Vaccination against bacterial diseases in farmed Atlantic salmon – experience and global applicability

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The blue future

- 2030-50: Need food for 9-10 billion people
- 2030: Global demand for seafood estimated to 261 million tones
  - 100 mill tones incl sea weeds in 2014
  - Aquaculture provided more fish for human consumption than capture fisheries (2014)
- Aquaculture an efficient and CO_2 – friendly way of supplying people with essential nutrients
- Governmental and private optimism; ambitious plans and available funding

Salmon production in Norway

- 310 mill smolts transferred to sea annually
- 1 300 000 tones farmed salmon produced annually

More than 70 % of global aquaculture is small scale production

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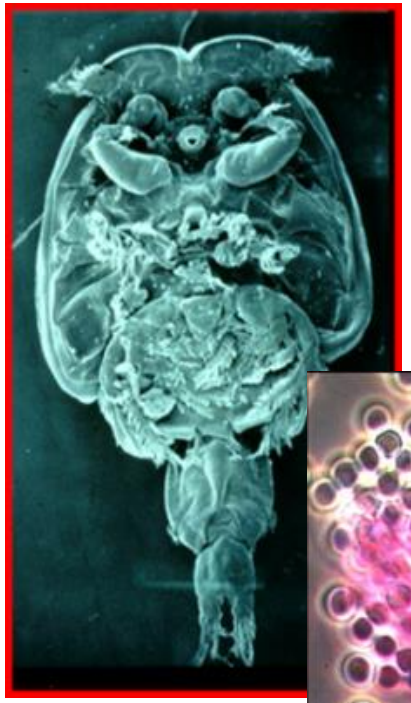
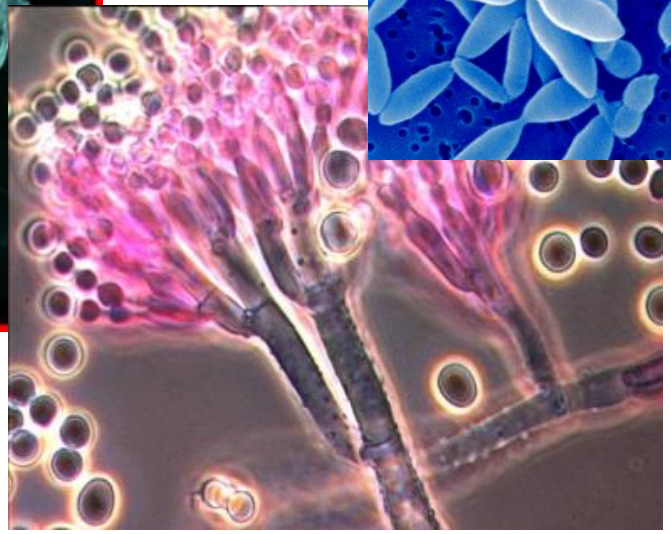
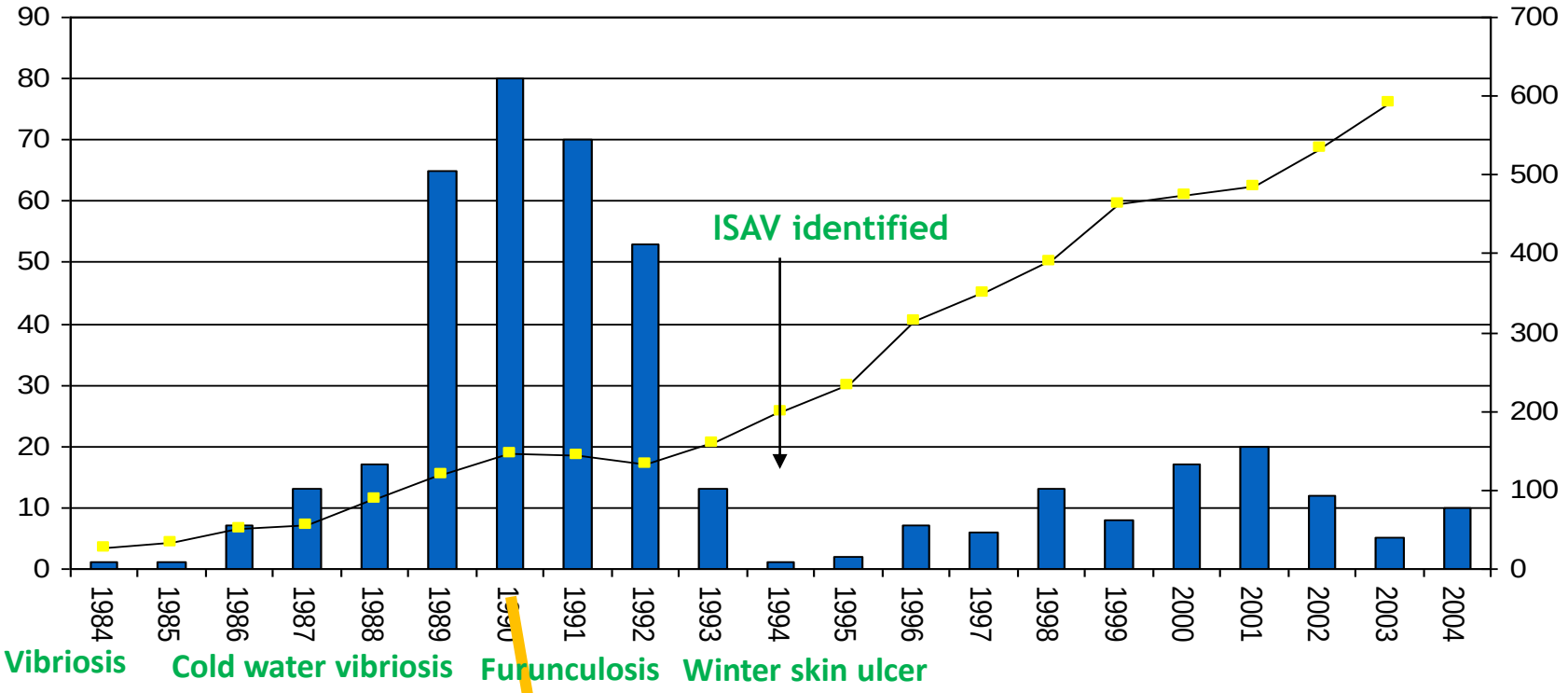
Aquatic animals diseases;

- Important constraints
- Devastating consequences





A brief history of salmon diseases



- ISA made notifiable
- Health certificate
- Compulsory health control in hatcheries
- Regulation on moving fish already put in sea

- Contingency plan,
- Introduction of zones to combat outbreaks
- Disinfection of wastewater from slaughterhouses and processing plants, and of the seawater supply in hatcheries
- Regulations on transport

"Stop ISA campaign"

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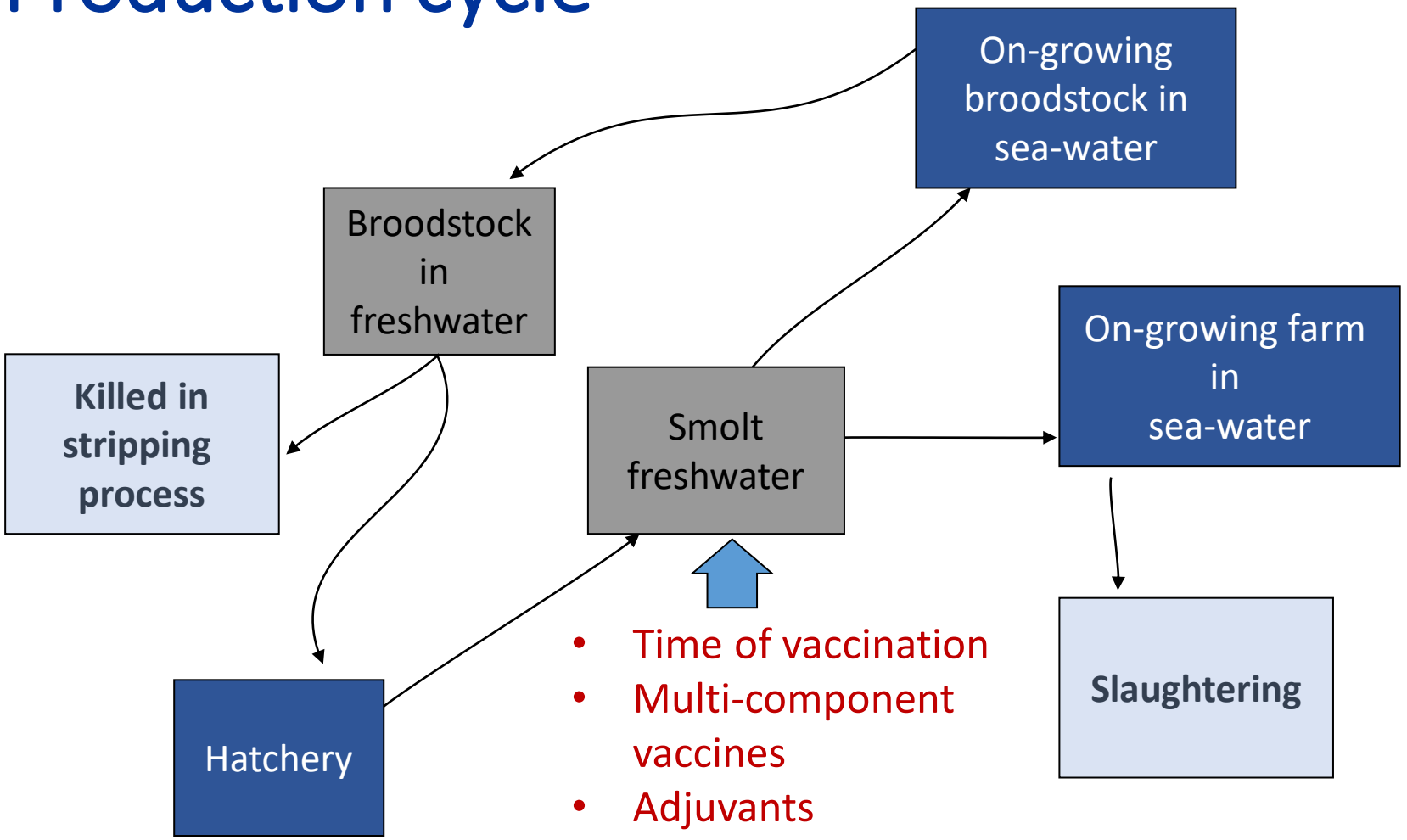
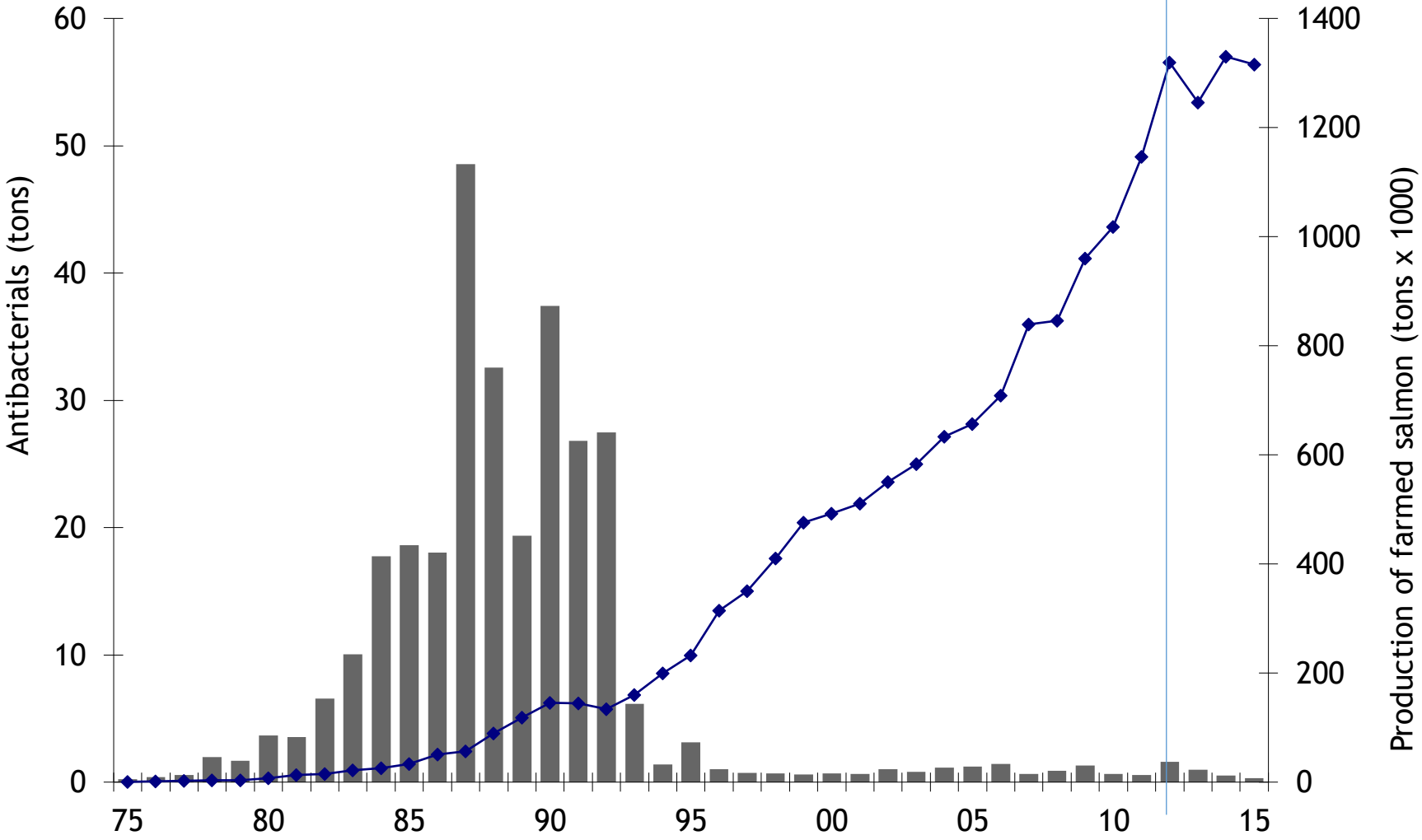
Production cycle



- Time of vaccination
- Multi-component vaccines
- Adjuvants
- One injection

Salmon production, vaccination and use of antibacterials 1975 - 2015



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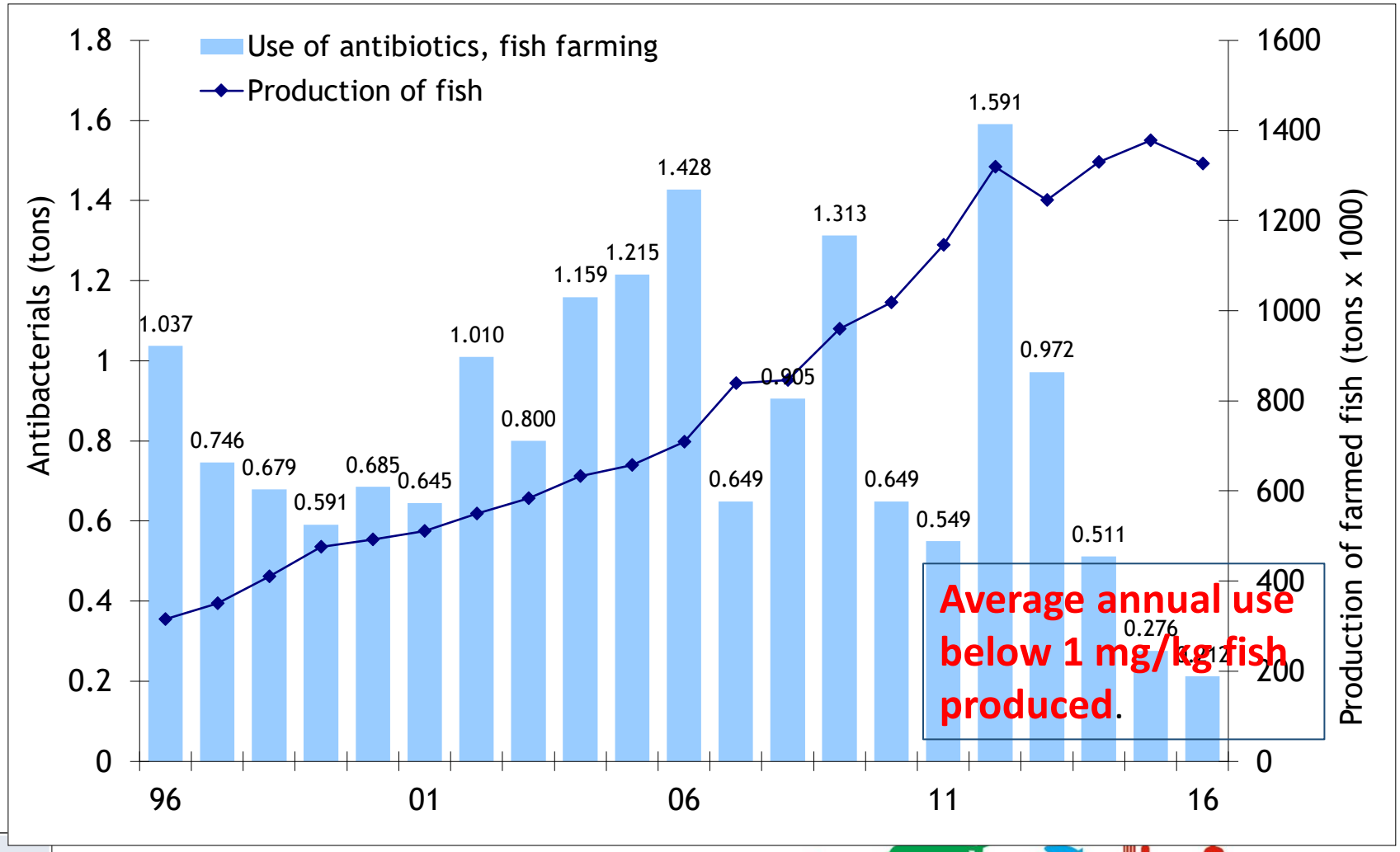
Antibacterials and fish production 1996 - 2016



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producion	Diagnosis	2013	2014	2015	2016	2017
Salmon growers	Bacterial infections					20
				24		
		26				
						40
		140				
			310			
	Cold water vibrosis	21				
		220				
		275				
	Ulcers	20		62		
	Yersiniosis					220
Salmon brood stock	Bact infections					95
	Yersiniosis					21

Antibiotic (in kg) prescribed for treatment of farmed fish where the amount prescribed were ≥ 20 kg

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Use of antimicrobials in aquaculture

- Chronic diseases that cause reduced growth, low food conversion rate and poor survival thus leading to reduced production
- Epidemic diseases that can cause mass mortalities
- Failure of preventive therapy
- New species in culture and new culture systems/management
  - use of veterinary medicines in a lag phase between the identification and characterization of pathogens and the development of disease control procedures
- Knowledge on when and how to give antibiotics efficiently

Efficacy of vaccination:

Most of the bacterial vaccines used in farmed salmon have a RPS of >70

Good herd immunity effect

Efficacy of vaccination:

PD-vaccination 2008 – 2010

	Vaccinates	Non-vaccinates
Mortality - %	15.0	22.5
Growth - % /day	0.75	0.72
Discarded at slaughter	1.28	2.74

Bang Jensen et al. 2012. Cohort study of effect of vacciantion on pancreas disease in Norwegian salmon aquaculture

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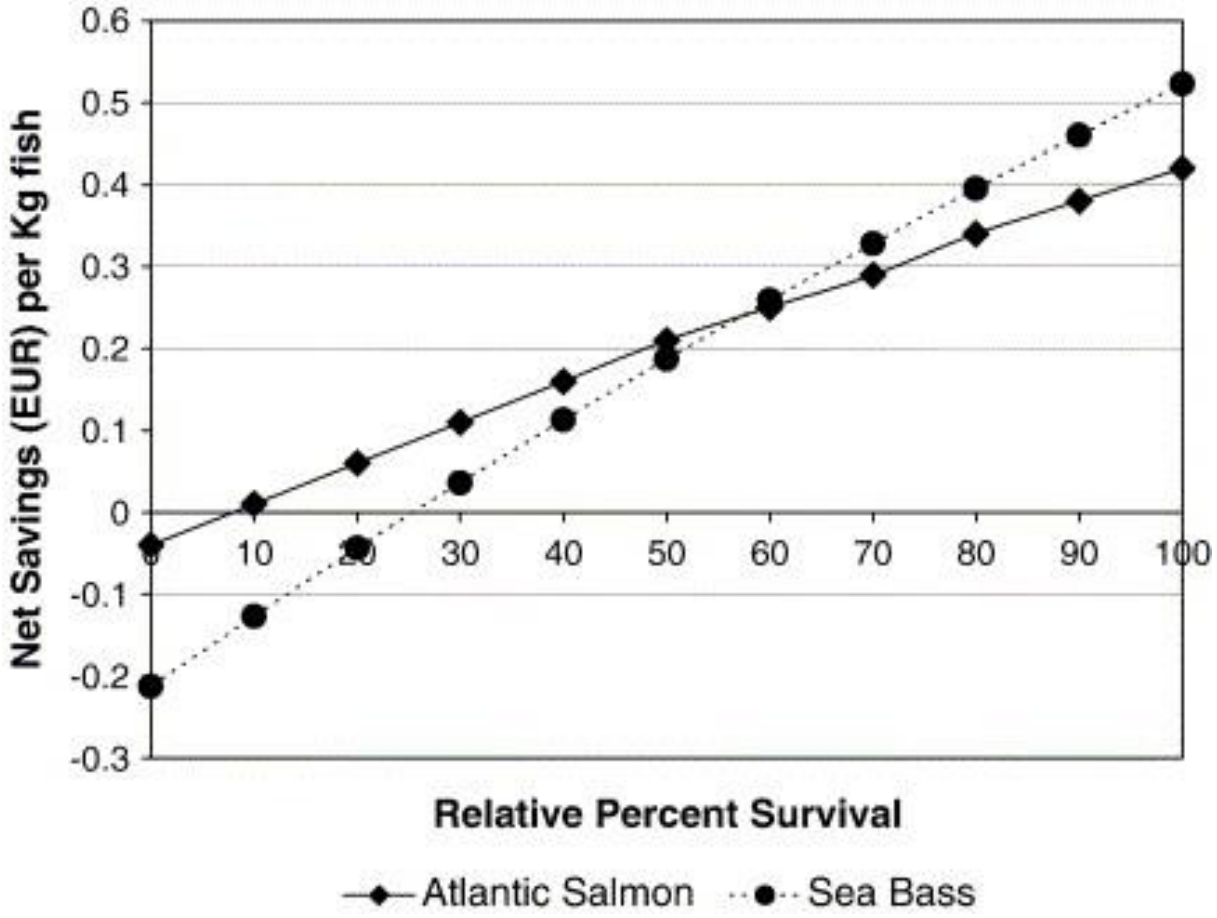
Economic break-even analysis in relation to the efficacy of vaccination.



Key factors:

- Species
- Market
- Disease profile

Thorarinsson &Powell; Aquaculture Volume 256, Issues 1–4, 15 June 2006, Pages 42-49

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Success criteria for ab-reduction (1)

- Competence in epidemiology and biosecurity to
  - understand disease dynamics
  - develop biosecurity-based regulations
  - develop farm biosecurity
    - prevention, control and containment systems
- Diagnostics
- Focus on Ab –consumption

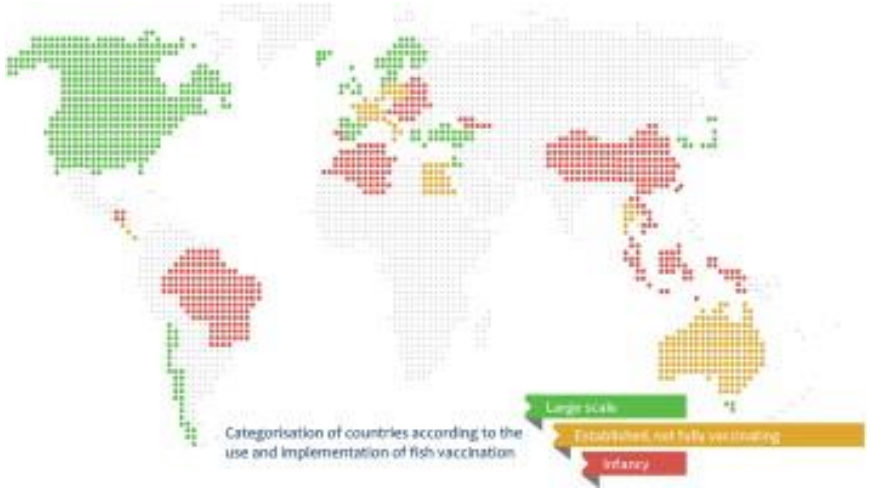
Success criteria for ab reduction (2)

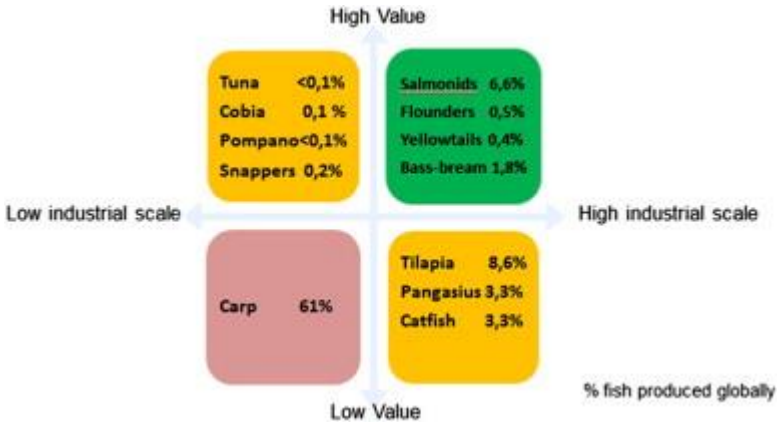
- Vaccines
  - Public –private –partnership to encourage vaccine development
  - Temporary licensing of vaccines
  - Efficient vaccination procedures

  - Encouraging the use of vaccines
    - Cost-benefit documentation

- Reduce the total load of infection

Use of vaccines and farming





How can we make vaccine investments profitable ?

Brudeseth et al; Fish & Shellfish Immunology Volume 35, Issue 6, December 2013, Pages 1759-1768

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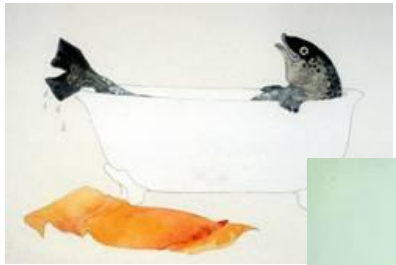
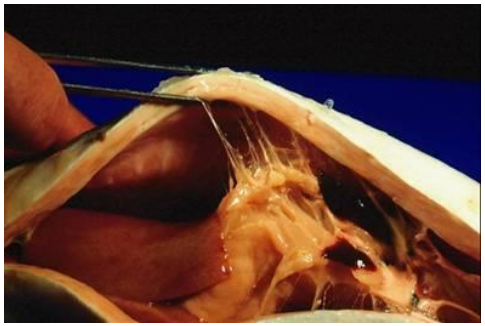
Challenges

- Vast diversity of cultured fish species and their pathogens (4-500 species)
  - Lacking knowledge on immune response
  - Vaccine development -Autogenous vaccines
- Licensing procedures
- Private-public partnership
- Promotion of vaccines as a necessary part of the biosecurity measure
- Delivery systems
  - Injection is immunologically efficient
  - Oral is a practical appl. method (only 5 vaccines)

Delivery systems

- Immersion
- Injection (i.p., i.m.)
- Oral





Algae based platform for oral delivery of drugs and vaccines (TransAlgae)

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Take home message

- Biosecurity measures incl. vaccines, are necessary parts of aquatic animal health management
- An efficient vaccination protocol can give the industry a beneficial cost/benefit ratio.
  - Ensure growth and reduce mortalities
- Diagnosic capability and standards for prudent used of ab needed

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