



Fish Diseases & Vaccination Potential in Hatchery Fish Stocks

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Fish Vaccines Really Do Work!

Norway Aquaculture Production – The introduction of vaccines was associated with,

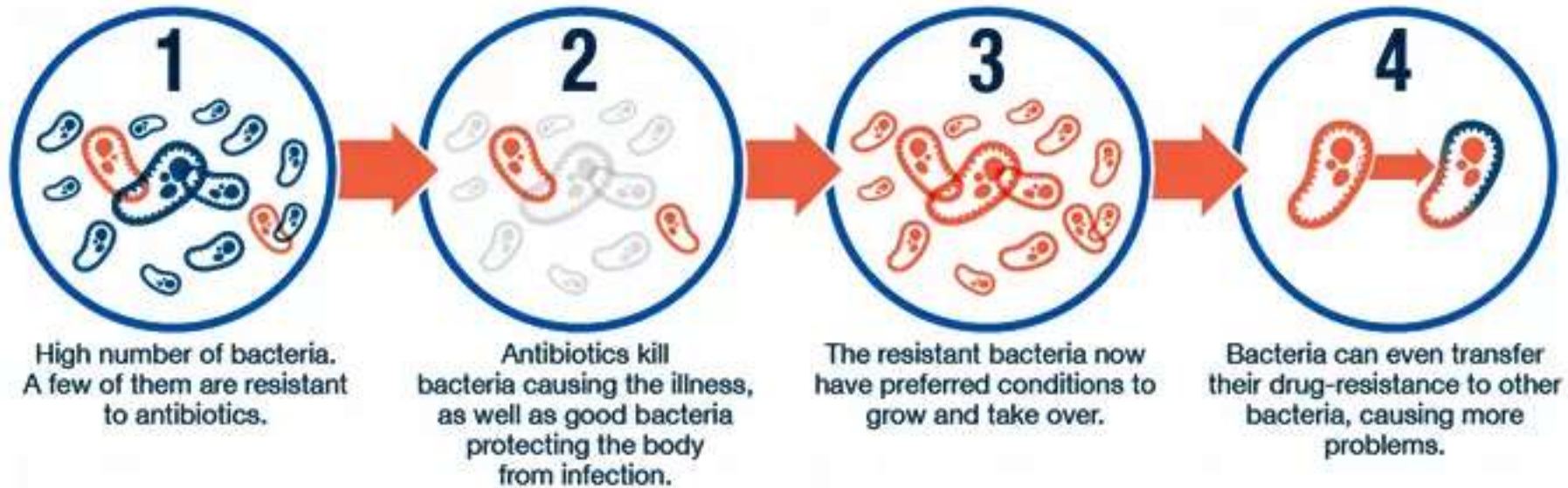
- **A reduction of antibiotics** from **50,000 kg in 1987** to **1,500 kg in 1997**
- **An increase in production** from **50,000 tons/yr** to **350,000 tons/yr** of fish that same period



Why not just use more Antibiotics?

Antibiotic Resistance !!!!

How does antibiotic resistance occur?



Why not just use more Antibiotics?

Antibiotic Resistance !!!!

**High levels of antibiotic resistance
found worldwide, new data show**

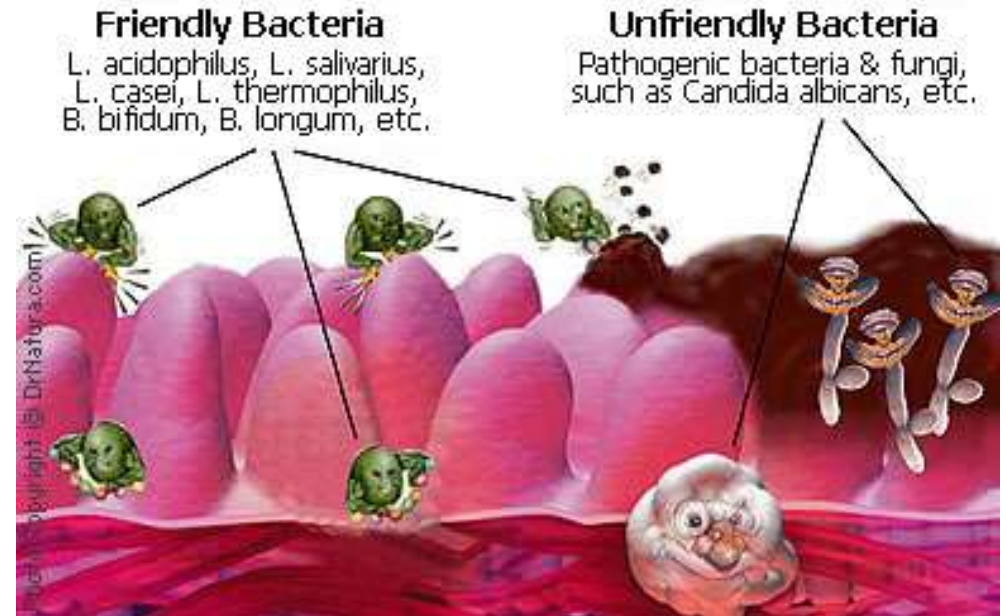
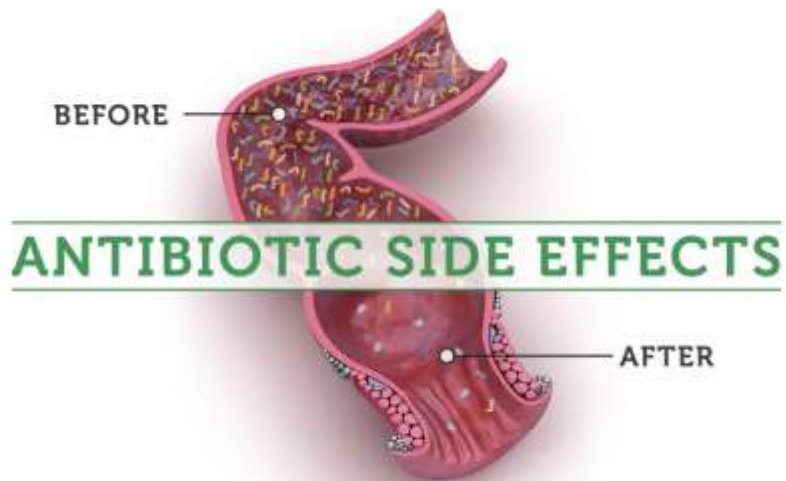
by the World Health Organization (WHO)

WHO's first release of surveillance data on antibiotic resistance reveals high levels of resistance to a number of serious bacterial infections in both high- and low-income countries. WHO's new Global Antimicrobial Surveillance System (GLASS) reveals widespread occurrence of antibiotic resistance among 500 000 people with suspected bacterial infections across 22 countries.



Why not just use more Antibiotics?

The presence of beneficial bacteria may play a significant role in the Fish Immune System!



Fish Vaccines Really Do Work!

Vibrio anguillarum/*Yersinia ruckeri* Vaccine Combo

- ▶ JOHNSON, K. A., FLYNN, J. K. and AMEND, D. F. (1982), Duration of immunity in salmonids vaccinated by direct immersion with *Yersinia ruckeri* and *Vibrio anguillarum* bacterins. *Journal of Fish Diseases*, 5: 207-213.
- ▶ GOULD, R.W., ANTIPA, R. and AMEND, D.F. (1979), Immersion Vaccination of Sockeye Salmon (*Oncorhynchus nerka*) with Two Pathogenic Strains of *Vibrio anguillarum*, *Journal of the Fisheries Research Board of Canada*, 1979, 36(2):222-225.
- ▶ ANTIPA, R. (1976), Field Testing of Injected *Vibrio anguillarum* Bacterins in Pen-Reared Pacific Salm. *Journal of the Fisheries Research Board of Canada*, 1976, 33:1291-1296.



Fish Vaccines Really Do Work!

▶ ***Infectious Hematopoietic Necrosis Virus (IHNV) vaccine***

- ▶ GARVER, K., LAPATRA, S., KURATH, G. (2005), Efficacy of an infectious hematopoietic necrosis (IHN) virus DNA vaccine in Chinook *Oncorhynchus tshawytscha* and sockeye *O. nerka* salmon. *Diseases of Aquatic Organisms* 64: 13-22.
- ▶ Alonso, M., & Leong, J. A. (2013). Licensed DNA Vaccines against Infectious Hematopoietic Necrosis Virus (IHNV). *Recent Pat DNA Gene Seq*, 7(1), 62-65.
- ▶ LaPatra, S. E., Corbeil, S., Jones, G. R., Shewmaker, W. D., Lorenzen, N., Anderson, E. D., & Kurath, G. (2001). Protection of rainbow trout against infectious hematopoietic necrosis virus four days after specific or semi-specific DNA vaccination. *Vaccine*, 19(28-29), 4011-4019.



Hatchery Fish - What do we vaccinate for?



- Bacterial Coldwater Disease



Black hole of



Wild fish diseases

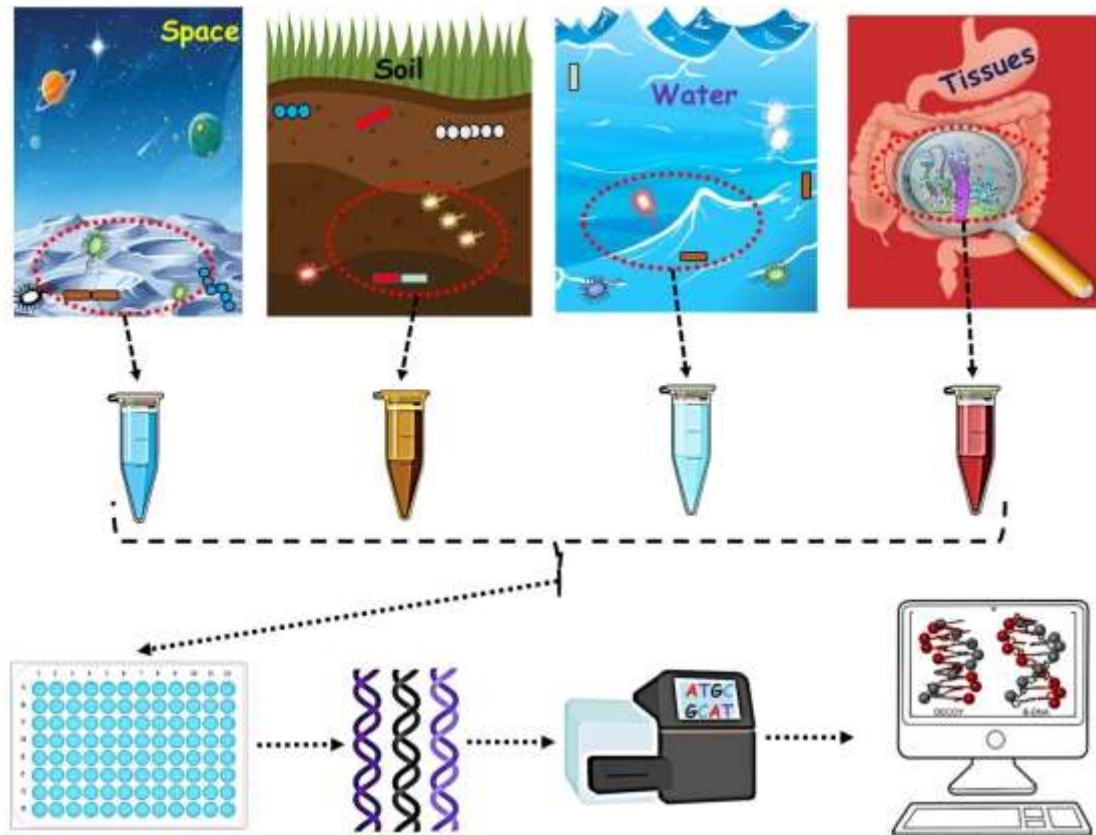


- Bacterial Kidney Disease
- IHNV

Parasites & Infectious Disease



Metagenomics made possible through Next Generation Sequencing (NGS)



- Optimal versus Detrimental Microbiome (Bacterial) populations
- Role vaccines and antibiotic treatments play in influencing this.

Metagenomics made possible through Next Generation Sequencing (NGS)

- Examine the blood and immune tissue microbiome of salmonids throughout the region to **identify possible bacterial pathogens associated with parasitic infections.**
- Look at fish blood and immune tissue microbiome differences in fish that have been **vaccinated versus those that have not.**
- Compare blood and immune tissue microbiomes in fish that have received **multiple treatments of antibiotics** with those that have not.



Summary

Our Goals:

- Identify the role that the underlying bacterial microbiome plays in fish survival.
- Continue to test and develop vaccines that have the potential to help give fish populations the advantage they need to recover and survive.



Questions!

