



Food and Agriculture Organization  
of the United Nations



# AMR in fisheries and aquaculture products

Products, Trade and Marketing Branch

Fisheries and Aquaculture Department

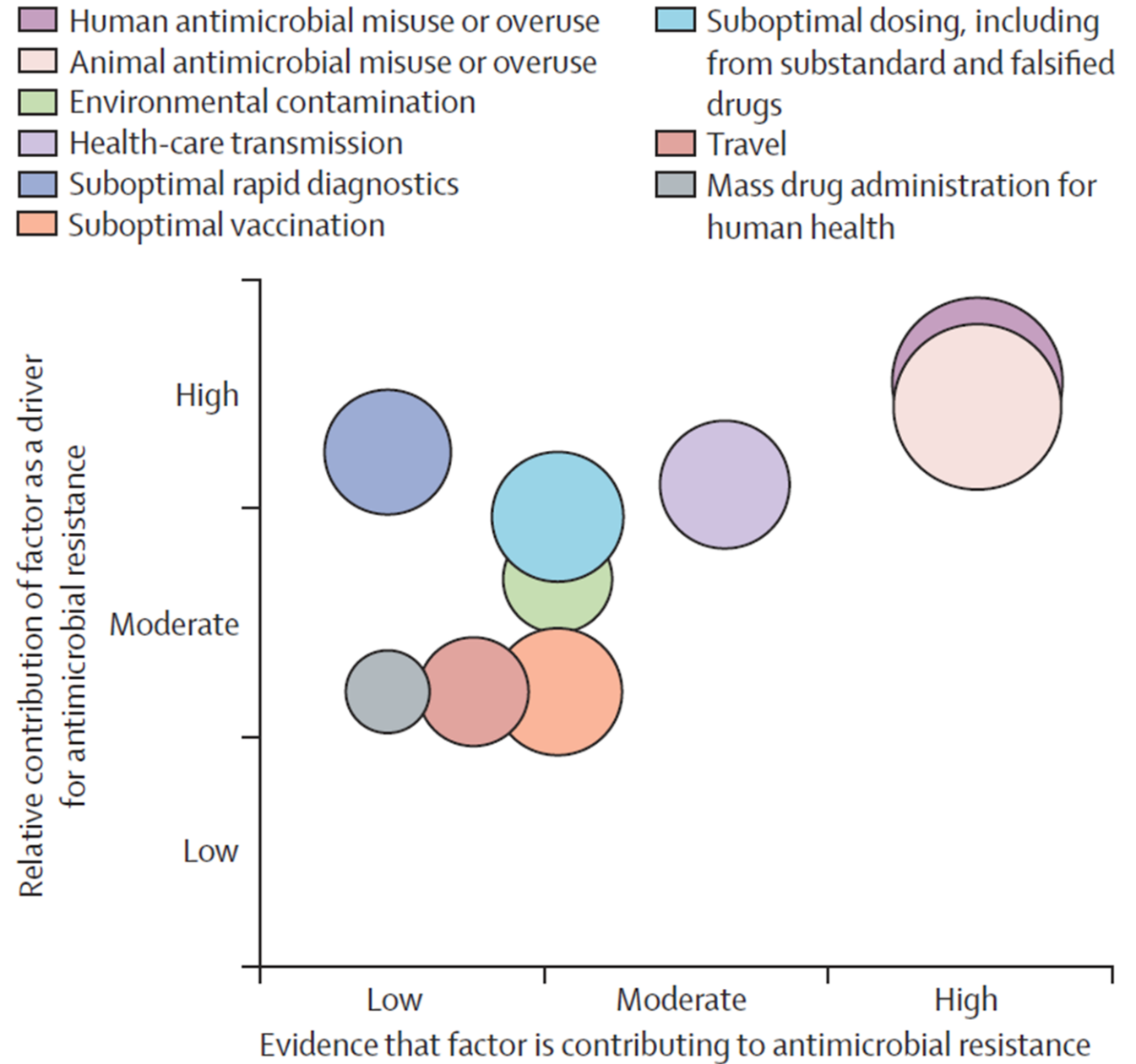
Food and Agriculture Organization of the United Nations

# What accelerates the emergence and spread of AMR?



Poor infection control, inadequate sanitary conditions and misused of antimicrobials among others

# Role of modifiable drivers for antimicrobial resistance: a conceptual framework

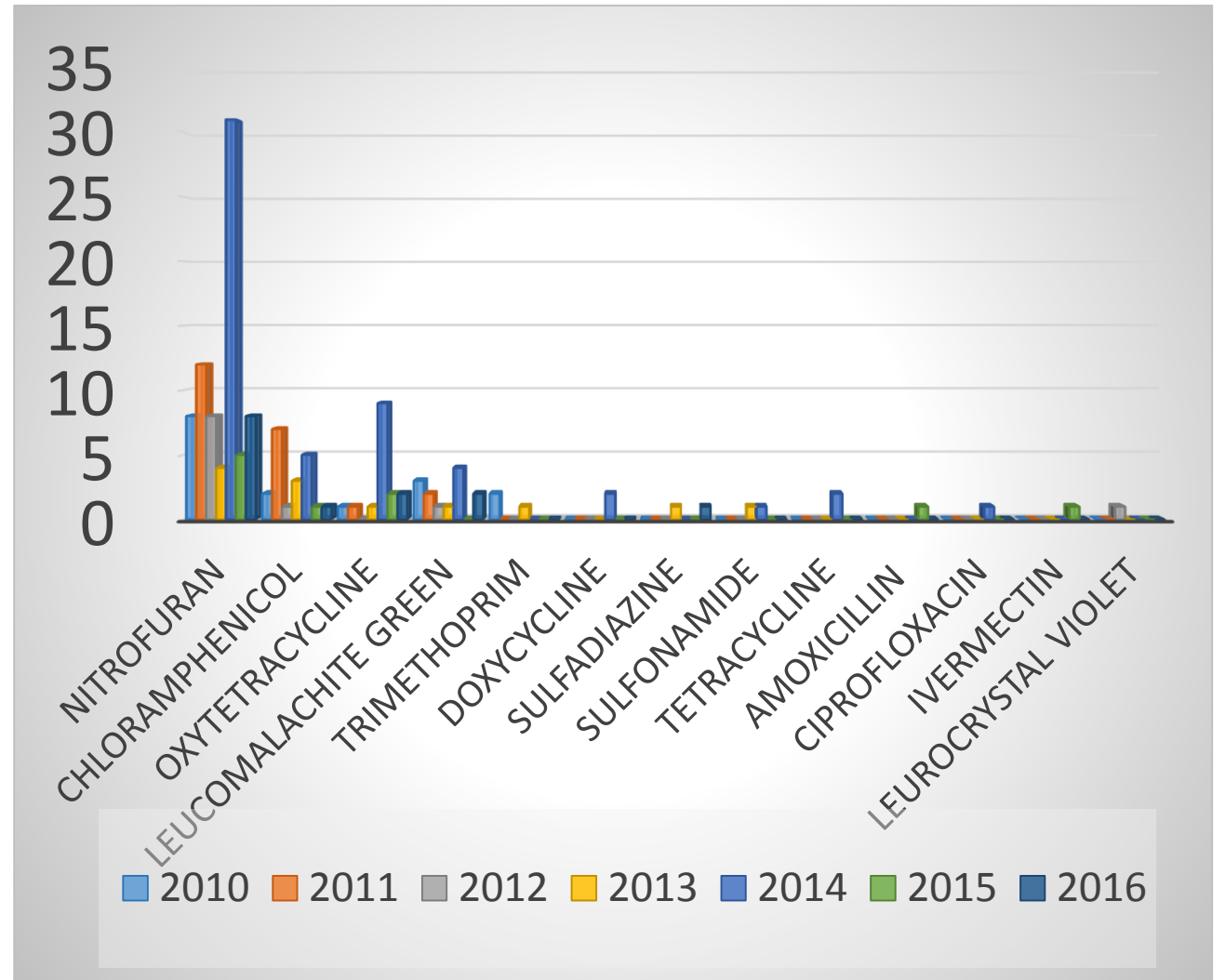
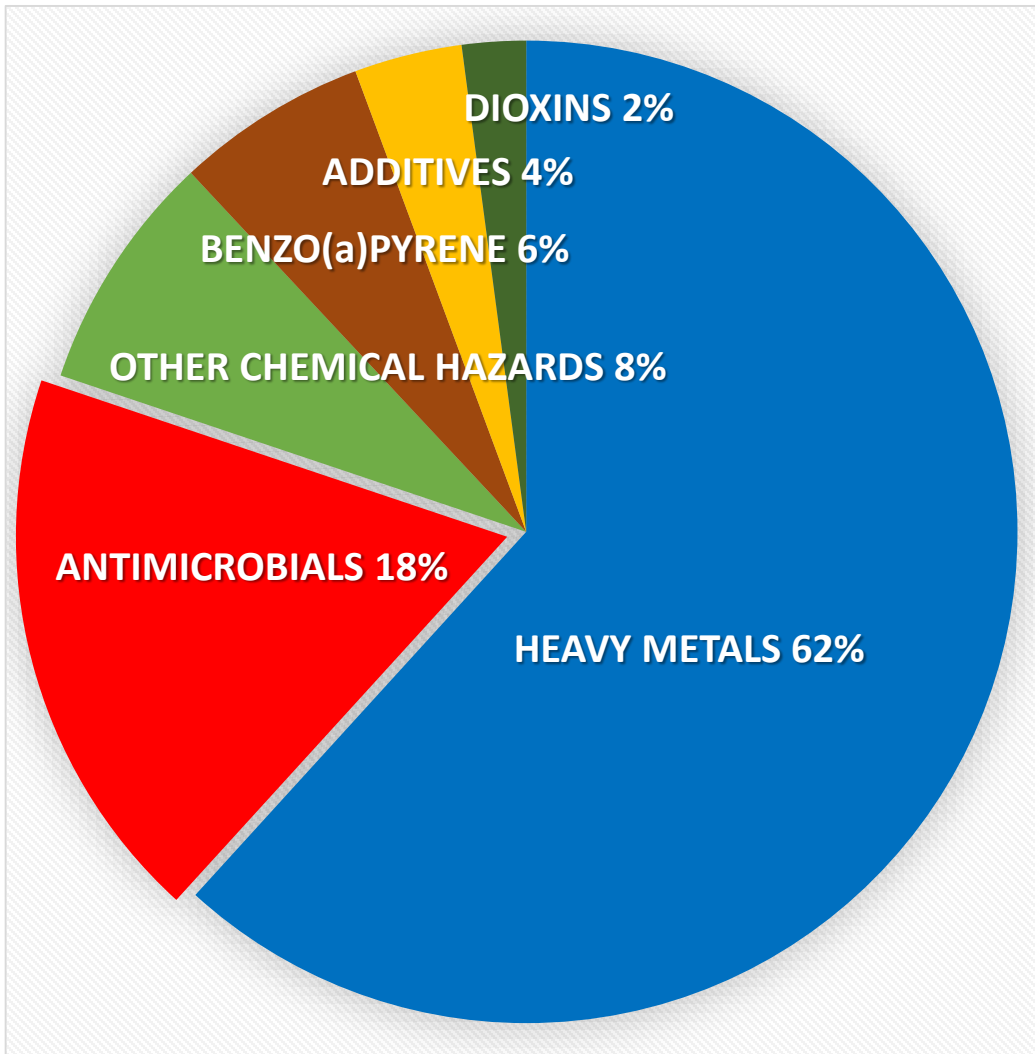


# EU FISH AND CRUSTACEANS PRODUCT ALERTS

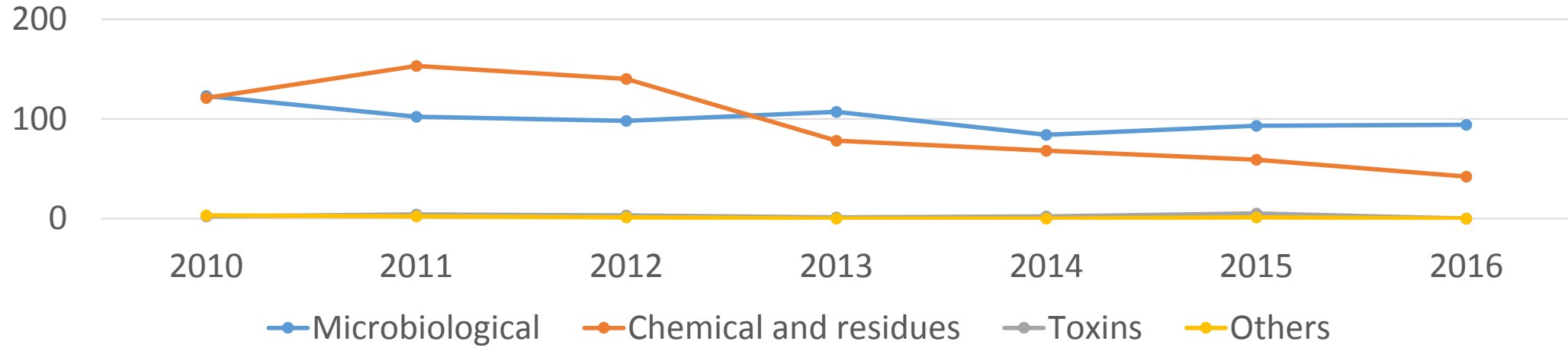
Hazard Category	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Microbiological	52	75	11	17	24	68	70	65	52	31	58	38	38
Chemical and residues	118	177	203	221	108	135	123	149	134	170	221	128	133
Histamine	39	22	29	44	39	51	35	32	44	53	40	33	42
Toxins	0	0	0	0	0	0	0	0	0	0	0	2	4
Parasitic infestation	51	21	15	27	38	70	85	96	54	11	18	11	22
Others	33	14	29	35	46	120	123	137	127	73	43	83	88
<b>TOTAL ALERTS</b>	<b>293</b>	<b>309</b>	<b>287</b>	<b>344</b>	<b>255</b>	<b>444</b>	<b>436</b>	<b>479</b>	<b>411</b>	<b>338</b>	<b>380</b>	<b>295</b>	<b>327</b>

Hazard Category	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Microbiological	51	25	6	4	8	8	13	7	9	3	6	10	15
Chemical and residues	103	128	122	108	111	145	43	40	31	24	57	31	46
Others	5	1	10	9	3	23	22	29	20	26	14	17	8
Biotoxins	0	2	1	0	0	0	0	0	0	0	0	0	0
<b>TOTAL ALERTS</b>	<b>159</b>	<b>156</b>	<b>139</b>	<b>121</b>	<b>122</b>	<b>176</b>	<b>78</b>	<b>76</b>	<b>60</b>	<b>53</b>	<b>77</b>	<b>58</b>	<b>69</b>

# IMPORT REFUSALS DUE TO CHEMICAL HAZARDS IN EU

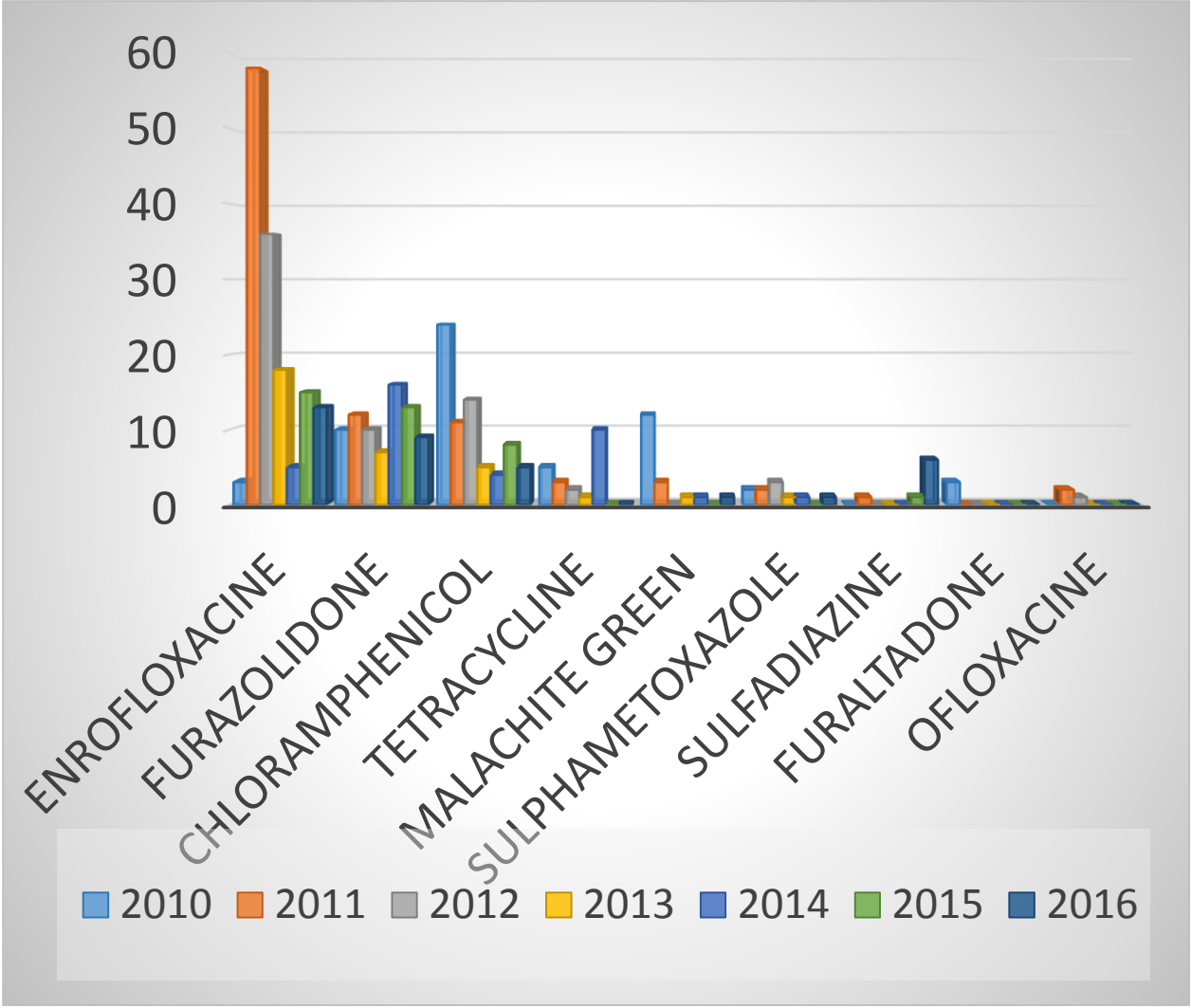
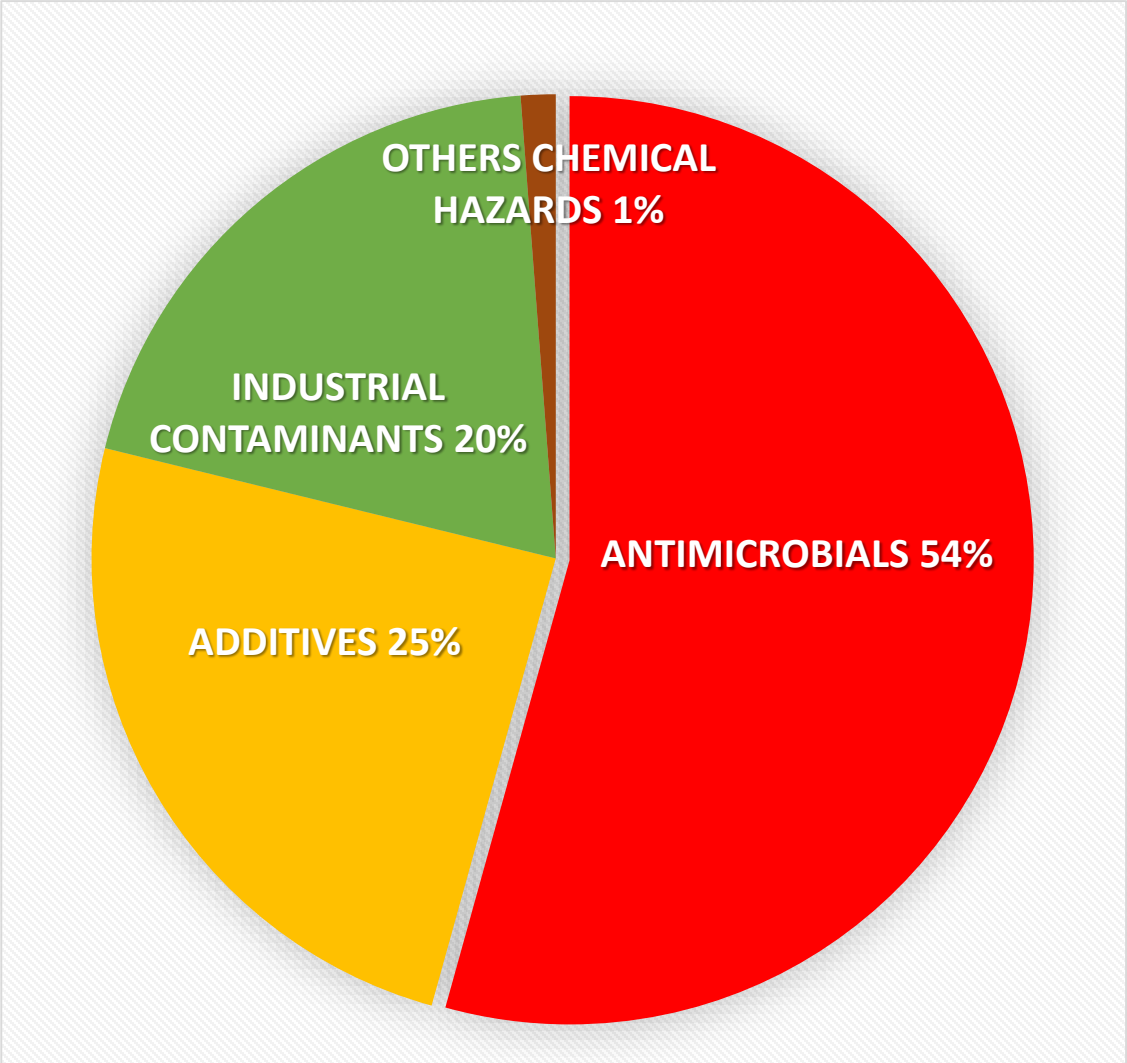


# JAPAN FISHERY PRODUCTS DETENTION

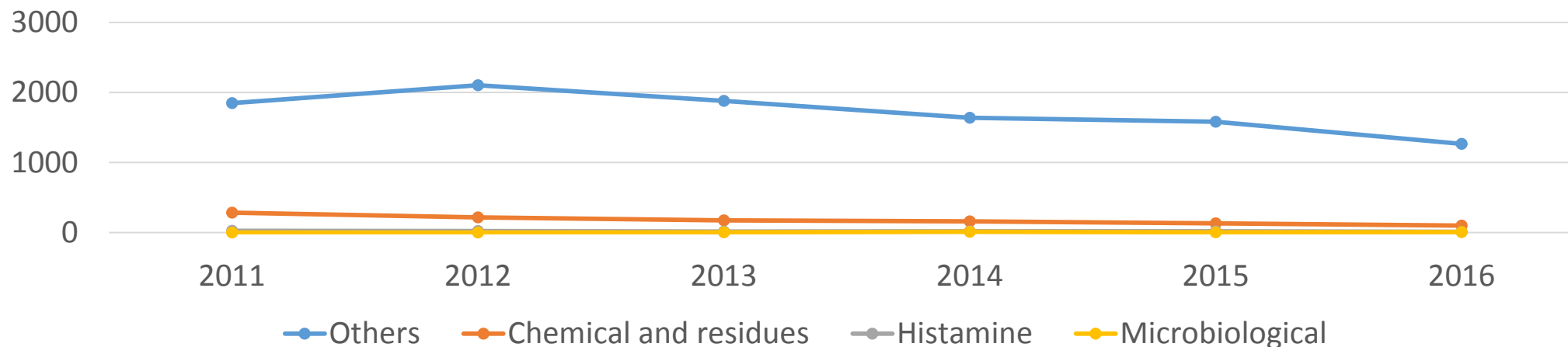


Hazard category	2010	2011	2012	2013	2014	2015	2016	TOTAL
Microbiological	123	102	98	107	84	93	94	701
Chemical	121	153	140	78	68	59	42	661
Toxins	2	4	3	1	2	5	0	17
Others	3	2	1	0	0	1	0	7
<b>TOTAL</b>	<b>249</b>	<b>261</b>	<b>242</b>	<b>186</b>	<b>154</b>	<b>158</b>	<b>136</b>	<b>1 386</b>

# IMPORT REFUSAL DUE TO CHEMICAL HAZARDS IN JAPAN



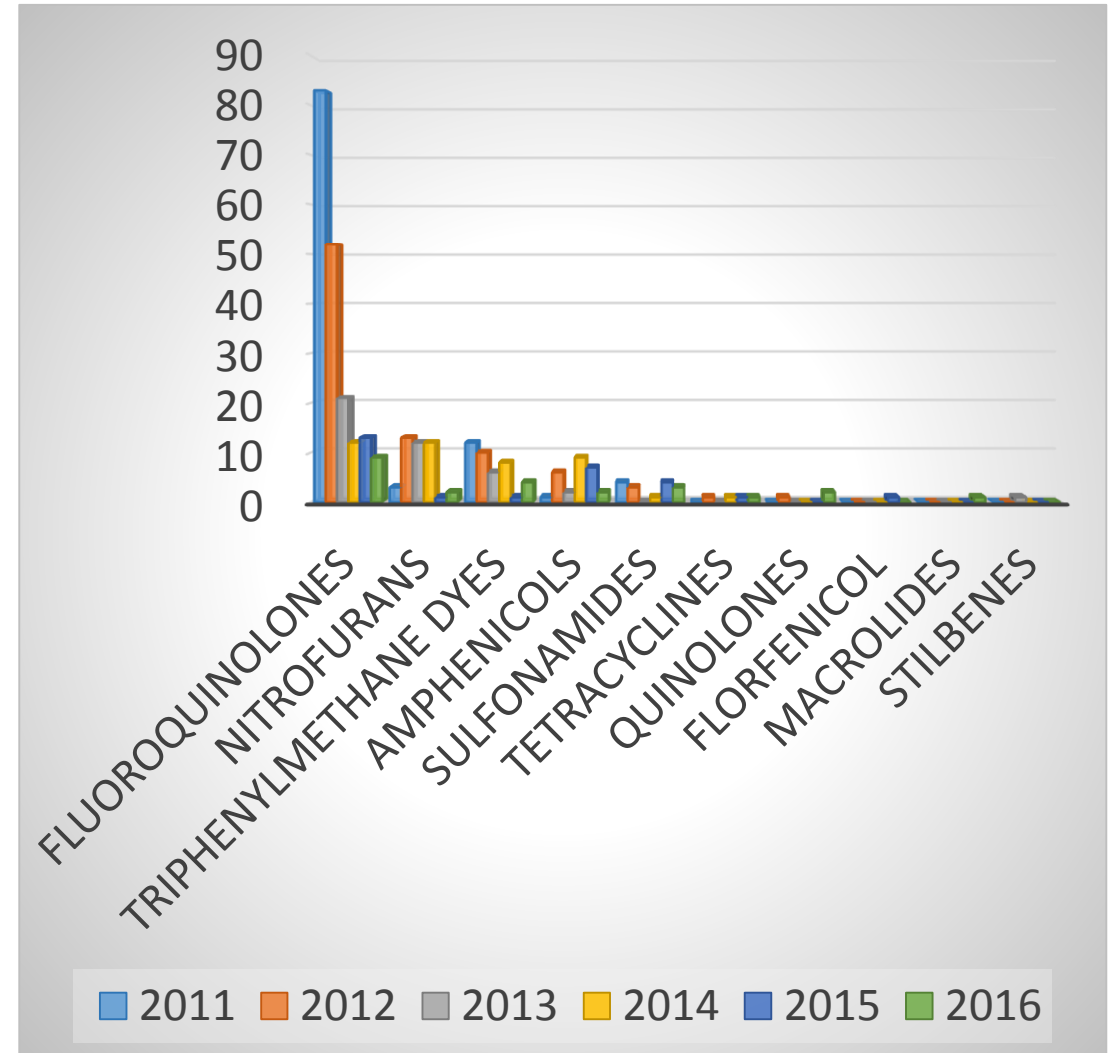
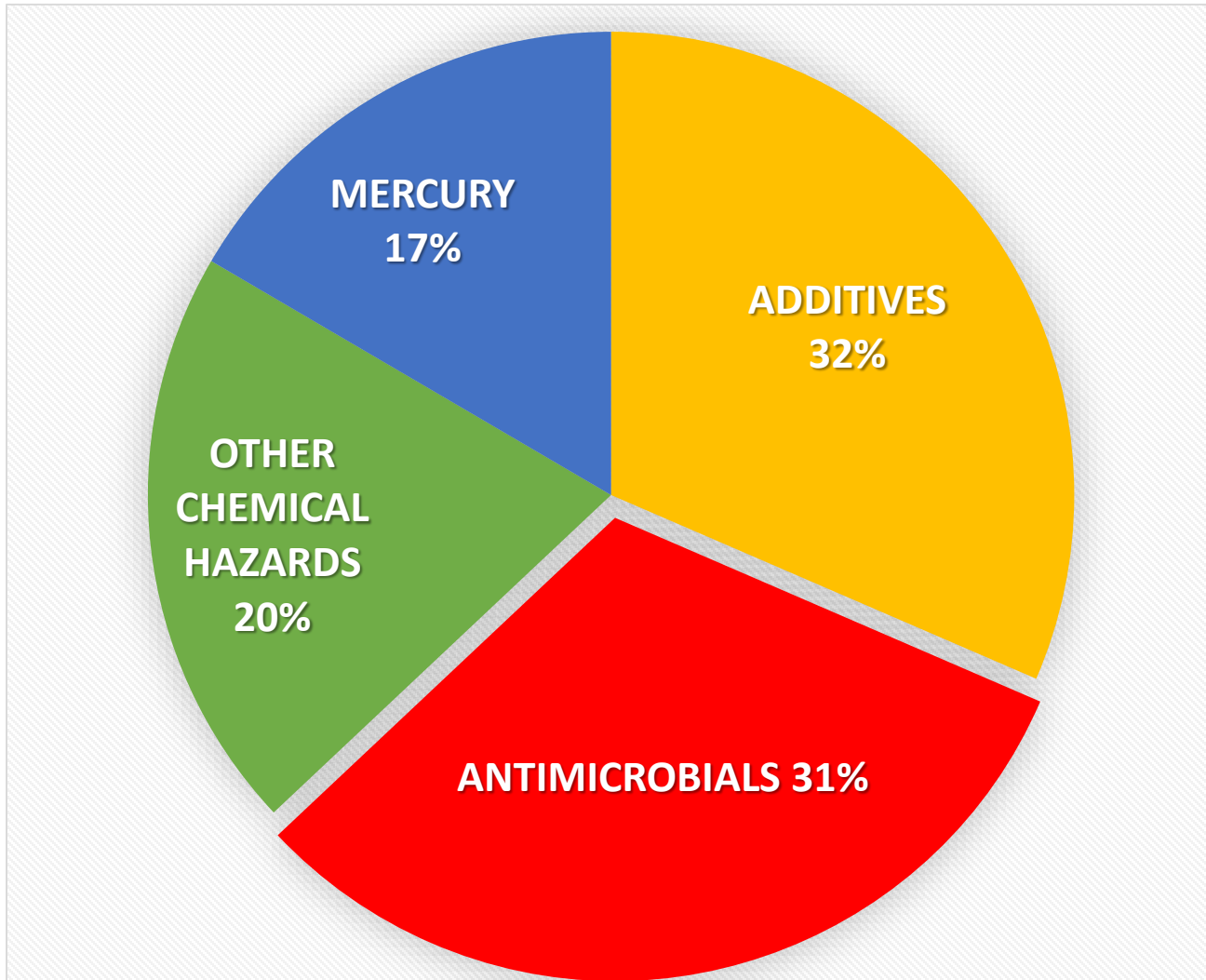
# CANADA, FISHERY PRODUCTS DETENTION



Hazard Category	2011	2012	2013	2014	2015	2016	TOTAL
Others	1 848	2 102	1 880	1 637	1 581	1 265	10 313
Chemical	284	219	175	159	131	102	1 070
Histamine	25	21	14	20	17	13	110
Microbiological	2	2	6	13	6	8	37
<b>TOTAL</b>	<b>2 159</b>	<b>2 344</b>	<b>2 075</b>	<b>1 829</b>	<b>1 735</b>	<b>1 388</b>	<b>11 530</b>



# IMPORT REFUSAL DUE TO CHEMICAL HAZARDS IN CANADA



# **Regulatory frameworks on antimicrobial residues use and MRLs**

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Amphenicols

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$	Action Level: $\text{ng/g(ppb)}$
Florfenicol	Approved	Salmonids	Muscle	0.8	800
Chloramphenicol	Banned	All	N/A	DTC	DTC
Thiamphenicol	Not accepted use	All	N/A	DTC	DTC
Emamectin Benzoate	Approved	Salmonids	Muscle	0.1	100
Ivermectin	Not accepted use	All	N/A	DTC	DTC

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Benzoylureas

Substance name	Regulatory Use Status	Species	Tissue	Action Level: µg/g(ppm)
Teflubenzuron	Approved	Salmonids	Muscle	0.3
Teflubenzuron	Approved	Salmonids	Skin	3.2

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Fluoro-quinolones

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$
Ciprofloxacin	Not accepted use	All	N/A	0.001
Danofloxacin	Not accepted use	All	N/A	0.001
Difloxacin	Not accepted use	All	N/A	0.001
Enrofloxacin	Not accepted use	All	N/A	0.001
Marboflaxin	Not accepted use	All	N/A	0.001
Norfloxacin	Not accepted use	All	N/A	0.001
Orbifloxacin	Not accepted use	All	N/A	0.001
Sarafloxacin	Not accepted use	All	N/A	0.001

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Macrolides and Nitrofurans

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$
Erythromycin	EDR	Fish, crustaceans	Muscle	0.03
Furaltadone	Banned	All	N/A	DTC
Furazolidone	Banned	All	N/A	DTC
Nitrofurantoin	Banned	All	N/A	DTC
Nitrofurazone	Banned	All	N/A	DTC

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Nitroimidazoles

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$
2-hydroxymethyl-1-methyl-5-nitroimidazole (HMMNI)	Banned	All	N/A	DTC
Ipronidazole (IPZ)	Banned	All	N/A	DTC
1-methyl-2-(2'-hydroxyisopropyl)-5-nitroimidazole (IPZ-OH)	Banned	All	N/A	DTC
Metronidazole (MNZ)	Banned	All	N/A	DTC
1-(2-hydroxyethyl)-2-hydroxymethyl-5-nitroimidazole (MNZ-OH)	Banned	All	N/A	DTC
Ronidazole (RNZ)	Banned	All	N/A	DTC
Dimetridazole (DMZ)	Banned	All	N/A	DTC

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Pyrethroids & Quinolones

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$
Cypermethrin	Not accepted use	All	N/A	0.1
Deltamethrin	Not accepted use	All	N/A	0.1
Flumequine	Not accepted use	All	N/A	DTC
Oxolinic Acid	Not accepted use	All	N/A	DTC



# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Steroids

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$
Boldenone (17 beta-boldenone)	Not accepted use	All	N/A	DTC
Methyltestosterone (17 alpha-methyltestosterone)	Not accepted use	All	N/A	DTC
Nandrolone (17 beta-19-nortestosterone)	Not accepted use	All	N/A	DTC
epi-Boldenone (17 alpha-boldenone)	Not accepted use	All	N/A	DTC
epi-Nandrolone (17 alpha-19-nortestosterone)	Not accepted use	All	N/A	DTC

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Stilbenes

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$
Dienestrol (DIEN)	Banned	All	N/A	DTC
Diethylstilbestrol (DES)	Banned	All	N/A	DTC
Hexestrol (HEX)	Banned	All	N/A	DTC

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Sulfonamides

Substance name	Regulatory Use Status	Species	Tissue	Action Level: µg/g(ppm)
Ormetoprim	Approved	Salmonids	Edible Tissue	0.1
Sulfadiazine	Approved	Salmonids	Edible Tissue	0.1
Sulfadimethoxine	Approved	Salmonids	Edible Tissue	0.1
Trimethoprim	Approved	Salmonids	Muscle	0.1
Sulfacetamide	Not accepted use	All	N/A	DTC
Sulfa-chloropyridazine	Not accepted use	All	N/A	DTC
Sulfadoxine	Not accepted use	All	N/A	DTC
Sulfaguanadine	Not accepted use	All	N/A	DTC
Sulfamerazine	Not accepted use	All	N/A	DTC

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Sulfonamides

Substance name	Regulatory Use Status	Species	Tissue	Action Level: µg/g(ppm)
Sulfamethazine	Not accepted use	All	N/A	DTC
Sulfamethiazole	Not accepted use	All	N/A	DTC
Sulfamethoxazole	Not accepted use	All	N/A	DTC
Sulfa- methoxypridazine	Not accepted use	All	N/A	DTC
Sulfa- monomethoxine	Not accepted use	All	N/A	DTC
Sulfamoxole	Not accepted use	All	N/A	DTC
Sulfanilamide	Not accepted use	All	N/A	DTC
Sulfapyridine	Not accepted use	All	N/A	DTC
Sulfaquinoxaline	Not accepted use	All	N/A	DTC
Sulfathiazole	Not accepted use	All	N/A	DTC
Sulfisoxazole	Not accepted use	All	N/A	DTC

# Canadian Food Inspection Agency Aquaculture Residue Monitoring List

## Tetracyclines & triphenyl-methane Dyes

Substance name	Regulatory Use Status	Species	Tissue	Action Level: $\mu\text{g/g(ppm)}$
Doxycycline	Not accepted use	All	N/A	DTC
Oxytetracycline	Approved	Salmonids, Lobsters	Muscle	0.2
Chlorotetracycline	Not accepted use	All	N/A	DTC
Tetracycline	Not accepted use	All	N/A	DTC
Gentian Violet	Not accepted use	All	N/A	DTC
Malachite Green	Not accepted use	All	N/A	DTC

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Amoxicillin	Amoxicillin	All food producing species	50 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/
			50 µg/kg	Fat		Antibiotics
			50 µg/kg	Liver		
			50 µg/kg	Kidney		
			4 µg/kg	Milk		

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Ampicillin	Ampicillin	All food producing species	50 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
			50 µg/kg	Fat		
			50 µg/kg	Liver		
			50 µg/kg	Kidney		
			4 µg/kg	Milk		
Benzylpenicillin	Benzylpenicillin	All food producing species	50 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
			50 µg/kg	Fat		
			50 µg/kg	Liver		
			50 µg/kg	Kidney		
			4 µg/kg	Milk		

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Bronopol	NOT APPLICABLE	Fin fish	No MRL required	NOT APPLICABLE	NO ENTRY	NO ENTRY
Cetrimide	NOT APPLICABLE	All food producing species	No MRL required	NOT APPLICABLE	NO ENTRY	NO ENTRY
Chlorhexidine	NOT APPLICABLE	All food producing species	No MRL required	NOT APPLICABLE	For topical use only.	NO ENTRY
Chlortetracycline	Sum of parent drug and its 4-epimer	All food producing species	100 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for liver and kidney do not apply to fin fish.	Anti-infectious agents/
			300 µg/kg	Liver		Antibiotics
			600 µg/kg	Kidney		
			100 µg/kg	Milk		
			200 µg/kg	Eggs		



# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Cloxacillin	Cloxacillin	All food producing species	300 µg/kg 300 µg/kg 300 µg/kg 300 µg/kg 30 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
				Fat		
				Liver		
				Kidney		
				Milk		
Colistin	Colistin	All food producing species	150 µg/kg 150 µg/kg 150 µg/kg 200 µg/kg 50 µg/kg 300 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish.	Anti-infectious agents/ Antibiotics
				Fat		
				Liver		
				Kidney		
				Milk		
				Eggs		

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Danofloxacin	Danofloxacin	All food producing species	100 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
			50 µg/kg	Fat		
			200 µg/kg	Liver		
			200 µg/kg	Kidney		
Dicloxacillin	Dicloxacillin	All food producing species	300 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
			300 µg/kg	Fat		
			300 µg/kg	Liver		
			300 µg/kg	Kidney		
			300 µg/kg	Milk		
30 µg/kg						

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Difloxacin	Difloxacin	All other food producing species	300 µg/kg 100 µg/kg 800 µg/kg 600 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish.	Anti-infectious agents/
				Fat	Not for use in animals from which eggs are produced for human consumption	Antibiotics
				Liver		
				Kidney		
Enrofloxacin	Sum of enrofloxacin and ciprofloxacin	All other food producing species	100 µg/kg 100 µg/kg 200 µg/kg 200 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish.	Anti-infectious agents/
				Fat	Not for use in animals from which eggs are produced for human consumption.	Antibiotics
				Liver		
				Kidney		

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Erythromycin	Erythromycin A	All other food producing species	200 µg/kg 200 µg/kg 200 µg/kg 200 µg/kg 40 µg/kg 150 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish.	Anti-infectious agents/ Antibiotics
				Fat		
				Liver		
				Kidney		
				Milk		
				Eggs		
Florfenicol	Sum of florfenicol and its metabolites measured as florfenicol-amine	Fin fish	1 000 µg/kg	Muscle and skin in natural proportions.	Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Flumequine	Flumequine	Fin fish	600 µg/kg	Muscle and skin in natural proportions.	Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
Oxacillin	Oxacillin	All food producing species	300 µg/kg 300 µg/kg 300 µg/kg 300 µg/kg 30 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
				Fat		
				Liver		
				Kidney		
				Milk		

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Oxolinic acid	Oxolinic acid	All food producing species	100 µg/kg 50 µg/kg 150 µg/kg 150 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which milk or eggs are produced for human consumption.	Anti-infectious agents/
				Fat		Antibiotics
				Liver		
				Kidney		
Oxytetracycline	Sum of parent drug and its 4-epimer	All food producing species	100 µg/kg 300 µg/kg 600 µg/kg 100 µg/kg 200 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish.	Anti-infectious agents/
				Fat		Antibiotics
				Liver		
				Kidney		
				Eggs		

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Paromomycin	Paromomycin	All food producing species	500 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for liver and kidney do not apply to fin fish. Not for use in animals from which milk or eggs are produced for human consumption.	Anti-infectious agents/
			1 500 µg/kg	Liver		Antibiotics
			1 500 µg/kg			
Sarafloxacin	Sarafloxacin	Salmonidae	30 µg/kg	Kidney	Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/
				Muscle and skin in natural proportions		Antibiotics

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Spectinomycin	Spectinomycin	All other food producing species	300 µg/kg 500 µg/kg 1 000 µg/kg 5 000 µg/kg 200 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/
				Fat		Antibiotics
				Liver		
				Kidney		
				Milk		
Sulfonamides (all substances belonging to the sulfonamide group)	Parent drug	All food producing species	100 µg/kg 100 µg/kg 100 µg/kg 100 µg/kg	Muscle	The combined total residues of all substances within the sulfonamide group should not exceed 100 µg/kg. For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Chemotherapeutics/
				Fat		
				Liver		
				Kidney		



# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Tetracycline	Sum of parent drug and its 4-epimer	All food producing species	100 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for liver and kidney do not apply to fin fish.	Anti-infectious agents/ Antibiotics
			300 µg/kg	Liver		
			600 µg/kg	Kidney		
			100 µg/kg	Milk		
			200 µg/kg	Eggs		
Thiamphenicol	Thiamphenicol	All food producing species	50 µg/kg	Muscle	For fin fish the muscle MRL relates to 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
			50 µg/kg	Liver		
			50 µg/kg	Kidney		
			50 µg/kg	Milk		
			50 µg/kg			

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Tilmicosin	Tilmicosin	All other food producing species	50 µg/kg	Muscle	For fin fish the muscle MRL relates to a 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. Not for use in animals from which eggs are produced for human consumption	Anti-infectious agents/ Antibiotics
			50 µg/kg	Liver		
			1 000 µg/kg	Kidney		
			1 000 µg/kg	Milk		
Trimethoprim	Trimethoprim	All other food producing species	50 µg/kg	Muscle	For fin fish the muscle MRL relates to a 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. For porcine and poultry species the fat MRL relates to 'skin and fat in natural proportions'. Not for use in animals from which eggs are produced for human consumption.	Anti-infectious agents/ Antibiotics
			50 µg/kg	Fat		
			50 µg/kg	Liver		
			50 µg/kg	Kidney		
			50 µg/kg	Milk		

# ANTIMICROBIALS IN EU

Pharmacologically active Substance	Marker residue	Animal Species	MRL	Target Tissues	Other Provisions (according to Article 14(7) of Regulation (EC) No 470/2009)	Therapeutic Classification
Tylosin	Tylosin A	All food producing species	100 µg/kg 100 µg/kg 100 µg/kg 100 µg/kg 50 µg/kg 200 µg/kg	Muscle	For fin fish the muscle MRL relates to a 'muscle and skin in natural proportions'. MRLs for fat, liver and kidney do not apply to fin fish. For porcine and poultry species the fat MRL relates to 'skin and fat in natural proportions'.	Anti-infectious agents/
				Fat		Antibiotics
				Liver		
				Kidney		
				Milk		
				Eggs		
Tyrosine	NOT APPLICABLE	All food producing species	No MRL required	NOT APPLICABLE	NO ENTRY	NO ENTRY

# Antimicrobial Resistance (AMR)

## AMR and food safety

- Ingestion of AMR organisms via food can, if they are pathogenic, result in human illnesses that might not respond to available antibiotic or other treatments.

Example: in freshwater fish, antibiotic resistance has been observed to tetracycline (90.71%) followed by ampicillin (70%) and amoxicillin-clavulanic acid (45%) in *salmonella spp* (Elhadi, 2014).

# AMR in fishery and aquaculture products

ASFIS	Common name	Category	Target	Antibiotic
Salmo Salar	Atlantic salmon	Smoked product	Listeria monocytogenes	ampicillin
Carpiones carpio	Carfu	Frozen freshwater product	Salmonella spp.	tetracycline
Carpiones carpio	Carfu	Frozen freshwater product	Salmonella spp.	ampicillin
Carpiones carpio	Carfu	Frozen freshwater product	Salmonella spp.	amoxicillin-clavulanic acid
Pangasius spp.	Catfish	Frozen freshwater product	Salmonella spp.	tetracycline
Pangasius spp.	Catfish	Frozen freshwater product	Salmonella spp.	ampicillin
Pangasius spp.	Catfish	Frozen freshwater product	Salmonella spp.	amoxicillin-clavulanic acid
Crassostrea gigas	Oyster	Fresh product	Escherichia coli	ampicillin
Crassostrea gigas	Oyster	Fresh product	Escherichia coli	cephalothin
Ruditapes philippinarum	Short-necked clam	Fresh product	Escherichia coli	ampicillin

# AMR in fishery and aquaculture products

ASFIS	Common name	Category	Target	Antibiotic
Ruditapes philippinarum	Short-necked clam	Fresh product	Escherichia coli	cephalothin
Mugil cephalus	Mullet	Salted product	Staphylococcus aureus	augmentin
Mugil cephalus	Mullet	Salted product	Staphylococcus aureus	methicillin
Penaeus monodon	Giant tiger prawn	Fresh product	Vibrio vulnificus	oxytetracycline
Salmo Salar	Atlantic salmon	Fresh product	Aeromonas salmonicida	oxytetracycline
Salmo Salar	Atlantic salmon	Fresh product	Aeromonas salmonicida	oxolinic acid
Gadus morhua	Cod	Fillet	Enterococcus faecium	nitrofurantoin
Galeorhinus galeus	Dogfish	Fillet	Enterococcus faecium	nitrofurantoin
Genypterus capensis	Kingklip	Fillet	Enterococcus faecium	erythromycin
Isurus oxyrinchus	Shortfin mako shark	Fillet	Enterococcus faecium	erythromycin

# AMR in fishery and aquaculture products

ASFIS	Common name	Category	Target	Antibiotic
Xiphias gladius	Swordfish	Fillet	Enterococcus faecium	erythromycin
Xiphias gladius	Swordfish	Fillet	Enterococcus faecium	rifampicin
Gadus spp.	Cod	Salted product	Staphylococcus aureus	benzalkonium chloride
Gadus spp.	Cod	Salted product	Staphylococcus aureus	peracetic acid
Gadus spp.	Cod	Salted product	Staphylococcus aureus	sodium hypochlorite
Sepia spp.	Cuttlefish	Fresh product	Staphylococcus aureus	benzalkonium chloride
Sepia spp.	Cuttlefish	Fresh product	Staphylococcus aureus	peracetic acid
Sepia spp.	Cuttlefish	Fresh product	Staphylococcus aureus	sodium hypochlorite
Merluccius spp.	Hake	Nugget	Staphylococcus aureus	benzalkonium chloride
Merluccius spp.	Hake	Nugget	Staphylococcus aureus	peracetic acid

# AMR in fishery and aquaculture products

ASFIS	Common name	Category	Target	Antibiotic
Merluccius spp.	Hake	Nugget	Staphylococcus aureus	sodium hypochlorite
Pterogymnus spp.	Panga	Fillet	Staphylococcus aureus	benzalkonium chloride
Pterogymnus spp.	Panga	Fillet	Staphylococcus aureus	peracetic acid
Pterogymnus spp.	Panga	Fillet	Staphylococcus aureus	sodium hypochlorite
Loligo vulgaris	Squid	Frozen ring	Staphylococcus aureus	benzalkonium chloride
Loligo vulgaris	Squid	Frozen ring	Staphylococcus aureus	peracetic acid
Loligo vulgaris	Squid	Frozen ring	Staphylococcus aureus	sodium hypochlorite
Xiphias gladius	Swordfish	Smoked product	Staphylococcus aureus	benzalkonium chloride
Xiphias gladius	Swordfish	Smoked product	Staphylococcus aureus	peracetic acid
Xiphias gladius	Swordfish	Smoked product	Staphylococcus aureus	sodium hypochlorite
Thunnus spp.	Tuna	Mojama(salted dry tuna)	Staphylococcus aureus	benzalkonium chloride
Thunnus spp.	Tuna	Mojama(salted dry tuna)	Staphylococcus aureus	peracetic acid
Thunnus spp.	Tuna	Mojama(salted dry tuna)	Staphylococcus aureus	sodium hypochlorite





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# Thank you for your attention

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