



Istituto Zooprofilattico Sperimentale
dell'Umbria e delle Marche "Togo Rosati"

Response: therapy and vaccination

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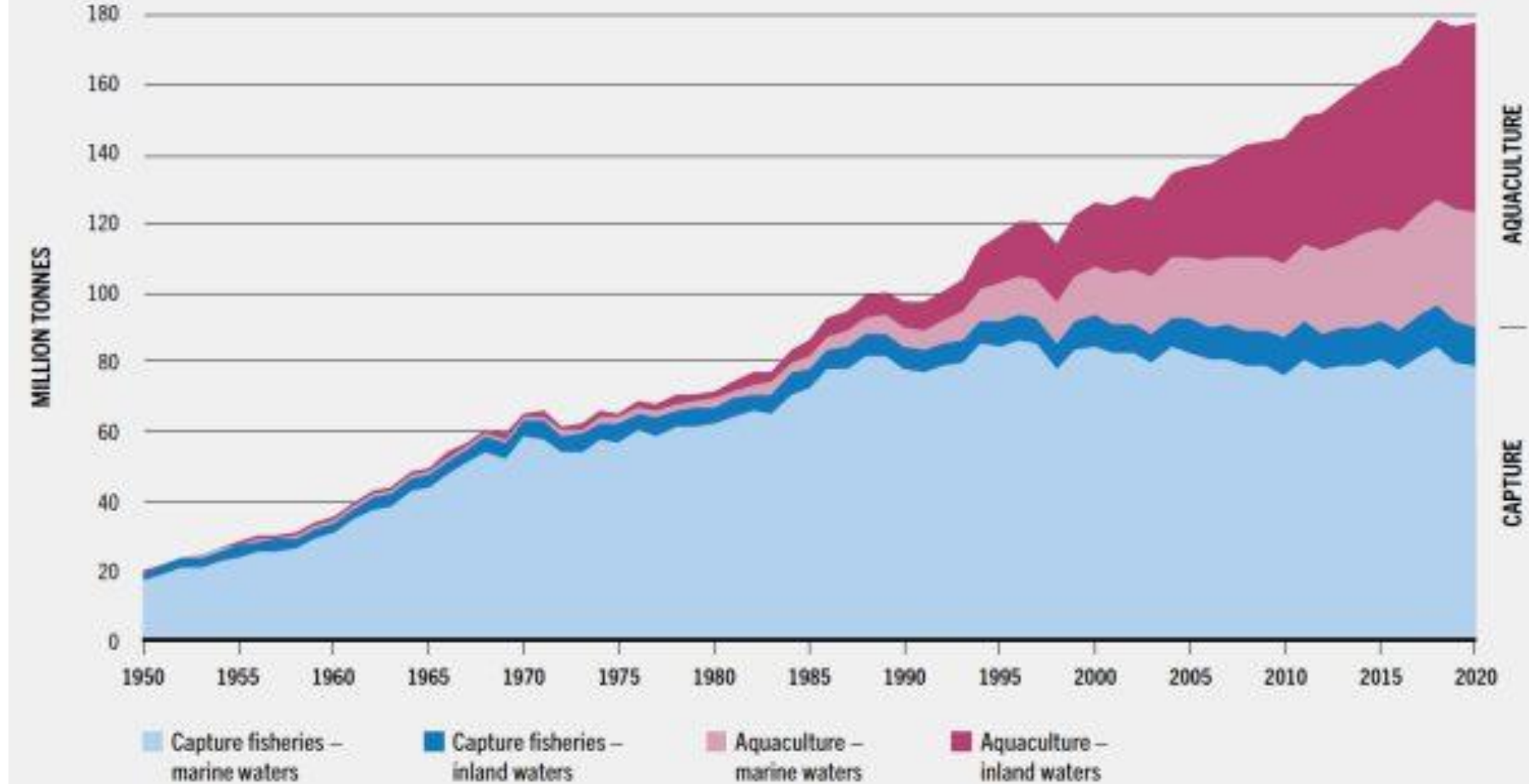


World Organisation
for Animal Health
Founded as OIE

Workshop for WOAH National Focal Points for Aquatic Animals in Europe
Chioggia – October 18-20, 2023

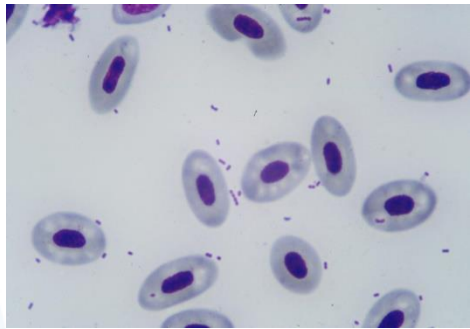
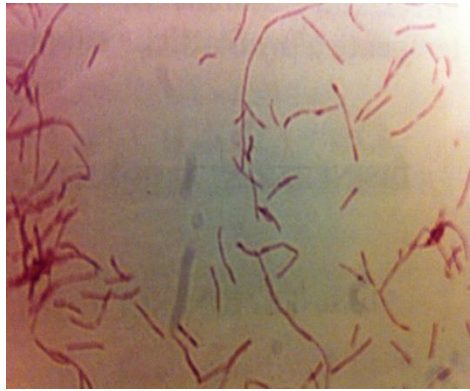
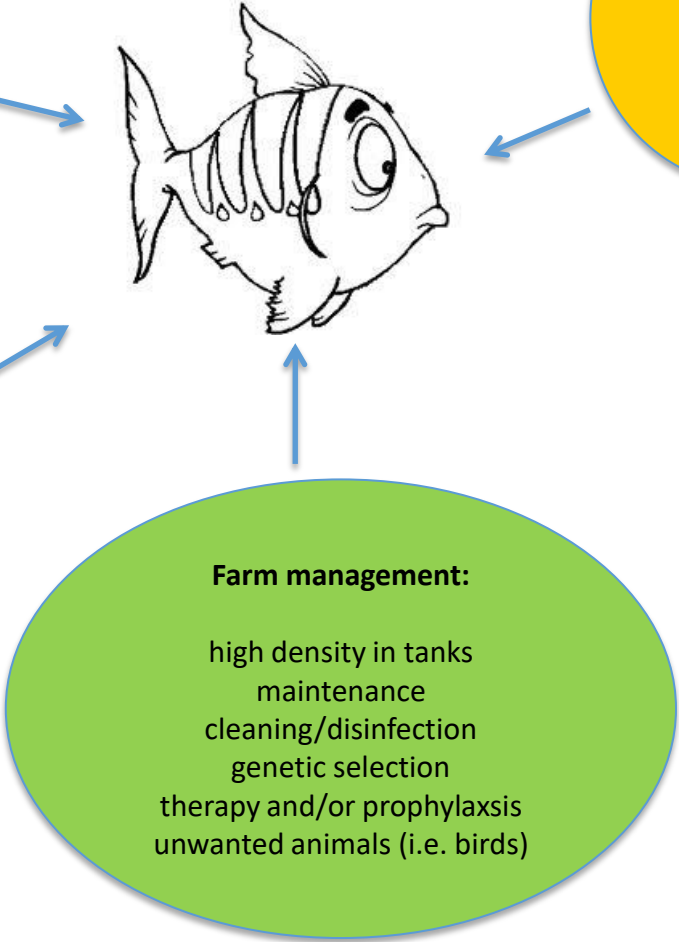
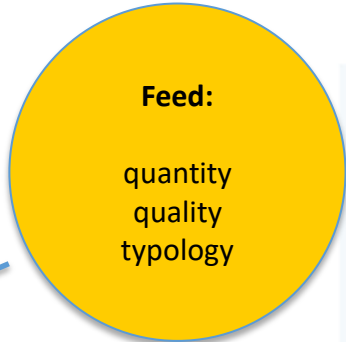
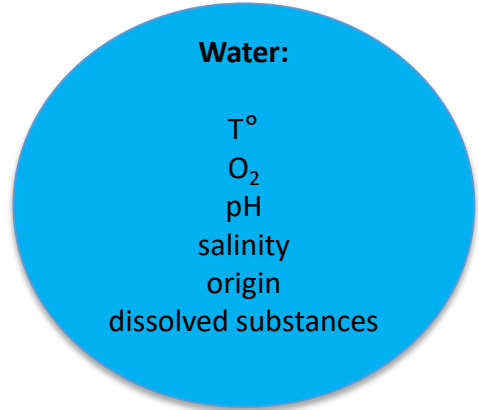


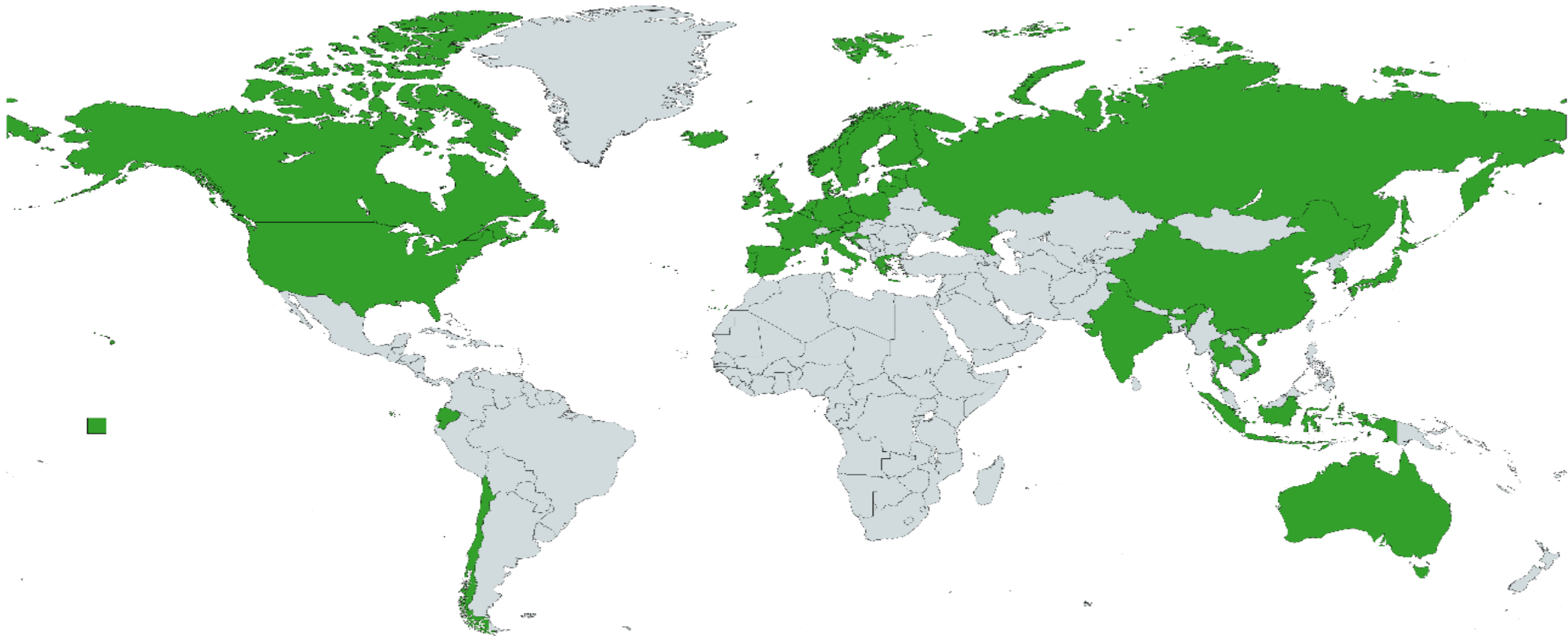
FIGURE 1 WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



NOTES: Excluding aquatic mammals, crocodiles, alligators, caimans and algae. Data expressed in live weight equivalent.
SOURCE: FAO.

The State of World Fisheries and Aquaculture 2022 – FAO Report

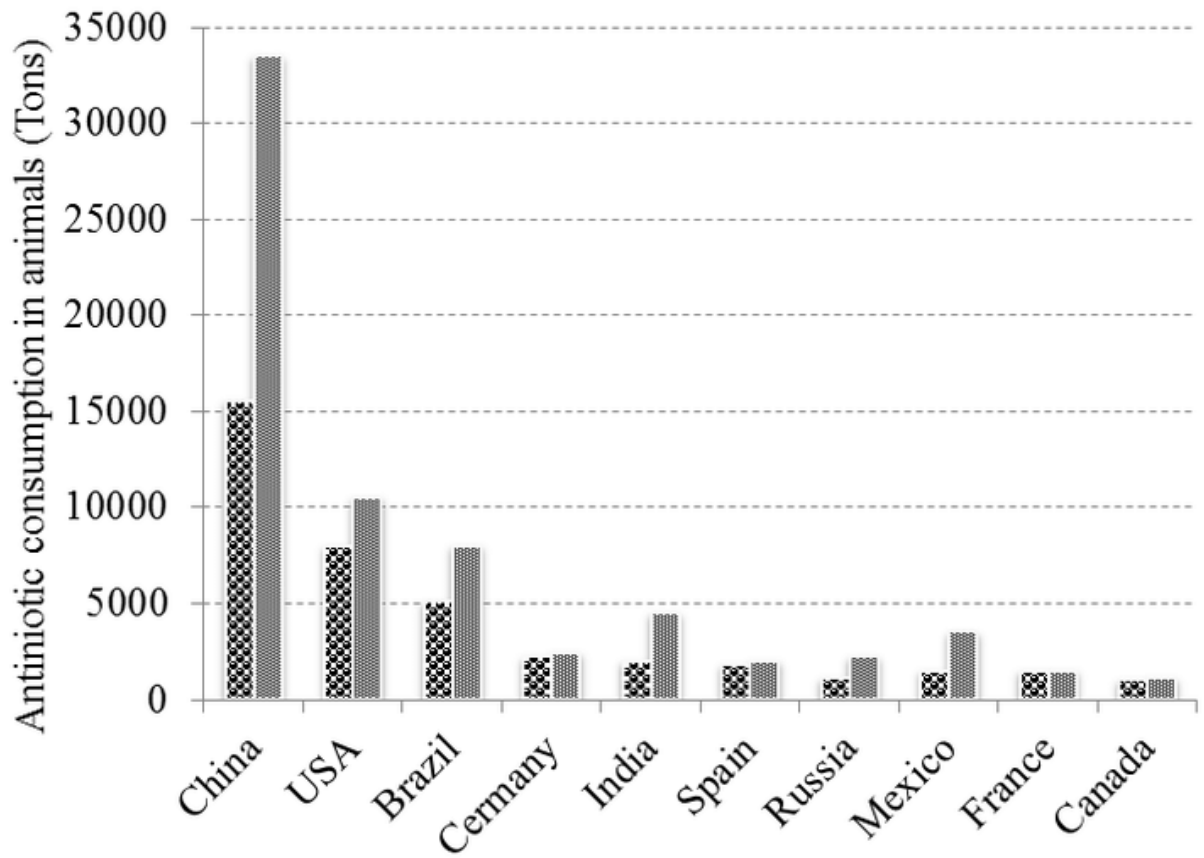




From Luthman et al., 2023 (in review)

1. How has the presence of AMR been translated into international steering documents and how does it relate to aquaculture?
2. How do the antibiotic regulations in 17 of the largest aquaculture-producing countries/regions compare to these recommendations as defined by the WHO and two leading aquaculture certification programs?





From Sarkar et al., 2018

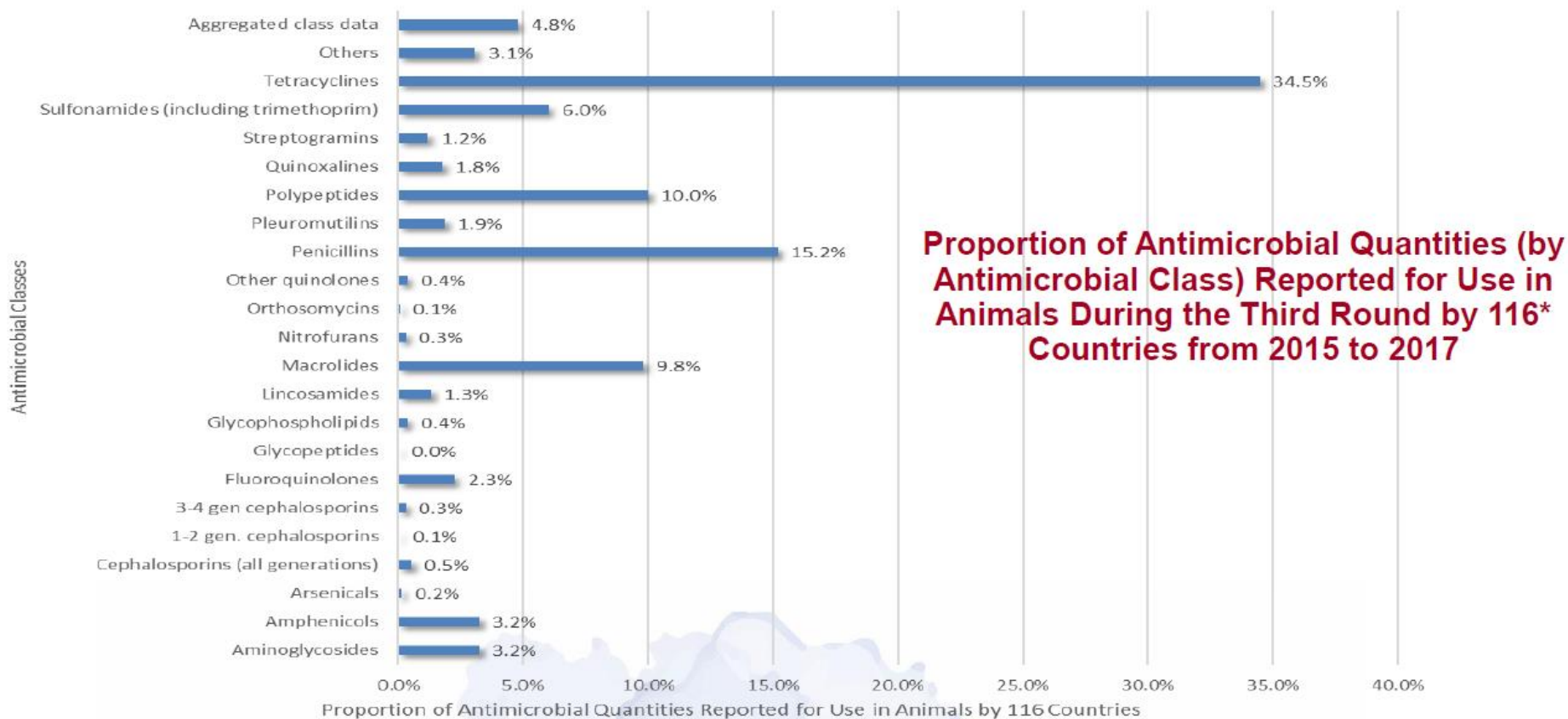
▨ 2010
▨ 2030



Main antimicrobials used in livestock farming in the world in 116 countries



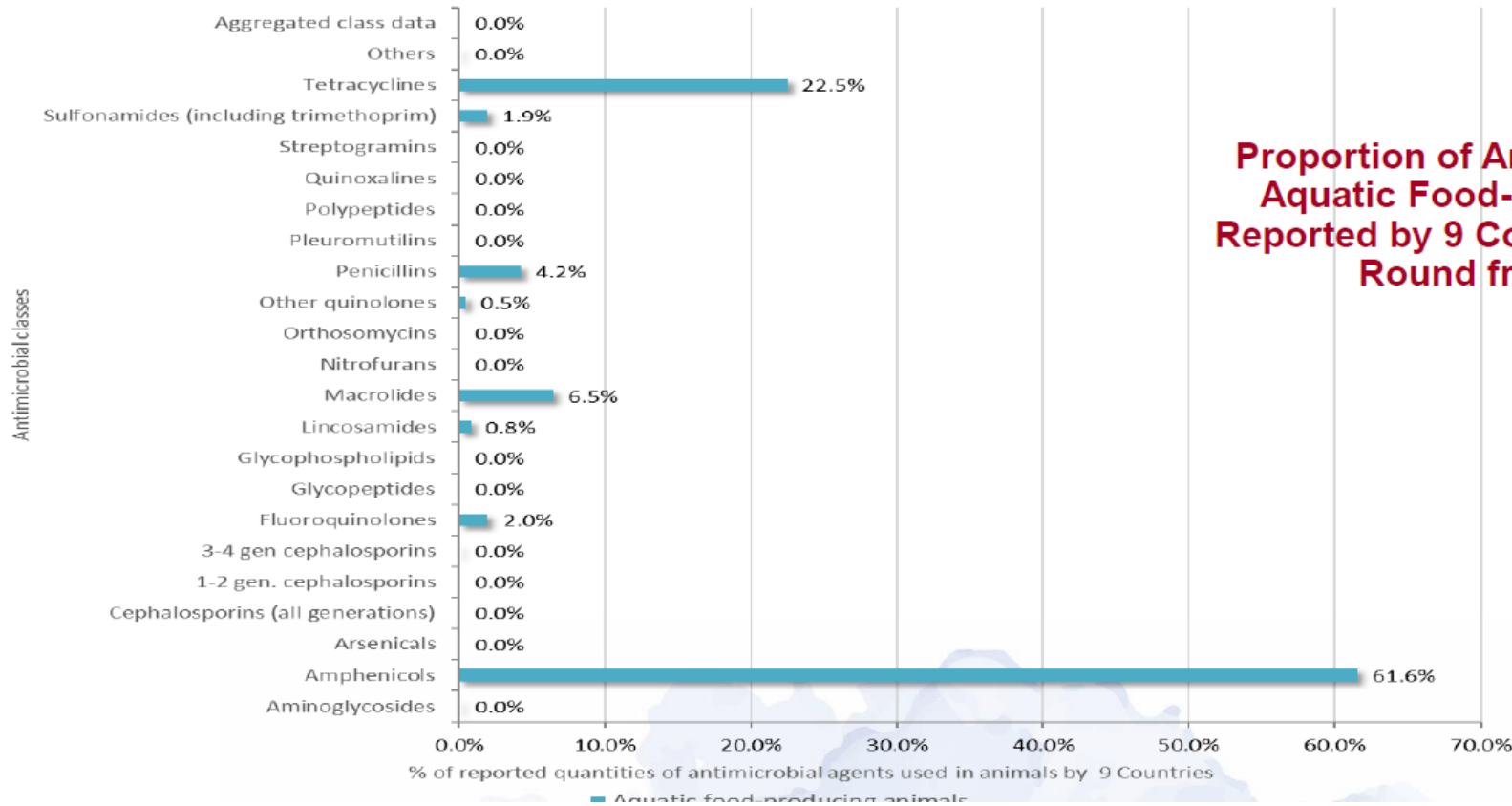
OIE GLOBAL CONFERENCE
ON AQUATIC ANIMAL HEALTH
COLLABORATION, SUSTAINABILITY: OUR FUTURE
SANTIAGO, CHILE, 2-4 APRIL 2019



Main antimicrobials used in aquaculture in 9 countries (N,USA, Jap.,Cile, DK,F, UK, Vietnam, Canada)



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Antimicrobials consumption in European aquaculture

Table 6. Estimated PCU (in 1,000 tonnes) of the population of food-producing animals^{1,2}, by country, in 2020

Country	Cattle	Pigs	Poultry	Sheep and goats	Fish	Rabbits	Horses	Total
Austria	422	357	89	36	0	0	38	942
Belgium	484	832	285	19	0	4	122	1,745
Bulgaria	114	76	42	100	14	<0.01	23	368
Croatia	103	92	49	52	21	0.01	11	329
Cyprus	20	45	13	43	0	0.1	2	123
Czechia	288	199	131	16	20	7	39	699
Denmark	380	1,754	123	12	46	0	70	2,385
Estonia	59	43	2	5	1	0	5	116
Finland	207	146	85	12	15	0	30	494
France	3,065	1,811	1,087	644	46	39	272	6,965
Germany	2,922	3,534	1,022	132	19	23	520	8,173
Greece	77	103	144	759	129	2	2	1,217
Hungary	152	315	211	82	9	8	24	801
Iceland	19	6	6	41	41	0	23	135
Ireland	1,304	294	111	344	38	0	100	2,190
Italy	1,424	782	766	571	59	30	157	3,790

European Medicines Agency, European Surveillance of Veterinary Antimicrobial Consumption, 2021.
 'Sales of veterinary antimicrobial agents in 31 European countries in 2019 and 2020'. (EMA/58183/2021)

Antibacterial approved in EU (from EMA-CVMP July, 2020, modified)

	N	GR	ES	I	F	DK	PL	CZ	D	H	FL	IE	S	HR	IS	NL	P	BG	RO
Amoxicillin				X															
Chlortetracycline				X															
Enrofloxacin																		X	X
Florfenicol	X	X		X	X	X		X		X				X			X	X	X
Flumequine		X	X	X	X													X	X
Oxolinic Acid		X			X	X													
Oxytetracycline	X	X	X	X	X		X	X			X	X		X			X	X	X
Sulfatrimethoprim		X		X	X				X										



Antiparasitic molecules approved in Europe (from EMA-CVMP, July 2020, modified)

	N	GR	ES	I	F	DK	PL	CZ	D	H	FL	IE	S	HR	IS	NL	P	BG	RO
Hydrogen peroxide	x											x			x				
Azametiphos	x																		
Bronopol	x		x		x														
Cypermethrin	x																		
Deltamethrin	x											x							
Diflubenzuron	x																		
Emamectin benzoate	x		x								x	x			x		x		
Formaldehyde		x	x														x		
Teflubenzuron*	x											x							

*medicated feed

EU REGULATION 2019/6 (DECEMBER 11TH 2018), RELATING TO VETERINARY MEDICAL PRODUCTS

Extra label drugs for aquatic species: use according to the “cascade principle”

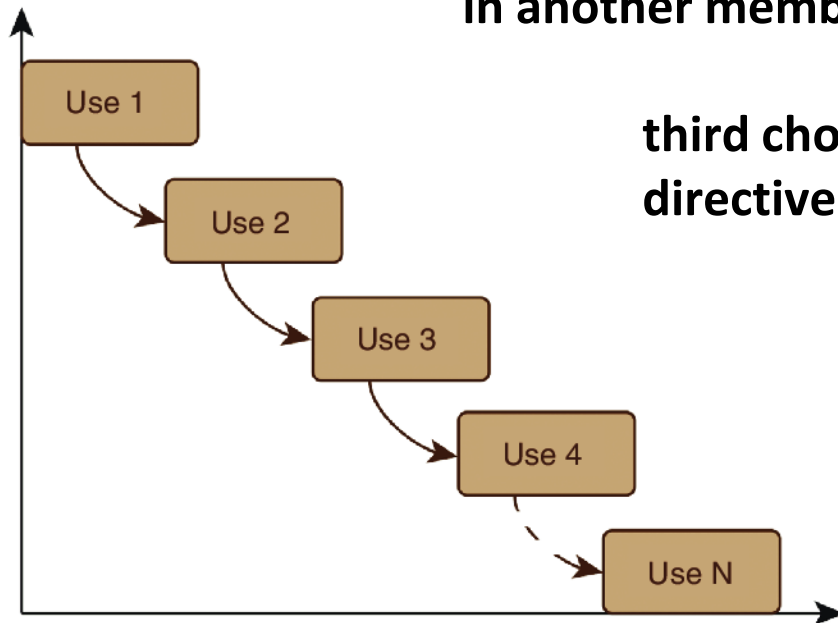
**Absence of authorized veterinary drugs for aquatic species in a member country:
first choice: authorized drug for aquatic species in another member country
for the same or another indication;**

**second choice: authorized drug for terrestrial species in the same or
in another member country;**

**third choice: authorized drug for human use (2001/83/EC
directive or regulation 2004/726 CE)**

fourth choice: galenic preparation

**fifth choice: authorized drug for veterinary use
in an extra EU country**



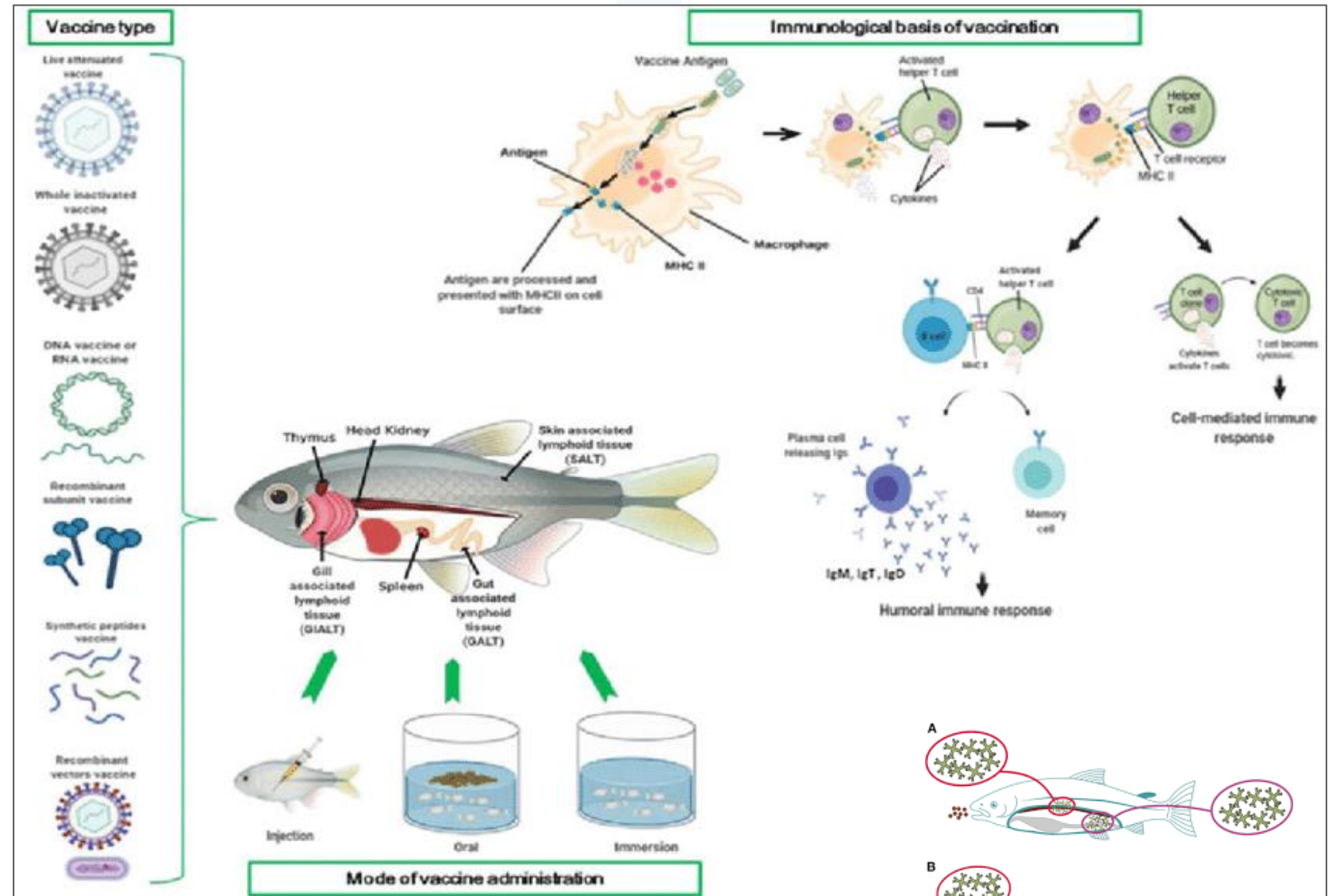
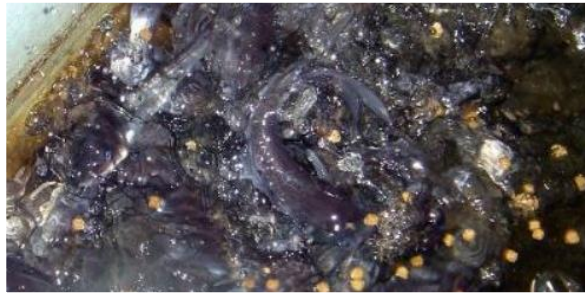
The European aquaculture situation...

- **Total lack of VMPs for minor species (sturgeon, cod, halibut, char, cat fish, grouper, etc.)**
- **Total lack of VMPs against parasites and restricted number of antibiotics in many EU countries.**
- **High costs and heavy bureaucratic procedures to obtain new market authorization**

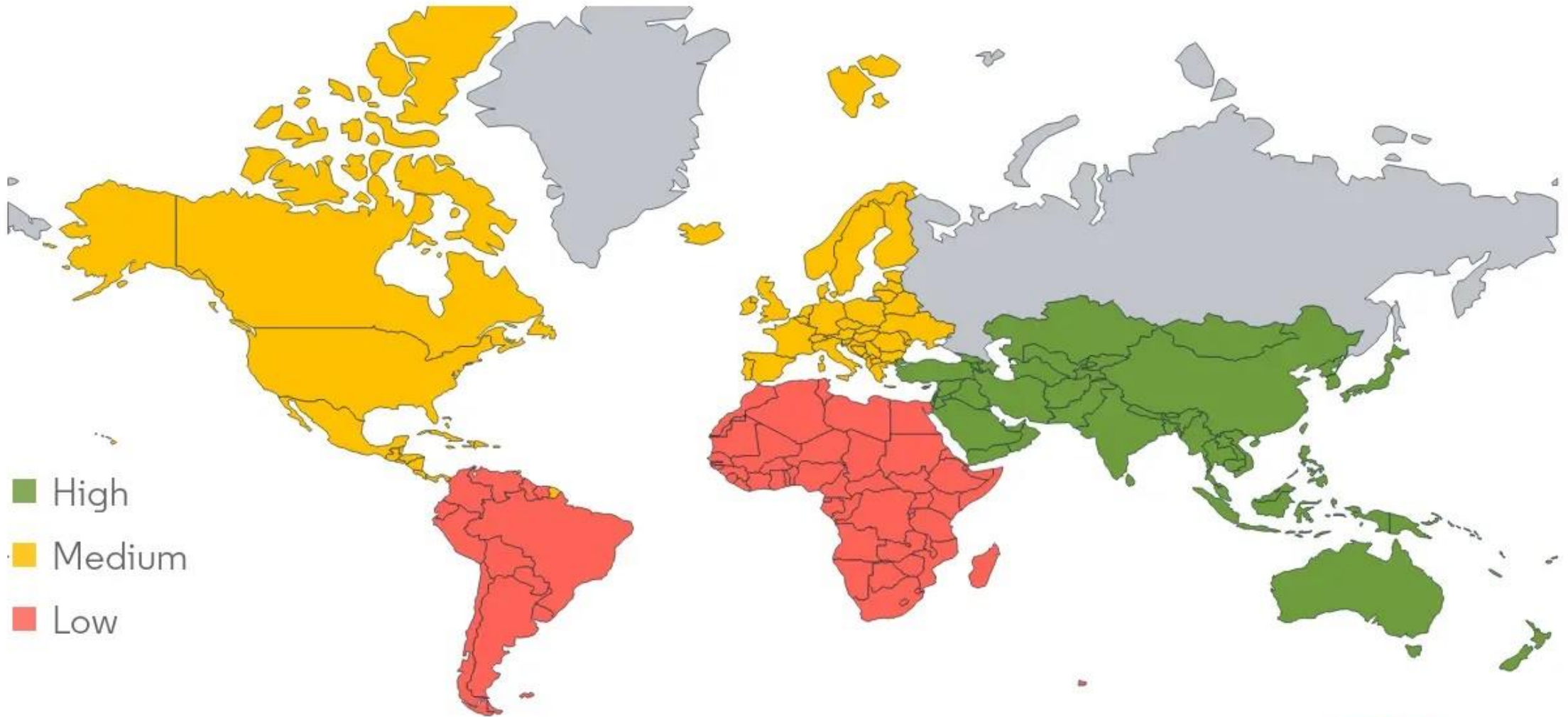


Need for alternative solutions

VACCINES AND VACCINATION STRATEGY



Aquaculture Vaccines Market - Growth Rate by Region



- High
- Medium
- Low

Source : Mordor Intelligence



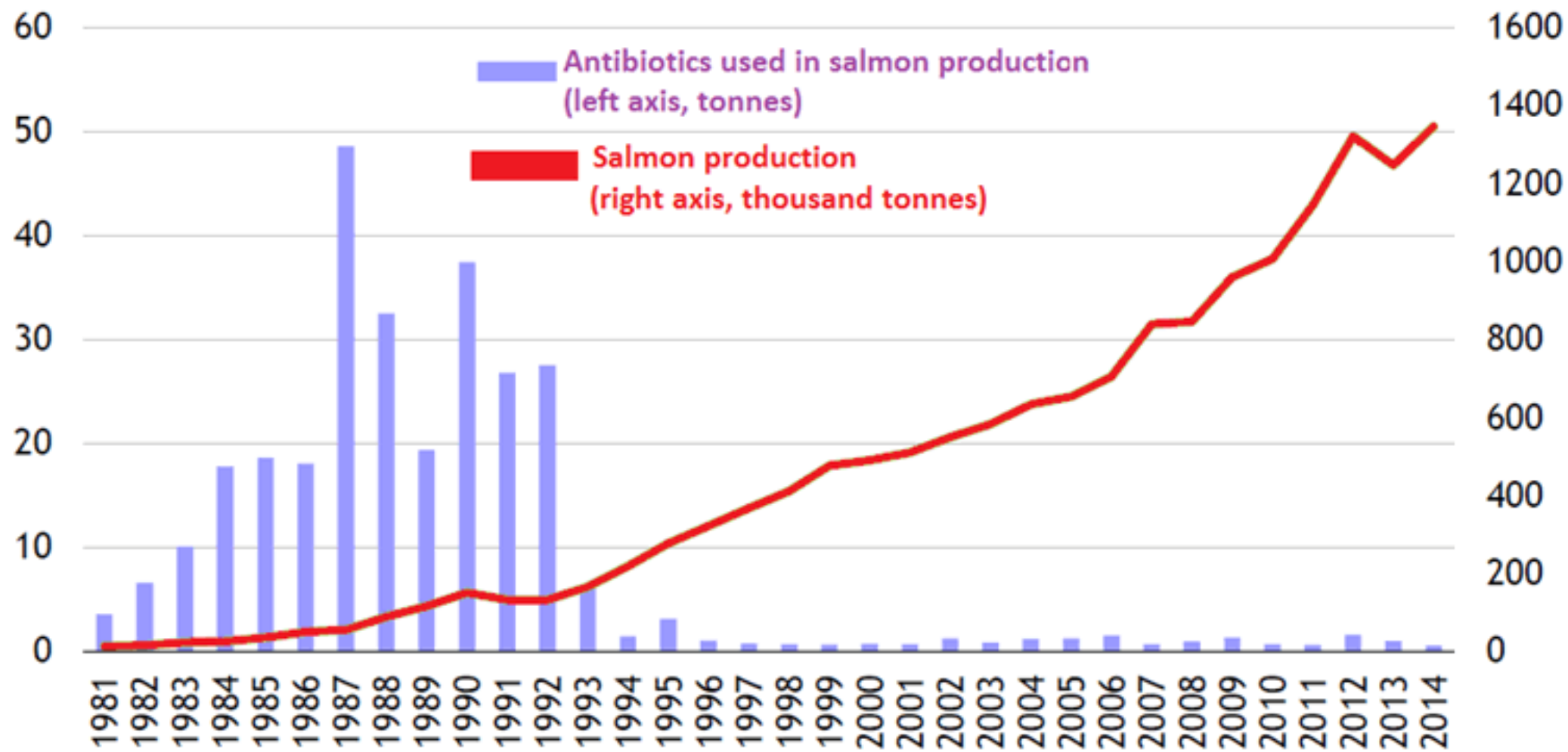
Vaccines available in EU aquaculture

	Pharmacological principle/ Trade Name	CZ	N	H	GR	IR	I	E	FIN	DK	NL	F	D
Vaccine	<i>Aeromonos salmonicida</i>		X			X	-	X	X			X	
	<i>Vibrio anguillarum</i>		X		X	X	X	X	X			X	
	<i>Yersinia ruckeri</i>				X	X	X	X	X	X		X	
	<i>Photobacterium damsela</i> <i>subsp. piscicida</i>				X			X					
	<i>Lactococcus garviae</i>				X		X	X					
	<i>Listonella anguillarum</i>				X		-	X					
	<i>Streptococcus parauberis</i>						-	X					
	<i>Tenacibaculum maritimum</i>						-	X					
	Multiple Valence		8				3	1		1			

From: <https://www.hma.eu/veterinary-medicines/cmdv/procedural-guidance/miscellaneous.html>, modified



The power of vaccines: Norwegian antibiotic use (left axis) vs. salmon output (right axis)

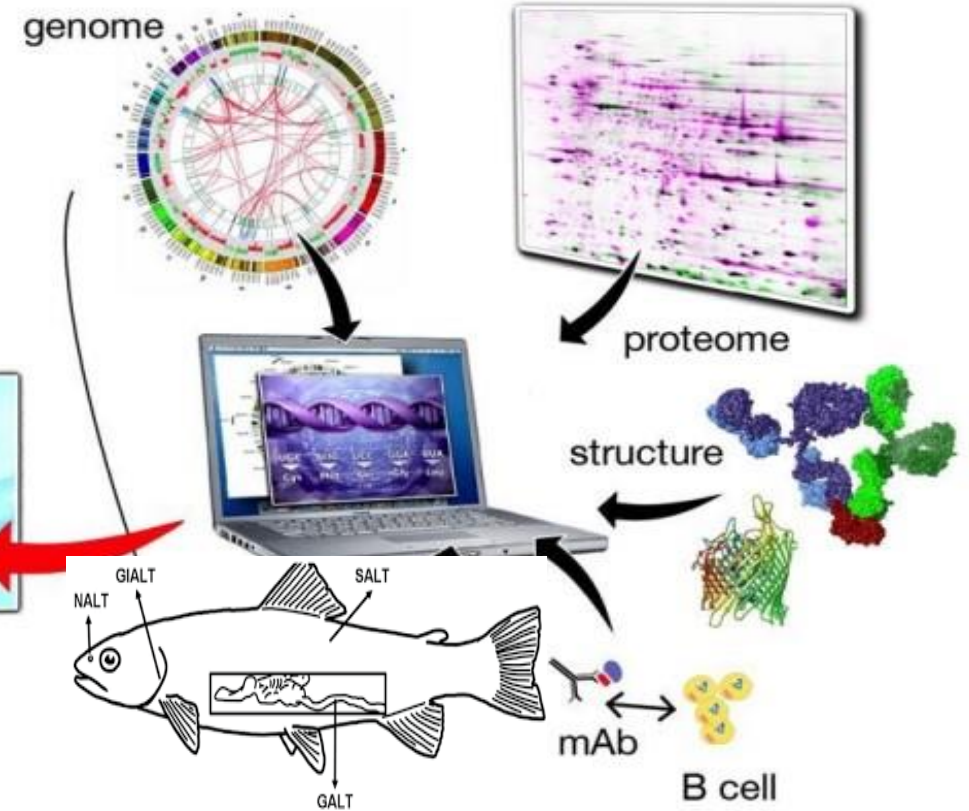
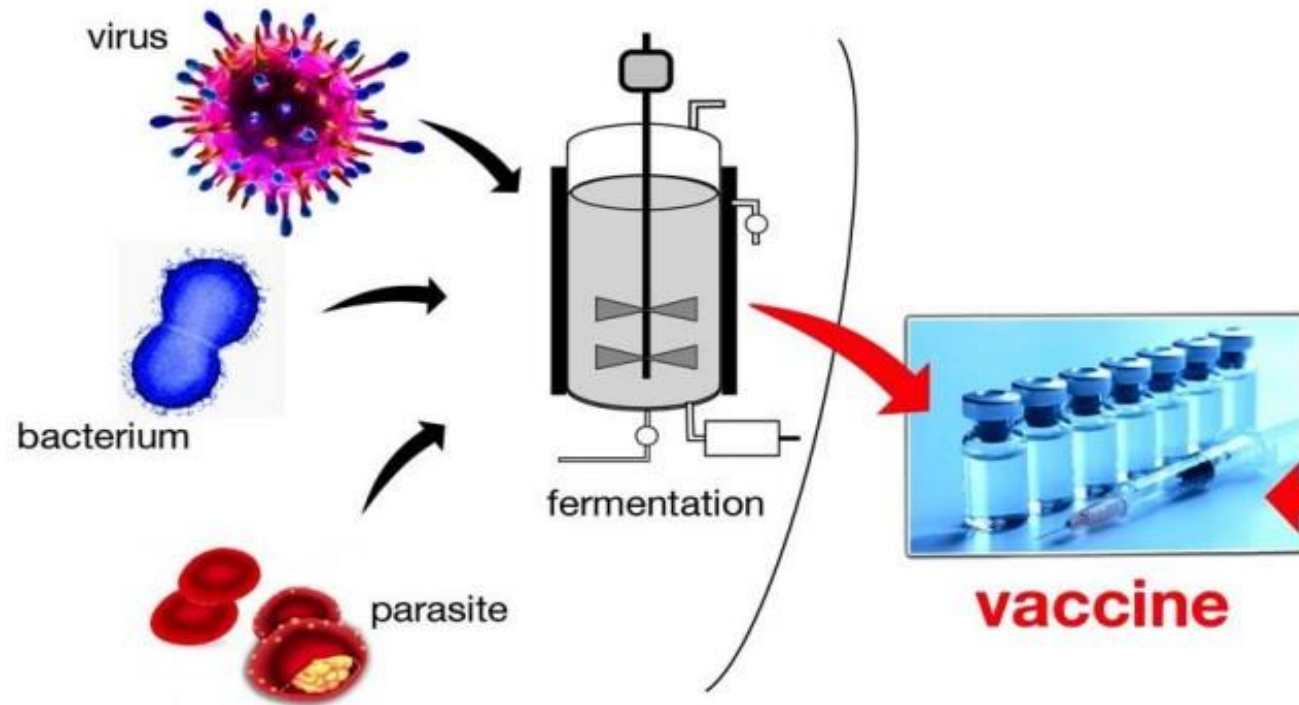


Source: Norwegian Veterinary Institute

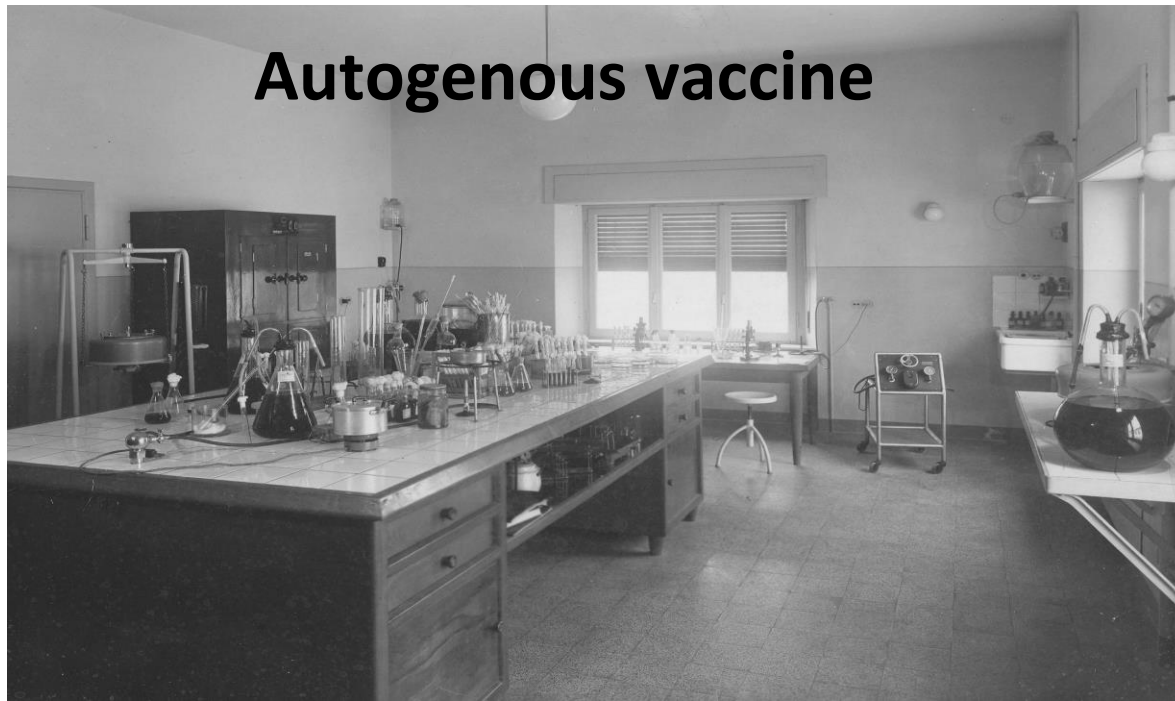
VACCINOLOGY and NEW VACCINES

CLASSICAL VACCINOLOGY
growing pathogens

REVERSE VACCINOLOGY
design from information

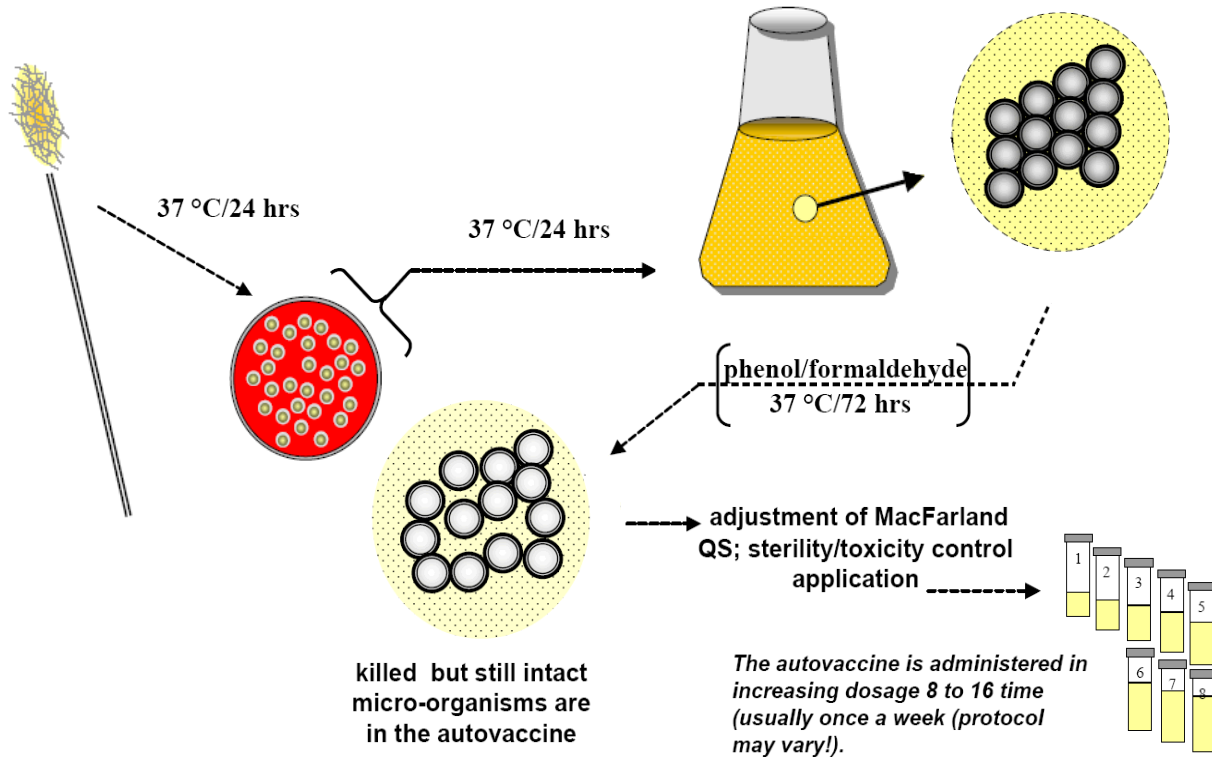


Autogenous vaccine



The autogenous vaccine is a veterinary immunological drug prepared with pathogens and / or antigens isolated from subjects affected by an outbreak of an infectious disease in a particular farm and used for the treatment of the same animals of the farm or animals of the same country, if the DVM believe it appropriate for evident epidemiological reasons (**DIRECTIVE 2001/82/EC** . Article 3. 2: Inactivated immunological veterinary medical products ...)





Why we use inactivated autogenous vaccines?

- absence of residual pathogenicity
- absence of recombination and reversion
- major stability in the conservation and during the use
- withdrawal period close to 0 days



Italian II.ZZ.SS. authorized to produce autogenous vaccines by the Ministry of Health

Lactococcosis by *Lactococcus garvieae*

IZSPLV - Turin

IZSve - Verona

Red mouth disease by *Yersinia ruckeri* biotype II
Lactococcosis by *Lactococcus garvieae*

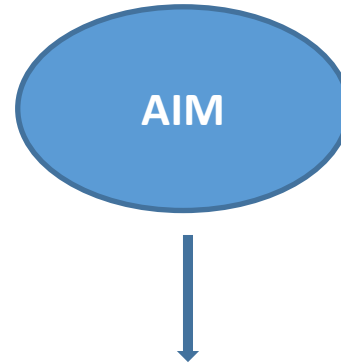
Vibriosis by *Vibrio harveyi*
Vibriosis by *Vibrio alginolyticus*

IZSLT - Siena

IZSUM - Perugia

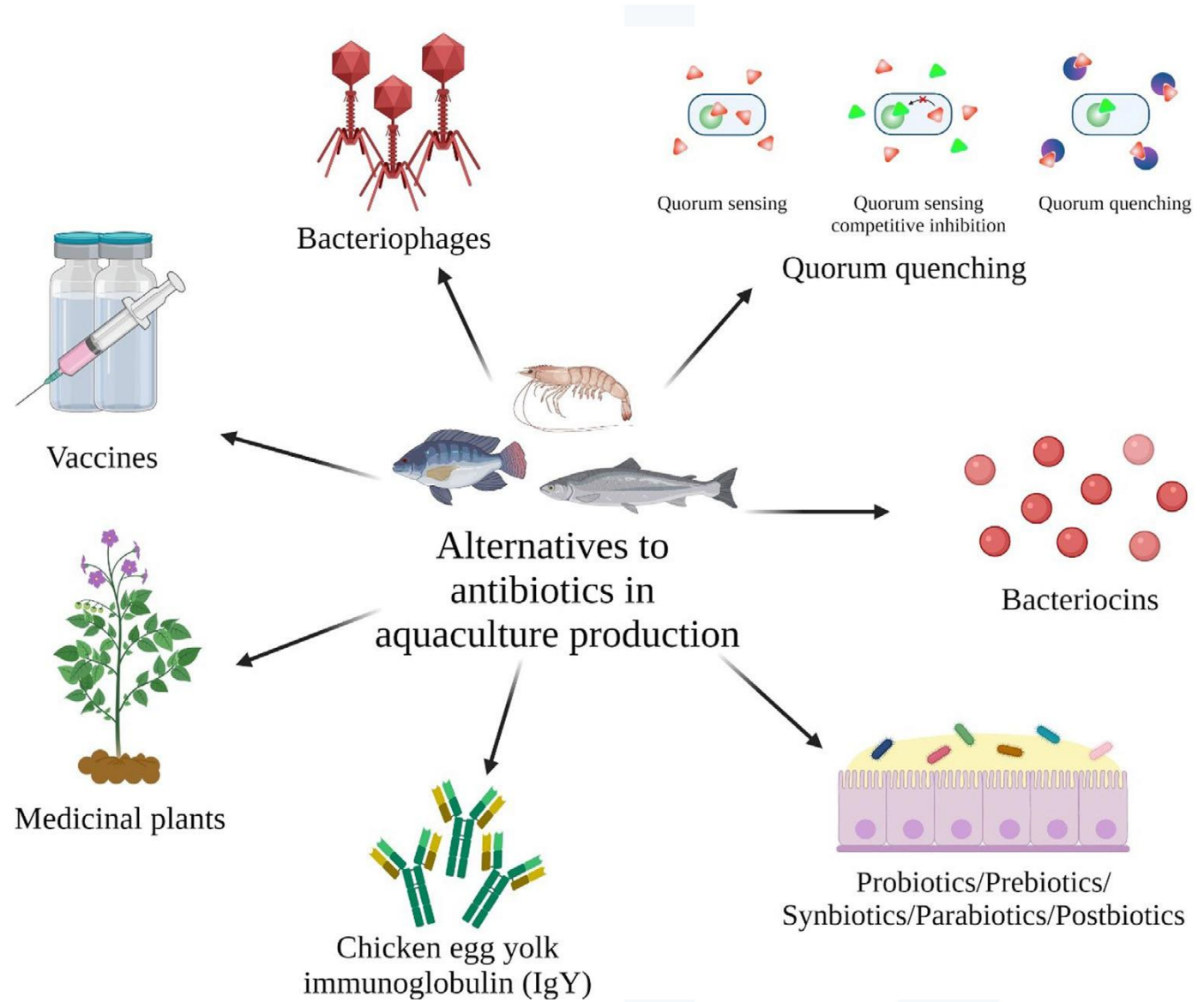
Red mouth disease by *Yersinia ruckeri* biotype II
Forunculosis by *Aeromonas salmonicida*
Lactococcosis by *Lactococcus garvieae*

Project: **“Integrated strategies for reduction of the use of the drug in aquaculture”**
financed by Italian Ministry of Agricultural, Food and Forestry Policies (PO FEAMP
2014-2020 MIPAAF)



Enhance the possibilities of using autogenous vaccines, which in many cases represent the only real alternative to the use of antimicrobials

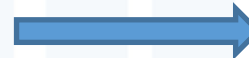
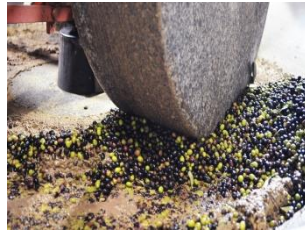
Not just vaccines...



From Bondad-Reantaso *et al.*, Reviews in aquaculture, 2023

Project: “Dietary supplementation with olive mill waste in farmed fish” - RC2021

financed by Italian Ministry of Health



- 1) evaluate the possibility of integrating the diet with polyphenolic extracts from vegetation waters and the effects on production performance, of fish (sea bream, *Sparus aurata*);
- 2) evaluate the effects on animal welfare and **immune response**;
- 3) estimate the presence of polyphenols in feed and in the meat of fish subjected to a controlled diet and their effects on the oxidative status.



possibility of reducing drugs in aquaculture

