



# Résistance aux antimicrobiens (RAM) en aquaculture

11 - 12 juillet 2024 Tunis, Tunisie



## Priority diseases and drug resistance in Mediterranean aquaculture

## Maladies prioritaires et résistance aux antimicrobiens dans l'aquaculture méditerranéenne



**DVM Amedeo Manfrin**

**Istituto Zooprofilattico delle Venezie - ITALY**

**NRL for fish, mollusc and crustacean diseases**

# Sea bass and bream are the most important species in European Mediterranean countries



## European Seabass *Dicentrarchus labrax*



Production (Tons)	Year						
	2014	2015	2016	2017	2018	2019	2020
Turkey	74,653	77,000	72,342	84,000	75,000	105,000	95,000
Greece	42,000	45,000	46,000	44,000	45,500	55,200	52,000
Spain	17,376	21,324	23,445	21,269	22,460	27,335	22,886
Italy	6,500	6,450	6,800	5,600	7,300	7,000	7,400
Croatia	3,215	4,075	5,310	5,616	6,220	6,089	6,637
France	2,021	1,980	1,928	1,945	1,433	2,123	2,100
Cyprus	1,817	1,725	1,442	1,500	1,500	2,836	2,500
Portugal	400	297	427	701	200	882	500
<b>Grand total</b>	<b>147,982</b>	<b>157,851</b>	<b>157,694</b>	<b>164,631</b>	<b>159,613</b>	<b>206,465</b>	<b>189,023</b>



## Gilthead Sea Bream *Sparus aurata*



Production (Tons)	Year						
	2014	2015	2016	2017	2018	2019	2020
Turkey	41,873	48,000	67,612	72,000	83,000	99,000	110,000
Greece	71,000	65,000	59,000	51,000	61,000	65,300	65,000
Spain	16,230	16,231	13,740	13,643	14,930	13,521	7,170
Italy	8,200	7,360	7,600	9,000	9,700	9,100	9,400
Cyprus	2,919	3,656	5,136	5,000	5,000	5,168	5,000
Croatia	3,655	4,488	4,101	4,830	5,591	6,774	7,451
France	1,105	1,502	1,671	1,853	1,879	2,081	2,000
Portugal	1,071	1,099	1,196	1,038	898	1,953	2,000
<b>Grand total</b>	<b>146,053</b>	<b>147,336</b>	<b>160,056</b>	<b>158,364</b>	<b>181,998</b>	<b>202,897</b>	<b>208,021</b>

# Hatchery production from 2008 to 2016...more than 1 billion fingerlings/year

Sea bass & sea bream juveniles production (thousands) 2008-2016



SPECIES	COUNTRY	YEAR									
		2008	2009	2010	2011	2012	2013	2014	2015	2016	
Sea Bass	TURKEY	180.000	117.500	105.000	149.000	205.000	172.000	178.000	220.000	242.500	
	GREECE	195.700	180.000	180.000	174.000	184.000	192.000	175.000	175.000	180.000	
	FRANCE	35.307	39.732	39.800	45.742	46.000	46.542	48.382	55.575	43.437	
	SPAIN	34.000	24.650	28.199	33.150	36.423	31.125	43.328	24.903	34.129	
	ITALY	55.000	55.000	55.000	48.000	40.000	45.000	42.000	27.500	26.000	
	CYPRUS	3.500	3.610	2.522	4.359	5.280	3.955	4.334	6.964	3.301	
	CROATIA	13.000	8.100	9.000	8.600	8.100	5.100	1.000	1.000	10.000	
	PORTUGAL	2.214	2.182	1.290	1.500	0	0	0	0	0	
<b>Total Sea Bass</b>		<b>518.721</b>	<b>430.774</b>	<b>420.811</b>	<b>464.351</b>	<b>524.803</b>	<b>495.722</b>	<b>492.044</b>	<b>510.942</b>	<b>539.367</b>	
Sea Bream	GREECE	214.000	150.000	160.000	242.000	245.000	266.000	237.000	245.000	268.000	
	TURKEY	80.000	72.000	85.000	140.000	185.000	138.000	149.000	120.000	214.000	
	ITALY	50.000	48.000	48.000	62.000	70.000	65.000	67.000	60.000	75.000	
	SPAIN	47.282	32.180	36.451	52.900	54.985	51.420	65.786	39.250	43.254	
	FRANCE	31.317	22.300	29.100	41.742	30.400	43.728	47.103	54.510	68.783	
	CYPRUS	13.000	8.589	8.929	18.479	7.976	14.267	23.588	27.927	27.190	
	CROATIA	7.000	6.000	8.929	6.900	5.400	3.400	0	0	4.000	
	PORTUGAL	21.722	3.810	1.378	1.000	0	0	0	0	0	
<b>Total Sea Bream</b>		<b>464.321</b>	<b>342.879</b>	<b>377.787</b>	<b>565.021</b>	<b>598.761</b>	<b>581.815</b>	<b>589.477</b>	<b>546.687</b>	<b>700.227</b>	
<b>TOTAL SEA BASS &amp; SEA BREAM</b>		<b>983.042</b>	<b>773.653</b>	<b>798.598</b>	<b>1.029.372</b>	<b>1.123.564</b>	<b>1.077.537</b>	<b>1.081.521</b>	<b>1.057.629</b>	<b>1.239.594</b>	



## Different kind of production and management



# New Mediterranean production in Northern Africa (FAO 2022)

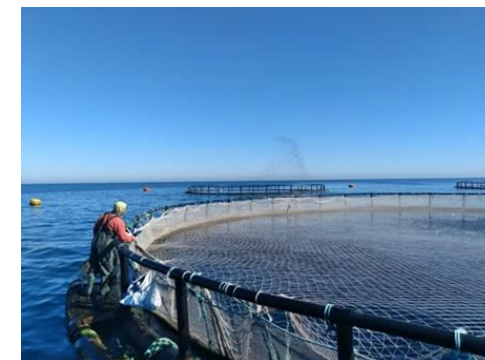
**TABLE 7** WORLD AQUACULTURE PRODUCTION BY REGION AND SELECTED MAJOR PRODUCERS

Regions and selected countries	2010			2020		
	Animals	Algae	All species	Animals	Algae	All species
	<i>(thousand tonnes, live weight)</i>					
Africa	1 286.1	138.3	1 424.4	2 250.2	104.1	2 354.3
<i>(percentage in world)</i>	<i>(2.23)</i>	<i>(0.69)</i>	<i>(1.83)</i>	<i>(2.57)</i>	<i>(0.30)</i>	<i>(1.92)</i>
Egypt	919.6		919.6	1 591.9		1 591.9
<i>(percentage in Africa)</i>	<i>(71.50)</i>		<i>(64.56)</i>	<i>(70.74)</i>		<i>(67.62)</i>
Northern Africa, excluding Egypt	10.1		10.1	40.1	0.3	40.4
<i>(percentage in Africa)</i>	<i>(0.78)</i>		<i>(0.71)</i>	<i>(1.78)</i>	<i>(0.27)</i>	<i>(1.72)</i>

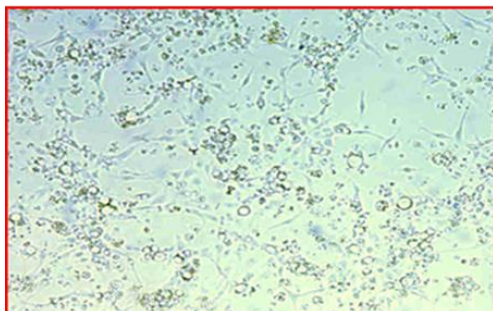
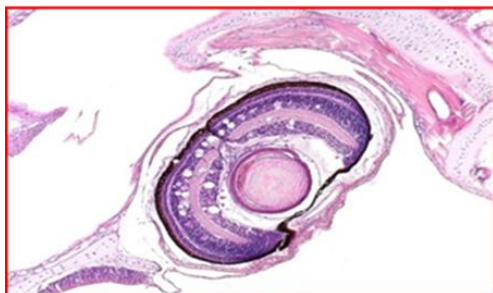
**Tunisia** produce 25.000 tons in 2023 (sea bass/bream)

**Marocco** produced 10.000 marine species

**Algeria**....no data but is increasing



## What's about diseases?



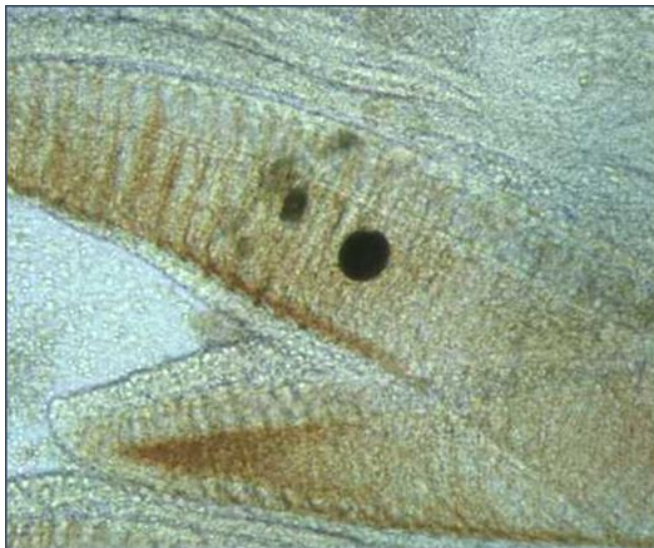
**Viral Encephalo Retinopathy - VER**  
(Betanodavirus) is still a big issue

Many marine species are affected

No therapy is available

Vaccination is possible but expensive and time consuming (by i.p. injection – 0.05 ml/fish)

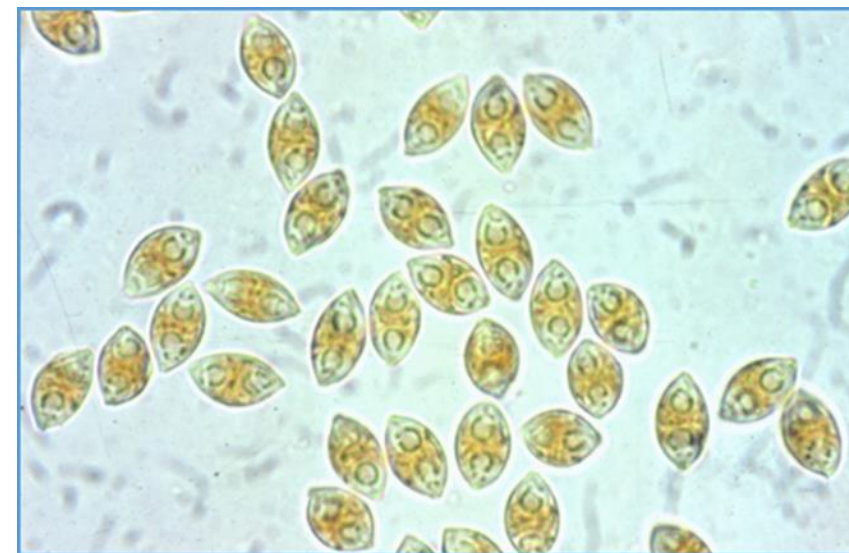
## The main problems are parasitic and bacterial diseases



*Oodinium sp*



*Diplectanum sp*



*Mixidium sp*

**No specific antiparasitic medicine are authorized in EU against marine parasites**



## Antiparasitic authorized in Europe (European Medicine Agency -CVMP July 2023)

	N	GB	GR	ES	I	F	DK	PL	CZ	D	H	FL	IE	S	HR	IS	NL	P	BG	RO
Acqua ossigenata	X	X											X			X				
Azametiphos	X	X																		
Bronopol	X	X		X		X														
Cypermétrina	X																			
Deltamétrina	X	X											X							
Diflubenzuron	X																			
Emamectina benzoato*	X	X		X								X	X			X		X		
Formaldeide			X	X														X		
Teflubenzuron*	X	X											X							

\* Medicated feed

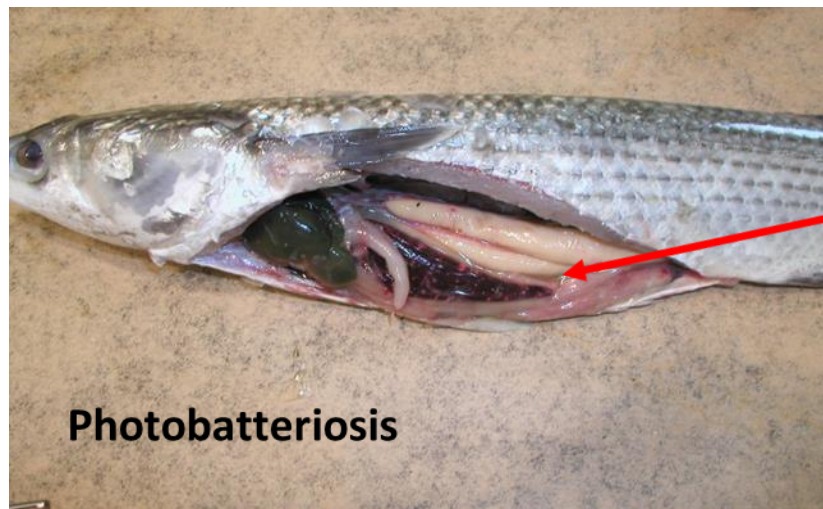


## “bacterial pathogens cause major losses to aquaculture, comprising around 34% of total diseases”

Soibam Khogen Singh, Maibam Malemngamba Meitei, Tanmoy Gon Choudhary, Ngasotter Soibam, Pradyut Biswas, Gusheinzed Waikhom,(2022) Chapter 15 - **Bacterial diseases in cultured fishes: an update of advances in control measures**, Bacterial Fish Diseases, Academic Press,

Billion of dollars are lost every years

# Bacterial diseases

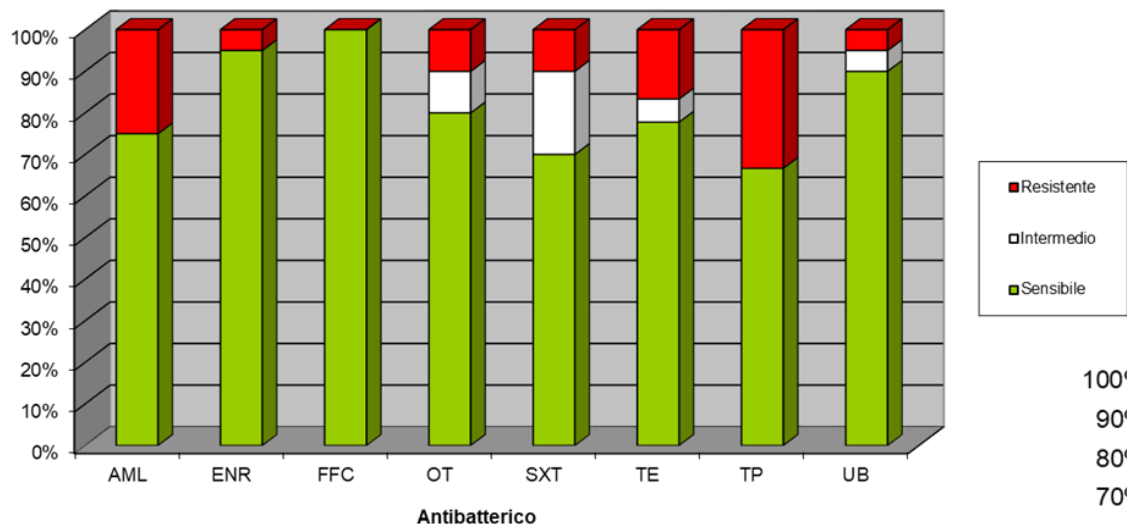


## Antimicrobials authorized in Europe (European Medicine Agency -CVMP July 2023)

	N	GB	GR	ES	I	F	DK	PL	CZ	D	H	FL	IE	S	HR	IS	NL	P	BG	RO
Amoxicillina		X			X															
Clortetraciclina					X															
Enrofloxacin																			X	X
Florfenicolo	X	X	X		X	X	X		X		X				X			X	X	X
Flumequina			X	X	X	X													X	X
Acido ossolinico	X		X			F	X													
Ossitetraciclina		X	X	X	X	X		X	X			X	X		X			X	X	X
Sulfam./Trimethoprim			X		X	X				X										

# Therapy is not so easy.....lack of medicine

## 30 *Photobacterium damsela* subsp. *piscicida* strains

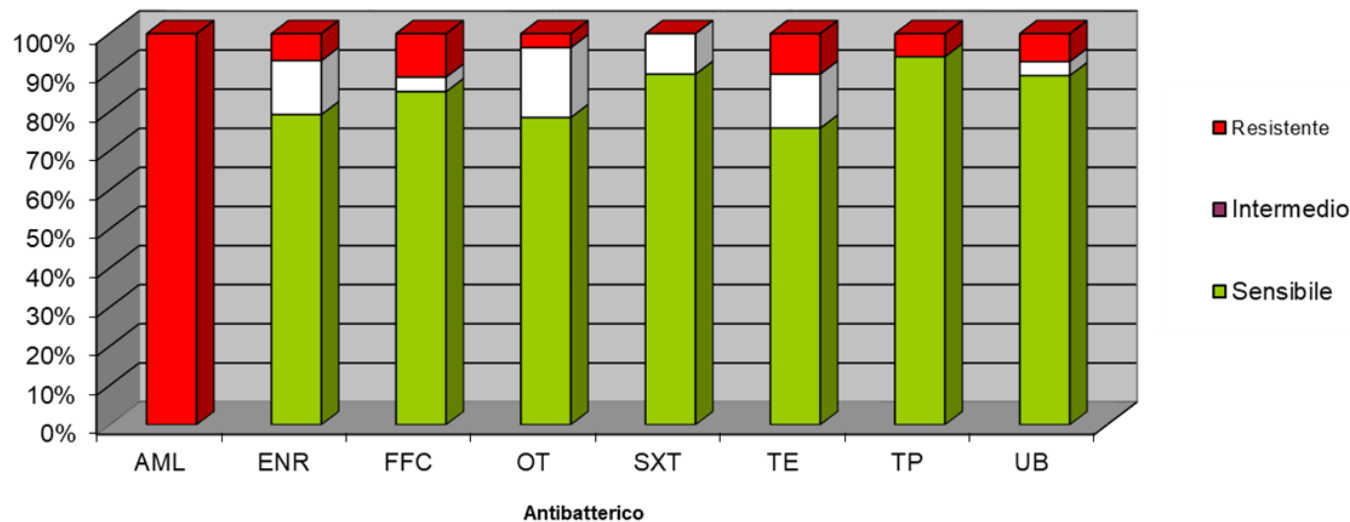
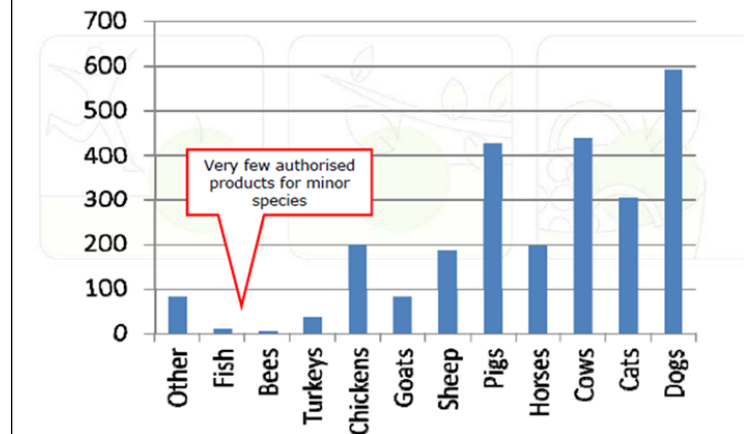


**Green bar** = susceptible to Antimicrobials

**Red bar** = resistant to Antimicrobials

*Vibrio anguillarum* naturally resistant to penicilline

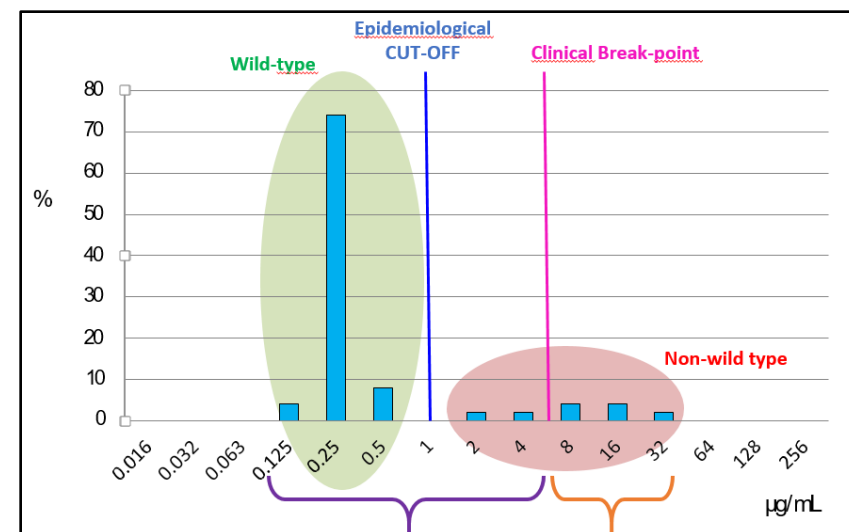
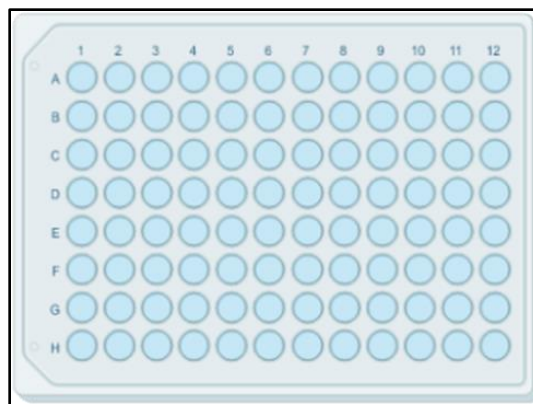
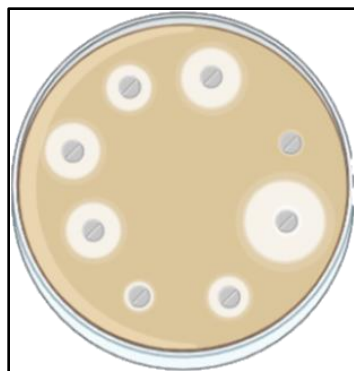
Average number of authorised products for animal species



## 30 *Vibrio anguillarum* strains

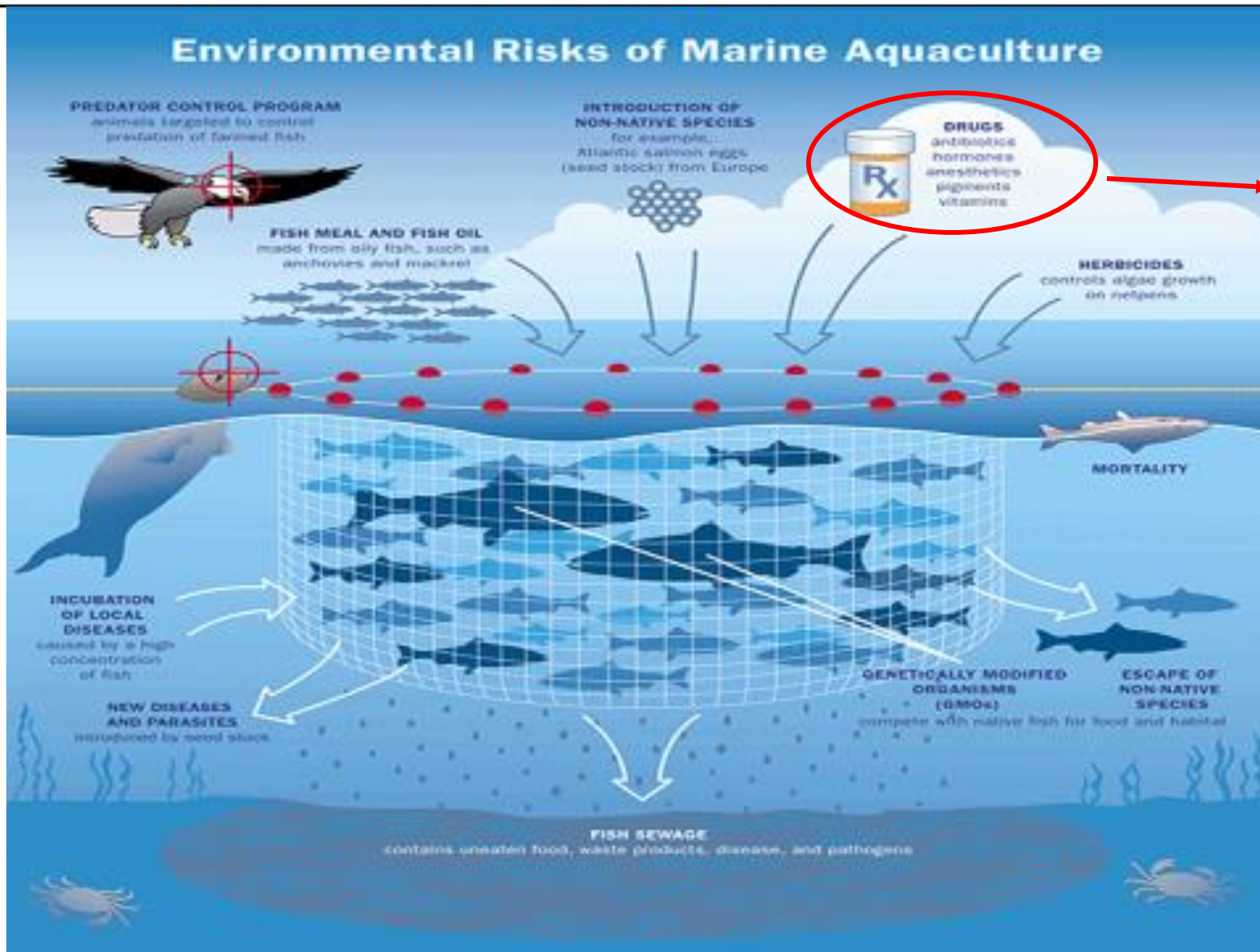
## There also some technical problems

- Antimicrobial susceptibility test (AST) are not all standardized.
- Lack of some criteria ( *e.g* cut off or clinical break points) to be sure that your bacterial strain is Susceptible or Resistant to an Antimicrobial
- Peter Smith *et al*, 2020 checked 190 papers and they concluded that many of them were incompletely described or incorrectly referenced.



## Main problems to perform antimicrobial therapy: outbreak management

- It's not easy to understand when and where the disease has started.
- Therapy with medicated feed should be encouraged ...bath treatment should be avoided.
- Sick animals don't eat and it's impossible to perform individual therapy (like for a cat, dog or beef).
- Prophylactic treatment should be forbidden but you need to start with metaphylactic therapy (to avoid the spread of infectious disease to healthy fish).
- In marine hatchery you need to absorb the antibiotic to Artemia or Rotiferus because many marine larvae or juveniles eat only «living feed».



Be careful to the environment



## European residues surveillance plan: very low number of non compliant samples

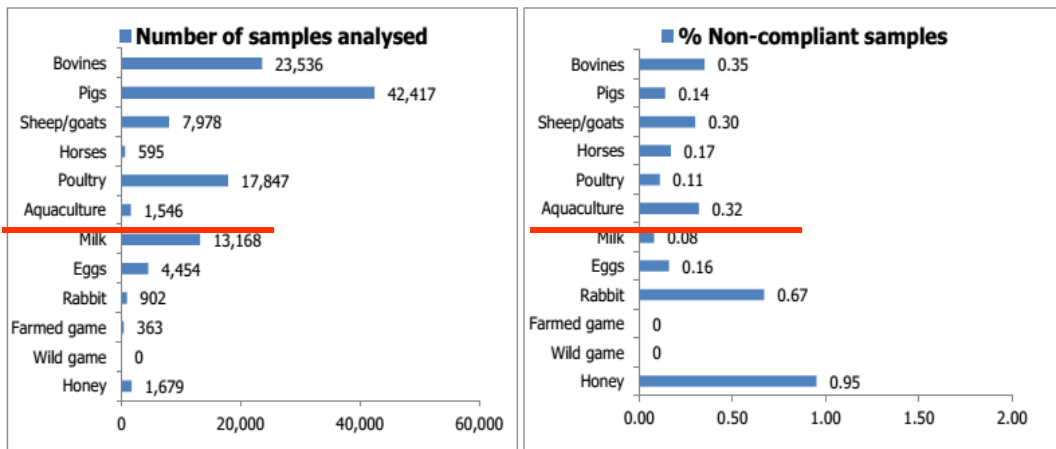


Figure 2: Number of targeted samples analysed and percentage of non-compliant samples for antibacterials (B1) in animal/product categories



2021

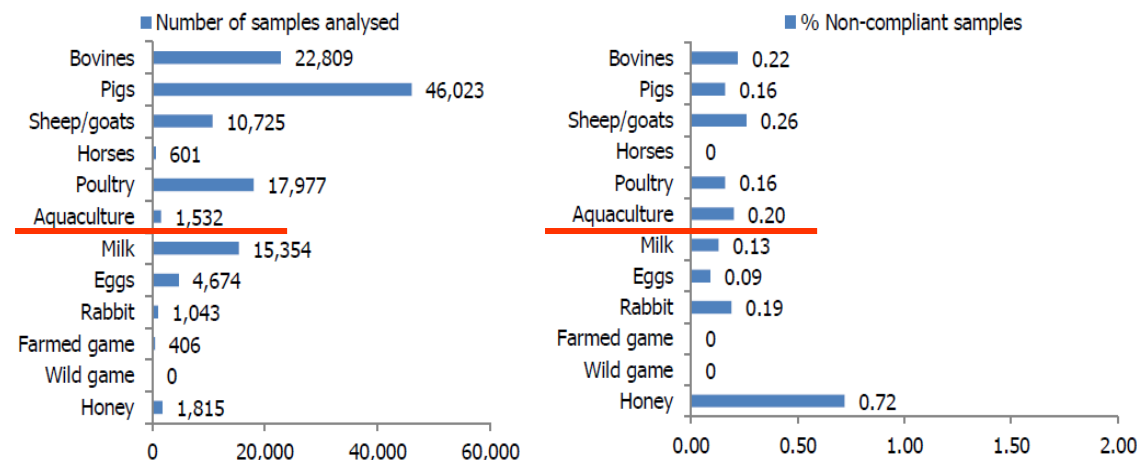
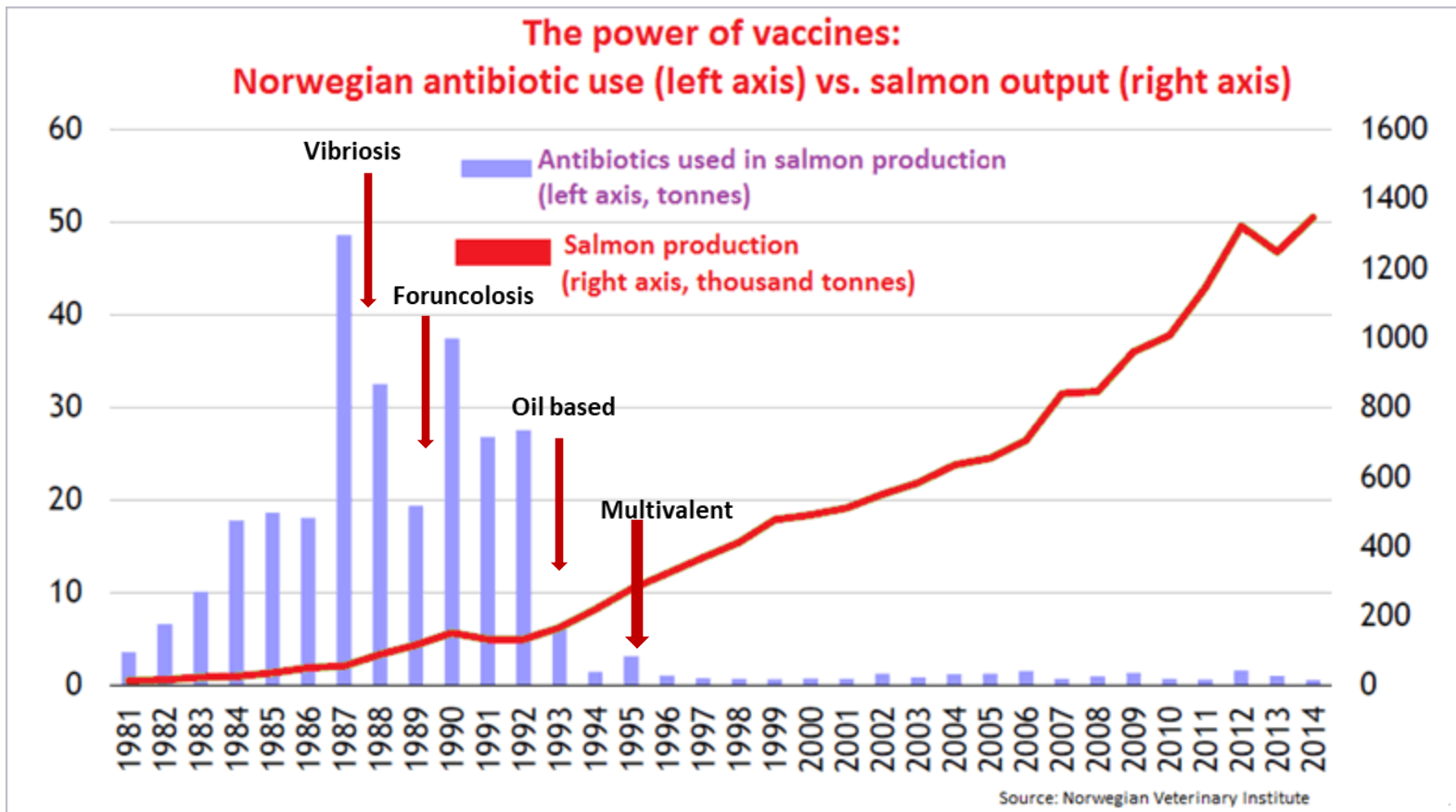


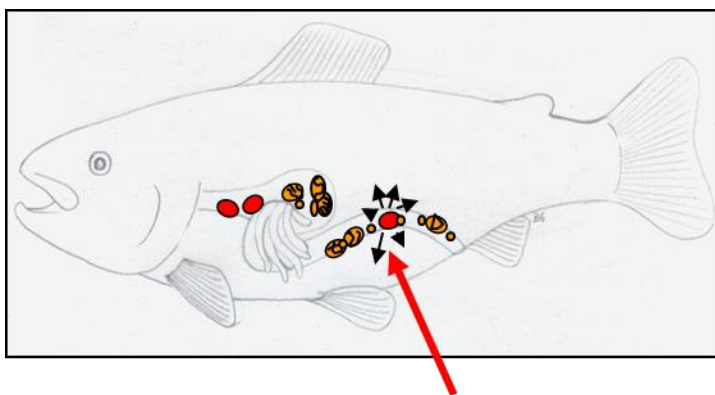
Figure 2: Number of targeted samples analysed and percentage of non-compliant samples for antibacterials (B1) in animal/product categories

# Conclusions: the best solution to reduce AMR is vaccination



## Administration route

- Bath/immersion
- Intraperitoneal
- Intramuscular
- Oral administration



**GALT-Gut Associated Lymphoid Tissue**



# Thanks...if you have any questions

