To what extent is the consumer exposed to *L. monocytogenes* by consuming RTE foods?

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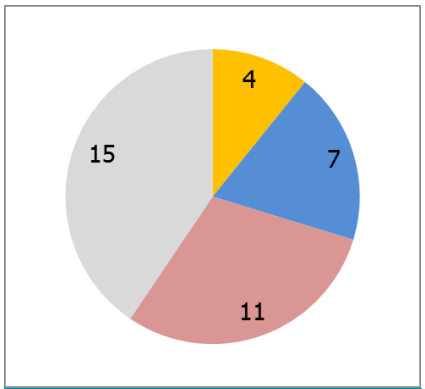
Stakeholder meeting, 19-20 Sep 2017

efsa
European Food Safety Authority

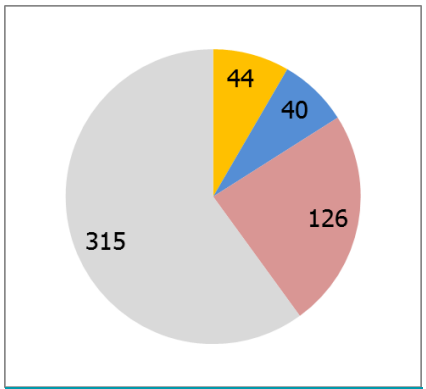
HAZARD IDENTIFICATION: OUTBREAKS

Reported 'strong-evidence' foodborne outbreaks caused by *Listeria* (EU/EEA; 2008-2015)

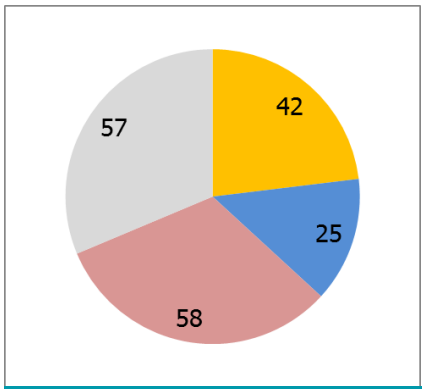
- By product category



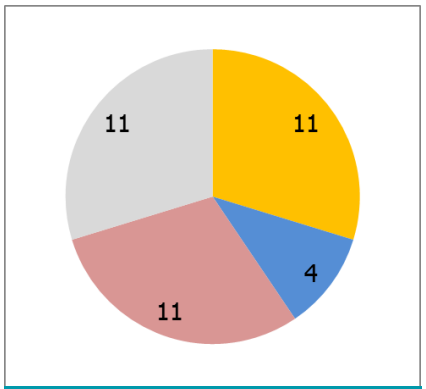
22 (or 59%) of 37 outbreaks



210 (or 40%) of 525 cases



125 (or 69%) of 182 hospitalisations



26 (or 70%) of 37 deaths

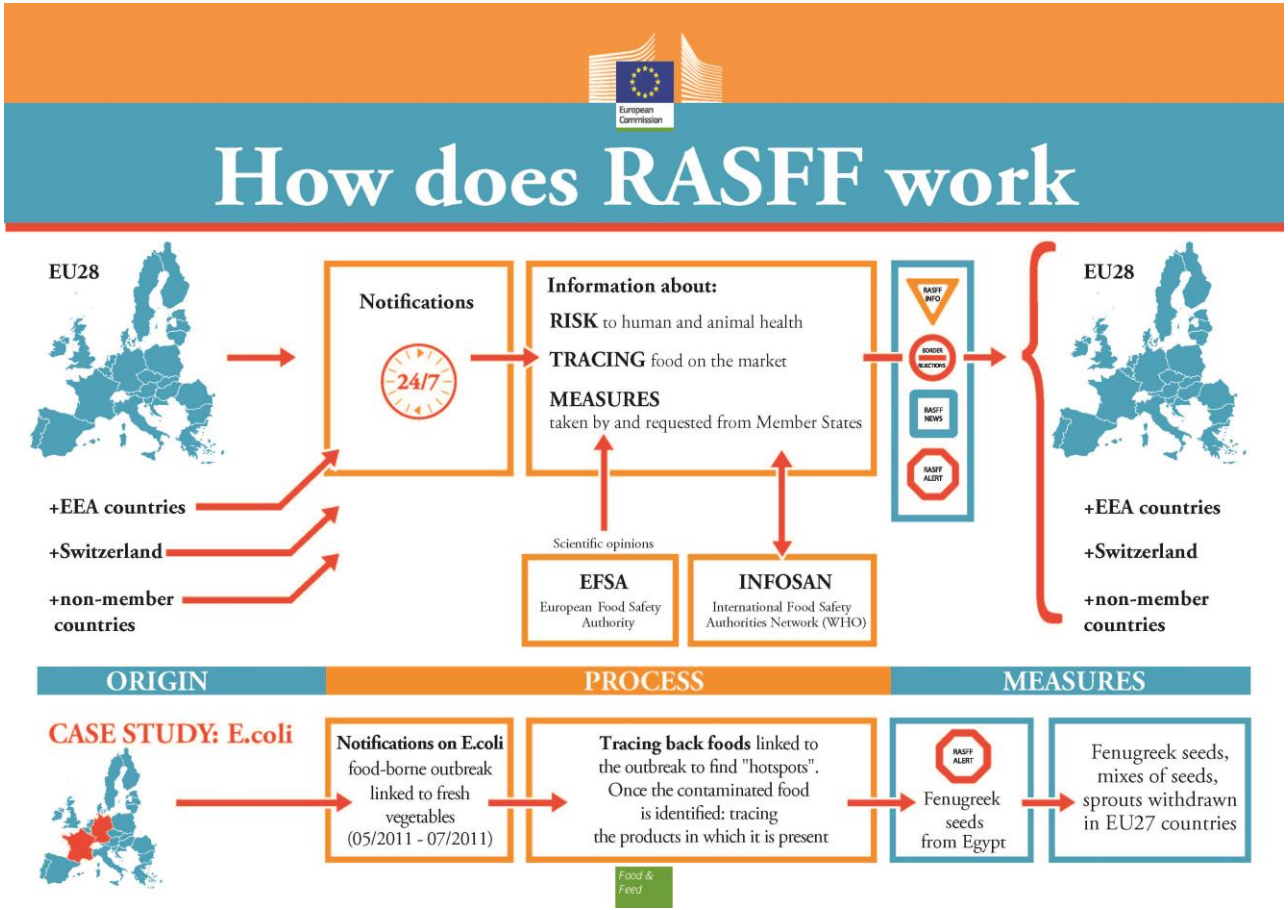
dairy

fish and seafood

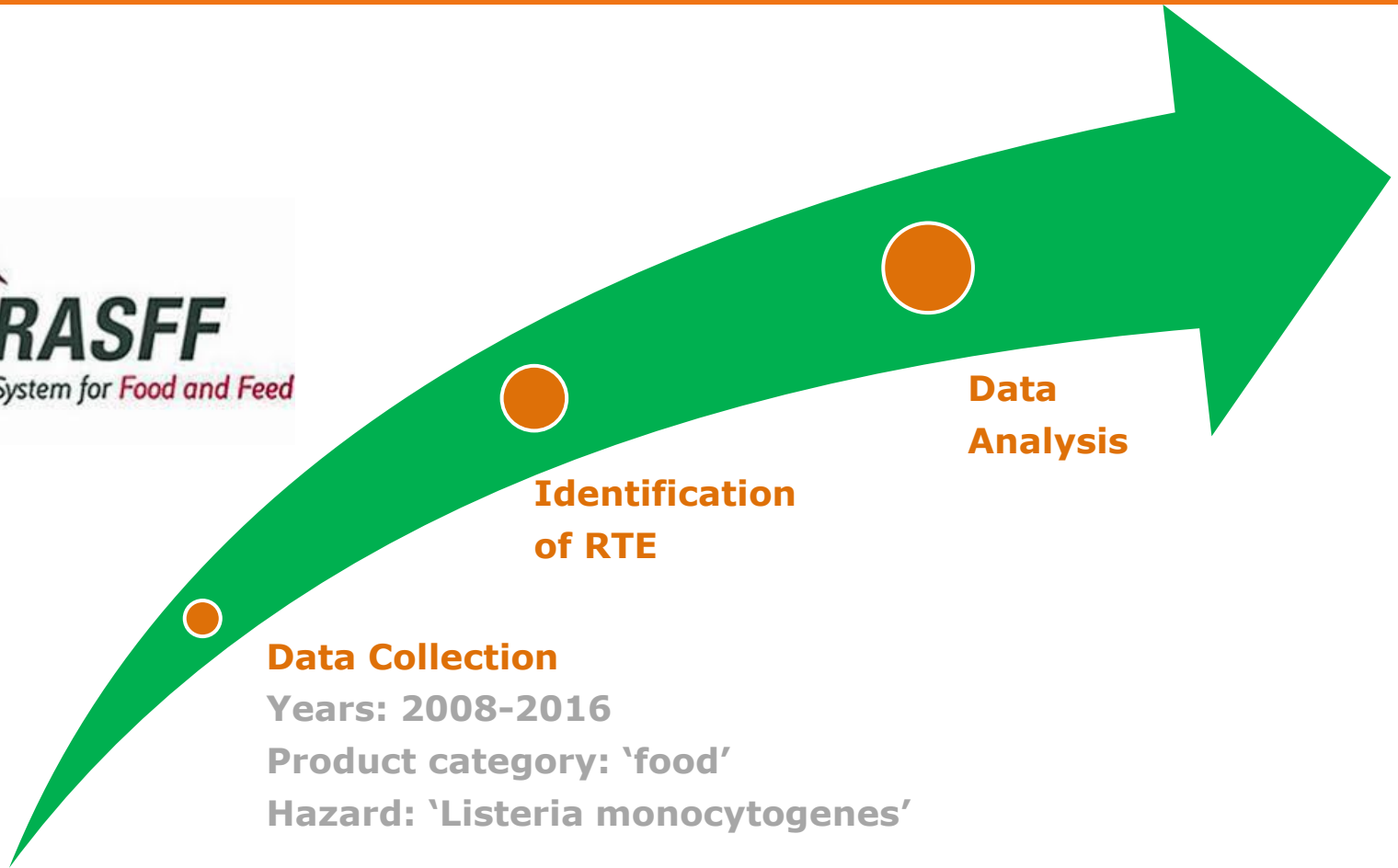
meat and meat products

other food categories

HAZARD IDENTIFICATION - RASFF



RASFF DATA ANALYSIS PROCESS



RASFF NOTIFICATIONS (2008-2016)

- 690 (or 91%) out of 760 considered as ready-to-eat
- Notifications for *L. monocytogenes* by product category and year of notification
- **Three RASFF product categories** associated with 87% of notifications

Product category	Year									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2008–2016 period (percentage)
Fish and fish products	11	26	39	54	22	27	43	35	31	288 (41.7)
Meat and meat products (other than poultry)	10	10	15	17	17	12	13	16	16	126 (18.3)
Milk and milk products	22	13	15	23	20	20	29	30	14	186 (27.0)
Cereals and bakery products		1								1 (0.1)
Cocoa and cocoa preparations, coffee and tea		1								1 (0.1)
Crustaceans and products thereof		3	4	1	4	1		1	2	16 (2.3)
Eggs and egg products	1									1 (0.1)
Fats and oils									1	1 (0.1)
Fruit and vegetables	1			2	5	1	5	4		18 (2.6)
Gastropods			1							1 (0.1)
Herbs and spices									1	1 (0.1)
Ices and desserts					1					1 (0.1)
Nuts, nut products and seeds							1	1		2 (0.3)
Other food product / mixed		1			2			2		5 (0.7)
Poultry meat and poultry meat products	1	2	2	1	1	3	1	2	4	17 (2.5)
Prepared dishes and snacks		1	4	1	2	5	2	2	7	24 (3.5)
Soups, broths, sauces and condiments								1		1 (0.1)
All product categories	46	58	80	99	74	69	94	94	76	690

EXPOSURE ASSESSMENT

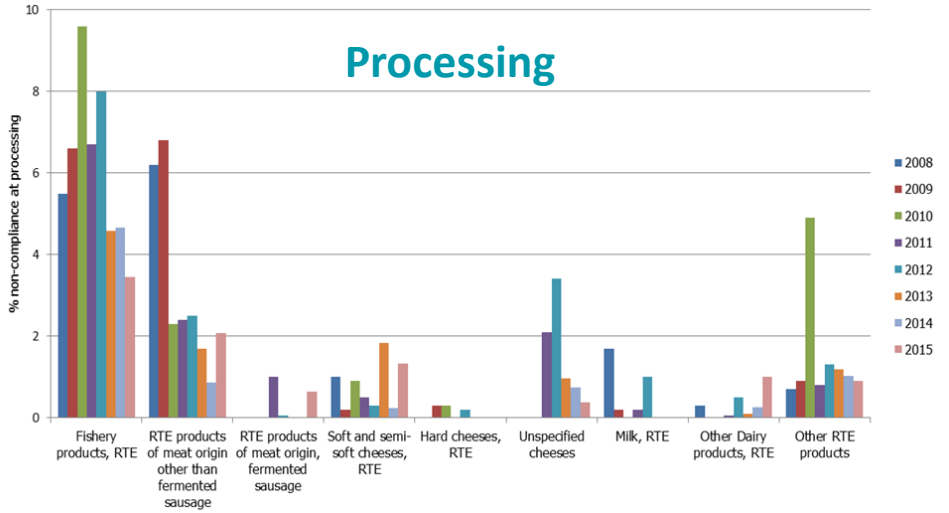
- ✓ Prevalence
- ✓ Concentration

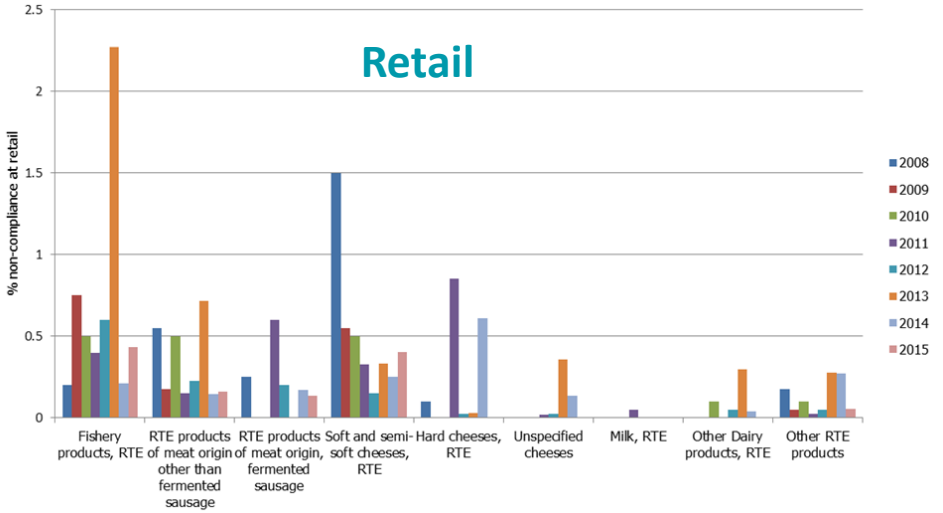
- ✓ Change in Concentration

- ✓ Serving size
- ✓ Number of servings

EXPOSURE ASSESSMENT – MONITORING DATA

Compliance to Food Safety Criteria





Although non-compliance at retail of less than 1% may be considered low, this may still correspond to many servings containing > 100 CFU/g when total consumption is taken into account

EXPOSURE ASSESSMENT – BASELINE SURVEY

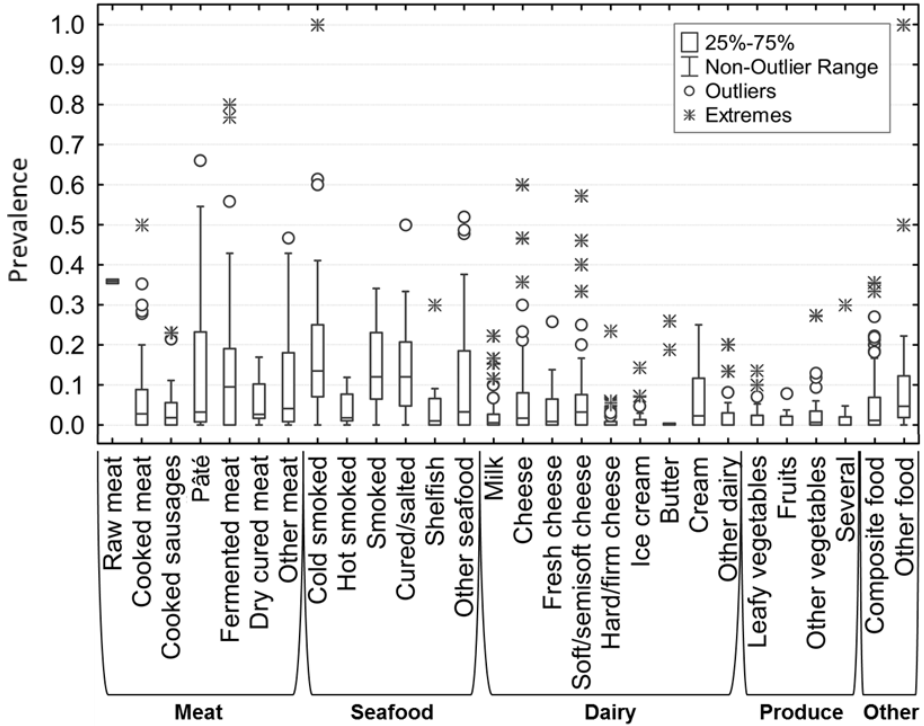
Product and subtype	Number of samples	At sampling		At end of shelf life	
		Prevalence with 95% CI (%)	Proportion > 100 CFU/g with 95% CI (%)	Prevalence with 95% CI (%)	Proportion > 100 CFU/g with 95% CI (%)
Total fish	**2,994**	**10.4 (9.1–11.7)**	**1.0 (0.7–1.4)**	**10.3 (9.1–11.6)**	**1.7 (1.3–2.3)**
Cold-smoked fish	599	17.4 (14.2–21.1)	1.7 (0.9–3.2)	16.0 (13.2–19.3)	2.0 (1.1–3.6)
Hot-smoked fish	525	6.3 (4.4–8.9)	1.3 (0.6–2.8)	6.7 (4.7–9.3)	1.7 (0.9–3.3)
Unknown smoked fish	1,625	8.8 (7.3–10.5)	0.6 (0.3–1.2)	9.1 (7.6–10.9)	1.8 (1.2–2.6)
Gravad fish	245	12.2 (8.7–17.0)	0.8 (0.2–3.2)	12.2 (8.6–17.1)	0.8 (0.2–3.2)
Total meat	**3,470**	**ND**	**ND**	**2.07 (1.63–2.64)**	**0.43 (0.25–0.74)**
Total cheese	**3,393**	**ND**	**ND**	**0.47 (0.29–0.77)**	**0.06 (0.02–0.24)**

CI: confidence interval; ND: not determined.

At the end of shelf life *L. monocytogenes* was more prevalent in RTE smoked and gravad fish, than in RTE heat-treated meat and RTE soft and semi-soft cheese products

EXPOSURE ASSESSMENT - LITERATURE

778 studies



Activity 1: an extensive literature search and study selection with data extraction on *Lm* in a wide range of RTE foods

- NP/EFSA/BIOCONTAM/2015/04-CT1
- 3/11/2015-2/10/2016


EXTERNAL SCIENTIFIC REPORT

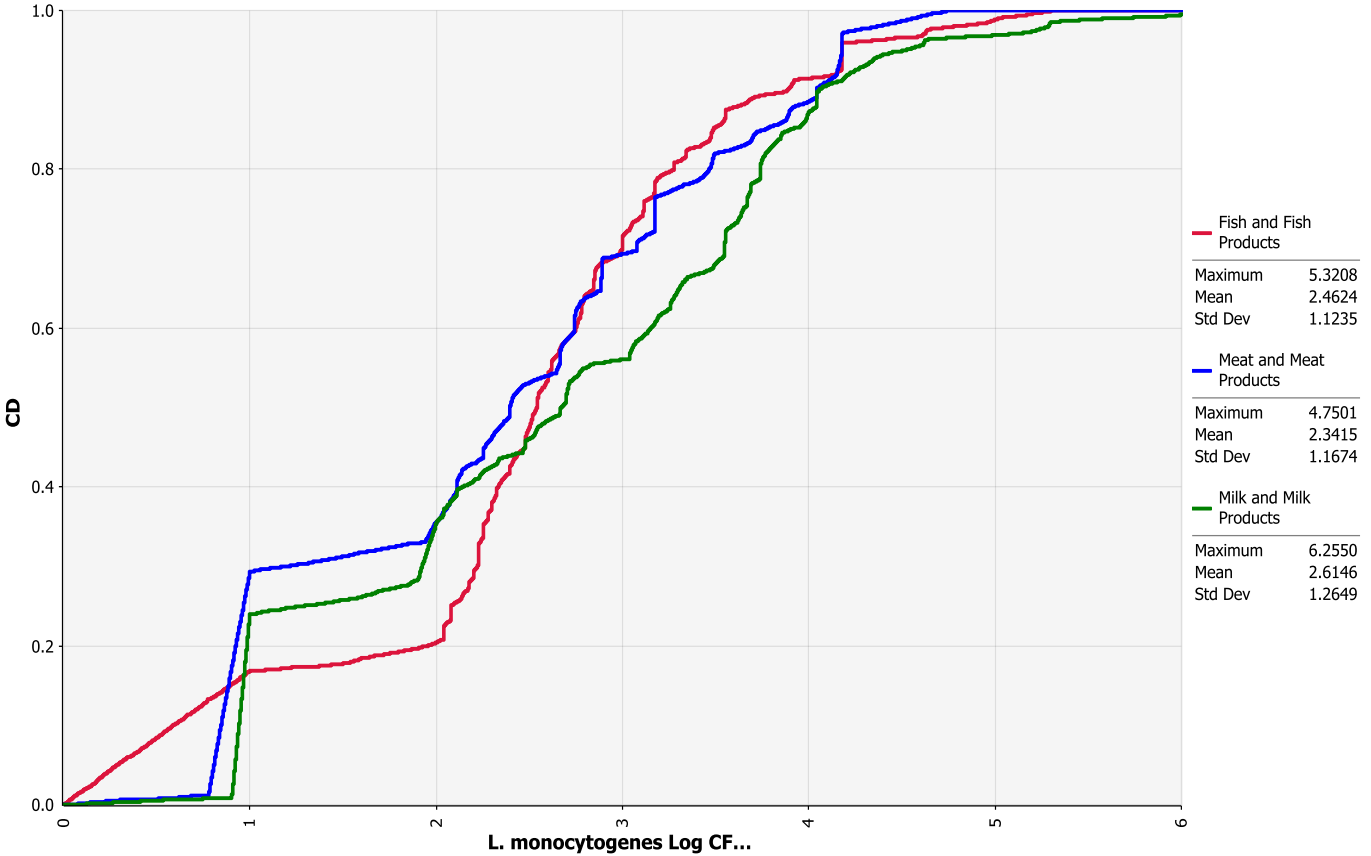
Closing gaps for performing a risk assessment on *Listeria monocytogenes* in ready-to-eat (RTE) foods: activity 1, an extensive literature search and study selection with data extraction on *L. monocytogenes* in a wide range of RTE food

In total, *L. monocytogenes* was detected in **78.1%**, **70.5%**, **51.8%**, **36.5%**, and **47.1%** of the studies dealing with **seafood**, **meat products**, **dairy products**, **produce** and **other products**, respectively

RASFF NOTIFICATIONS (2008-2016)

Cumulative density function (CDF) of *L. monocytogenes* concentration for

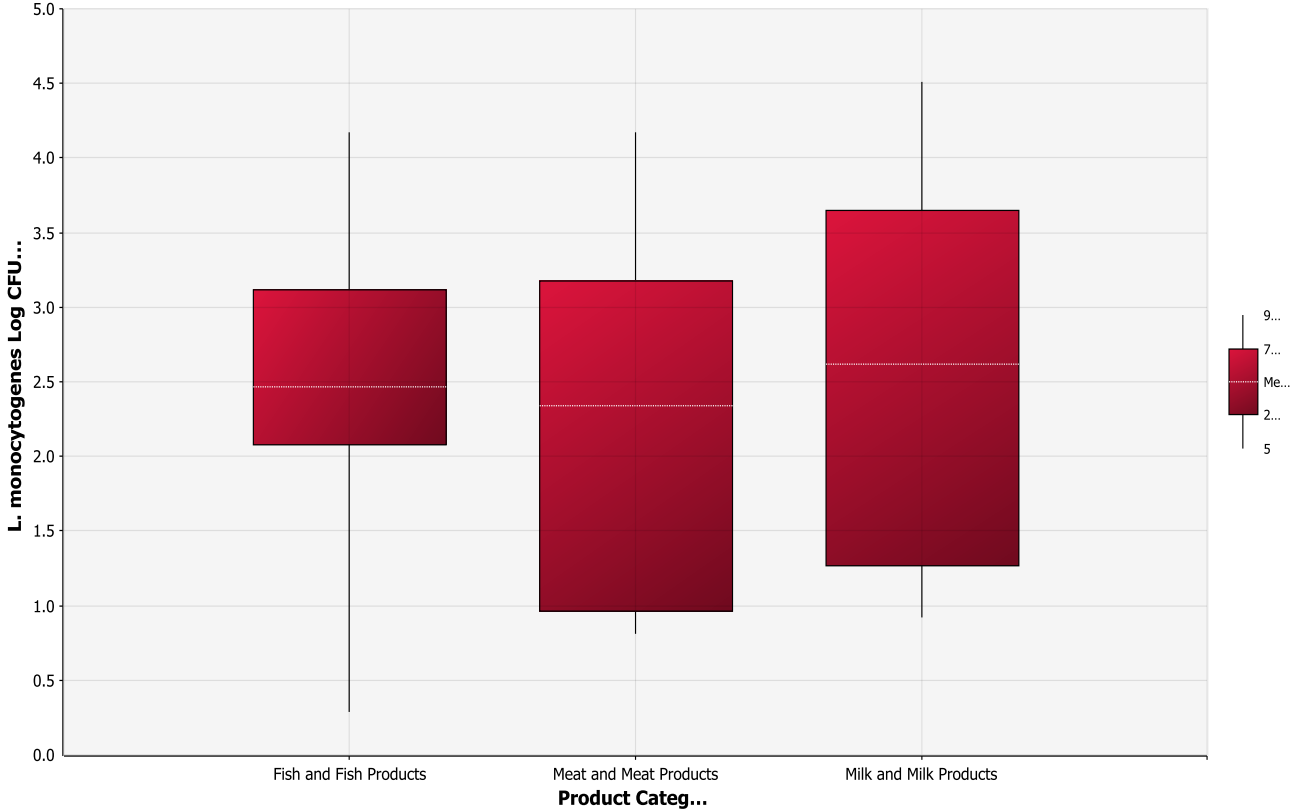
- fish and fish products (n=130)
- milk and milk products (n=126)
- meat and meat products other than poultry (n=81)



RASFF NOTIFICATIONS (2008-2016)

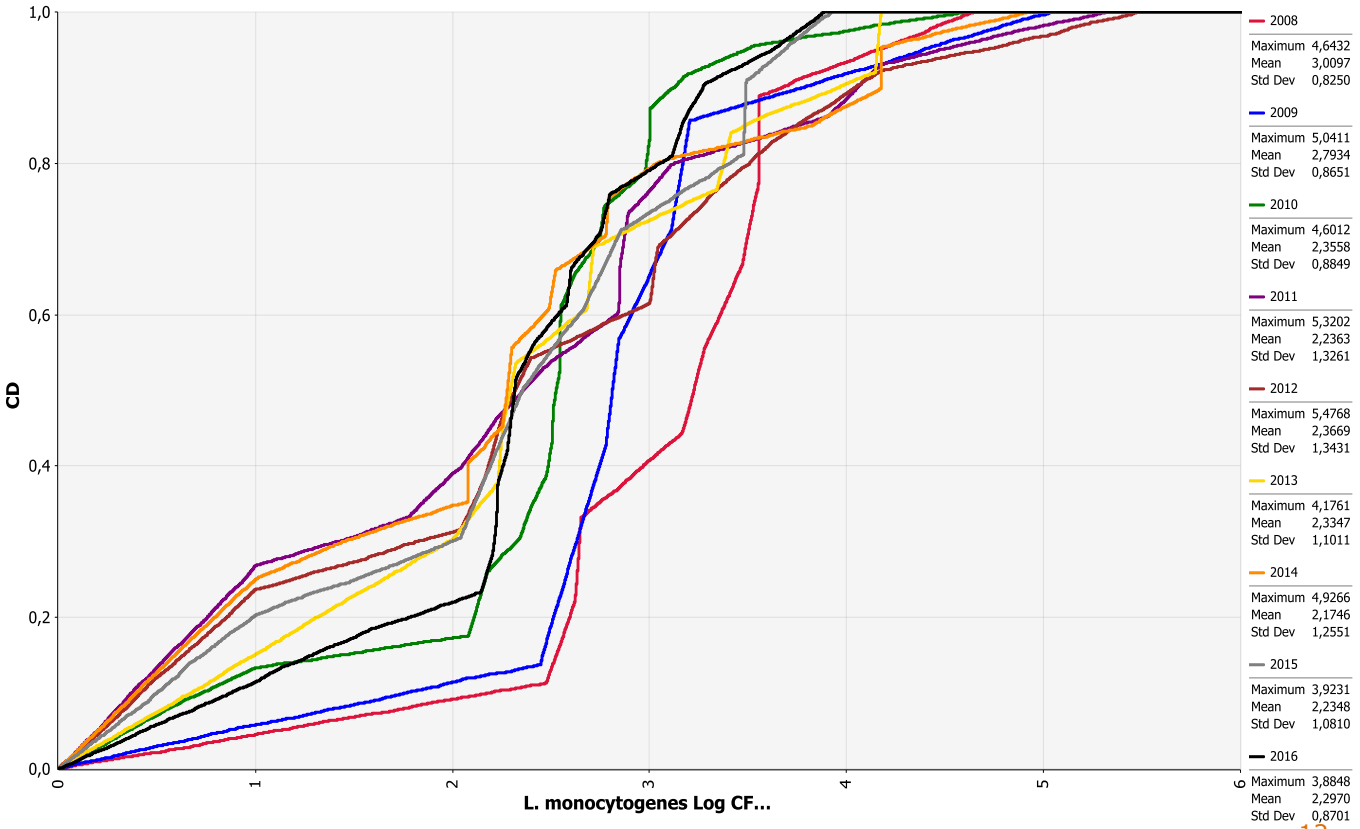
Box plot of the reported *L. monocytogenes* concentration for <u>different product categories</u>

- fish and fish products
- milk and milk products
- meat and meat products other than poultry



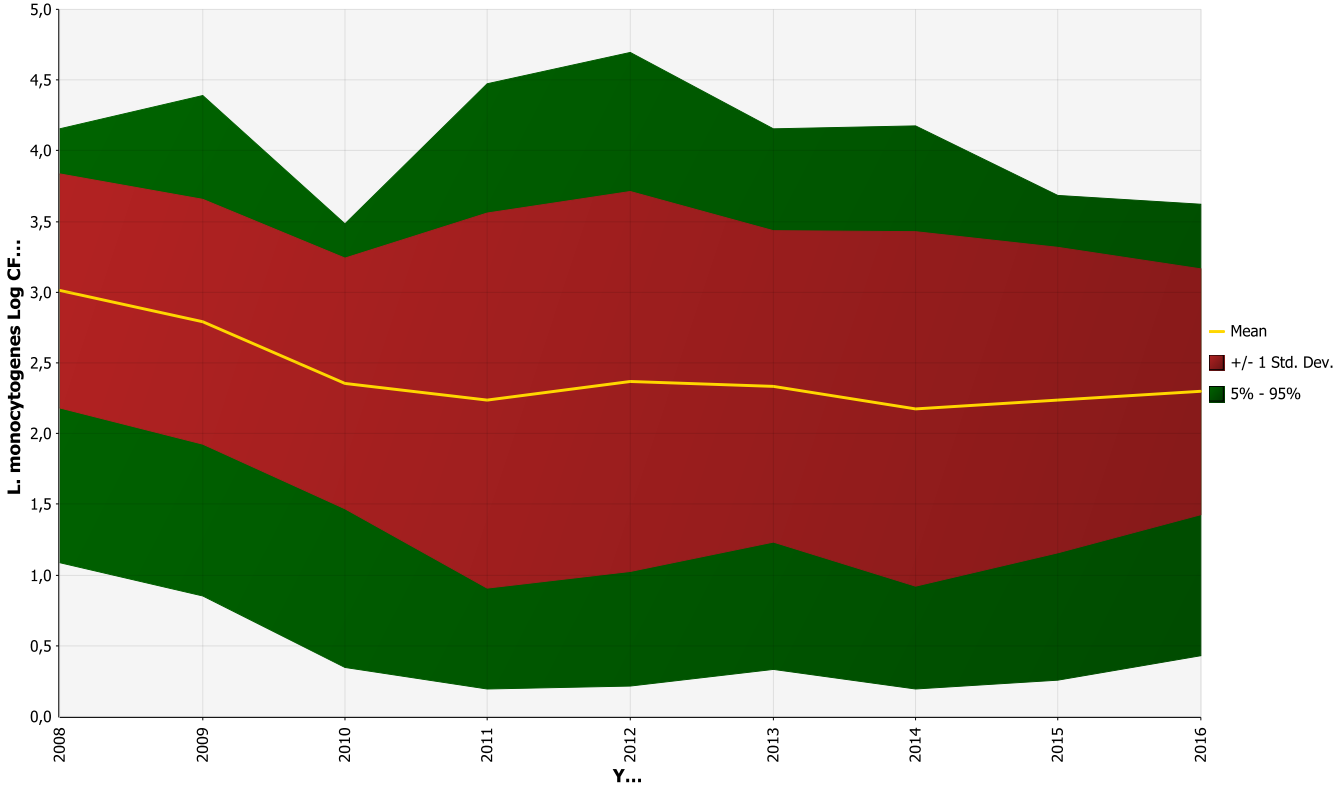
RASFF NOTIFICATIONS (2008-2016)

Cumulative density function (CDF) of *L. monocytogenes* concentration in fish and fish products



RASFF NOTIFICATIONS (2008-2016)

Summary trend graph for *L. monocytogenes* concentration in fish and fish products



EXPOSURE ASSESSMENT- STORAGE TEMPERATURE

Year reported	Country	N	Minimum temperature	Mean temperature	Max temperature	% refrigerators running at temperature °C[a]							Reference
						>4	>5	>6	>7	>8	>9	>10	
1990	UK	75		<5	15		6						(Rose et al., 1990)
1991	UK	252	0.9	6	11.4		70						(Evans et al., 1991)
1992	UK	150	0.8	6.5	12.6		71						(Flynn et al., 1992)
1993	France	102			14			70					(Victoria, 1993)
1994	Netherlands	125					70		28		2		(de Lezenne Coulander, 1994)
1997	Greece	136									50		(Sergelidis et al., 1997)
1997	UK	108	2	5.9	12		50						(Worsfold and Griffith, 1997)
1998	UK	645	-2	7	13		70						(Johnson et al., 1998)
2002	France	119	0.9	6.6	11.4		80						(Laguerre et al., 2002)
2003	UK	901					31					3	(Ghebrehewet and Stevenson, 2003)
2003	Greece	110				74		46		23		8	(Bakalis et al., 2003)
2005	Ireland	100	-7.9	5.4	20.7		59						(Kennedy et al., 2005a)
2005	Portugal	86						70					(Azevedo et al., 2005)
2005	Greece	258	-2	6.3				50				10	(Taoukis et al., 2005)
2005	Netherlands	31	3.8		11.5				68				(Terpstra et al., 2005)
2006	UK	24		5			33						(Breen et al., 2006)
2007	Spain	30		6.98[b]		83.7	74.0	61.9	48.5	35.3	23.6	14.5	(Carrasco et al., 2007)
2010	Greece	100	-0.3	6.3[c]	13.0	84	72	56	36	24	13	7	(Koutsoumanis et al., 2010)
2010	Spain	33	0.6	7.9	14.5	84.9		78.8		51.5		15.1	(Garrido et al., 2010a)
2010	UK	50		5.9			71			30	29		(WRAP, 2010)
2014	Italy	84	2.5	8.1	15.9	94			73.8			51.2	(Vegara et al., 2014)
2015	Sweden			5.9[d]						16			(Marklinder and Erikkson, 2015)
2016	UK	43	-1.7	5.9[e]	16.9	79.1	62.8	39.5	14.0	4.7	4.7	0.0	(Evans and Redmond, 2016a)

23 survey studies, mean temperature ranged from **5 to 8.1°C**

EXPOSURE ASSESSMENT- SERVING SIZE

Age groups (years)	Fish products				Meat products						Cheese	
	Gravad fish[a]		Smoked fish		Cooked meat		Heat-treated sausages		Pâté		Soft and semi-soft cheese	
	F	M	F	M	F	M	F	M	F	M	F	M
1–4	25	-[b]	26	21	22	23	38	44	19	22	21	20
5–14	47	68	54	56	31	32	54	63	28	29	27	43
15–24	132	101	56	57	39	51	68	90	36	49	40	43
25–44	95	151	64	78	42	53	61	79	41	53	48	45
45–64	96	134	61	87	42	53	63	78	41	49	46	44
65–74	144	129	60	58	40	42	55	70	31	44	32	40
≥ 75	154	132	49	66	30	42	63	61	33	38	36	41

F: female; M: male.

(a): In the gQMRA model it was assumed that the serving size of gravad fish is the same as that of smoked fish.

(b): There were no servings in this group.

- Mean of the mean serving sizes (g) in the most recent national surveys from the EFSA food consumption database
- The largest mean of the mean serving sizes were found for gravad fish followed by smoked fish and heat-treated sausages

EXPOSURE ASSESSMENT- NUMBER OF SERVINGS

Age groups (years)	Gravad fish[(a)]		Smoked fish		Cooked meat		Heat-treated sausages		Pâté		Soft and semi-soft cheese	
	F	M	F	M	F	M	F	M	F	M	F	M
1–4	7	0	271	306	749	864	1,000	982	591	650	232	202
5–14	13	5	222	225	2,488	2,778	2,444	2,838	958	1,211	475	475
15–24	43	73	398	263	2,788	4,055	1,642	2,713	671	1,057	679	593
25–44	253	164	831	933	8,449	11,252	4,696	7,659	1,644	2,892	2,296	2,033
45–64	337	314	1,389	1,567	9,213	11,563	5,287	8,027	1,589	2,735	2,455	2,558
65–74	287	189	1,006	994	3,869	4,001	2,049	2,402	782	1,076	1,049	1,054
≥ 75	88	39	1,586	1,574	3,565	2,780	2,021	1,990	1,231	1,177	1,334	1,183
Mean (all ages)	1,028	784	5,703	5,862	31,121	37,293	19,139	26,611	7,466	10,798	8,520	8,098

F: female; M: male.

(a): In the gQMRA model it was assumed that the number of servings of gravad fish is 22.3% of those of smoked fish.

Mean number of servings (in millions) per year in the EU/EEA estimated from the most recent national surveys (1997–2012) in the EFSA food consumption database and population data from 2015

CONCLUSIONS OF HAZARD IDENTIFICATION

- ✓ The RASFF food product categories 'meat and meat products other than poultry', 'fish and fish products' and 'milk and milk products' accounted for **87%** of the 690 **RASFF notifications** related to *L. monocytogenes* in RTE food (2008–2016)
- ✓ The 'meat and meat products', 'fish and seafood' and 'dairy' food categories caused **59%** of the strong-evidence **food-borne outbreaks** caused by *Listeria* and **40%** of the human cases in the EU/EEA (2008–2015)

This finding reinforces the fact that these food categories continue to have public health significance from a food safety perspective

CONCLUSIONS OF EXPOSURE ASSESSMENT

- ✓ **EU monitoring:** lower non-compliance at retail (for most of the years was < 1%) than at processing at least partly explained by the application of the different limits of FSCs at both stages
- ✓ **ELS:** asymmetric distribution of prevalence values with several outliers and extreme values. The median of the prevalence was < 10% for all subcategories, except for fermented sausages (10%), cold-smoked fish (13%), smoked fish (either cold- or hot-smoked; 12%) and cured/salted fish (12%). Wide variability between studies
- ✓ **EU-BLS:** at the **end of shelf life *L. monocytogenes*** was more prevalent in RTE smoked and gravad fish (10.3%, and 1.7% > 100 CFU/g), than in RTE heat-treated meat (2.1%, and 0.43% > 100 CFU/g) and RTE soft and semi-soft cheese (0.5% and 0.1% > 100 CFU/g) products

CONCLUSIONS OF EXPOSURE ASSESSMENT

- ✓ The **average** / **highest maximum** *L. monocytogenes* concentration found among RASFF notifications related to RTE foods was:
  - ✓ **2.61** / **6.25** $\log_{10}$ CFU/g for the category 'milk and milk products
  - ✓ **2.46** / **5.32** $\log_{10}$ CFU/g and 'fish and fish products'
  - ✓ **2.34** / **4.75** $\log_{10}$ CFU/g for the category 'meat and meat products other than poultry'
- ✓ The *L. monocytogenes* concentration was **> 2 $\log_{10}$ CFU/g** in ~ 80% ('fish and fish products') and 65% ('milk and milk products,' 'and 'meat and meat products other than poultry') of RASFF notifications

CONCLUSIONS OF EXPOSURE ASSESSMENT

- ✓ **Cooked meat and heat-treated sausage** were the subcategories with most consumed servings per person and year in the EU/EEA and for meat products the number of servings was in general greater for males than for females
- ✓ A combination of results from the BLS and consumption data indicates that approximately **55 million servings contaminated with > 100 CFU/g** may be consumed by the ≥ 75 age group per year in the EU/EEA
- ✓ Unsafe practices (incl. storage time and temperatures) are not uncommon within the elderly group (**> 10% of persons studied**), and can have a potential impact on the human listeriosis risk

CONCLUSIONS OF EXPOSURE ASSESSMENT

- ✓ The extent of **different behaviors among risk groups** may vary between Member States to the same extent that socioeconomic factors, traditions and types of food vary. Since the majority of studies on food handling are from a few countries only this may lead to some uncertainty about the generalizability of the results presented
- ✓ Temperature of domestic refrigerators is highly variable. A review of studies showed **mean**, **minimum** and **maximum** temperatures ranging from **< 5 to 8.1 °C**, **-7.9 to 3.8 °C** and **11.4 to 20.7 °C**, resp.
- ✓ A recent analysis of domestic refrigerator temperature distributions suggested that the countries were separated into two groups: **northern** (N (6.1, 2.8)) and **southern European countries** (N (7.0, 2.7))