

Imported food risk statement
Marinara mix and *Salmonella* spp.

Commodity: Marinara mix. This is a composite product that contains a variety of different types of seafood, such as crustaceans, fish and molluscs and is not a ready-to-eat product. Marinara mix in ambient stable sealed packages is not covered by this risk statement.

Microorganism: *Salmonella* spp.

Recommendation and rationale
<p>Is <i>Salmonella</i> spp. in marinara mix a medium or high risk to public health:</p> <p><input type="checkbox"/> Yes</p> <p><input checked="" type="checkbox"/> No</p> <p><input type="checkbox"/> Uncertain, further scientific assessment required</p> <p>Rationale:</p> <ul style="list-style-type: none"> • <i>Salmonella</i> spp. are a serious hazard as they cause incapacitating, though not usually life threatening, illness of moderate duration and sequelae are rare. • There is limited evidence of salmonellosis attributed to marinara mix. • Marinara mix requires cooking prior to consumption which will inactivate <i>Salmonella</i> spp. • Post-cooking contamination is unlikely if good food handling practices are followed. • International and Australian compliance and recall data has shown limited evidence of <i>Salmonella</i> spp. associated with marinara mix.
General description
<p>Nature of the microorganism:</p> <p><i>Salmonella</i> spp. are facultative anaerobic Gram-negative, non-spore forming rod-shaped bacteria. They are found in the intestinal tract of warm and cold-blooded vertebrates and in the surrounding environment (FSANZ 2013).</p> <p>Growth of <i>Salmonella</i> spp. can occur at temperatures ranging between 5.2 – 46.2°C, pH of 3.8 – 9.5 and a minimum water activity of 0.93 when other conditions are near optimum. <i>Salmonella</i> spp. can survive for months or even years in low moisture foods (and other low moisture environments) and are able to survive frozen storage at -20°C. <i>Salmonella</i> spp. are sensitive to normal cooking conditions, however, foods that are high in fat and low in moisture may have a protective effect against heat inactivation (FSANZ 2013; Li et al. 2013).</p>
<p>Adverse health effects:</p> <p><i>Salmonella</i> spp. are a serious hazard as they cause incapacitating but not usually life threatening illness of moderate duration. Sequelae can occur but are rare (ICMSF 2002). People of all ages are susceptible to salmonellosis. However, the elderly, infants and immunocompromised individuals are at a greater risk of infection and generally have more severe symptoms (FSANZ 2013).</p>

Salmonellosis symptoms include abdominal cramps, nausea, diarrhoea, mild fever, vomiting, dehydration, headache and/or prostration. The onset of illness of salmonellosis is typically 24 – 48 hours after exposure to an infectious dose (range of 8 – 72 hours) and symptoms usually last for 2 – 7 days. Severe disease such as septicaemia sometimes develops, predominantly in immunocompromised individuals. A small number of individuals develop sequelae such as arthritis, appendicitis, meningitis or pneumonia as a consequence of infection. The fatality rate for salmonellosis is generally less than 1% (FDA 2012; FSANZ 2013).

The particular food matrix and strain of *Salmonella* spp. influence the level of *Salmonella* spp. required for illness to occur. It has been reported that as few as one to 100 cells have caused illness, however, in other cases significantly more cells were required for illness to occur (ICMSF 1996; FDA 2012).

Consumption patterns:

In the 2011 – 2012 Nutrition and Physical Activity Survey (part of the 2011 – 2013 Australian Health Survey) no children (aged 2 – 16 years), <1 % of adults (aged 17 – 69 years) and <1% of people aged 70 and above reported consumption of marinara mix (Australian Bureau of Statistics 2011). Survey data was derived from one day of dietary recall data.

Key risk factors:

Marinara mix consists of a range of different seafood, therefore, key risk factors for the various types of seafood will be considered.

A key risk factor for the production of bivalve molluscs is microbiological contamination of the waters in which they grow. As bivalve molluscs are filter feeders, they can accumulate bacteria such as *Salmonella* spp. from polluted aquatic environments. In marine environments *Salmonella* spp. typically only survive for short periods of time, but *Salmonella* spp. maintain viability for much longer when ingested by oysters and can multiply quickly under conditions which allow growth (i.e. higher temperatures). Contamination with *Salmonella* spp. can also occur during the bivalve mollusc shucking process or during further handling (FSANZ 2005; FDA 2011; Codex 2013).

Fish may be contaminated with *Salmonella* spp. as a result of near-shore harvest water contamination, poor sanitary practices during post-harvest handling and processing, and poor aquacultural practices (FSANZ 2005; FDA 2011). Crustaceans trapped in estuarine or inshore marine waters may be contaminated with potentially pathogenic bacteria from sewage, such as *Salmonella* spp. Post-harvest handling and processing, such as hand-peeling of shrimp under insanitary conditions, has the potential to introduce pathogens, such as *Salmonella* spp. (ICMSF 2000; FSANZ 2005).

Temperature abuse during handling, transport and/or storage may allow the growth of *Salmonella* spp. (FSANZ 2005). However, illness may occur with exposure to low levels of *Salmonella* spp.

Risk mitigation:

To manage *Salmonella* contamination, seafood should be sourced and produced under conditions where the potential for *Salmonella* contamination is minimised (i.e. from quality shellfish harvest areas or fishing grounds). The shellfish control authority (government agencies) classifies shellfish harvest areas, based in part on an assessment of water quality. All growing water and/or molluscan flesh should be monitored for the presence of indicators for the presence of faecal contamination. As a result of harvest area classifications, shellfish harvesting is restricted to certain waters and may also be subject to specific conditions. For example depuration can be used in which live animals are placed in clean water to slowly rid themselves of pathogens, although efficacy varies depending on pathogen (FDA 2011; ICMSF 2011; Codex 2013; ASQAAC 2016).

Use of low temperatures (<5°C) during processing, transport and storage will reduce the rate of growth for most microbial pathogens (FSANZ 2005; Codex 2013). Good hygienic practices in food manufacturing and food handling will minimise *Salmonella* contamination of marinara mix.

Marinara mix requires cooking prior to consumption. Cooking food to an internal temperature of 70°C for at least 2 minutes will inactivate *Salmonella* spp. (Bell and Kyriakides 2009).

In Australia, Division 2 of [Standard 4.2.1 in the Australia New Zealand Food Standards Code](#) (the Code) states that a seafood business must systematically examine all of its primary production and processing operations to identify potential seafood safety hazards and implement controls that are commensurate with the food safety risk, and must take all necessary steps to prevent the likelihood of seafood being, or becoming, contaminated. Specifically, Division 3 requires businesses engaging in the primary production, processing, or manufacturing activities concerning bivalve molluscs to implement a documented food safety management system that effectively controls the hazards. The food safety management system incorporates the conditions of the [ASQAP Manual](#) for managing risk in the harvesting, relaying, depuration and wet storage of shellfish.

[Schedule 27 of the Code](#) has a microbiological limit for cooked crustacea for *Salmonella* of n=5, c=0, m=not detected in 25g and a microbiological limit for raw crustacea for *Salmonella* of n=5, c=0, m=not detected in 25g.

Compliance history:

The imported food compliance data sourced from the Imported Food Inspection Scheme of the Australian Department of Agriculture and Water Resources for January 2007 – May 2016 showed that there were no fails for the 112 *Salmonella* spp. tests applied to marinara mix.

There has been one notification on the European Commission's Rapid Alert System for Food and Feed (RASFF) for *Salmonella* spp. in seafood mix from Vietnam during the period January 2007 – May 2016.

There have been no food recalls in Australia due to the presence of *Salmonella* spp. in imported or domestic marinara mix from January 2007 – May 2016.

Surveillance information:

Salmonellosis is one of the most commonly reported enteric illnesses worldwide, and the second most frequently reported cause of enteric illness in Australia. It is a notifiable disease in all Australian states and territories with a notification rate in 2015 of 72.8 cases per 100,000 population (17,089 cases). This is an increase from the previous five year mean of 56.4 cases per 100,000 population per year (ranging from 49.2 – 69.4 cases per 100,000 population per year) (FSANZ 2013; NNDSS 2016).

Illness associated with consumption of marinara mix contaminated with *Salmonella* spp.

A search of the scientific literature via Web of Science, PubMed, Scopus, CAB abstracts, US CDC Foodborne Online Database and other publications during the period 1990 – April 2016 identified there are limited reports of salmonellosis outbreaks associated with consumption of marinara mix:

- There were three confirmed salmonellosis outbreaks linked to consumption of seafood dishes on the US CDC Foodborne Online Database, however, it was not stated if they included marinara mix (CDC 2015).

Prevalence of *Salmonella* spp. in marinara mix

A search of the scientific literature via Web of Science, PubMed, Scopus, CAB abstracts and other publications during the period 1990 – April 2016 did not find any data on the prevalence of *Salmonella* spp. in marinara mix.

Other relevant standards or guidelines

- Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2003).
- Codex code of practice for fish and fishery products *CAC/RCP 52-2003* applies to the growing, harvesting, handling, production, processing, storage, transportation and retail of fish, shellfish and aquatic invertebrates and products thereof from marine and freshwater sources that are intended for human consumption. Section seven, eight, 13A, 13B, 14 and 15 of *CAC/RCP 52-2003* is specific to the processing of live and raw bivalve molluscs; fresh, frozen and minced fish; lobsters; crabs;

shrimps and prawns; and cephalopods, respectively, and describes controls at individual processing steps (Codex 2013).

- Codex standard for quick frozen lobsters *CODEX STAN 95-1981* covers the production and processing of quick frozen lobsters, including cooked squat lobsters (red and yellow) (Codex 2014a).
- Codex standard for quick frozen shrimps or prawns *CODEX STAN 92-1981* covers the production and processing of quick frozen shrimps or prawns, including fully cooked shrimps or prawns (Codex 2014b).
- Codex standard for live and raw bivalve molluscs *CODEX STAN 292-2008* covers the production and processing of live and raw bivalve molluscs (Codex 2015).
- Codex standard for fresh and quick frozen raw scallop products *CODEX STAN 315-2014* covers production and processing of fresh and quick frozen raw scallop products, including those intended for further processing (Codex 2016).

Approach by overseas countries

Many countries and regions, such as the United States, Canada and the European Union, have HACCP-based regulatory measures in place for production of this commodity.

In Europe, cooked crustaceans and molluscan shellfish have a *Salmonella* limit of n=5, c=0, m=absence in 25g for products placed on the market during their shelf-life. Also live bivalve molluscs and live echinoderms, tunicates and gastropods have a *Salmonella* limit of n=5, c=0, m=absence in 25g for products placed on the market during their shelf-life (European Commission 2007).

Other considerations

Biosecurity restrictions apply to products under this commodity classification. Refer to the [BICON database](#).

This risk statement was compiled by FSANZ in: November 2016

References

ASQAAC (2016) Australian shellfish quality assurance program. Australian Shellfish Quality Assurance Advisory Committee.

<http://safefish.com.au/wp-content/uploads/2016/07/Australian-Shellfish-Quality-Assurance-Program-Operations-Manual-2016.pdf>. Accessed 31 August 2016

Australian Bureau of Statistics (2011) National Nutrition and Physical Activity survey, 2011-2012, Basic CURF, CD-ROM. Findings based on ABS Curf data.

Bell C, Kyriakides A (2009) *Salmonella*. Ch 18 In: Blackburn CW, McClure PJ (eds) Foodborne pathogens - Hazards, risk analysis and control. 2nd ed, Woodhead Publishing Limited and CRC Press LLC, Cambridge, p. 627–674

CDC (2015) Foodborne outbreak online database (FOOD). Centers for Disease Control and Prevention, Atlanta. <http://www.cdc.gov/foodborneoutbreaks/>. Accessed 3 February 2016

Codex (2003) General principles of food hygiene (CAC/RCP 1 - 1969). Codex Alimentarius, Rome. <http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/>. Accessed 5 August 2016

Codex (2013) Code of practice for fish and fishery products (CAC/RCP 52-2003). Codex Alimentarius, Rome. <http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/>. Accessed 2 September 2016

Codex (2014a) Standard for quick frozen lobsters (CODEX STAN 95-1981). Codex Alimentarius, Rome. <http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/>. Accessed 2 September 2016

Codex (2014b) Standard for quick frozen shrimps or prawns (CODEX STAN 92-1981). Codex Alimentarius, Rome. <http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/>. Accessed 2 September 2016

Codex (2015) Standard for live and raw bivalve molluscs (CODEX STAN 292-2008). Codex Alimentarius, Rome. <http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/>. Accessed 2 September 2016

Codex (2016) Standard for fresh and quick frozen raw scallop products (CODEX STAN 315-2014). Codex Alimentarius, Rome. <http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/>. Accessed 2 September 2016

European Commission (2007) Commission Regulation (EC) No 1441/2007 of 5 December 2007 amending Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs. Official Journal of the European Union 7.12.2007:L322/12–L322/29

FDA (2011) Fish and fishery products hazards and controls guidance - fourth edition. US Food and Drug Administration, Silver Spring. <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Seafood/ucm2018426.htm#sampling>. Accessed 31 August 2016

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. 2nd ed, US Food and Drug Administration, Silver Spring. <http://www.fda.gov/food/foodborneillnesscontaminants/causesofillnessbadbugbook/default.htm>. Accessed 23 July 2015

FSANZ (2005) Proposal P265: Primary production and processing standard for seafood - Final assessment report. Food Standards Australia New Zealand, Canberra. http://www.foodstandards.gov.au/code/proposals/documents/P265_Seafood_PPPS_FAR.pdf. Accessed 7 September 2016

FSANZ (2013) Agents of foodborne illness. 2nd ed, Food Standards Australia New Zealand, Canberra. http://www.foodstandards.gov.au/publications/Documents/FSANZ_FoodborneIllness_2013_WEB.pdf. Accessed 4 September 2013

ICMSF (1996) Salmonellae. Ch 14 In: Microorganisms in food 5: Microbiological specifications of food pathogens. Blackie Academic and Professional, London, p. 217–264

ICMSF (2000) Fish and seafood products. Ch 3 In: Microorganisms in food 6: Microbial ecology of food commodities. Aspen Publishers, Gaithersburg, p. 130–189

ICMSF (2002) Selection of cases and attributes plans. Ch 8 In: Microorganisms in food 7: Microbiological testing in food safety management. Kluwer Academic/Plenum publishers, London, p. 145–172

ICMSF (2011) Fish and seafood products. Ch 10 In: Microorganisms in food 8: Use of data for assessing process control and product acceptance. Springer, New York, p. 107–133

Li H, Wang H, D'Aoust JY, Maurer J (2013) *Salmonella* species. Ch 10 In: Doyle MP, Beuchat LR (eds) Food microbiology: Fundamentals and frontiers. 4th ed, ASM Press, Washington D.C., p. 225–261

NNDSS (2016) Notifications of a selected disease by State and Territory and year. National Notifiable Disease Surveillance System, Department of Health and Ageing, Canberra. http://www9.health.gov.au/cda/source/rpt_4_sel.cfm. Accessed 19 May 2016