for the origin information, and again the foodservice business must not provide false or misleading information in its response. The ACCC and state and territory regulators advised that they receive negligible complaints in relation to false or misleading claims about seafood origins in foodservice (DIIS, June 2017, p. 11). Between 2012-2017 the ACCC reported no complaints about false and misleading seafood origin claims in the foodservice sector. At the state and territory level surveys of restaurants and analysis of plot compliance statistics indicate there are low numbers of complaints in relation to seafood origin claims.

As part of the Australian Government's reforms, origin labelling requirements were moved from FSANZ Standard 1.2.11 in the Australian New Zealand Food Standards Code into the Australian Consumer Law with the full implementation of the Country of Origin Labelling Information Standard **2016**. With the agreement of all ministers of the Legislative and Governance Forum on Consumer Affairs (consisting of all state and territory governments) the long-standing exemption of foodservice from mandatory origin labelling was maintained.

In December **2020** Senate Standing Committees on Rural Affairs and Transport released a recommendation that "the exemption regarding country of origin labelling under standard 1.2.11 of the Australian New Zealand Food standards code for cooked or preprepared seafood sold by the foodservice sector be removed, subject to a transition period of no more than twelve months.

The Australian government will undertake a review of the 2016 reforms in **2021** (DIIS, July 2020).

6. AUSTRALIAN FOOD LABELLING TIMELINE

The following discussion summarises major milestones and initiatives over the last 40 years in the development of Australia's seafood labelling laws and regulations.

A. Policy Background

Pre 2000

In **1976** Australia became a party to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora).

In **1980** *The Model Food Act* covering sale and food preparation offences, labelling and hygiene requirements, regulation and administration and enforcement, was agreed to by the Conference of Health Ministers.

In **1991** the Commonwealth passed the *National Food Authority Act,* the first federal legislation enacted to unify food standards in Australia. The legislation confirmed the 1990 agreement of Australian Health Ministers to a national method of setting food standards.

In **1999** the Commonwealth established the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC* Act*)* mandating that Commonwealth fisheries and those Australian fisheries oriented to exports obtain a certification for export to demonstrate sound environmental management of the fishery.

Australia registers a List of CITES Species under the (EPBC Act), and seafood exports and imports by species name are subject to this Convention.

2000 Model Food Provisions

In **2000** COAG accepted the *Food Regulation Agreement* as the basis of a national approach to food regulation and included Model Food Provisions Annex A and Annex B for State and Territory legislation. The *Australian and New Zealand Food Standards Code* was adopted in November 2000.

The Model Food Provisions[50] that are split into Annex A and Annex B[51], provide a legislative basis for a 'substantially equivalent' national uniform food safety regime. Each of the States and Territories used these annexes as the base to amend their respective food acts. Annex A was to be applied uniformly while Annex B could vary between jurisdictions. Through this approach food standards developed by FSANZ are automatically adopted by reference, through respective jurisdictional Food Acts, when these are gazetted.

2002 Ruello advice to FRDC

In **2002** Ruello noted in a seminal seafood marketing report (Ruello & Assoc., 2002, p. 8 &10)

"Two critical factors identified in 1999, and also reported in the 1991 study, were consumer scepticism about the accuracy of the species labels on fish and whether fish and seafood labelled as fresh was indeed fresh and had not been frozen. Confusion and uncertainty about fish names continues to dog sales and damage the industry's image (particularly that of retailers); it also presents a major barrier to research and the collection of reliable statistics on the industry."

and also

"The question of naming and labelling fish is even more important now than in 1991 because of the need for reliable product identification and traceability in a food safety plan. Furthermore, consumers are now more

[50] www.foodregulation.gov.au/internet/fr/publishing.nsf/Content/key-system-documents

[51] See Appendix 3

inclined to seek legal redress in the case of food poisoning or allergic reaction to a mislabelled fish, and yet many retailers seem to be totally unaware of the importance of accurate labelling."

2011 Blewett Review

In **2011** the Blewett Report independently reviewed national food labelling law and policy. The report noted a key policy making framework relevant to consumer access to seafood information is based on a Food Labelling Hierarchy, illustrated in Figure 5 (Garcia, 2019, p. 112).

This identifies three tiers of government intervention in food labelling in descending priority order[52]:

1. Food Safety - Consumer access to information posing direct, acute and immediate risks to health, where labelling for food safety purposes is initiated by governments often in the Food Standards Code. All food domestically produced or imported food for domestic consumption is required to comply with the Food Standards Code.

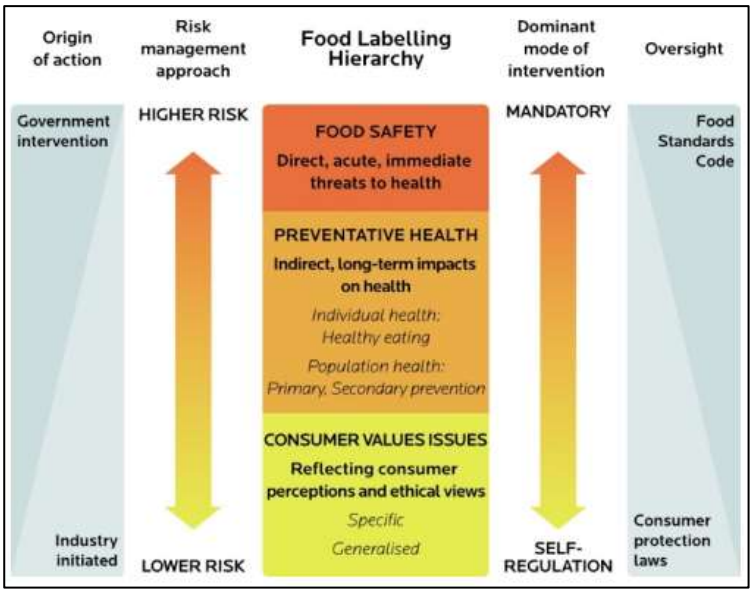


Figure 5. Food Labelling Hierarchy

2. Preventative Health - Consumer access to information posing indirect, long-term risks to population health (including chronic disease), where labelling for preventative health purposes may be initiated by governments or in tandem with industry (co-regulatory),

3. Consumer Values - Consumer access to information on matters of customer perceptions and ethical values, where labelling is generally determined by businesses in response to consumer demand.

The Blewett Report recommended against extending origin labelling to foodservice businesses.

2011 Front-of-Pack Labels - Health Stars

In **2011** the Forum agreed to develop a single interpretive front-of-pack labelling system and Health Star Rating (HSR) system, and to review the effectiveness of the *fast-food menu labelling* schemes including implementation and emerging issues since the release of the endorsed *National Principles for Introducing Point-of-Sale Nutrition Information in Standard Food Outlets* earlier that year.

2014 Senate Review of Seafood Labelling

In **2014** The Senate Rural and Regional Affairs and Transport References Committee conducted an *Inquiry into the Current Requirements for Labelling of Seafood and Seafood Products*. The Committee supported extending origin labelling to seafood sold in the foodservice sector.

In **2015** the same committee (as in 2014) conducted an *Inquiry into the Food Standards Amendment (Fish Labelling) Bill 2015*.

2015 FSANZ Labelling Enquiry

FSANZ conducted a review of labelling in 2015 - Food Regulatory Standing Committee in 2015 (FRSC, 2015).

[52] The Food Labelling Hierarchy was agreed to by Australian, State and Territory Ministers in response to the 2011 review of food labelling law and policy, *Labelling Logic: Review of food Labelling Law and Policy* (often referred to as the 'Blewett Review'), p.40.

In summary it found a lack of articulation of policy guidelines and jurisdictional implementation consistent with Best Practices. Its relevant conclusions for food labelling highlighted:

- Food regulators must seek to achieve consistent industry compliance with food labelling requirements and jurisdictional food laws,
- Some overarching principles applied by food regulators which result in the food labelling compliance are not articulated or in any bi-national agreement,
- Rather than prosecutions, more immediate and productive ways of securing compliance with The Code should be considered such as orders and undertakings,
- Current informal approaches to resolving labelling non-compliance are not articulated anywhere,
- A number of enforcement actions are reflected in the Model Food Provisions, but are missing from the Enforcement Guidelines, and
- In terms of enforcement actions reflected in the Model Food Provisions, not all jurisdictions currently have all the actions at their disposal for responding to labelling non-compliance. This requires amendments to existing legislation in the affected jurisdictions and the agreement of the relevant Government.
- Opportunities for improvement include a bi-national Food Labelling Compliance and Enforcement Framework, to be developed by FRSC. This framework should transparently articulate:
    - The existing overarching principles which result in the food labelling compliance and enforcement system being consistent with best practice,
    - The mechanisms used by food regulators to facilitate co-ordination and consistency,
    - Regulators consider generating compliance that is important and invest in activities to generate compliance,
    - Regulators use a consistent, risk-based, graduated and proportionate approach in monitoring compliance with food labelling requirements,
    - The criteria used by food regulators in determining risk, graduation and proportionality,
    - The use of informal actions to gain compliance is valid, timely and cost-effective, and
    - That food regulators use a hierarchy of regulatory responses.

2016 Meat & Dairy Nomenclature

In **2016** the FRSC (Australian Food Regulation Standing Committee) prepared advice to the Ministerial Forum (Food Regulation Standing Committee, 2016) regarding dairy substitute beverages, especially with regard product naming conventions and the use of the word "milk".

Whilst it is likely that plant-based alternative products will have a similar look, smell, taste and mouthfeel to their respective animal products, the Forum had concerns as to whether current food standards adequately differentiate the products and assist consumers to understand the source and nutritional profile of meat, dairy, and their plant-based alternatives[53].

The FRSC report found that dairy substitute beverages are adequately regulated by current permissions in The Code, including consideration of naming conventions. This conclusion was supported by the Forum.

In **2016,** a new provision was introduced into the Australian Food Standards Code that allows the name of a food to be further qualified (FRSC, 2019, p. 6). This qualification is a key change that enables labelling for Novel Foods, plant-based and cellular products.

The new provision relates to context and makes it clear the food is not a food as defined in The Code. For example, the descriptor 'soy' for soy milk is intended to make it clear to the consumer that the food they are

[53] It is noted that many food products that are not intended to substitute for animal products also use meat or dairy terminology – for example chicken salt contains no chicken, and peanut butter contains no butter.

purchasing is not a dairy milk product to which FSANZ Standard 2.5.1 applies. This contextual principle applies now across The Code and allows the naming of foods such as 'ginger beer', 'peanut butter' or 'soy milk' when these foods do not meet defined terms for "beer, butter and milk" respectively. This approach is consistent with the ACCC's guidelines (ACCC, 2006).

The Code allows use of the generic names "meat" and poultry", but not milk. The ingredient list must clarify the protein source. However, this provision aside, plant-based foods that use meat or dairy terminology must still meet the consumer law requirement to not misrepresent their products or mislead or deceive consumers.

The Food Regulation Standing Committee (FRSC), which is responsible for coordinating policy advice to the Forum, facilitated stakeholder engagement with industry, public health and consumer organisations, and relevant professional associations through a Consultation Paper: *Review of fast-food menu labelling schemes and two Roundtable discussions for key industry stakeholders held on 16 February and 16 March 2018*.

Sanitarium Amendment

In August **2013,** Australian food manufacturer Sanitarium, proposed the following amendment to the Food Standards Code allowing the labelling of the dairy analogue products:

> *If a food name is used in connection with the sale of a food (for example in the labelling), the sale is taken to be a sale of the food as the named food unless the context makes it clear that this is not the intention*

In April **2015** this amendment was gazetted in The Code (effective in 2016) in a new standard following dairy related submissions. No meat industry submissions were made to the process/proposal. While this amendment was focused on dairy analogue products, from **2016** onwards the new standard begins to be referenced for use by manufactured plant-based protein products.

Source: Meat Category Branding Briefing Note, RMAC, 2021

Country of Origin Labelling Information Standard

In **2016** the Australian Government (via the ACCC) released the Country of Origin Labelling Information Standard which obliges retail sellers of seafood to make origin information available to purchasers upon request when that purchaser must comply with the new retail origin labelling requirements.

In June **2017**, the Australian Government (DIIS, June 2017) published a Seafood Origin Working Group Paper to "present key findings on consumer access to seafood origin information, and how the seafood supply chain handles the flow of origin information". An addendum to this paper was released in November 2017.

On 1st July **2018** the Country of Origin Labelling Information Standard became mandatory. The Food Standards Code was also amended on this date to remove country of origin labelling requirements from FSANZ and transfer them to an ACCC administered act, and to the Legislative and Governance Forum on Consumer Affairs (CAF), consisting of Australian government, state and territory ministers.

2018 Misleading Labels and Descriptors

In June **2018**, the Forum agreed that further targeted consultation be undertaken to develop policy options that aim to improve and strengthen fast food menu labelling in Australia. From October 2018 the FRSC consulted to develop an options paper on how food standards, including labelling, definitions and other elements be considered.

Forum Ministers[54] confirmed their commitment to maintaining the integrity of the food system, regarding food and consumer laws prohibit misleading conduct, which includes *misleading descriptions of food on labels*. The Forum also noted recent international regulatory amendments in relation to the naming of food products, including meat and dairy alternative products. The Forum requested the Food Regulation Standing Committee develop an options paper on how food standards, including labelling, definitions and other elements be considered.

The Forum also considered advice prepared by the FRSC concerning seafood labelling in the food service sector.

[54] www.foodregulation.gov.au/internet/fr/publishing.nsf /Content/forum-communique-2018-October

The Forum was advised of the current Australian provisions that enable consumers to request country of origin information for seafood directly from the foodservice business and that based on extensive consumer research, there is insufficient evidence to warrant extension of the current Australian Country of Origin Labelling legislation to seafood in the foodservices sector.

In May **2019** the FRSC's Labelling Paper (FRSC, 2019) described how food labelling definitions can be used to address misleading descriptions of food. The paper outlined matters for consideration including a long history of non-animal food product use (globally and in Australia).

Referring to the earlier conclusions from the Blewett Report, the Forum noted a lack of evidence to suggest that consumers are being misled by emerging food names at either:

- The top of the Food Hierarchy (Food Safety), or
- The middle of the Food Hierarchy (Preventative Health).

The FRSC concluded that food names impacted consumers at the lowest level of the Food Hierarchy (Consumer Values). The potential for consumers to be misled by the current names for plant-based alternatives to dairy and meat products would not be considered a risk to public health and safety. Rather, it sits towards the bottom of the pyramid as a consumer value issue. Consequently, it could be considered a consumer affairs responsibility.

The current Code labelling requirements help consumers make an informed choices and consumer and fair-trading laws require that label information cannot be false, misleading or deceptive. The FRSC concluded that the current Code achieves these aims.

The report recommended the Ministerial Forum consider three options:

- Maintain status quo and take no further action. This option is based on the fact there is no evidence to indicate there is a problem for consumers failing to understand the true nature of plant-based products re source and nutrition. Plant-based dairy alternatives and meat products are adequately regulated under the current labelling requirements of The Code and consumer and fair-trading laws.
- Refer the matter to the Legislative and Governance Forum on Consumer Affairs, as the matter relates to consumers being misled.
- Seek further information to inform the evidence base, such as a consumer survey or relevant research.

2019 Plant-based and Synthetic Foods

In August **2019**, the Forum resolved on a majority (but not unanimous) basis that plant-based foods mimicking animal-based foods are adequately regulated under the current labelling requirements and consumer and fair-trading laws.

Ministers discussed 'synthetic' or laboratory-based cellular products and asked FRSC to consider regulatory and labelling issues relating to these foods, with a view to developing a policy guideline to adequately differentiate 'synthetic' animal products from their natural or conventional equivalents.

In November **2019** the FSANZ Forum endorsed an ambitious plan to reform the Bi-national Food Regulation System to ensure it remains strong, robust and agile into the future[55]. A key element underpinning the reform agenda is a comprehensive review of the *Food Standards Australia New Zealand Act 1991* (FSANZ Act).

This decision reflects the knowledge that the System is operating in a complex operating environment with changing consumer expectations and significant technological advancements.

In November **2019** the Ministerial Forum noted that concerns have been raised by some stakeholders that the labelling and naming of plant-based alternatives to animal-derived products may be misleading to consumers, while other stakeholders have indicated that they considered these products are beneficial to both consumers and the economy.

Plant-based 'milk' and 'meat' products are gaining popularity and the Forum discussed how these products are referred to in the FSANZ Food Standards Code. The Ministerial group recognised the value of the meat and

[55] FSANZ Ministerial Forum Communique 15 November 2019

dairy sector to both economies, and also recognised the growing value of the alternative products sector and agreed that both have a place in the market for consumers. Ministers noted claims that manmade and synthetic foods are trading on the intellectual properties of primary producers and appealing to the unconscious values consumers attach to natural products like dairy and meat products.

Ministers also noted the measures that the EU and USA have introduced to protect the intellectual property of producers, particularly dairy and meat.

In September **2020** – Minister Littleproud hosts a roundtable on truthful labelling of plant-based food and drink products. The outcome of the roundtable is establishing a Plant-based Alternatives Labelling and Marketing Working Group.

B. 2020 FSANZ Act Review

In October **2020** the Australian Government (Dept of Health) consulted with stakeholders regarding a review of the Act (*Food Standards Australia New Zealand Act 1991)* and FSANZ's operations (Nous Group, 2020).

1. FRDC Submission

With regard to labelling, in its two submissions to the review (FRDC, 16 Nov 2020), (FRDC online, 16 Nov 2020), the FRDC stated that regulation of seafood should seek to address a market failure related to:

- Lack of linkage between safety, labelling and country-of-origin rules, leading to consumer confusion or fraud,
- Lack of consistency between and within jurisdictional agencies,
- Lack of clarity over enforcement - jurisdictional authority,
- Promotion of a level trade playing field between states, and
- Better education of supply chains meeting requirements.

The corporation noted that "confusion and consumer concern exist around the mis-labelling of seafood products." FRDC recommended, *inter alia*:

- Mandatory adoption of its species name standards (Australian Fish Names, and Aquatic Plant Names),
- Correct labelling to enabling consumer choice, to protect consumer health (e.g., allergens), and to facilitate accurate source, species and product identification, through-chain traceability, and therefore product recall,
- Greater consideration needs to be given to promoting consistency in application of standards across Australian jurisdictions,
- Existing passive promotion of standards by FSANZ does not go far enough[56] and does not resolve consumers' seafood mislabelling concerns, and
- The lack of consistency for seafood labelling regulations creates opportunity for confusion and can make traceability of product more difficult. Consumers need to have confidence in product labelling to be able to make an informed choice. For example, imported product is labelled in an inconsistent manner leading to consumer confusion. Basa can be imported and becomes Pacific Dory at the shopfront and becomes just Dory, competing with other local "Dory" species. The regulatory tools are not available to address the issue.

In wrapping up its submission from a joint FRDC and SafeFish perspective, FRDC highlighted three pressing issues that need to be resolved:

- Inconsistencies in the way regulation is applied between and within jurisdictions,
- Updating of food standards, and

[56] The Scoping Paper compared the role of FSANZ with food regulators in UK, USA, EU and Canada. The UK, US and Canadian regulators had a larger advisory, monitoring, and enforcement roles in their charters.

- Lack of formal recognition of Fish and Plant Names Standard.

C. 2020 Ministers Roundtable

In September **2020** DAWE commissioned two roundtable industry discussion groups to review and assess plant-based and cellular meat product labelling. These Working Groups finalised their work (March 2021) and submitted final reports to the Minister with no timeline set for further advice.

1. Alternative Protein Working Group

The Roundtable, convened by Minister Littleproud, has established a *Plant-based Alternative Labelling and Marketing Working Group* that submitted a discussion paper in March **2021**.

Sources[57] quoted the minister as follows:

"There is a place for both plant-based and genuine meat and dairy products in Australia's agricultural system, but we need to set the divide so that one is not unfairly trading on the reputation of the other. More accurate and truthful labelling of plant-based products will prevent consumers from being misled and protect against the misuse of the meat and dairy sectors' reputations".

The paper considered:

- Existing food regulations, noting that current requirements prevent plant-based alternatives from using meat or dairy terms exclusively on their labelling or in advertising,
- Whether Australian consumers were able to identify between plant-based alternatives and meat and dairy products,
- Whether Australian consumers are confused by the nutritional composition of plant-based alternatives,
- A range of international approaches. The Working Group was unable to form a view on what if any of these approaches should be adopted in Australia.

The paper concluded that there is no specific industry guidance for the labelling and marketing of plant-based alternatives compared to meat and meat-based products and dairy products to assist consumers to be clearly informed as to their nature, composition and nutritional value.

The working group considered a broad range of approaches to address this and submitted these to the Minister, but could not come to a consensus decision on a preferred approach.

2. Synthetic Foods Working Group

A working group was convened by DAWE to assess existing regulations and Food Codes regarding *Synthetic Foods* and the capacity of Australia's Food Regulator System to respond. The report was to be submitted to the Ministerial Forum in early **2021**.

In **March 2021** the FSANZ committee minutes and applications to change the Food Code[58] confirm there are no significant applications or agreement yet in place to establish this "synthetic" animal products policy guideline.

The Working Group finalised its advice with no consensus position on recommended outcome.

FSANZ advised (24 **April 2021**): Ministers noted claims that manmade and synthetic foods are trading on the intellectual properties of primary producers and appealing to the unconscious values consumers attach to natural products. The FRSC was asked to provide a view.[59].

[57] www.foodnavigator-asia.com/Article/2021/01/05/Eight-must-know-regulatory-updates-expected-for-the-APAC-F-B-industry-in-2021
[58] www.foodstandards.gov.au/code/applications/Pages/A1186.aspx
[59] https://health-search.clients.funnelback.com/s/ search.html?query= Synthetic +foods&collection=health&profile=foodregulation&Submit=

Evaluation of Country of Origin Labelling for Food

In **July 2020** the Australian government released Terms of Reference to undertake a review of the Country of Origin Labelling regulations for food.

D. 2021 Senate Inquiry

On 15 **June 2021** the Australian Parliament's Rural and Regional Affairs and Transport Legislation Committee opened an inquiry into *Definitions of Meat and Other Animal Products*. The committee is to report by the end of **February 2022**.

The inquiry will address the following matters:

1. The management by the Department of Agriculture, Water and the Environment of the legislative and regulatory framework underpinning the compulsory levy investment into meat category brands as declared through the *Australian Meat and Live-stock Industry Act 1997*, taking specific account of:
    a. The potential impairment of Australian meat category brand investment from the appropriation of product labelling by manufactured plant-based or synthetic protein brands, including:
        i. the use of manufactured plant-based or synthetic protein descriptors containing reference to animal flesh or products made predominately from animal flesh, including but not limited to "meat", "beef", "lamb", and "goat"; and
        ii. the use of livestock images on manufactured plant-based or synthetic protein packaging or marketing materials.
    b. The health implications of consuming heavily manufactured protein products which are currently being retailed with red meat descriptors or livestock images, including:
        i. consideration of unnatural additives used in the manufacturing process, and
        ii. consideration of chemicals used in the production of these manufactured protein products.
    c. The immediate and long-term social and economic impacts of the appropriation of Australian meat category branding on businesses, livestock producers and individuals across regional, rural and remote Australia, including:
        i. the reliance upon imported ingredients,
        ii. the support of regional employment, and
        iii. the state and commonwealth taxation contribution from the Australian red meat and livestock sector.
    d. The implications for other Australian animal products impaired from the appropriation of product labelling by manufactured plant-based or synthetic proteins.
    e. Any related matters.

7. OVERSEAS – CURRENT EMERGING INITIATIVES

A. Global Perspective

We are at the start of a major shift in global food production and flows.

The global food production industry faces new threats in responding to critics regarding its resource use. To feed an expanding global middle class population meat and fish producers face the challenge of producing ever-increasing quantities of safe, affordable animal proteins, from a small carbon footprint using finite land and water resources, while increasing animal welfare in order to meet consumer demand.

Plant-based meat substitutes have offered one alternative food pathway for the last 30 years. *Cellular* agriculture (the production of animal -based products outside the animal from cell cultures), offers another. *Precision fermentation* of microorganisms is a longer-term developmental variant on cell culturing.

Regardless of the pathway, consumer awareness and trust in supply chains will be critical to market uptake of new products. Food labelling is the key to that door, in both a regulatory and a voluntary branding sense.

Regulations regarding meat replacement products and cell-based meats are currently being reviewed by up to 40 countries. The following references and observations are therefore as current as possible as at the date of this paper.

B. USA Initiatives

In the US, dishes like the *Impossible Burger* are already branded and labelled by regulators, paving the way for public acceptance of synthetic foods. But to date, the US Government has not approved the sale of any cellular meat products.

3. Health now Drives Labelling

A recent report by the US FMI (US Food Marketing Institute, 2020), a national food organisation of food producers, food retailers and critical service providers (e.g., insurance), identified a large shift in food label relevance to consumers, and related trends in in the forty years to 2020:

1980s - Economic Focus: Consumers focussed on high food and "gasoline" prices, unemployment, economising, and "consumer activism." Health and wellness were not an emphasis.

1990s - Manufacturer Claims: Government focused more on nutrition labelling, and the Nutrition Facts panel was born. Consumers started to read food labels and focus on manufacturers' claims about health benefits.

2000s - Ingredients List Focus: More and more consumers seeking out food and beverages with the shortest list of ingredients (up 50% in the decade to 2017). And they also seek locally grown or produced foods (up 60%). In 2005, the top concerns, in descending order, were fat content, cholesterol, trans-fat, calories, chemical additives, and sugar/artificial sweeteners.

2020 - Food is Medicine Focus: Consumers increasingly look to specific foods for health benefits, against a backdrop of rising health care costs and growing attention to self-care strategies. About two-thirds of shoppers view foods as "medicine for their body". Cardiovascular health ranks highest on the list of desired benefits from food, followed by weight loss/weight management, energy, brain function, and digestive health.

4. Food Labelling Trends

The key food labelling trends identified (AT Kearney, 2016), (US Food Marketing Institute, 2020) were.

Health Dominates

Health is now in the centre of food retail - consumers are moving targets on their needs and perspectives. Your health is a function of what you eat. Consumers have new wellness expectations from food retailers – they

broadly eye food as "medicine" to boost health. However, the details play out differently by consumer demographics, including with different generations.

Consumers' perspectives have widened to include not just nutrition and safety, but health benefits, environmental sustainability, ethical production, wellness, and well-being (including emotional energy levels, sleep behaviours health, and others).

Free-from Labels

Shoppers exhibit strong opinions about food labels, health, and transparency. They are embracing "free-from" products with simpler ingredients lists. They are moving along a path that is somewhere between "clean label" and "clear label[60]."

Transparency

Consumers are increasing their requirements for transparency, both for ingredients within packages and information about sourcing, animal welfare, and other factors that go beyond ingredients.

Retail Ally

Consumers trust their primary retailer as a health ally. They also trust guidance from retail dietitians and other health professionals. Millennials (born early 1980s - late 1990s) in particular are advocates of retail private brands, and these brands are embracing free-from and organic strategies.

Private Label

Consumers are rewarding retailers with private label lines. Private label sales are trending upward, particularly those with increased retailer investment.

Fresh

Demand for fresh foods is outpacing centre store foods and processed foods.

5. Investor Realignment

Cargill Inc., (a global agribusiness and investor in cellular meat start-ups, Memphis Meats and Aleph Corporation), sees three relevant trends.[61]

Environmental Preservation is a Must-have.

Consumers no longer just seek out packaging, brands, and ingredients that are responsible and sustainable, they expect it. Transparent ethical supply chains, animal welfare, or sustainable sourcing is driving consumer interest upward.

Plant-based Meat and Dairy is Now Mainstream.

Plant-based trends are rising faster than any other food trend. Consumer demand has increased rapidly (68% annual compound rate) for food and beverages that make plant-based claims regarding health, sustainability, or ethical production.

"Clean eating" is Relying on Label Claims.

This causes confusion. Health-conscious consumerism is a global food trend. But as consumers continue to navigate this desire for healthier foods, their struggle to determine whether to focus on ingredients, macronutrients, holistic eating, or perhaps "gut health" or "brain health" has resulted in information overload for confused shoppers.

To ease this burden, on-package claims have made a big jump towards "clean" labels and subsequently towards "clear labels". The top clean label claims in 2019 included, "All natural/100% natural", "Made with real ingredients", "No added sugar", "Organic" and No-additives or preservatives.

[60] There is no definition of "clean" food label but it a product using as few ingredients as possible, and those ingredients are items consumers recognise as wholesome. Fresh, real and less processed are the key words. Professional marketers discourage use of the "clean" food label due to its confusion. A "clear" food label is one that defines the ingredients in detail on the pack or via an electric form at point of sale.

[61] www.cargill.com/salt-in-perspective/food-trends-of-2020

6. Label Demographics

The FMI report (US Food Marketing Institute, 2020) compared food label perspectives for Baby Boomers (born 1946 - 64), Matures (born 1964 - early 1980s) and Millennials (early 1980s - late 1990s):

- Boomers are more likely than Millennials (51% to 36 %) to look at calorie/nutrition graphics,
- Boomers also more frequently check expiration dates, ingredients lists and brand name,
- Boomers and Matures often focus on ingredients, production, and sourcing,
- Younger adults are more likely to embrace non-traditional attributes such as transparency about a product's improving impact on the environment and treatment of animals,
- Millennials and young adults give greater weight to attributes that go beyond what's in food products, including fair treatment of employees, animals, the environment, business ethics and sustainability,
- Younger adults show more trust than older consumers in technology-based sources of information about which foods to eat, fitness apps, bloggers, and TV personalities,
- Millennials are far more actively engaged in private brands and are the leaders in unit and dollar share spent on this segment. Younger consumers are more prone to be advocates for private brand items on social media. It is not surprising that retailers have been launching and growing private brand lines, geared to organic and clean label, to further engage this shopper segment.
- Millennials are somewhat less confident than older consumers about food safety in stores, and
- Shoppers believe restaurants are associated with bigger food safety risks than stores.

7. Ingredients Boom

Today there are more food descriptive variables than ever on labels, influencing shopper decisions about ingredients, nutrition, labels, organic, transparency and ethics. Shoppers' confusion is increasing as a result. Figure 6 drawn from the 2018 FMI national food trend surveys, highlights groups of product and ingredient descriptors.

As in Australia, some US product descriptors are mandatory on the label, while others are subject to retailers' inhouse branding and marketing strategies. Shopper confusion about the expanding list of variables and the added uncertainty of meaning for each, results in them adopting purchase strategies that avoid "negatives" and avoid overly processed products.

8. Claims on Labels

Consumers have become more sceptical about the actions of stakeholders along food supply chains, from farm to retailer and food service outlet. They are seeking a lot more information about their food than ever before, and part of the reason is a lack of trust. The FMI study suggests that consumers still trust supermarkets, but for many it's not as unconditional as before.

Figure 7 identifies the food label descriptors that shoppers want more information about. Shopper stress is compounded further by labels and claims that a food product is "natural", not because this category is undesirable, but because its public use continues to trigger legal claims of product misrepresentation, and therefore shopper unease.

9. The Future is Smart Labels

An increasing range and number of products enable consumers to scan a QR (Quick Response) code for deeper information at the point of sale.

Personal space management during the Covid-19 pandemic has educated may new consumers and food service customers regarding the simplicity and power of QR code apps on their smart phone.

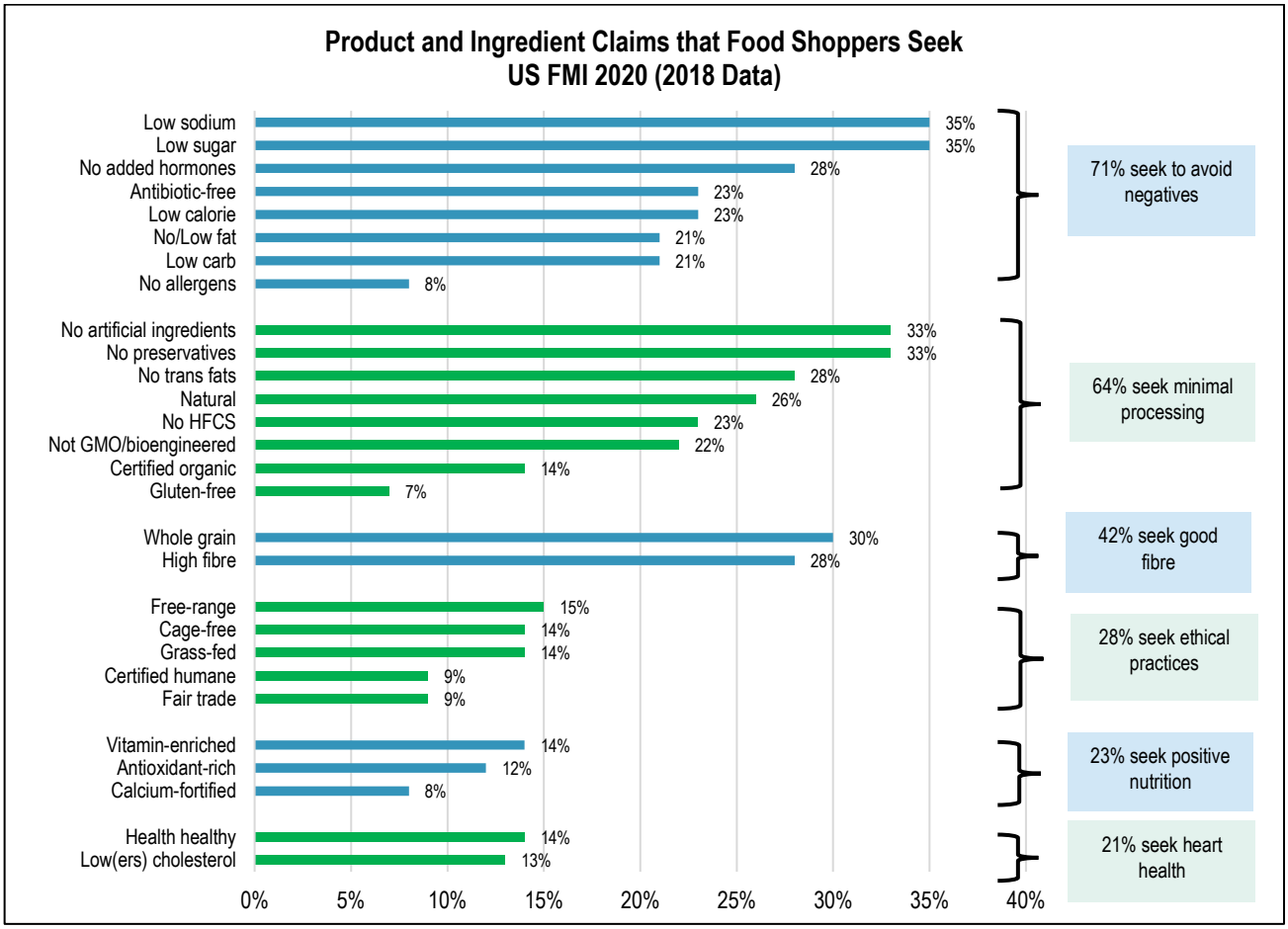


Figure 6. How US Shoppers Rate Food Label Descriptors

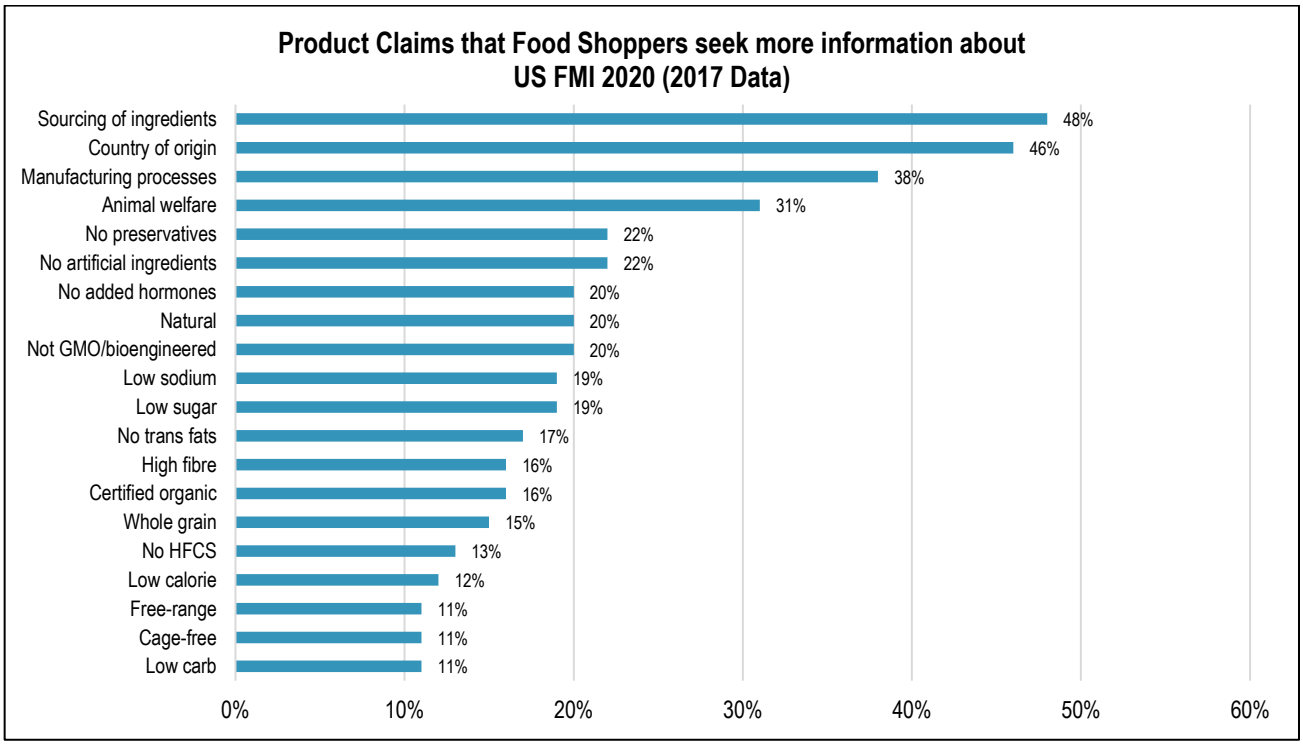


Figure 7. Food Product Claims that Shoppers want More Information About

This technology provides information to consumers on a wide range of attributes that could never fit on a package label, ranging from purposes of ingredients, farm provenance stories, to details on processing, to

treatment of animals. Related information can be obtained in multiple ways, such as online, via smartphone scans of products and through toll-free phone numbers.

In the US the majority of retailers (71%) publish health and wellness blogs (US Food Marketing Institute, 2020). Retailers also provide consumer education on topics that include menu labelling, biotech (GMO) labelling, Nutrition Facts Label updates, definition of healthy, definition on organic, and clean/clear labelling.

10. Nomenclature is Increasingly Important

In July **2018**, after many years of lobbying from the US National Milk Producers Federation and two stalled bills in the Senate and the House of Representatives, the USFDA signalled it plans to start enforcing regulations that define "milk" as an animal product. The USFDA was concerned that the labelling of some plant-based products is leading consumers to believe that those products have the same nutritional attributes as dairy products (FRSC, 2019, p. 13).

A **2017** US study (Wilks & Phillips, 2017) assessed by online survey, consumer market perceptions for a range of *in vitro* meat (IVM) types. Nearly all respondents (80–90%) indicated that they currently ate fish, poultry, pork/bacon/ham and beef, but not horse or dog/cat. Respondents said they were most unlikely to eat fish if produced as IVM, but were also less likely to eat poultry, pork/bacon/ham and beef if produced as IVM.

A more extreme assessment and forecast of US food production over the next decade is reported in *Rethinking Food and Agriculture 2020-2030* (RethinkX, 2019 Sept). This approach assumes rapid technological development of, and consumer acceptance of, foods produced from Precision Fermentation. The main conclusion drawn by the RethinkX Report is that the cost of proteins will be forced down due to cellular product competition, to 20% of current prices by 2030 (with cattle production down 50%), and 10 times cheaper by 2035. With regard to food labelling the report notes:

- Current US labelling laws, *inter alia*, are barriers to introduction of modern foods and have to be overcome,
- Increased transparency is needed by modernising food labelling to better communicate health benefits, health risks, and environmental impacts to consumers. Labelling laws should have clear meanings.
- Labels should prioritise consumers' right to know – instead of simplistic food labels, consumers should be able to scan a QR code that shows details of the content of food they intend to purchase, including the source of all ingredients, manufacturing methods, heavy metal content, health impact to children and adults, and environmental impact.

In response to this RethinkX Paper (Beef Central, 2021) biotechnology Professor Paul Wood AO, at Monash University believes "reports released in recent years to promote alternative proteins from groups such as the US-based RethinkX and Australian-based Food Frontiers have quoted selectively from sources to draw conclusions that present a negative view of livestock production systems, but which don't reflect the actual data or conclusions of the papers they reference."

11. Genetically Engineered Fish

In **2017** the first genetically modified animal eaten for human consumption was sold to meat consumers. It was a seafood product. US firm AquaBounty Technologies (First transgenic salmon sold, 2017) sold 4.5 tonnes of genetically modified Atlantic Salmon *(Salmo salar)* grown at its aquaculture development facility to customers in Canada. Neither country requires the Salmon to be labelled as genetically engineered.

BlueNalu Inc.

In **July 2020**, US firm BlueNalu Inc. coinvested[62] with Pulmuone Inc. of South Korea to collaborate in areas such as marketing, regulatory, operations and distribution with an aim to bring BlueNalu's products initially to markets in South Korea, Asia and the USA during the coming years.

[62] www.bluenalu.com/bluenalu-signs-mou-with-pulmuone-announces-partnership

The San Diego based company claims its cellular aquaculture technology will allow it to produce a wide array of seafood products from a variety of species, without genetic modification, and will be free of microplastics, toxins, mercury and other environmental contaminants. It notes that cell-based seafood is a solution to food security and addresses the important issues of traceability, transparency and safety.

The company's initial focus is to develop cellular seafood products made from cell samples taken from "Mahi Mahi, Red Snapper, Tuna, and Yellowtail". It selects preferred development species that are attractive as seafood but not easily or currently developed in volume by aquaculture[63]. Other preferred species include Bluefin Tuna, Chilean sea bass (also called Patagonian Toothfish), Shrimp (Prawns), and Salmon.

The company also boasts its products will have the same taste and texture of existing premium seafood while being sustainable and free of harmful levels of mercury, pathogens, parasites, microplastics and other environmental contaminants.

BlueNalu secured additional funding in **January 2021** as global seafood industry leaders Thai Union Group from Thailand, and Rich Products Corporation USA (owner of the global SeaPak brand) committed significant funding. BlueNalu plans to use the money to open a 40,000 square foot pilot production facility, complete USFDA regulatory review for its first products, and initiate marketplace testing (Thai Union, others join $60 million funding round for cell-cultivated seafood maker , 2021).

Meat Tech 3D Inc.

Israeli firm Meat Tech is researching cellular meat production (initially for beef, with pork, poultry and seafood planned) in bioreactors in ways similar to all other innovators.

But Meat Tech is also applying bioprinting techniques (Figure 8) in downstream processing to overcome current constraints related to inedible "scaffolding" media on which to grow meat cells. Extrusion technologies are also considered an option for the final product. (Meat Tech 3D Inc., 2020)

Commentators at the Cultured Meat Symposium also claimed three areas where they see that cellular seafood will be more attractive to consumers than wild catch seafood:

- Free of microplastics,
- Free from heavy metals, and
- Free from antibiotics.

These claims are yet to be confirmed as cellular meat scales up to commercial viability once regulatory approval is granted to service consumer markets.

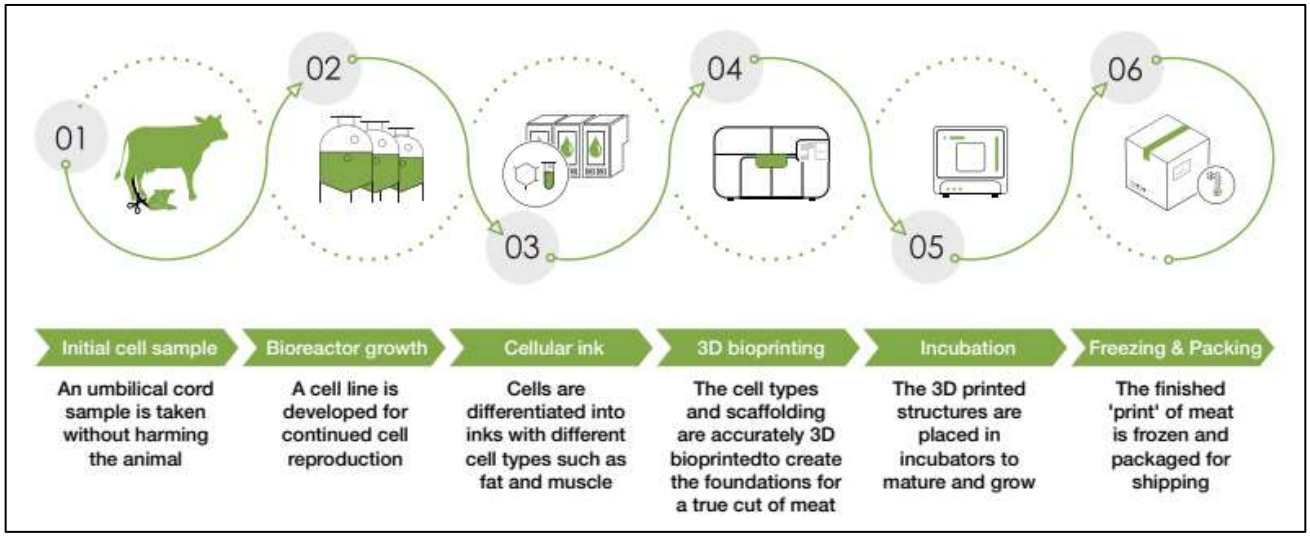


Figure 8. Meat Tech 3D Bioproduction Chain

[63] Cultured Meat Symposium 19, www.youtube.com/watch?v=itySk7xloaA

12. Approval for Pig Cellular Meat

In **December 2020** the USFDA approved[64] a first-of-its-kind intentional genomic alteration (IGA) in a line of domestic pigs, referred to as *GalSafe* pigs, which may be used for food or human therapeutics.

GalSafe pigs may potentially provide a source of porcine-based materials to produce human medical products (e.g., blood-thinning drug heparin) that are free of detectable alpha-gal sugar. Tissues and organs from *GalSafe* pigs could potentially address the issue of immune rejection in patients receiving xenotransplants, as alpha-gal sugar is believed to be a cause of rejection in patients.

The USFDA also evaluated the safety of the IGA for the animals and people eating meat from them. The USFDA determined that food from *GalSafe* pigs is safe for the general population to eat. The product developer indicated that it initially intends to sell meat from *GalSafe* pigs by mail order, rather than in supermarkets.

The potential impact that the approval of the IGA in *GalSafe* pigs would have on the US environment is no greater than from conventional pigs. The conditions under which *GalSafe* pigs will be kept are far more stringent than those for conventionally farmed pigs. Additionally, no animal safety concerns were noted for *GalSafe* pigs beyond those that would be expected in well-managed, commercial swine operations.

It's important to note that these pigs have not been evaluated for use as xenotransplantation products for transplantation or implantation into human subjects.

13. US Regulations

In August **2018** the US state of Missouri (Dept of Agriculture, State of Missouri, 2018) passed a law that prohibits plant-based products and cultured meat from using the word 'meat'. A new definition of meat mandates that the term meat can only be used for products that are "derived from harvested production livestock or poultry." Plant-based products must have:

- A prominent statement on the front of the package, immediately before or immediately after the product name, that the product is "plant-based," "veggie," "lab grown," "lab-created," or a comparable qualifier; and
- A prominent statement on the package that the product is "made from plants," "grown in a lab," or a comparable disclosure.

However, the USDA's national labelling authority overrides that of the states; hence the USDA's future ruling on what cell-based meat can be called will, in theory, be final (Warner, 2019).

In **2019** the USFDA and USDA agreed to share regulatory duties for cell-based meat. The agreement outlines the point of transfer as follows:

> *'USFDA oversees cell collection, cell banks, and cell growth and differentiation. A transition from USFDA to USDA oversight will occur during the cell harvest stage. The USDA will then oversee the production and labelling of food products derived from the cells of livestock and poultry. The USDA would oversee production and labelling of meat developed from cells of livestock and poultry.*

The north American Meat Institute (representing traditional meat producers and processors) and the Alliance for Meat, Poultry and Seafood Innovation (representing cellular meat developers) are working together to advance new methods of producing real, high-quality, safe meat, poultry and seafood products directly from animal cells.

But an array of farm and livestock groups say terms such as "meat", "poultry", or "roast" should be reserved to describe flesh from food-bearing animals such as cattle, pigs, and poultry. To them, lab-grown meat is "fake meat" that should not be sold as meat. The high-tech companies developing cell-based meat call it a "clean meat" that does not involve slaughter and requires less land and fewer resources such as water and grain to produce than livestock.

Historically when developing labels for foods use new methods or technologies, the USFDA have focused on characteristics of the finished product rather than the production process. Departures from this production

[64] www.fda.gov/news-events/press-announcements/fda-approves-first-its-kind-intentional-genomic-alteration-line-domestic-pigs-both-human-food

process must be described on the food label. But cell-based meats may have a range of final characteristics, so labelling may require careful evaluation. The USFDA has indicated that careful consideration relating to product characteristics is needed to inform labelling decisions for such products.

Meat industry trade groups have urged the USDA to begin the rulemaking process so it can gather information about the characteristics of cell-based meat and poultry. This will provide the substantive data, while also ensuring that the current mandatory labelling standards remain high.

Food labelling ties in critically to consumer perception and so the success of cell-based foods will turn, in large measure, on the nomenclature used. The initial regulatory USFDA-USDA collaboration is clearly not yet settled, with a public brawling over cell-based regulation between the agencies in January 2021[65]. Either way, the products will be obliged to have USDA approval of their labels before the products go on sale. Consistent with its statutes, USDA requires preapproval of all labels before manufacturers can market their products.

Seafood

In US markets, the USFDA[66] has sole oversight of cell-based seafood[67] other than catfish and has called for public comment on how to label it. However, the agreement does not mention cell-cultured meat made from the cells of other fish, such as tuna and shellfish (US Government Accountability Office, 2020 April). Already there is inconsistency arising by fishery species.

Seafood is a big differentiator for US supply chains and retailers. A national survey (US Food Marketing Institute, 2020, p. 28) of US retailers concluded that 44% of respondents expected store space allocation for fresh seafood to increase, Vs. only 6% that anticipated it to decrease. Nearly 20% of US consumers say they would like to eat more seafood.

The FMI study also quotes Nielsen research that found shoppers most concerned about quality and freshness. Transparency in sourcing plays a bigger role in consumers' seafood buying. The study noted that sales of all seafood with sustainability claims increased 3% over the past year, while sales of seafood with Marine Stewardship Council labelling grew 27% and sales of seafood with Sustainable Fishing labelling grew 30%.

Product naming is one of the main challenges in commercialising products derived from new technologies. The key problem is what to call these products.

A recent study assessed the challenge of label nomenclature for cell-based seafood and meat (including poultry) products to meet USFDA regulations (Hallman & Hallman-II, 2020). USFDA Regulations require that all foods that do not have defined *standards of identity* (per regulation 21CFP130.8) be labelled with a common or usual name so that consumers can make informed choices about the products they buy. Similarly, the USDA requires that common or usual names be used to label meat (9CFR317.2) and poultry products (9CFR381.117). Assuming lab-grown seafood and meat is identical (in form, taste, texture, smell, and nutritional and culinary attributes), the obvious variance from farm or aquatic sourced food is the *in vitro* non-animal-harvest source of the product. *In vitro* meats will also offer consumers lower resource demand (land, water) and environmental impacts (microplastics). As the paper notes "there is power inherent in labelling a concept, because the name given to it can evoke images, emotions, metaphors, and meanings that profoundly shape public perceptions and acceptance" (Hallman & Hallman-II, 2020, p. 2268).

This product nomenclature matter is now very contentious among global farmers and fishers, meat and seafood consumers, activists and regulators. The Hallman paper lists many efforts (often influenced by the USDA/USFDA discourse) to find a common acceptable term for cellular meats (USA, UK, New Zealand, Belgium, Portugal, China, Netherlands, France, Brazil, India, etc). The variously proposed list of nomenclature is bewildering[68]. Creating consensus around a single common or usual name is critical both for regulatory reasons and for shaping public perceptions and understanding of the products that are labelled with it.

[65] www.thecounter.org/usda-fda-clash-regulates-genetically-engineered-ge-meat/
[66] www.agriculture.com/news/business/characteristics-of-cell-based-meat-matter-for-labeling-meat-lobby-says#:~:text=The%20FDA%20and%20USDA%20agreed%20in%202019%20to,meat%20developed%20from%20cells%20of%20livestock%20and%20poultry.
[67] Seafood refers to shellfish, sea fish, and freshwater fish served as food.
[68] Refer Chapter 3, Section C

There is a further point critical to seafood. Because products produced from the cells of live fish contain proteins that can cause an allergic response among some individuals, it is important that the label enable fish or shellfish-allergic consumers to identify these products as potential allergens.

The Hallman study concluded that "Cell-base seafood" enables consumers to recognise that the products are neither wild caught nor farm raised, signals potential allergenicity, is seen as an appropriate name for describing the technology/process, and it performs well with respect to measures of consumer acceptance, particularly in comparison to conventional products. It meets the US regulatory requirements to distinguish products from those already known to consumers and to signal allergenicity.

C. European Initiatives

The European Union has developed the world's most comprehensive legal labelling requirements for seafood products. The following discussion is designed to present the relevant level of detail for discussion.

1. Common Market Regulations 2014

In December 2014 new regulations (European Commission, 2014) were established for labelling of all fishery and aquaculture products under the Common Organisation of the Markets (CMO) Regulation (EU) No1379/2013, referred to as the CMO.[69]

The regulations are summarised here in the body of this paper (and not in Appendices) to illustrate the increasing complexity of label messaging, and to prioritise the scope and intent of the regulations that are the basis for the evolution of Novel Foods (both plant-based and cellular seafood) worldwide.

These requirements apply to all unprocessed and some processed products (e.g., salted, smoked products, cooked shrimps in their shells). Products sold to consumers or mass caterers must bear the following information.

2. Mandatory Label Information

These products can be 'Prepacked' and 'Non-prepacked'.

- *Name* the commercial and scientific name of the species,
- *Production method* whether the product was caught at sea or in freshwater, or farmed,
- *Catch area* the catch or production area or country,
- *Waters* the fresh, marine or farmed water type. To allow consumers to have a better understanding of where the product comes from, the information on the catch or production area must be provided in detail:
  - For fish caught at sea:
    - In the Northeast Atlantic, Mediterranean and Black Sea: the name of the FAO sub-area or division,
    - In other waters: the name of the FAO area,
  - For freshwater fish: the body of water and the EU country of origin or the non-EU country of provenance,
  - For farmed fish: EU or non-EU country of final rearing period,
- *Gear* the type of fishing gear (seines, trawl, gillnets, etc) used to catch the product,
- *Defrosted* whether the product has been defrosted. For pre-packed products, this information must accompany the commercial name. For non-prepacked products, the information need not accompany the name of the food, although it must be shown on billboards or posters.
- *Best Before Date* the date of minimum durability (also known as the 'best before' or 'use by' date), in line with general food labelling rules, as follows:
  - All prepacked products which are not highly perishable must display the 'best before' date. By contrast, highly perishable products should display the 'use by' date.

[69] www.ec.europa.eu/fisheries/cfp/market/consumer-information_en

  - All non-prepacked products, products prepacked for direct sale or on sales premises at the consumer's request, EU countries can decide whether to adopt national rules stipulating that the 'best before' or the 'use by' date should be displayed.
  - For live bivalve molluscs, the 'best before' date can be replaced by the label 'these animals must be alive when sold'.
- *Allergens*
  - For prepacked products, a clear reference to the name of any allergens should be included in the list of ingredients. This should appear in a typeset (e.g., font style, or background colour) which clearly distinguishes it from the rest of the list of ingredients.
  - For non-prepacked products, products pre-packed for direct sale or on sales premises at the consumer's request, information on allergens is also mandatory. However, EU countries can adopt national measures about the 'means' by which this information is provided.
  - Where no list of ingredients exists, the presence of allergens must be indicated as follows: 'contains…'

Additional requirements for Prepacked products:

- *Ingredient* list of all ingredients in descending order of weight should be displayed next to 'Ingredients'. This is not necessary for single-ingredient foods that have the same name as the ingredient.
- *Quantity of Ingredients* This must be expressed as a percentage, and shown when the ingredient:
  - Appears in the name of the food,
  - Is emphasised on the labelling,
  - Is essential to characterise a food.

  There are certain exceptions to this, e.g., if the drained net weight is provided.

- *Net Quantity (Net weight)* must be expressed in grams or kilograms. The drained net weight of the food must also be shown where a solid food is in a liquid medium (also frozen or quick-frozen). If the food has been glazed, the declared net weight of the food must exclude the glaze. In this case, one of these four possibilities should be indicated on the label (example of 250 g):
  a) Net weight = 250 g and Drained net weight = 250 g
  b) Net weight = Drained net weight = 250 g
  c) Drained net weight = 250 g
  d) Net weight (without glaze) = 250 g.
- *Conditions for Storage and Use* any special storage conditions and/or conditions of use must be shown.
- *Business Name and Address* the name and address of the food operator responsible for the food information, and under whose name the food is marketed, should be displayed. If the operator is not in the EU, the name and address of the importer must be shown.
- *Country of Origin or Provenance* this must be shown where failure to do so could mislead the consumer.
- *Nutrition Declaration* (from 13 Dec. 2016): This includes energy value and the amount of fat, saturates, carbohydrates, sugars, protein and salt per 100 g or 100 ml. Vitamins, minerals and other specified nutrients can be included. This can be expressed as 'per portion' or percentage of 'reference intake'. Unprocessed products that include a single ingredient or category of ingredients are exempt.
- *Packaged in a Protective Atmosphere* this must be included if the product was packaged in certain gases.
- *Date of freezing or Date of First Freezing* this requirement only applies to unprocessed products. The date must be indicated as follows: 'Frozen on day/month/year'.
- *Added Water* added water must be shown in the list of ingredients in accordance with the requirements of the FIC Regulation. For fishery products having the appearance of a cut, joint, slice, portion, fillet or a whole fishery product, the added water must also be shown in the name of the food if the added water makes up more than 5% of the weight of the finished product.
- *Added Proteins of Different Animal Origin* the name of the food must indicate the presence of added proteins and of their animal origin.
- *Formed Fish* products which give the impression that they are made of a whole piece of fish but actually consist of different pieces combined using other ingredients (e.g., food additives, food enzymes) or other means, need to indicate this. The operator is bound to use the term 'formed fish'.

- *Identification Mark* the name of the country, the approval number of the establishment where production takes place and the abbreviation EC, or its translation in other EU languages, must be shown when the product is produced in the EU. For imported products, only the name of the country and the approval number of the establishment are mandatory.
- *Date of Packaging* this date must be shown for live bivalve molluscs. This date must comprise at least the day and the month.

3. Voluntary Label Information

In addition to the mandatory information required, the following information can be provided if it is clear, unambiguous and verifiable, and does not mislead the consumer. Voluntary information must not be displayed to the detriment of the space available for mandatory information.

- Date of catch/harvest,
- Date of landing,
- Port of landing of fishery products,
- More detail regarding the fishing gear, including if the fish was caught by other fishing techniques not listed (e.g., by hand or diving) this can be indicated voluntarily.
- Vessel's flag state,
- Environmental, ethical or social information,
- Production techniques and practices,
- Nutritional content / Nutrition declaration,
- Other: Any other information that the food business operator considers useful for the consumer, provided it is clear, unambiguous and verifiable.

4. Food Nomenclature

In December **2013**, European Union regulations stated that designations such as 'milk', 'butter', 'cheese', 'cream' and 'yogurt' can only be used for products derived from animal milk[70].

In June **2017**, the European Court of Justice concluded that these terms cannot be legally used to designate a purely plant-based product and that the prohibition applies even with the addition of descriptive or clarifying terms indicating the plant origin of the product. However, there is a list of exceptions, including coconut milk, peanut butter, and ice cream. Soya and tofu products are not exempted.

In April **2018**, France passed an amendment to its agriculture bill that prohibits any product largely based on non-animal ingredients from being labelled like a traditional animal product. Under this legislation, food producers can no longer use meat terms such as "vegetable steak", "soy sausage", or "bacon flavoured strips" to describe products that are not partly or wholly made up of meat.

In October **2018** the European Parliament advised[71] that:

> *The European Commission is aware of the new technologies intended to produce laboratory-grown meat ('cultured meat') using cell cultures. Article 3(2)(a)(vi) of Regulation (EU) No 2015/2283(1) on* ***Novel Foods*** *stipulates that food consisting of, isolated from, or produced from a cell culture or tissue culture from animals, plants, micro-organisms, fungi or algae is considered one of the Novel Food categories listed in the regulation.*
>
> *Cultured meat may fall in this category. In such case, it would require a pre-market authorisation which would include a safety assessment performed by the European Food Safety Authority (EFSA). The Novel Food Regulation contains provisions for the safety assessment of such foods before they are placed on the market and for specific labelling requirements to ensure a high level of health protection and consumer information about specific characteristic or food property.*

[70] The EU evolution from 2013 to April 2018 has been sourced from (FRSC, 2019)
[71] www.europarl.europa.eu/doceo/document/E-8-2018-004200-ASW_EN.html

In April **2019** the European Parliaments' Agricultural Committee approved a ban on producers of vegetarian food using nomenclature usually deployed to describe meat. Instead, the Committee proposed that terms such as 'veggie discs'[72] rather than 'veggie hamburger' be used.

In October **2020**, however, this ban was largely overturned as the European Parliament voted[73] down a motion that would have banned meatless food products from having names associated with meat. But non-dairy foods must now avoid referring to "milk" or "cheese" in their descriptions. Producers of meatless foodstuffs will be allowed to continue calling them "sausages" and "burgers" if they desire, rejecting a proposal to have such trade practices banned. The motion had proposed that: "names ... currently used for meat products and meat preparations shall be reserved exclusively for products containing meat," using the examples of steak, sausage, escalope, burger and hamburger.

The proposed amendments were made following pressure from the meat lobby and agricultural associations, who said that otherwise, meat-eating consumers could be confused and buy vegetarian or vegan products instead of meat products.

However, many producers of non-dairy alternatives to milk will not be happy as a 2017 ban on referring to such products as "milk" or "cheese" has now been extended. In future, designations for non-dairy products may not even use terms such as "milky taste", "cheese-style" or "dairy substitute."

Exceptions will be made for peanut butter or coconut milk, names that have been in use for decades.

The traditional EU meat industry says[74] words like ham, salami and steak are deeply rooted in Europe's cultural heritage, according to an open letter last month from groups including farm lobby Copa-Cogeca (the united voice of farmers and agri-cooperatives in the EU).

The EU has prohibited the use of "milk" on labels for plant-based drinks, leading some companies to opt for "mylk" instead. France has already introduced a ban on "meat" terms in plant-based foods, while the Netherlands opted to keep them.

The EU's position on nomenclature and therefore regulation, is emerging but at present could be described as very volatile and uncertain.

5. Traceability - EU V Australia

The traditional role of food traceability has been focussed on consumer protection through food safety.

This food safety focus is largely due to the efforts of the EU and USA to identify and limit the entry of IUU (Illegal Unreported or Unregulated) seafood into their markets.

A recent report noted that if similar strong IUU regulations were introduced in Australia, there would be stronger incentives to extend traceability technologies beyond food safety to include lawfulness of fishing activity (Garcia, 2019, p. 192). Today Australia's food supply chains use a range of marker technologies and tests, including DNA, trace elements and stable isotopes, to deliver innate chemical fingerprints that tie products to their production or manufacturer origin. Not only will this support provenance claims, but it will identify substitution and counterfeit goods[75]. However, DNA tracking linked to food labels is not yet undertaken in Australia.

Broader use of DNA has been considered for some years. Traceability is increasingly being applied within seafood supply chains to address a wider range of issues and concerns among consumers, seafood companies, government agencies, and the non-profit sector about the legality and sustainability of seafood products (Lewis & Boyle, 2017).

Scientific and media revelations regarding seafood fraud through intentional mislabelling, Illegal Unreported or Unregulated fishing[76], and human rights and slavery abuses have prompted consumers to broaden the meaning of traceability, a cause now increasingly taken up by global 3rd party certifiers.

[72] www.theguardian.com/food/2019/apr/04/eu-to-ban-non-meat-product-labels-veggie-burgers-and-vegan-steaks
[73] www.dw.com/en/european-parliament-votes-to-allow-veggie-sausages/a-55373087
[74] www.bloomberg.com/news/articles/2020-10-20/veggie-burger-or-veggie-disc-on-the-menu-eu-vote-will-decide
[75] www.mla.com.au/research-and-development/food-safety/red-meat-traceability-information-hub/
[76] In 2016 MRAG concluded that the overall value loss to the Pacific tuna fishery from IUU fishing US$616.11 million, with 25% of that loss coming from reduced employment and access fees. www.m2cms.com.au/uploaded/5/ZN1981%20-%20MRAG%20AP%20FFA%20IUU%20Report.pdf

DNA testing of seafood is proposed as a key element of these initiatives. It is considered a good tool to authenticate end-to-end supply chain species and interoperability claims for products. DNA technologies have advanced, and testing can now authenticate fresh and processed (i.e., cooked, battered, canned, picked, preserved) foods including seafood.

Consumers are also becoming more motivated to seek the point-of-sale story behind their seafood as well as its sustainability, safety and nutritional aspects. As a result, governments are expanding the scope of seafood traceability, especially regarded traded products (Lewis & Boyle, 2017, p. 14).

The EU proposes regulations that make full use of available technology, including DNA testing, in order to deter operators from falsely labelling catches. (2013 Reg. [EU] 1379/2013 23).

In Australia DNA testing and nanotechnologies are currently applied to or emergent regarding:

- Plants, and therefore could readily be applied to plant-based meat substitutes. These products have been in consumer markets for ~30 years now.
- Meat and dairy products. Enhanced DNA technology along supply chain and for processed foods and could readily be applied to "cellular meats" as that material is drawn directly from real animal stem cells.
- Seafood products to confirm their spatial provenance (e.g., Australian wild abalone exported to Asian markets) but not linked to food labelling, and
- Industrial aquatic products such as Pearls (to confirm their origin - marine or manufactured) and provenance.

6. United Kingdom

Brexit Fallout

In December **2020** the UK formally departed from the EU Common Organisation of the Markets (CMO) Regulations.

Fisheries and seafood supply were central to final Brexit negotiations and are not yet published. However, the existing EU regulations regarding seafood labelling provide a baseline for relevant seafood labelling regulation.

The CMO required that seafood suppliers are subject to UK food laws that apply to all foodstuffs, as well as seafood specific regulations. Regulation applies to all foods intended for the final consumer, regardless of the stage in the chain at which they are packed. Food that is pre-packed by the seller or packed on the premises at the request of the customer (pre-packed for direct sale) are treated in the same way as for food sold loose.

Online Food information V Labelling

The previous EU/UK CMO regulation only applied to labels - the new regulation applies to all food information. This will include sales where the consumer is not present such as mail order, telephone or internet sales. In these situations where the consumer cannot see the actual product the mandatory information must be available to the consumer before the purchase is made.

UK Traceability, at a minimum must include:

- Lot or batch number,
- Supplier name and address,
- Name and identification number of fishing vessel(s) or name of aquaculture unit,
- Date of catch or harvest,
- Quantity,
- Predominant area where caught or farmed,
- Category of fishing gear used,
- Commercial designation and scientific name for species,
- FAO alpha-3 code.

UK labelling must include:

- Name of product,
- List of ingredients,

- Name and address of manufacturer,
- Country of origin / place of provenance,
- Nutrition labelling: 'back of pack' information will become mandatory on the majority of pre-packed foods, single ingredient unprocessed foods are exempt e.g., fish fillets. Details of health claims (e.g., Omega-3) must be shown.
- Frozen fish fillets would not have to carry an ingredients list. All other products will need to carry ingredients labelling. A category of foods described as 'fish' comprised of a mixture of fish, would still be exempt from ingredients listing, as long as no indication is given on the species. Unprocessed fish would fall with the scope of the fish labelling regulations. These require the commercial designation of all the fish in a mix to be declared, although this would not need to be as an 'ingredients list'.
- Date marking depending on the type of food, consumers will continue to see 'best before' and 'use by' dates on pre-packed foods. For fish there will also be a date of first freezing shown on food labels. A declaration of 'defrosted' is required if the product has been previously frozen but is sold chilled.
- A minimum font size is introduced for the mandatory information on most food labels,
- The types of vegetable oil used in food, such as palm oil, must be stated,
- Allergen information is extended to non-pre-packed foods and catering situations with flexibility in how businesses provide this to consumers,
- Added water in fishery products which have the appearance of being made from a cut, joint, slice, portion or whole fillet will need to be shown in the name of the food if it makes up more than 5% of the final product.
    - Frozen fishery products often have a glaze of frozen water to protect the product from loss of quality during frozen storage. Water used as a glaze is no longer considered to be part of the food and would be packaging. Therefore, it does not need to be declared in the ingredients and cannot be declared using a QUID declaration of the fish and water. The drained or net weight must be given.
    - The optimum level of glaze is around 10% of the weight, although there is no legal maximum for amount of glaze that can be used. The deglazed weight or 'net weight' is the true amount of product once the glaze is removed.
- Formed fish where a product gives the impression of having been made from a whole piece of fish when it is in fact made from pieces. Formed fish labelling is complex. For example:
    - A cod fish cake or a cod fillet fish finger does not require a label as the consumers' expectation from the product and species name is not mislead,
    - A breaded fish portion made from a sawn portion of a fish block, pressure formed in a mould into the shape of a fillet, does require a label,
    - A breaded fish portion made by hand-laying 3 - 4 pieces of fish fillet together in a mould the shape of a fillet and freezing, also requires a label,
    - A breaded goujon (small strip of fish coated in breadcrumbs and deep-fried) made from flat fish frozen paired top and bottom fillets which is then sliced across the cross section into goujons, does require a label. The product name would not be a fish finger and therefore the consumers' expectation would likely be of a single piece from a fillet. A label would therefore be required.

Distance Selling

The UK regulations require[77] that if you sell food products online or by phone or mail order, you must make the required information available for free to the customer before they buy (except the durability and freezing dates) and when it is delivered to them.

Consumer Trends

Research by Barclays, a UK investment bank[78] in 2019 found there is "a bigger market opportunity for plant-based (and maybe even lab-grown) protein than was projected for electric vehicles ten years ago". They conclude that:

- 70% of food consumers prefer no artificial ingredients,

[77] www.gov.uk/guidance/food-labelling-giving-food-information-to-consumers#showing-the-best-before-or-use-by-date

[78] www.investmentbank.barclays.com/our-insights/carving-up-the-alternative-meat-market

- Less than ⅓ of consumers would buy a product with artificial ingredients, and
- 40% of consumers are willing to pay a 50% premium for "natural" food.

Barclays estimate that global sales of alternative meats could grow from 1% of the total market for meat to 10% over the next decade.

In June **2021** Australia confirmed a Heads of Agreement for a new Free Trade Agreement with the UK, to include agricultural and food products.

D. Canadian Initiatives

Canada has been at the forefront of market acceptance of genetically modified seafood, as per the *AquAdvantage*™ Atlantic salmon produced by AquaBounty (noted earlier). But the literature suggests there are only four Canadian firms active in the 55 or so cellular meat start-ups publicly announced worldwide[79].

The industry literature suggests Canada suffers from lack of clarity and low fish names enforcement.

1. Fish Name Umbrellaing

A **2021** paper (Cawthorn, Murphy, Naaum, & Hanner, 2021) concluded that the integrity of Canada's domestic seafood supply chain is being eroded by poor organisation and transparency in fisheries data reporting and market labelling. The study notes that market confusion also arises from "vague multispecies" fish name "umbrellaing", in preference to a "one species, one name" approach.

Official seafood trade statistics, and to some extent production records, are reported with insufficient data to specify the precise species involved, to track trade flows along supply chains to consumers, and to inform fishery managers.

The paper's authors concluded that:

"Canada's labelling legislation should be aligned with that of the EU in mandating scientific names on seafood products, along with additional criteria (geographical origin, processing history, production and harvest-methods) to promote consumer choice and effective 'boat-to-plate' traceability. Finally, this legislation should be enforced through ongoing regulatory monitoring of labelling authenticity including DNA barcoding".

Suggested improvements in "taxonomic granularity" and accurate through-chain information sharing will enable accurate ground-truthing of wild catch species exploitation and fishery sustainability.

E. Asian Initiatives

The following discussion summarises a scan of contemporary Novel Food labelling issues in key food markets relevant to Australian producers.

1. China

Meat consumption is a relatively recent phenomena in China. In the **1960s**, the average Chinese person consumed less than five kilograms of meat annually, growing strongly to 20 kg per capita by the late 1980s and has now reached 63 kg (Time Magazine, 2021). Today, China produces 50% of global pigs, and consumes 28% of global meat, and half global pork.

African swine fever (ASF) wiped out half of China's pig herd between 2018 and 2019 (ABARES, 2021), dropping China's pork consumption by 40%. That fact together with China's deep traditional pork cuisine preference means that plant-based pork substitutes have surged in popularity.

In 2018 China's market for plant-based meat substitutes was estimated at US $910 million (compared with US $684 million in the USA) and is projected to grow 20% to 25% annually.

[79] www.startalberta.com/news/advancing-cellular-agriculture-in-canada-how-to-g

Livestock production occurs on 35% of China's land surface, with 38% of arable land being used to grow livestock feed crops and 31% being used for grazing.

In **2015** researchers (Sun, Yu, & Han, 2015) considered the environmental prospects for cultured meat in China. They concluded that the overall impact of replacing livestock products with cultured meat would be beneficial for China's environment, potentially improving food security because less land is needed to produce the same amount of protein and energy.

Research indicates it is likely that food safety and nutrition will be the key concerns that motivate Chinese consumers to choose cultured meats, including pork. Analysis by Cellular Agriculture Australia found following the swine fever pandemic that 40% of Chinese respondents knew about cellular meat and 70% were willing to try it. (Australian Pork Newspaper, 2021 January, p. 10)

In Hong Kong, if cell-cultured meat is cooked, it can effectively go on the market now, according to Nicole Rawling from the US non-profit firm Good Food Institute[80]. However, the statutory support for this has not yet been confirmed.

2. Singapore

Singapore's food regulator SFA (Singapore Food Agency) gave approval on 2 **December 2020**[81] for the first regulatory approval to market cell-based meat. The cellular "chicken nugget" products are produced and marketed by US firm Eat Just Inc.

SFA said the product, to be manufactured and sold in Singapore, will be labelled as "cultured meat". Eat Just's CEO, Josh Tetrick said[82] the meat will be manufactured in large cultivators or bioreactors that will resemble a beer brewery or similar facility.

3. Japan

In **January 2021** cell-based start-up Aleph Farms[83] formed an alliance with Japan's Mitsubishi Corporation to develop lab-cultivated meat products[84]. The company promotes slaughter-free steaks.

Based in Israel and part funded by US agribusiness Cargill, Aleph grows meat directly from beef cells using a 3D tissue platform. Aleph forecasts shorter production cycle times for its cellular meats – 3-4 weeks compared to 2 years for traditional farming.

Aleph Farms will provide its cellular meat manufacturing platform to cultivate whole-muscle steaks on a large scale to service the Mitsubishi Corporation, which operates 1,700 consumer-food group companies across 90 countries[85].

4. India

The FSSAI (Food Safety and Standards Authority of India) published a draft notification in **2020** proposing to prohibit the use of dairy nomenclature for plant-based products.

Under the existing law that is now being reiterated, a product that intends to substitute for "milk" or any milk-based or composite product cannot use a dairy term[86].

The introduction and related regulation of cellular meat is currently under investigation in India.

[80] www.foodnavigator-usa.com/Article/2019/02/11/The-world-is-watching-the-cell-based-meat-industry-says-Memphis-Meats-VP-Subpar-early-products-can-stigmatize-an-entire-category-for-decades-to-come
[81] www.just-food.com/news/singapore-gives-green-light-to-cell-based-meat_id144842.aspx
[82] www.straitstimes.com/singapore/environment/worlds-first-cell-cultured-chicken-likely-to-be-at-restaurants-in-singapore
[83] Cargill is a significant shareholder in both the leading global cultured meat companies, Memphis Meats and Alepf Farms.
[84] www.just-food.com/news/aleph-farms-to-develop-cell-based-meat-products-in-japan-with-mitsubishi_id144974.aspx
[85] www.vegnews.com/2020/11/israeli-startup-unveils-first-commercial-prototype-of-cell-based-steak
[86] https://www.foodnavigator-asia.com/Article/2021/01/05/Eight-must-know-regulatory-updates-expected-for-the-APAC-F-B-industry-in-2021

F. Pet Food

Cellular meat firms are targeting petfood markets, offering competitive low "commodity" based prices.

Pets are not fussy about the source or ethics of the manufactured meat they eat – if it looks, smells and tastes good, it is acceptable (The Economist, 2021).

US firm, Because Animals Inc. has developed cellular cat food products from mouse stem cells[87], while another firm Bond Pet Foods, Colorado, is growing chicken cells by inserting genes for nutritionally important chicken proteins into cells of brewer's yeast. These reproduce faster than chicken cells do, and they expect to be on the market by 2023.

[87] www.becauseanimals.com/pages/making-meat

8. AUSTRALIA - CURRENT EMERGING INITIATIVES

A. Local Perspective

1. Competitive Advantage

As a small open advanced economy Australia's food industry typically adopts and adapts European and north American food technologies and regulatory trade regimes. Increasingly we are also tracking food standards and market trends in food markets in major Asian economies[88].

Regulations presently being developed overseas, especially in USA and EU, are being watched closely by both Australian industry and regulators, for guiding principles that offer a viable and safe cell-based meat and seafood production industry.

Australia's competitive advantage faces challenges from these changes. The potential indirect impacts of this shift on Australian producers are great, but not necessarily all adverse. Downside risks certainly exist, but the global entry of lower cost cellular commodity foods may also further differentiate and leverage Australia's best practice natural food production systems in global markets.

Competitive advantage management for Australia will be about mutual supply collaboration between traditional producers and protein substituters, rather than competition. As the AFI study (AFI, 2020 February) notes "Segregation and competition with alternative proteins companies could do more harm than good for all markets."

This report finds that while animal protein substitution will continue to increase in the next 10 years, "the levels and rate of substitution will not present a material threat to the viability of animal agriculture by 2030". (Note that the study included seafood in "animal" production).

Producers of plant-sourced protein (e.g., pulses) also stand to gain from increased market share. However, new demand for animal-sourced protein from a rising population will outweigh any additional market share those alternative proteins may gain in the near future.

To ensure producers and industry actors can capitalise on these opportunities, it will be important for Australian agriculture to present a united front in the aim of producing sufficient protein for the growing population.

Segregation and competition between traditional and alternative proteins providers could do more harm than good for all markets. Enabling traditional and alternative protein producers to work in collaboration (such as using the by-product of insect farmers as feed for chicken, pork and fish) could also provide a mutual sustainability benefit for the industry.

This report found that a business-as-usual estimation of the additional opportunity for the protein market in 2030 is estimated at A$19.9 billion, of which A$3.1 billion is for alternative protein categories.

The production of alternative protein offers opportunity for Australian agriculture, provided that:

- The industry is mindful of the limited natural capital (land, soils, water, marine environments) which can be used for protein production in a resource constrained future, and makes informed decisions on the most efficient and sustainable use of this capital,
- Australian agriculture (including fisheries) presents a united front in the aim of producing sufficient protein for the growing population, and
- The industry monitors the marketing language used by some alternative protein companies to ensure accurate representations of both plant- and animal-sourced proteins are presented to consumers.

Overall, the report concluded that "The emerging market for alternative proteins should be seen not as a threat to existing production systems but as a means of diversifying choices for producers, processors and consumers to fill the growing gap between global protein demand and supply."

[88] e.g., Australia's *Safefish* (Annual Report 2020 p15) reported on changes to China's National Food Safety Standards.

Today's strategy to leverage and regulate tomorrow's food labelling must be anchored in an Australian perspective of the global changes underway. The issues are complex, dynamic, and across global markets and legislatures. They reach from consumers back up supply chains and into production systems and technologies on farms, in fisheries, and in the information cloud.

Our decision makers and investors need an in-depth view of the impacts and emerging issues, a task that is beyond the scope of this paper. In order to comment on our capacity for efficient food labelling, we need to understand the bigger trends driving global and Australian meat and seafood.

2. Red Meat Industry

Australia has a large and expanding world competitive red meat (cattle and sheep[89]) and livestock industry (MLA, 2021). In 2018-19 the industry's integrated supply chain (livestock producer-processor-market-consumer) turnover totalled $72.5 billion and employed 434,000 people. Red meat sales in that year were 89% higher than 2013–14 levels, driven by increasing demand for high quality protein in global markets.

Recent US research (A metabolomics comparison of plant-based meat and grass-fed meat indicates large nutritional differences despite comparable Nutritional Facts panels , 2021) published by Duke University, finds:

- Metabolite abundance between the plant-based meat alternative and grass-fed ground beef differed by 90%,
- Several metabolites were found either exclusively (22 metabolites) or in greater quantities in beef (51 metabolites),
- Several other metabolites were found exclusively (31 metabolites) or in greater quantities (67 metabolites) in the plant-based meat alternative,
- Large differences in metabolites within various nutrient classes (e.g., amino acids, dipeptides, vitamins, phenols, tocopherols, and fatty acids) with physiological, anti-inflammatory, and/or immunomodulatory roles indicate that these products should not be viewed as truly nutritionally interchangeable but could be viewed as complementary in terms of provided nutrients.
- The new information this study provides is important for making informed decisions by consumers and health professionals. It cannot be determined from this study's data if either source is healthier to consume.

The research concludes this new information is important for making informed decisions by consumers, and to inform dietary advice by health professionals.

MLA notes (MLA, 2021) that consumers need to understand that plant-based foods are not nutritional substitutes and are certainly not replacements for red meat as part of a balanced diet. Branding plant-based products differently to that of meat is consistent with the fundamental objective of food labelling to inform healthier choices in line with Australian Dietary Guidelines. Current branding of plant-based meat products focuses on their functional role as an alternative protein choice – it does not inform consumers of the nutritional differences between animal and plant foods, important for following a nutritionally adequate diet in line with Australian Dietary Guidelines.

According to the Red Meat Advisory Council (RMAC), the Australian red meat and livestock industry position for minimum regulated standards is to prohibit:

- The use of plant protein descriptors that contain any reference to animal flesh or products made predominately from animal flesh, including but not limited to "meat", "chicken", "beef", "goat" and "lamb"
- The use of livestock images on plant protein packaging or marketing materials.

[89] https://www.mla.com.au/prices-markets/Trends-analysis/fast-facts/

In seeking opportunities for regulatory protection of meat category branding, RMAC cites the use of Standards to enact labelling reform, including:

- Amending the Food Standards Code to specify the context in which referenced descriptors and images can be used under the *Food Standards Australia and New Zealand Act 1991*,
- Establishing a new Australian Consumer Law information standard under section 134 of Schedule 2 to the *Competition and Consumer Act 2010*, and
- Testing existing FSANZ standards through a favourable state or territory jurisdiction enforcement agency (i.e., argument that 2015 changes related to the Sanitarium Amendment were specific to dairy).

3. Market Initiatives

Products

Australian supermarkets offer a smaller but increasing range of meat-free products. Coles offers a range of plant-based meat-free under the inhouse-brand Herb & Sons[90]. Woolworths range includes American style streaky "Meat Free Bacon", made in Taiwan from soybeans[91].

Meat and Livestock Australia's marketing team notes[92] that plant-based meat substitutes have been around for many years, but lab-grown meat presents consumers with a different proposition – it is not just a substitute, but an artificial replication.

Lab-grown meat will likely win consumer favour from two global mega trends:

- Health and wellbeing: Promising to provide good nutrients without the greenhouse gases, saturated fats / cholesterol risks, and other 'nasties'. Ingredients can be manipulated at the lab bench to improve human health aspects.
- Ethics and sustainability: Consumers want ethical treatment of workers, humane treatment of animals and sustainable stewardship of natural resources.

Shelf Placement

Concerns have also been raised (FRSC, 2019, p. 10) about dairy and meat alternatives occupying the same shelf space in supermarkets as dairy milk and meat.

Plant-based milk alternatives are often placed next to dairy milk, and vegetarian sausages may be found in the barbeque meats section. This has led to claims that consumers may purchase these products unintentionally, although there is no available evidence to confirm this. Shelf placement in supermarkets is outside the scope of the food regulation system.

Australian Consumer Attitudes to PBMs

Independent consumer market research (Pollinate, 2021) was commissioned by the red meat industry and undertaken across Australia in July 2021 to "understand community understanding and attitudes to plant-based meat and their product packaging."

[90] www.thegrocerygeek.com.au/portfolio item/9801/#:~:text= Coles'% 20Herb %20&%20Sons%20plant%20based%20meat-free%20product, full%20of%20flavour%20just%20like%20your%20favourite%20meats.
[91] www.woolworths.com.au/shop/productdetails/90398/made-with-plants-meat-free-bacon
[92] www.mla.com.au/prices-markets/market-news/2018/is-lab-grown-meat-the-real-thing/

A multi-pronged approach was used to investigate (survey and field work) potential consumer confusion in differentiating between plant based meat and animal meat. Participants were shown images of six products (see Figure 9) currently available in Australian supermarkets – five plant-based meats and one animal meat control product (beef mince).

Figure 9. Consumer Research Product Images 2021

The research found that 88% of Australians have "heard of the term "plant-based meat" before today". The key findings (RMAC, 2021 July) from the research were:

1. <u>Product packaging is a key driver of consumer confusion.</u>
    - At the start of the survey, respondents underwent a packaging association task to directly test whether product packaging contributes to consumer confusion around differentiating animal vs plant-based meat. Net misattribution for each plant-based meat product ranged from 13% to 33% (average misattribution per product being 25%). Misattribution for all plant-based meats tested was higher than the animal meat control (beef mince),
    - Most (61%) mistook at least one plant-based meat product as containing animal meat,
    - Those who mistook at least one plant-based meat as containing animal meat were more likely to be:
        - Elderly (aged 65+),
        - Speak a language other than English with family / friends, and
        - Have a household income of $40k or below.
    - Half of Australians (51%) find packaging for the products tested in the survey to be confusing,
    - Reflecting on their own personal experiences, 1 in 3 consumers (32%) think they've mistaken plant-based meat for animal meat due to its packaging in the past, and almost 2 in 3 (62%) believe that other people may have also made the same mistake.

2. Specific packaging features that cause this confusion mainly revolve around the use of animal imagery and minimising 'plant-based' references in favour of meat descriptors.
    - Among the 51% of Australians who find the packaging tested in-survey at least somewhat confusing, 1 in 3 (36%) mention animal imagery as a driver of confusion. A combination of small or hard to read font for 'plant-based' references (19%) and the use of meat descriptors (14%) also contribute to consumer confusion.
    - Almost 2 in 3 (64%) say they expect plant-based meat to contain animal meat if its packaging does at least one of the following:
        - Describes the product as 'meat',
        - Uses images / icons of animals (e.g., cows, chickens, and pigs),
        - Uses words like 'beef', 'chicken', and 'lamb'.
3. There is strong community support for clearer packaging for plant-based meat.
    - Most consumers think that plant-based meat packaging should not be allowed to…
        - Describe the product as 'meat ' (73%),
        - Use images / icons of animals (e.g. cows, chickens, and pigs) (70%),
        - Use words like 'beef', 'chicken', and 'lamb' (63%).
    - Just over half of Australians (56%) feel plant-based meat packaging should not be allowed to use any of the three features above.

4. Research Initiatives

Australian consumer demand for dairy and meat alternative foods is expanding. Consumers choose dairy or meat alternatives for a variety of reasons, including, allergies, religious belief, concerns about sustainability and animal welfare, or simply due to taste.

But plant-based food substitutes[93] for dairy and meat are often, not always, fortified with calcium or protein to achieve parity with dairy milk. Other dairy milk nutrients may also be absent, and sugar added. The Australian Dietary Guidelines allow for alternatives to dairy, but they note that plant-based milk alternatives are not naturally high in nutrients found in cows' milk and recommend choosing alternatives that have been fortified[94].

In **2015** two joint Australian - French studies (Bonny, Gardner, Pethick, & Hocquette, 2015) and (Hocquette, et al., 2015) reviewed cellular meats. The authors took a long-term view, envisioning a new cultured meat product category supported by regulators. Over the longer term the genetic modified organisms or cultured meat may become sufficiently developed for these products to enter the market as a labelled food category without the competition complexity with meat products. In parallel, they suggest that conventional meat producers can better assimilate agroecology concepts and biotechnologies (cloning and genetic modification) to sustainably adapt to the changing environment and respond to the increasing competition from artificial meats. In that future, food labelling laws would confirm a new cell-based product category of meat.

Plant-based milk alternatives in Australia's four major supermarkets grew by 58% between 2016 and **2018** (Grains & Legumes Nutrition Council, 2018). Nielsen scan data saw growth in dairy-free milk of more than 150% in the five years to 2016, with the trend expected to continue (FRSC, 2019). The FRSC notes that similar growth trends are apparent in New Zealand for milk substitutes.

Meat alternatives have also experienced strong growth in recent years[95], with claims that:

- In the USA, there has been a 600% increase in people identifying as vegans in the last three years, and
- In Australia, from 2014 to 2016, the number of food products launched carrying a vegan claim rose 92%.

[93] Images of plant-based product have been sourced from (FRSC, 2019)
[94] National Health and Medical Research Council 2013
[95] www.foodrevolution.org/blog/vegan-statistics-global/

Meat-free food categories in particular, are experiencing strong growth as consumers worry about the sustainability of current meat production systems.

A **2019** Australian study (Warner, 2019) considered the consumer market acceptance of IVM (*in vitro* meat) including regulation and labelling. *In vitro* cell culture is usually conducted in an aseptic lab environment, due to risk of contamination which can result in bacterial contamination – but secure scaled-up production[96] design without use of antibiotics is yet to be realised. A key concern of regulators will be food safety based on audit trails in each step of the production chain as part of a food company HACCP plan.

A range of companies are currently engaged in clean meat developments[97] - all products will be required to go through strict regulatory and food labelling assessments before landing on supermarket shelves. The study notes that regulations in place in 2014 in the EU and USA were inadequate to deal with cell-based meat production without significant development. New regulation is now emerging in both markets but in differing directions, including via protracted legal action over use of the term "meat". Today, market entry is fast approaching, but global regulatory and food labelling pathways are still very unclear for this product category.

The paper concluded that it will likely require an extended period for cellular meat to be consistently available in high-end restaurants and even longer to be available for the mass market, for the bulk of consumers to accept the technology. The progress in plant-based meat analogues is already well achieved, with products such as the *Impossible™ Burger* and other products already available. But these developments may make the development of some cellular meat products obsolete, as plant-based options push out new IVM options. But the challenges remain of mimicking not only the nutritional attributes, flavour, shape and structure of real meat, but also the changes required in regulation and labelling.

Other plant-based alternative foods exist for eggs (*Just Egg* based on mung bean protein isolate), and tuna (a fishless food made from textured soy flour and wheat extract) (FRSC, 2019, p. 5).

Qld Red Claw Crayfish

An Australian aquaculture researcher at the University of the Sunshine Coast[98] has secured a seed grant from US-based research institute New Harvest to develop cell-based crayfish meat, based on the Qld Red claw crayfish *(Cherax quadricaninatus)*. There are currently ten cellular agriculture companies around the world focusing on developing cell-based seafood.

WA Start-up

The WA Government has also funded three PhD industry internship programs to undertake cultivated meat research.

The Industry and PhD Research Engagement Program will take place at Cass Materials, a cellular agriculture start-up based in Perth creating an affordable and edible cellulose-based scaffold for cultivated meat production.

Melbourne University

Melbourne University has established the Future Food Hallmark Research Initiative[99], research activities for which will include cell-based meat development

B. Regulation and The Code

The Australian Food Code (1.2.4 – Ingredient Labelling of Foods) states:

All ingredients in the food must be declared in the statement of ingredients for the food using one of the following:

- *The common name of the ingredient,*

[96] See www.future-meat.com
[97] See www.cleanmeats.com.au
[98] See www.proteinreport.org/new-harvest-funds-australian-research-cell-based-crayfish-meat?page=1%2C%2C0
[99] www.research.unimelb.edu.au/research-at-melbourne/multidisciplinary-research/hallmark-research-initiatives/future-food#research

- *A name that describes the true nature of the ingredient*
- *A generic name for the ingredient*

The names of ingredients should be accurate and sufficiently detailed to ensure that they are not false, misleading or deceptive, or likely to mislead or deceive.

1. FSANZ[100]

FSANZ claims the Food Regulation System in Australia and New Zealand is equipped to deal with new types of foods, including foods produced by new technologies.

There are currently no permissions or requirements in the Food Standards Code for cell-based meats. While FSANZ has been aware of cell-based meats for some time, the agency has not yet been approached by a food business seeking regulatory approval.

FSANZ's view is that cell-based meats would be captured within existing standards in The Code and require pre-market approval[101]. Depending on the composition of cell-based meats, these standards may include those for:

- Novel Foods - foods without a history of traditional human consumption in Australia and New Zealand,
- Processing aids – substances used in production but serve no technological function in the final food,
- Food additives – substances that serve a technological function in the final food for sale,
- Foods produced using gene technology,
- Vitamins and minerals,
- Labelling that indicates the true nature of the food,
- Definition of cell-based meat,
- Food Safety requirements.

The FSANZ website confirms the initial discussion in this paper regarding other global activity, specifically:

- USDA and USFDA are establishing a framework for regulating cell-based meat and poultry,
- The EU has decided to assess cell-based meat under the EU Novel Food Regulations,
- Israel, China, Japan, The Netherlands, and Singapore appear to be moving quickly to ensure a clear path to market for this method of meat production.

FSANZ notes that, while Novel Food cellular meat development is currently in the early stages, the aim of the regulatory framework is to provide a transparent path to market for cell-based meat alternatives.

C. Seafood Production and Flows

1. Global Production and Trade

Global seafood consumption is growing faster than all other animal protein foods. Between 1961 to 2017 global food fish consumption grew at 3.1% per annum, a rate almost twice that of annual world population growth (1.6%), and outpacing all other animal protein foods (meat, dairy, milk, etc.) at 2.1% (FAO, 2020, p. 3).

As capture fisheries are at their maximum sustainable harvests, global growth in seafood demand is being met by increased aquaculture production. In 2018 Aquaculture (at 52%) passed capture fisheries (FAO, 2020, p. 72) as the largest seafood contributor to global seafood consumption. There has been no growth for capture fisheries for decades, nor will there be in the future due to sustainability issues.

Seven species groups dominate (62%) global aquaculture supply: Carp (30%), Tilapia (7%), Oysters (6%), Prawns (6%), Catfish/Pangasius (5%), Japanese Carpet Shell (5%), and Atlantic salmon 3%).

[100] This discussion includes extracts from the FSANZ website www.foodstandards.gov.au
[101] www.foodstandards.gov.au/consumer /generalissues/Pages/Cell-based-meat.aspx

In 2018, 38% of all fish captured or farmed were traded internationally (FAO, 2020, p. 73). Cross-border trade in seafood is dominated by aquaculture species. The largest seafood importers by value share are primarily developed economies with advanced seafood labelling laws: USA (14%), Japan (9%), China (9%), Spain (5%), Italy (4%), Germany (4%), South Korea (4%), and France.

Aquaculture's growing dominance and limited seafood species will concentrate international seafood trade under leading brands. Aquaculture investors will develop their enterprises at increasing production scale from a limited genetic base that is valued and preferred by consumers and commercially viable.

The shift from capture seafood to farmed seafood will increase supply chain and market control for both investors and regulators. Product diversity will come from genetics and market differentiation, as has been the long-term trend for terrestrial meat protein systems (beef, pork, poultry). Australia as a significant trader of seafood relative to its small production, must be engaged in this process for its own economic benefit.

Trade litigation in the US has been stimulated by escalating shrimp and salmon imports[102]. In general, these anti-dumping cases are ineffective but related fraud and product label misrepresentation matters go unresolved.

The literature reviewed in this paper suggests there will come a point, suggested to be before 2040 (ATKearney, 2019) when manufactured seafood based on cellular production will be more attractive to seafood consumers on a triple bottom line basis, than aquaculture[103]. At that point seafood consumers will likely have product choices from four global production systems:

1. Wild catch – premium seafood for select species in high-end consumer markets,
2. Aquaculture – premium and mainstream seafood in retail and food service,
3. Plant-based – vegetarian and vegan meat replacement products consumer markets
4. Cellular – commodity seafood.

The report concludes (ATKearney, 2019, p. 10) that product development for existing vegan products will transform plant-based meats into a whole new food category that, together with cellular meat, will be attractive to significant consumer market segments, disrupting existing capture, farmed meat and seafood producers. The disruption and increased market competition will greatly impact the content and intent of seafood labels, for both the mandated regulatory and voluntary components.

2. Australian Consumption and Trade

Most (~68%) of Australia's fisheries harvest is used for domestic human consumption, after deducting:

- Industrial products (~16%, including sardines, pearls, pet food, fish meal, fish oil),
- Exports (~17% comprising high value species such as lobster and abalone).

Australia imports 66% of seafood (see Figure 10) to fill the large gap in domestic supply, especially packaged seafood (Ridge Partners, 2020, p. 33). As a result, Australia's seafood trade profile differs from that of other developed countries - we export high value fresh products and import low value frozen and canned seafood. Any domestic market growth is met by imported seafood, even though there are large underutilised TACCs in sustainable Australian Fisheries (Ridge Partners, 2020, p. 11). Seafood imports are expanding (ABARES).

In 2017 Australia's seafood consumption (by value) was met by supply from six sources (FAO, 2020, p. 79). Asia dominated (67%) with two thirds of imports, from Thailand, China, Vietnam, and New Zealand (ABARES, 2020, p. 32). This supply was dominated by finfish (canned tuna), frozen prawns. Other supply came from domestic production (13%), followed by Europe (11%), North America (4%), South America (3%) and Africa (3%).

[102] www.thefishsite.com/articles/trends-in-the-international-trade-of-seafood-products-1

[103] Insect-based meat replacement food products are a further option. Insect based products offer a superior conversion rate for energy and protein compared to conventional meat. However, the negative consumer perceptions of these food products mean they will likely be used primarily as feeds for livestock or ingredients in some food processing systems.

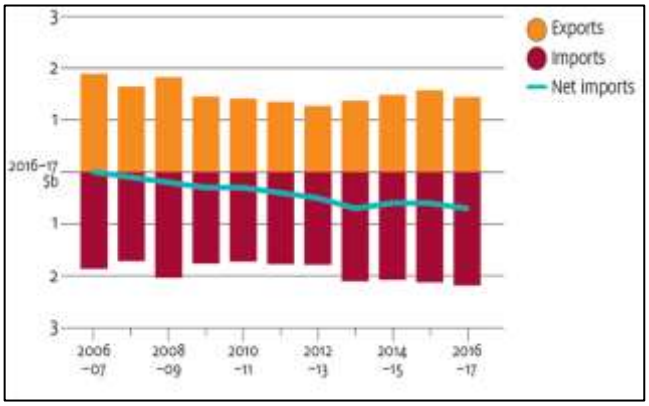


Figure 10. Domestic Consumption Fuelled by Imports

Seafood is consumed less than poultry, pork and beef, but more than mutton and lamb. Seafood has become relatively expensive compared with poultry but less expensive relative to beef and veal (ABARES, 2020, p. 35).

Apparent per capita seafood consumption has increased over the last 18 years by 9% from 12.7 kg in 2000 to 13.8 kg in 2018. Population has grown 31% over the period, but apparent seafood consumption per capita has been comparatively flat.

Table 11. Australia: Seafood Consumption 2000-18

Year	Population million	Apparent Consumption kg per head	% of Consumption from imports
1999-2000	18.82	12.7 kg	57.9%
2009-2010	22.11	14.6 kg	64.3%
2017-18	24.91	13.8 kg	64.9%
Growth 2000-18	31%	9%	

The preceding discussion summarises the scale and scope of Australia's domestic seafood production and the traded components of these flows. It is clear that Australian:

- Producers are directly and significantly exposed to seafood labelling changes in our large overseas export markets, especially in Asia, the EU and USA
- Consumers are directly and significantly exposed to seafood labelling changes from imported seafood.

9. WASTE CREATED BY FOOD LABELS

A. Label Date Confusion

Date marks give a guide[104] to how long food can be kept (best before date) before it begins to deteriorate or may become unsafe to eat (use by date).

However, consumers do not widely understand the difference between these two dates. The food supplier is responsible for placing a use by or best before date on food.

Under Australian law these two separate date markings may be required on food labels:

1. Best Before Date

Best before date is a food **quality indicator**.

Most foods have a best before date. Foods can be safely consumed for a while after the best before date, but they may have lost some quality.

Foods that have a shelf life of two years or longer, e.g., some canned foods, do not need to be labelled with a best before date, as it is difficult to give the consumer an accurate guide as to how long these foods will keep. They may retain their quality for many years and will be consumed before they spoil.

Foods that have a best before date can legally be sold after that date provided the food is fit for human consumption.

2. Use by Date

Use by date is a food consumption **safety indicator**.

Foods that must be eaten before a certain date for health or safety reasons should be marked with a use by date. Foods should not be eaten after the use by date and cannot legally be sold after this date because they may pose a health or safety risk.

The only food that can have a different date mark on it is bread, which can be labelled with a baked-on date if shelf life is less than a week.

If specific storage conditions are required for a product to keep until its best before or use by date, suppliers must include this information on the label, e.g., 'This seafood should be kept refrigerated'.

B. Do food labels create waste?

1. Australia

Australian research finds that food waste at the consumer level is often caused by poor purchasing habits, confusion over labels, risk perception (especially by young consumers), excess buying, and poor storage (Langley, et al., 2020).

Consumer insights can inform supply chain members as to how date labelling could be standardised so that communication about shelf life is clear along supply chains and to consumers.

The evidence so far suggests that vague or inaccurate expiry date labelling does increase food waste, at significant economic cost. But it is not easy to motivate better labelling as the costs are incurred by producer/manufacturers while the benefits of better labelling are lost and accrue to the broader market and economy.

[104] www.foodstandards.govt.nz/consumer/labelling/ dates/Pages/default.aspx

2. FAO

Looking specifically at the economic gains of food loss and waste reduction, the FAO found the solutions generating greatest economic value per tonne are standardised date labelling, consumer education campaigns and packaging adjustments, all of which are measures aimed at prevention, rather than waste diversion (FAO, 2019, p. 59).

Such approaches require relatively low investments, compared to high investments required for waste diversion along supply chains.

3. USA

A **2016** US study (ReFED, 2016) recommended improving informative labels and messages concerning freshness, safety, and expiry dates. The study noted that standardised date labels (e.g., "Sell by", "Best by", etc.) generally do not reflect food safety, but indicate when food will taste best.

Yet consumer confusion around date labels is a huge driver of waste, causing an estimated 20% of household food waste.

The study concluded that better food labelling would prevent 398,000 tonnes of food waste annually, with a positive impact on national economic value of US $1.812 Bn annually.

In **2019**, US researchers (Neff, et al., 2019) found confusion among consumer attitudes and behaviours related to food date labels leads to unnecessary discards of food as waste.

This study calls attention to the issue that much food may be discarded unnecessarily based on food safety concerns, though relatively few foods are likely to be unsafe before becoming unpalatable.

The USDA estimates 31% of food may be wasted at the retail and consumer levels. Clear and consistent date label information is designed to help consumers understand when they should and should not worry. Notably, consumers between 18-34 years are more likely to rely on label dates to discard food.

4. Europe

UK

In **2020** the Waste and Resources Action Plan[105] (a **UK** charity) cited a need to improve labelling, including clearer information to indicate ideal storage conditions for food products (Langley, et al., 2020, p. 29). Label recommendations include:

- Only stating a 'use by' date where there is a food safety reason to do so (and use 'best before' otherwise),
- Only having one date label,
- Only stating 'use within x days' where there is a food safety reason to do so,
- Providing clear advice on best storage practices for food, using effective symbols and graphics, and
- Applying consistent chilled storage advice for products that need it.

A further spin-off benefit from better labelling is that improving "best before" and "use by" labelling may enable retailers to sell food that would otherwise be wasted.

Spain

Supermarket pricing sensitivity trials in **2019** in **Spain** using machine-learning, helped retailers cut waste and increase their revenues through dynamic pricing. Where electronic shelf labels automatically discount the prices of food products as their expiration date comes near, the trial supermarket improved inventory management (revenue increase of 6%) and reduced lost product volumes (33%).

[105] www.wrap.org.uk

Two-thirds of Spanish consumers faced with choosing between a discounted price on a product with a shorter expiration date, and the same product with a longer expiration date sold at its full price chose the discounted price (FAO, 2019, p. 119).

C. Energy Efficiency

1. Human Food

Australia's five main food categories (meat and seafood, bakery, packaged and processed foods, dairy and eggs, and fresh fruit and vegetables) each represent different levels of energy input and greenhouse gas emissions, which can be identified using a Life Cycle Assessment (LCA).

The Fight Food Waste CRC report (Langley, et al., 2020, p. 35) suggests meat and fish have relatively high retail values and edible waste contributions, and therefore may be good environmental and economic candidates for revised labelling. However, the data shows that fish (seafood) are relatively low waste emitters compared to broadacre livestock (meat and dairy), a favourable consumer purchase variable that modern revised food labels may seek to differentiate.

The FFWCRC report also notes the need and opportunity for technology-enhanced food labelling. Two options have been identified:

- "Smart Labels" that relay detailed information about the product in real time (i.e., temperature, freshness, time of production, origin). Such labels have the potential to be accessible by supply chain stakeholders, retailers, and consumers alike, and be integrated in block chain contracts.
- Time Temperature Indicators (TTI) on labels that display the quality of the food product (via a colour patch) based on the time packaged and temperatures the packaging has been exposed to.

DEFINITIONS

It is important to clarify the fundamental definitions and procedures related to food labelling. It is equally important to clarify what we do not define in the seafood lexicon.

1. Food

FSANZ (Food Standards Australia New Zealand Act 1991) - includes:

- Any substance or thing of a kind used, capable of being used, or represented as being for use, for human consumption (whether it is live, raw, prepared or partly prepared); and
- Any substance or thing of a kind used, capable of being used, or represented as being for use, as an ingredient or additive in a substance or thing referred to in paragraph (a); and
- Any substance used in preparing a substance or thing referred to in paragraph (a); and
- Chewing gum or an ingredient or additive in chewing gum, or any substance used in preparing chewing gum; and
- Any substance or thing declared to be a food under a declaration in force under section. It does not matter whether the substance, thing or chewing gum is in a condition fit for human consumption. Food does not include a therapeutic good within the meaning of the *Therapeutic Goods Act 1989*. Food may include live animals and plants.

US Food and Drug Administration - Food means a raw, cooked, or processed edible substance, ice, beverage, or ingredient used or intended for use or for sale in whole or in part for human consumption, or chewing gum.

2. Meat

FSANZ – Meat means the whole or part of the carcass of any of the following animals, if slaughtered other than in a wild state (buffalo, camel, cattle, deer, goat, hare, pig, poultry, rabbit or sheep) and any other animal permitted for human consumption under a law of the State **but does not include: (i) fish**; or (ii) avian eggs; or (iii) foetuses.

Meat Flesh means meat that consists of skeletal muscle and any attached (a) animal rind, or (b) fat, or (c) connective tissue, or (d) nerve, or (e) blood, or (f) blood vessels, or (g) skin in the case of poultry.

3. Fish

FSANZ Standards Code 2.2.3 - Fish means a cold-blooded aquatic vertebrate or aquatic invertebrate including shellfish, but not including amphibians or reptiles. For the purpose of the standard, fish is defined as," any aquatic vertebrate or invertebrate (excluding mammals and amphibians) in any form, including whole fish, or part thereof, in raw or cooked form, or as a fish product".

AS 5300-2019 Fish Names Standard – Fish means any aquatic vertebrate or invertebrate (excluding mammals and amphibians) in any form, including whole fish, or part thereof, in raw or cooked form, or as a fish product

US Food and Drug Administration - Fish means fresh or saltwater finfish, crustaceans and other forms of aquatic life (including alligator, frog, aquatic turtle, jellyfish, sea cucumber, and sea urchin and the roe of such animals) other than birds or mammals, and all molluscs, if such animal life is intended for human consumption. Fish includes an edible human food product derived in whole or in part from fish, including fish that have been processed in any manner.

4. Seafood

FSANZ Standard 4.2.1 and *FRDC Fish Names Committee* – all aquatic vertebrates or aquatic invertebrates intended for human consumption, but excluding amphibians, mammals, reptiles and aquatic plants in any form, including whole fish, or part thereof, in raw or cooked form, or as a fish product.

Safe Seafood Australia - Seafood means all aquatic vertebrates and aquatic invertebrates intended for human consumption, but excluding amphibians, mammals, reptiles, and aquatic plants.

5. Aquatic Plant

AS 5301-2020 Aquatic Plant Names Standard - For the purpose of this Standard, aquatic plants are defined as vascular plants, aquatic protists, and photosynthetic prokaryotes that are used commercially as a source of food, therapeutics, derivatives and additives, that naturally require saltwater or freshwater habitats for growth.

6. Cell-based Meat

FSANZ – Cell-based meat is produced using animal cell culture technology, where meat is produced from animal cells using a combination of biotechnology, tissue engineering, molecular biology and synthetic processes. Cell culture technology does not reproduce the animal itself, but produces a product that is intended to resemble traditional meat from an animal, such as steak, minced meat, etc. Technology has advanced to a stage where this is possible, so companies are increasingly exploring cell-based meat options as an alternative to farmed meat.

7. Milk

FSANZ – Milk means the mammary secretion of milking animals, obtained from one or more milkings for consumption as liquid milk or for further processing, but excluding colostrums; or such a product with phytosterols, phytostanols and their esters added.

8. Novel Food

European Commission (EU) 2015/2283[106] - Novel Food is defined as food that had not been consumed to a significant degree by humans in the EU before 15 May 1997, when the first Regulation on Novel Food came into force. Novel Food can be newly developed, innovative food, food produced using new technologies and production processes, as well as food which is or has been traditionally eaten outside of the EU. A Novel Food must be:

- Safe for consumers,
- Properly labelled, so as not to mislead consumers,
- If novel food is intended to replace another food, it must not differ in a way that the consumption of the Novel Food would be nutritionally disadvantageous for the consumer.

Pre-market authorisation of Novel Foods on the basis of an evaluation of principles is necessary.

Health Canada - A Novel Food is:

- A substance, including a microorganism (a living thing so small you need a microscope to see it), that does not yet have a history of safe use as a food,
- A food that has been manufactured, prepared, preserved or packaged by a process that:
    - Has not been previously used for that food, and
    - Causes the food to undergo a major change.
- A food that comes from a plant, animal or microorganism that has been genetically modified so that the plant, animal or microorganism:
    - Shows characteristics that it didn't before,
    - Doesn't show characteristics that it did before,
    - Has 1 or more characteristic that no longer falls within the expected range

FSANZ Standard 1.5.1 Novel Foods - Novel Foods are non-traditional foods that require assessment by FSANZ in order to establish their public health and safety considerations before they are added to the food supply. Such foods have regard to:

- The potential for adverse effects in humans; or

[106] (European Commission, 2021)

- The composition or structure of the food; or
- The process by which the food has been prepared; or
- The source from which it is derived; or
- Patterns and levels of consumption of the food; or
- Any other relevant matters.

Categories of Novel Foods may include, but are not limited to, the following:

- Plants or animals and their components,
- Plant or animal extracts,
- Herbs, including extracts,
- Dietary macro-components,
- Single chemical entities,
- Microorganisms, including probiotics, and
- Foods produced from new sources, or by a process not previously applied to food.

9. Label

EU Regulation 1169/2011, The Food Information to Consumer Regulation (FIC) – Label means any tag, brand, mark, pictorial or other descriptive matter, written, printed, stencilled, marked, embossed or impressed on, or attached to the packaging or container of food.

United Nations / FAO Codex Standard 1-1985 – labelling includes any written, printed or graphic matter that is present on the label, accompanies the food, or is displayed near the food, including that for the purpose of promoting its sale or disposal.

FSANZ Australian Food Standards Code - in relation to a food being sold, Label means any tag, brand, mark or statement in writing or any representation or design or descriptive matter that:

a) Is attached to the food or is a part of or attached to its packaging; or
b) Accompanies and is provided to the purchaser with the food; or
c) Is displayed in connection with the food when it is sold[107].

In relation to food being sold, labelling means all labels for the food together. A requirement for the labelling of a food for sale to include specified content is a requirement for at least one of the labels to have that content.

- Nutrition information panel,
- Percentage labelling,
- Food identification,
- Information for people with food allergies or intolerances,
- Date marking,
- Ingredients list,
- Labels must tell the truth,
- Food additives,
- Directions for use and storage,
- Legibility requirements,
- Country of origin,
- Nutrition and health claims.

10. Plant-based alternative

FSANZ – Plant-based alternative means a product derived from plants (including nuts, seeds, legumes, algae, fungi), which can be used as a substitute to dairy or meat products. They are often designed to mimic the taste, look, texture and smell of an animal or dairy product.

[107] Image sourced from FSANZ website.

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APPENDICES

Appendix 1. Labelling Standards in The Code

Chapter 1. Standards that apply to all Foods

PART 1.1 Preliminary
PART 1.2 Labelling and other information requirements
- Standard 1.2.1 Requirements to have labels or otherwise provide information
- Standard 1.2.2 Information requirements – food identification
- Standard 1.2.3 Information requirements – warning statements, advisory statements and declarations
- Standard 1.2.4 Information requirements – statement of ingredients
- Standard 1.2.5 Information requirements – date marking of food for sale
- Standard 1.2.6 Information requirements – directions for use and storage
- Standard 1.2.7 Nutrition, health and related claims
- Standard 1.2.8 Nutrition information requirements
- Standard 1.2.10 Information requirements – characterising ingredients and components of food

PART 1.5 Foods requiring pre-market clearance
- Standard 1.5.1 Novel foods
- Standard 1.5.2 Food produced using gene technology
- Standard 1.5.3 Irradiation of food

PART 1.3 Substances added to or present in food
- Standard 1.3.3 Processing aids
- Standard 1.3.2 Vitamins and minerals
- Standard 1.3.1 Food additives

PART 1.6 Microbiological limits and processing requirements
- Standard 1.6.1 Microbiological limits in food
- Standard 1.6.2 Processing requirements for meat [applies in Australia only]

PART 1.4 Contaminants and residues
- Standard 1.4.1 Contaminants and natural toxicants
- Standard 1.4.2 Agvet chemicals [applies in Australia only]
- Standard 1.4.4 Prohibited and restricted plants and fungi

Chapter 2. Food Standards

PART 2.2 Meat, eggs and fish
Standard 2.2.3 Fish and fish products
This instrument is a standard under the Food Standards Australia New Zealand Act 1991 (Cth). The standards together make up the Australia New Zealand Food Standards Code. See also section 1.1.1—3.
Note 2 The provisions of the Code that apply in New Zealand are incorporated in, or adopted under, the Food Act 2014 (NZ). See also section 1.1.1—3.
Note 3 This Code does not define specific names for fish. An Australian Fish Names Standard (AS SSA 5300) has been published which provides guidance on standard fish names to be used in Australia.
1. Hard copies of the Australian Fish Names Standard (AS 5300) are available from FRDC's Online Shop at http://www.seafood.net.au/shop.
2. A searchable database of Australian Standard Fish Names is available at http://www.fishnames.com.au.
3. New Zealand common, Māori, and scientific names for fish species
2.2.3—1 Name
This Standard is Australia New Zealand Food Standards Code – Standard 2.2.3 – Fish and fish products.
Note Commencement: This Standard commences on 1 March 2016, being the date specified as the commencement date in notices in the Gazette and the New Zealand Gazette under section 92 of the Food Standards Australia New Zealand Act 1991 (Cth). See also section 93 of that Act.
2.2.3—2 Definitions
Note In this Code (see section 1.1.2—3): fish means a cold-blooded aquatic vertebrate or aquatic invertebrate including shellfish, but not including amphibians or reptiles.
2.2.3—3 Labelling of formed or joined fish
For the labelling provisions, for a food that consists of raw fish that has been formed or joined in the semblance of a cut or fillet of fish using a binding system without the application of heat, whether coated or not, the following information is required:
(a) a declaration that the food is either formed or joined;

(b) in conjunction with that declaration, cooking instructions that would result in microbiological safety of the food being achieved.

Note 1 The labelling provisions are set out in Standard 1.2.1.

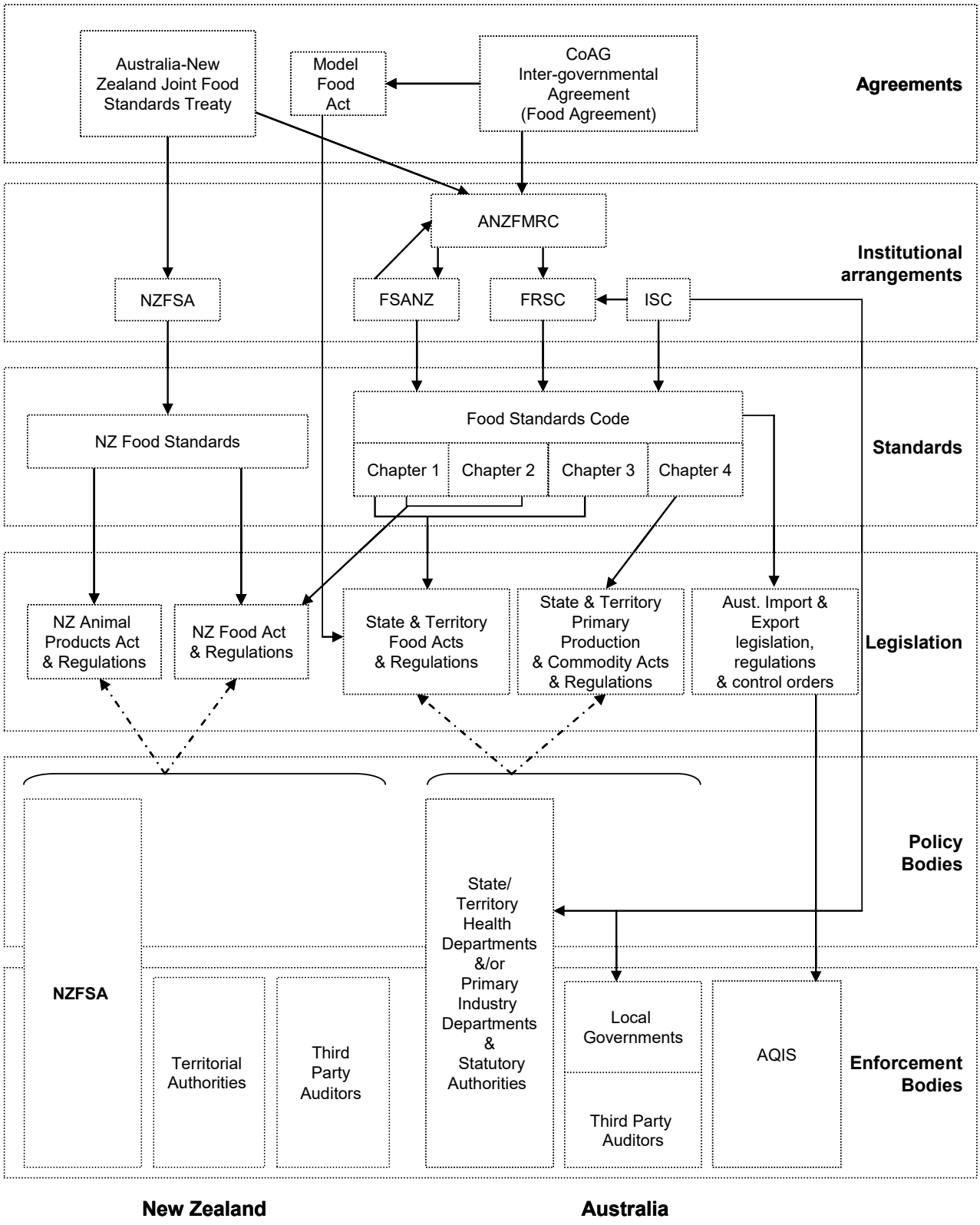
Note 2 Section 1.4.1—3 and section S19—6 prescribe the maximum level of histamine permitted in fish and fish products.

Chapter 3. Food Safety - Not relevant to this paper

Chapter 4. Primary Production Standards

Standard 4.2.1 Primary production and processing standard for seafood.
This standard is not relevant to seafood labelling.

Appendix 2. Australia-New Zealand Food Safety Regulatory System[108]



[108] Productivity Commission, Performance Benchmarking of Australian and New Zealand Business Regulation: Food Safety 2009.

Appendix 3. Model Food Provisions relevant to Food Labelling

In 1980 *The Model Food Act,* covering sale and food preparation offences, labelling and hygiene requirements, regulation and administration and enforcement, was agreed to by the Conference of Australian Health Ministers.

The 2000 *Food Regulation Agreement* became the basis of a national approach to food regulation and included Model Food Provisions Annex A and Annex B for State and Territory legislation. The Agreement states in Part IV - FOOD LEGISLATION AND ADOPTION OF FOOD STANDARDS:

State and Territory Food Acts

Clause 10. State and Territories Best Endeavours

> *The States and Territories will use their best endeavours to ensure that their respective Parliaments retain in force, legislation that complies with clause 13 and which gives effect to the provisions listed at Annex A and Annex B of this Agreement which provide for the effective and consistent administration and enforcement of the Food Standards Code (including the Food Safety Standards).*
>
> *'food legislation' means the laws regulating the packaging, labelling, sale, handling and distribution of food;*

The Model Food Provisions[109] (Annex A and Annex B) provide a legislative basis for a 'substantially equivalent' national uniform food safety regime. Each of the States and Territories used these annexes as the base to amend their respective food acts.

The following clauses drawn from Annex B relate directly to seafood labelling.

Part 2, Offences relating to food

Clause 7: False Description of Food

> *(1) A person must not cause food intended for sale to be falsely described if the person ought reasonably to know that a consumer of the food who relies on the description is likely to suffer physical harm. Maximum penalty: $75,000 in the case of an individual and $375,000 in the case of a corporation.*
>
> *Note. Examples of food that is falsely described are contained in section 18 [of Annex A].*
>
> *(2) A person must not sell food that the person ought reasonably to know is falsely described and is likely to cause physical harm to a consumer of the food who relies on the description. Maximum penalty: $75,000 in the case of an individual and $375,000 in the case of a corporation.*

Part 4, Inspection and seizure

Clause 11: Power of Seizure

> *An authorised officer may seize any food, or any vehicle, equipment, Package or labelling or advertising material, or any other thing at all, that the authorised officer believes on reasonable grounds is evidence that an Offence under this Act or the regulations has been or is being committed.*

Clause 14: Interfering with Seized Items

> *A person must not, without the permission of an authorised officer, detain, remove or tamper with any food, vehicle, equipment, package or labelling or advertising material or other thing that has been seized under this Act, unless it has been returned in accordance with Division 2 or an order disallowing the seizure has been made under that Division. Maximum penalty: $50,000 in the case of an individual and $250,000 in the case of a corporation.*

[109] www.foodregulation.gov.au/internet/fr/publishing.nsf/Content/key-system-documents

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