

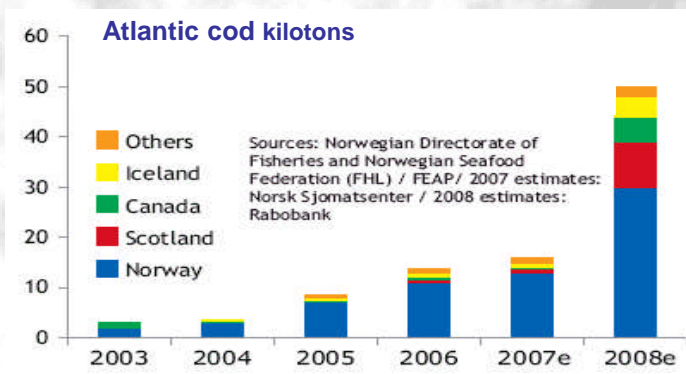
## Vaccination of cod



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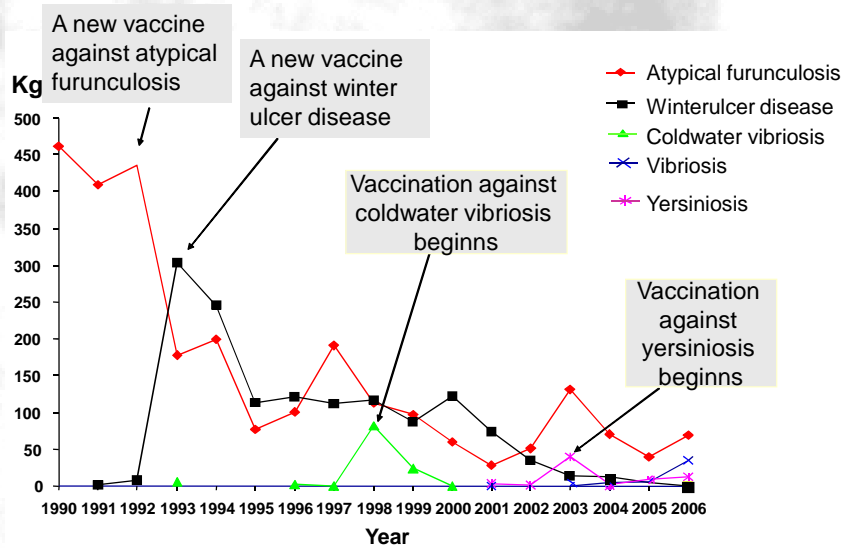
## Cultivation of Atlantic cod



### Considerations

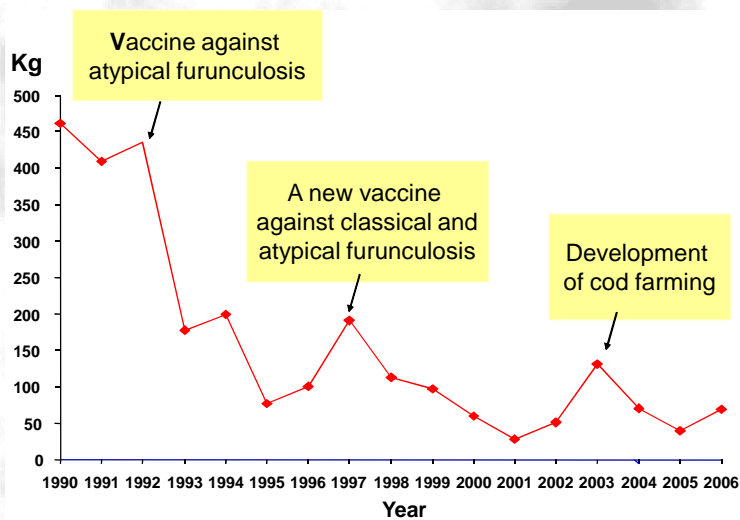
- The effect of cultivated cod on wild fish stocks
- Environmentally save prophylaxis

## The use of antibiotics in Icelandic aquaculture 1990 - 2006



Gísli Jónsson 2007

## The use of antibiotics against atypical furunculosis in Icelandic aquaculture 1990 - 2006



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Disease/pathogen	Sensitive fish	Vaccine available	Protective antigen
<b>Bacterial diseases</b>			
<i>Vibriovibrii</i> / <i>Listonella (Vibrio)</i> <i>anguillarum</i>	salmonids cod, halibut & many more	yes yes	Lipopolysaccharide (LPS)
<i>Vibrio salmonicida</i> / <i>cold water vibriosis</i>	salmonids cod & more	yes yes	Lipopolysaccharide (LPS)
Atypical furunculosis/ <i>A. salmonicida</i> <i>undirt. achromogenes</i>	salmonids cod*, halibut, wolfish, turbot, flounder, & many more	yes no no	Protein
<i>Francisella philomagia</i>	cod	no	
<i>Streptococcus parauberis</i>	cod	no	
<i>Mycobacterium sp.</i>	cod	no	
Tenacibaculum/ Flexibacter/Cytophaga group	cod	no	
<b>Viral diseases</b>			
Infectious pancreatic necrosis (IPN) IPNV (Birnaviridae)	salmonids cod, halibut & many more	yes no	
Viral encephalopathy and retinopathy (VER) or viralnervous necrosis (VNN)/ Nodavirus	cod, halibut & many more	no	
Viral haemorrhagic septicaemia (VHS) VHSV (rhabdoviruse)	salmonids, fresh water fish cod, haddock & many more	no	
* Experimental vaccines under development			

## Determination of vaccine efficacy

RPS (Relative Percent Survival) estimation:

$$RPS = 1 - \left[ \frac{\% \text{ mortality in vaccinated fish}}{\% \text{ mortality in control fish}} \right] \times 100$$

European Pharmacopeia:

RPS ≥ 70 for i.p. vaccines

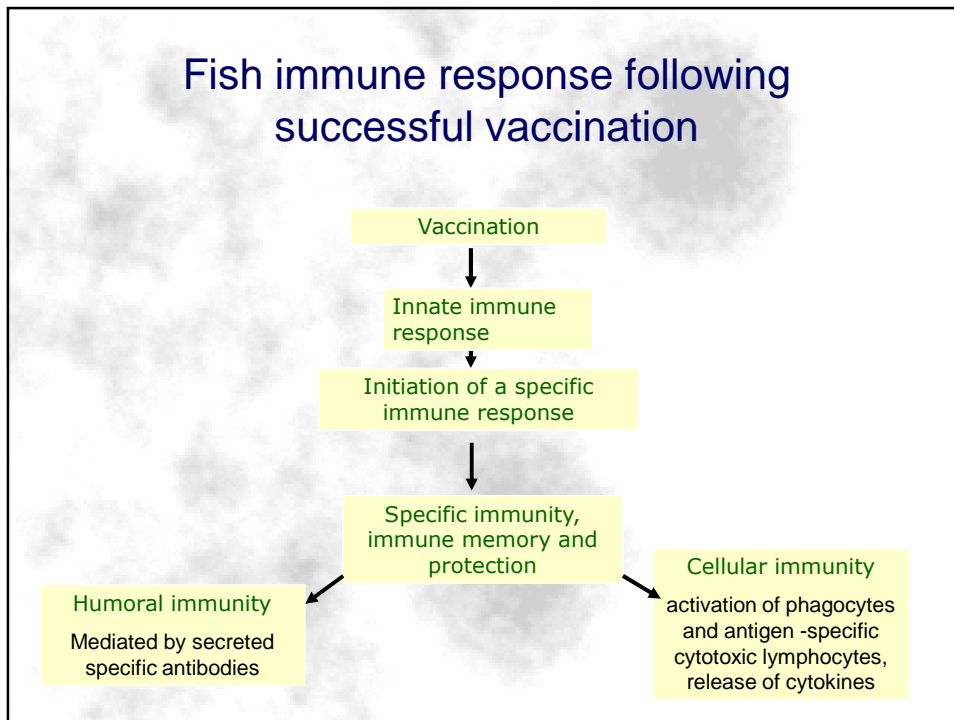
RPS ≥ 60 for bath vaccines

The LD<sub>50</sub> is also used to determine vaccine efficacy and is calculated by the formula of Reed & Muench

*Am J Hyg* 1938;27:493-497

Effective fish vaccines have a long-term protection

## Fish immune response following successful vaccination



## Polyvalent vaccines

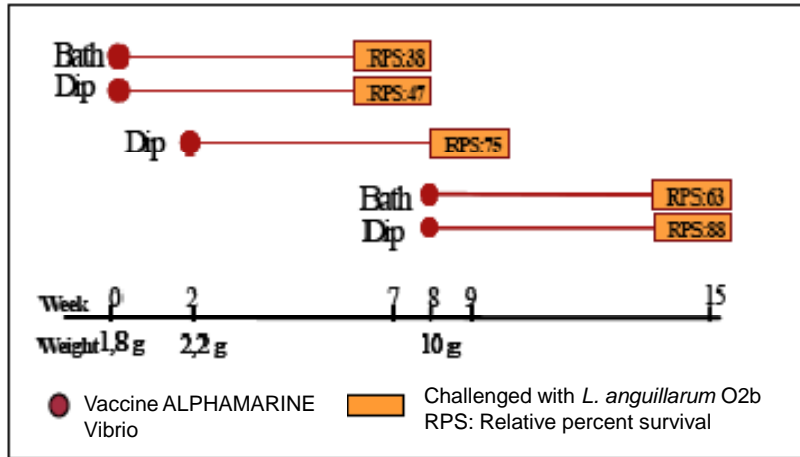
### Examples

- ALPHA JECT 6-2 (6 valent oil-based vaccine) *Vibrio anguillarum* serovar O1 and O2a, *Aeromonas salmonicida*, *Vibrio salmonicida*, *Moritella viscosa* and infectious pancreatic necrosis virus (IPN)
- ALPHA MARINE Vibrio (3 valent water-based vaccine) *Vibrio anguillarum* serovar O1, O2a and O2b

## Vaccination against vibriosis of cod < 15g

### Dip or bath

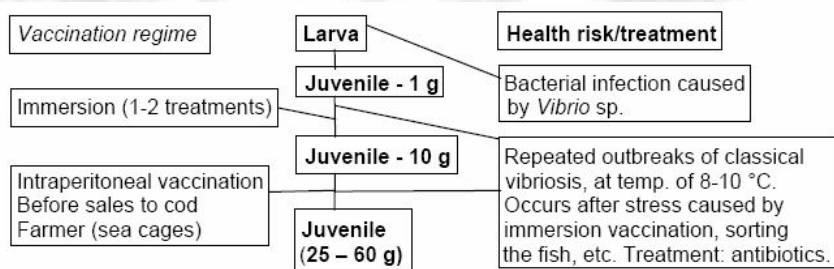
Faktaark [www.forskningsradet.no/havbruk](http://www.forskningsradet.no/havbruk)



Dipping gave better protection than bathing in all groups

## Vibriosis in Atlantic cod– a challenge in intensive culture

Current production of juveniles in intensive cod farming



25 November 2006

By Solveig Nygaard, Fish Health and Environment Inc., Veterinarian Specializing in Fish

[http://aqua.intervet.com/news/2006-11-25\\_-\\_vib\\_in\\_atlantic\\_cod.asp](http://aqua.intervet.com/news/2006-11-25_-_vib_in_atlantic_cod.asp)

## Site effects in cod following vaccination by injection



- **Development of an evaluation scale for cod**

Maira, C., Lystad, Y., Schrøder, M.B., Lund, V. and Gudmundsdottir, B.K. Bieffektvurderinger hos torsk (*Gadus morhua*) etter stikkvaksinering – bruk av en vurderingsskala tilpasset til torsk. Norsk Fiskeoppdrett, November 2007.

How can it be explained that vaccination of cod is not as effective as vaccination of other teleost fish such as the salmonids?

- Low production of specific antibodies
  - Specific antibodies detected are mainly anti-LPS antibodies (T-cell independent)
  - Titer of specific antibodies is low compared to salmonids
  - High concentration of natural antibodies
- There are indications of defective antigen presenting & many more factors are involved



- Build up of research on cod immunology is needed

## Concluding remarks

- Scientific publications in the field of fish vaccinology are comparatively scarce, as much of the research performed is owned by commercial companies
- There is a need for improved vaccines for vibriosis of cod and new vaccines for outbreaks of other pathogens

