



Food and Agriculture
Organization of the
United Nations

FMM/RAS/298: Strengthening capacities, policies and national action plans on
prudent and responsible use of antimicrobials in fisheries Final Workshop
in cooperation with AVA Singapore and INFOFISH
12-14 December, Concorde Hotel, Singapore

Antibiotic treatment failures in salmon Aquaculture

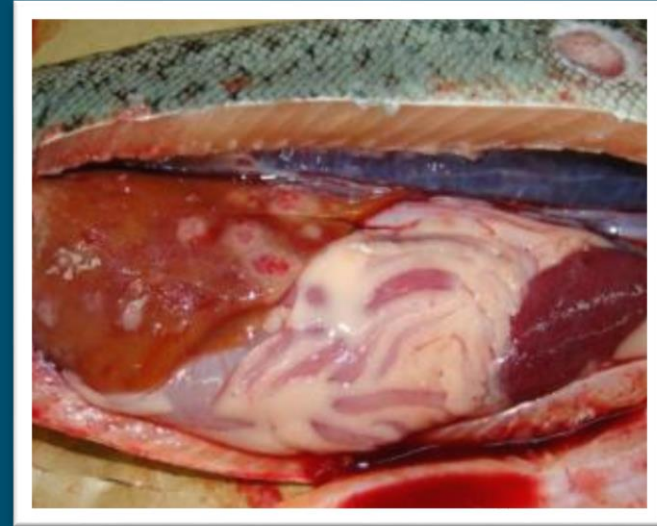
Sophie St-Hilaire, DVM, PhD, MBA

ssthilai@cityu.edu.hk



Industry complaint

- Difficulty treating *Piscirickettsiosis*
 - ~50% of treatments failing
 - Following antibiotic labels and veterinary guidelines
 - Repeated treatments
- Financial implications



Reasons for treatment failure

○ Resistance

- Sensitivity analyses suggest not resistance (Henriquez et al 2016)

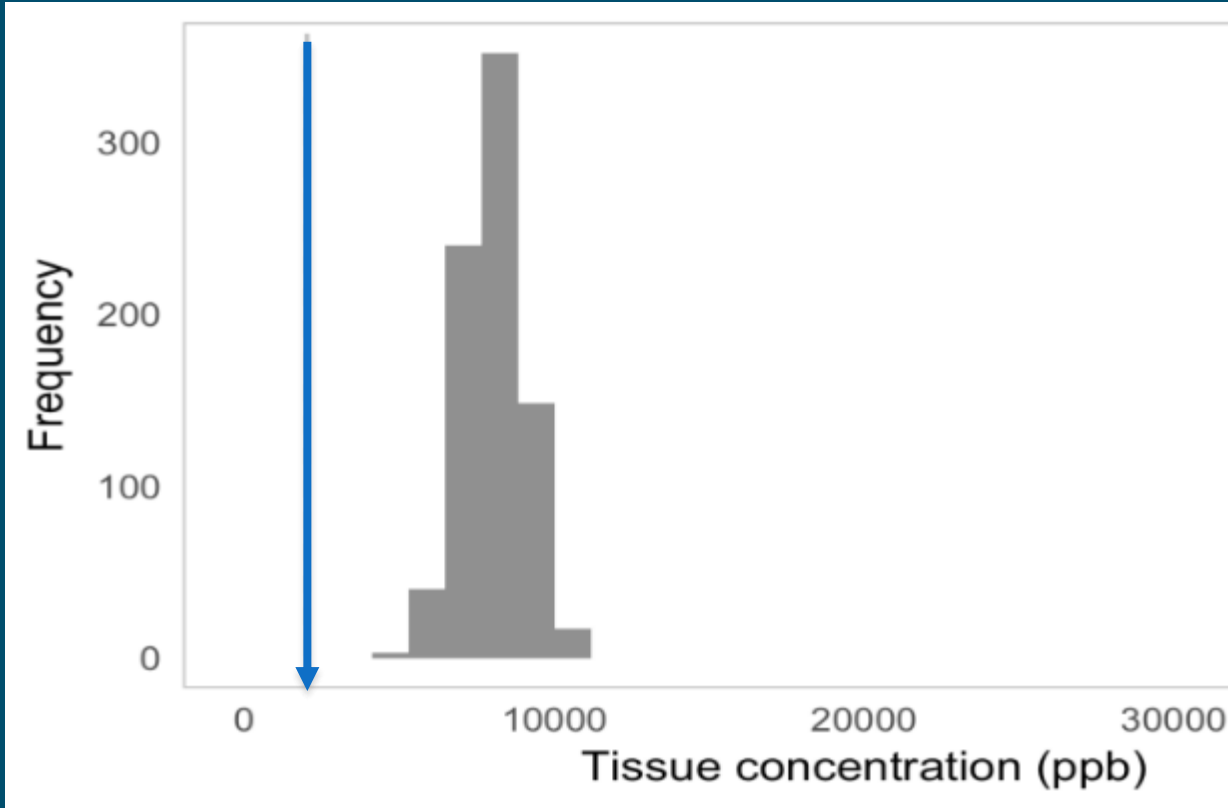
○ Improper diagnosis

○ Inadequate drug concentration in target tissues

○ Inadequate duration of treatment



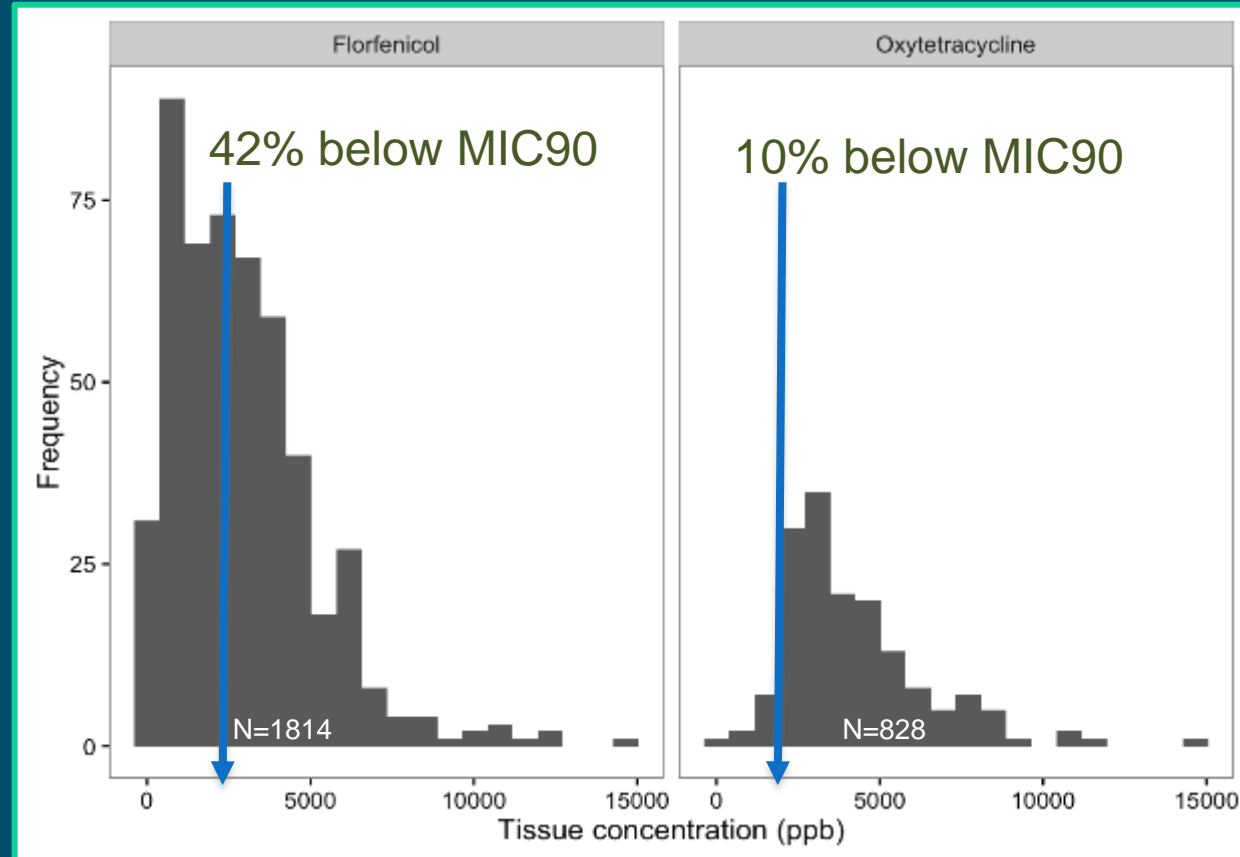
Expected antibiotic concentration (metaphylactic treatment)



Observed antibiotic concentration

Price et al 2017

- Large variation; extreme values
- High proportion below MIC90 for florfenicol
- **Sub-therapeutic levels of antibiotics in tissues**



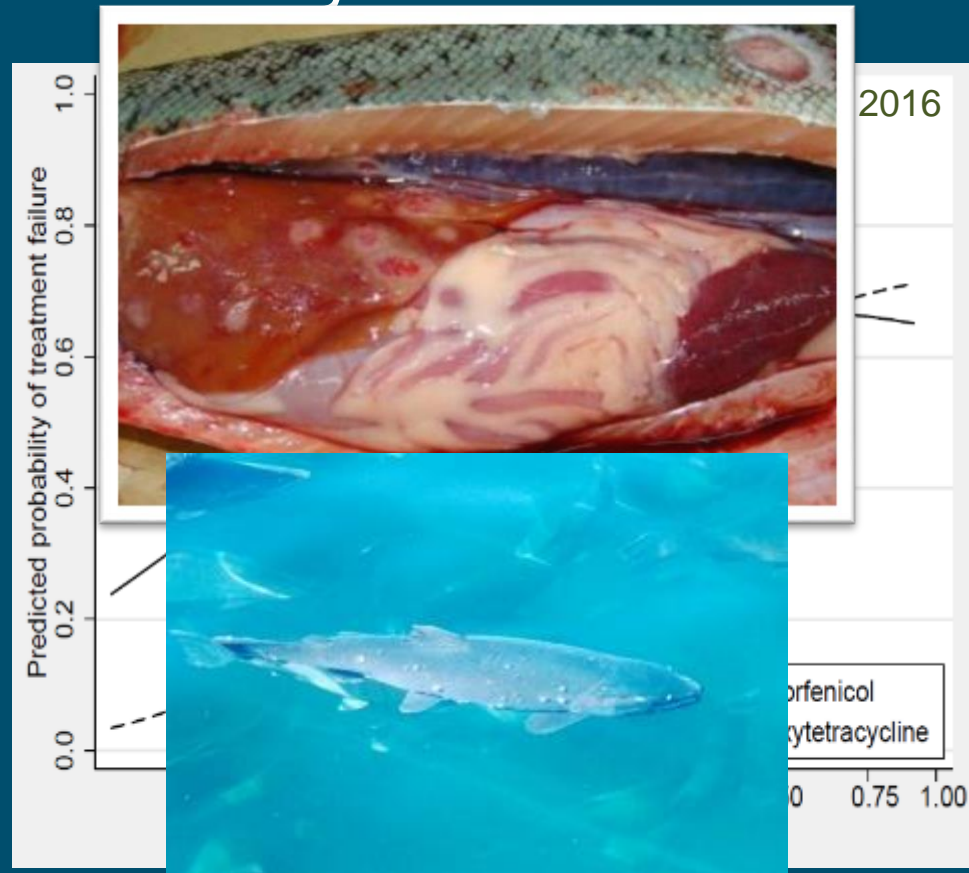
Inadequate antibiotic concentrations in fish

- Dose too low
 - Insufficient amount in feed
 - Biomass miscalculation
 - Feed mixing
 - Fish not eating
 - Too sick
 - Feeding strategy



Predicted probability of treatment failure given specific pre-treatment mortality

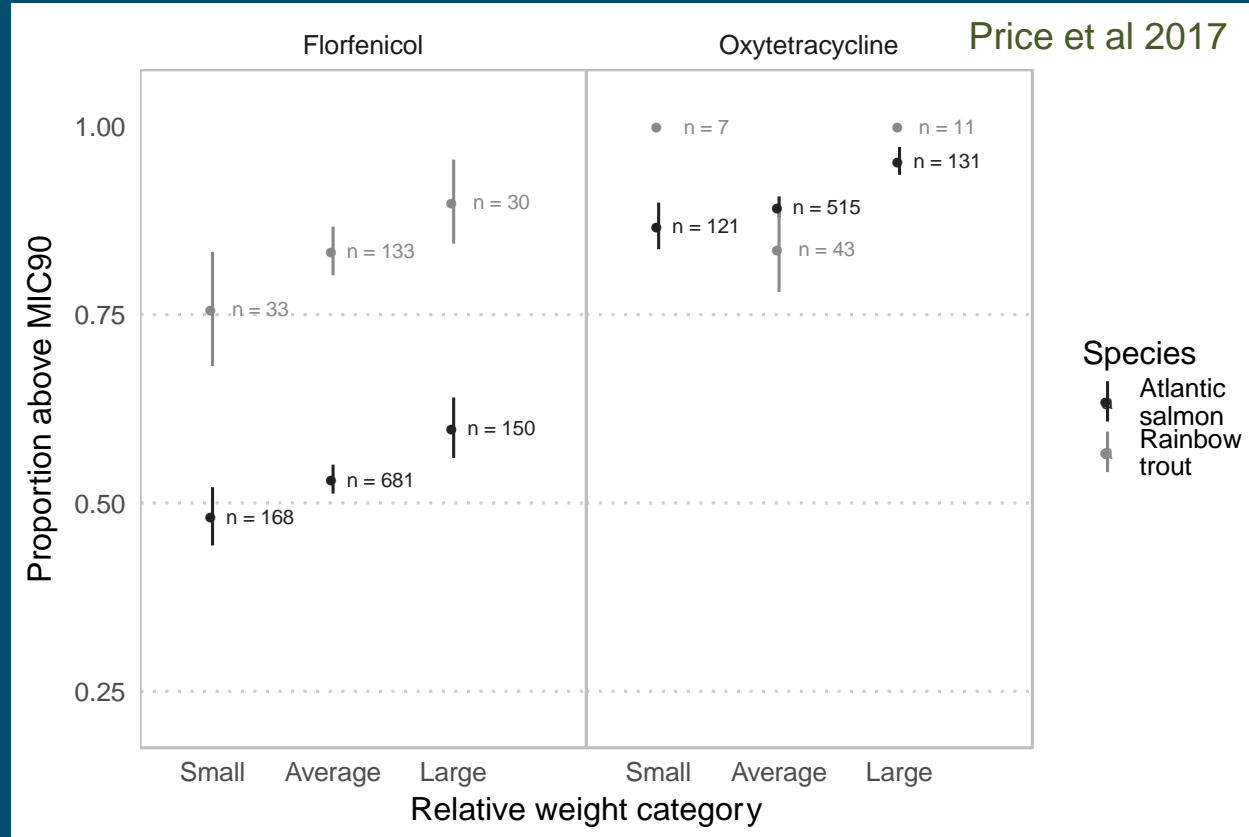
- **Within farm**, pens with high mortality had higher probability of treatment failure than pens with low mortality
 - Fish go off feed when sick
 - Chronic disease bacteria “hide”



Antibiotics in large vs small fish

Florfenicol

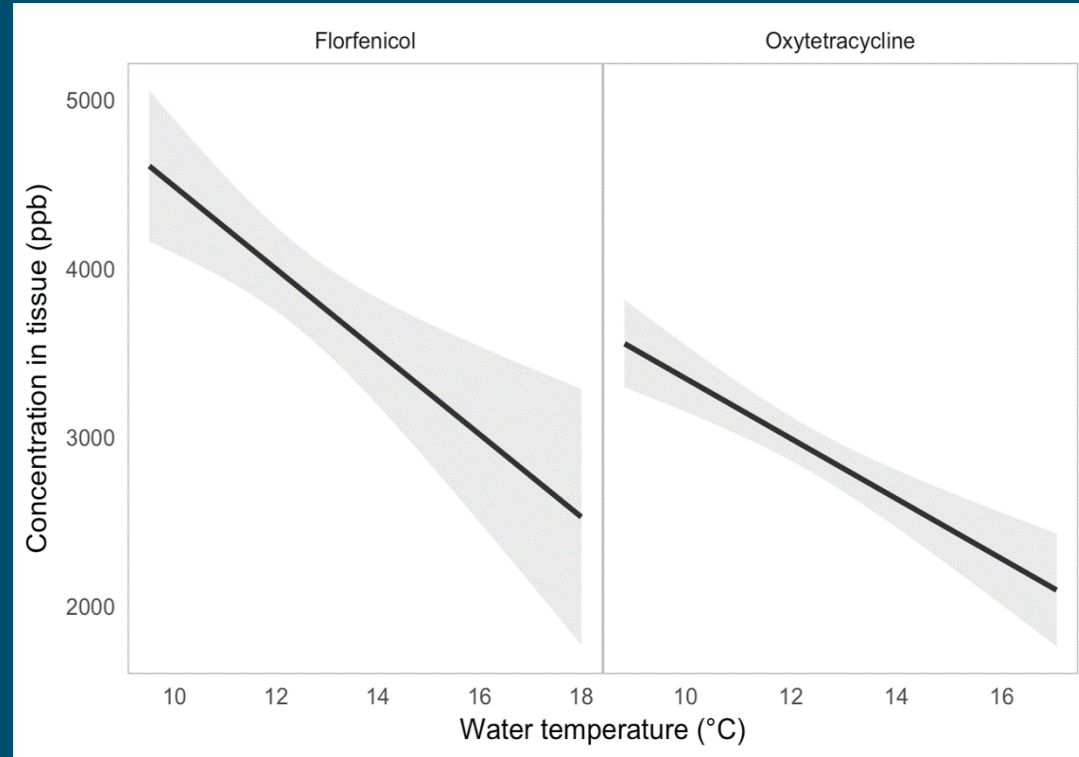
- **Within pen**
larger fish more likely to be above the MIC90
 - Suggests feed consumption rate not the same for different size fish
- Not observed for OTC



Inadequate antibiotic concentrations

Pharmacokinetics

- Metabolism varies with temperature
 - Florfenicol at 11 C ~12 hrs
 - Oxytetracycline at 8 C ~50 hrs
- Lower concentrations at higher temps
- Temperature effect not considered
- Dose rate not considered



Antibiotic Labels

Active Ingredient

Oxytetracycline hydrochloride, 440 g/kg

Terramycin-Aqua Indications

Salmonids: For the treatment of ulcer disease caused by *Haemophilus piscium*, furunculosis caused by *Aeromonas salmonicida*, columnaris disease caused by *Chondrocyclus (Flexibacter) columnaris*, cold-water disease caused by *Cytophaga psychrophila* and enteric redmouth disease

Feeding Directions

Salmonids: The medicated feeds are to be fed as the sole ration for 10 consecutive days. If mortality is not reduced by the fifth day of treatment, the diagnosis should be re-evaluated.

MIXING DIRECTIONS

Salmonids: Thoroughly mix Terramycin-Aqua with the feed. The amount of medicated feed to be added depends on the fish feeding rate. The amount of medicated feed that will provide 75 mg of oxytetracycline HCl per kg of feed can be prepared from the following table.

Fish feeding rate (% of body weight)	Amount of medicated feed (g/kg of feed)	To provide the following g of oxytetracycline HCl per kg of feed
1.0	16.88	7.50
1.5	11.36	5.00
2.0	8.52	3.75
2.5	6.82	3.00
3.0	5.68	2.50

○ Temperature effect on efficacy should be considered

○ Aqueous suspensions of pathogens

○ Not replicating pathogens

○ 10 days

- Designed for small populations; used on large populations
 - 1 million + fish
 - Fish survive beyond treatment

Need better guidelines

Avoiding subtherapeutic treatments

○ Consider population level pharmacodynamics

- Re-evaluate dose and frequency
 - Individuals vs population
 - Temperature and feeding rate
 - Target site
- Administration of feed and fish behavior
 - Frequency of feedings
 - Stage of disease

Need innovation



Acknowledgements

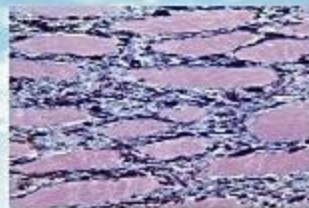
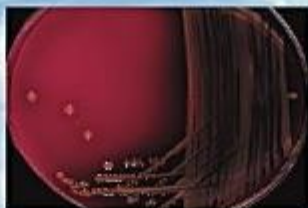
- Graduate student : Derek Price DVM, PhD
- Funding
 - Canadian Excellence Research Chair
 - SalmonChile



UNIVERSITY
of Prince Edward
ISLAND



**Celebrating
30 Years**



8TH INTERNATIONAL

SYMPOSIUM ON AQUATIC ANIMAL HEALTH

SEPTEMBER 2-6, 2018 • CHARLOTTETOWN, PEI, CANADA



Fish Health Section



www.isaah2018.com

Hosted by



American Fisheries Society
Fish Health Section



UNIVERSITY
of Prince Edward
ISLAND



PRINCE EDWARD ISLAND

BioAlliance