Acute and Chronic Exposure of Selected Great Lakes Fish to *BoNT/E*

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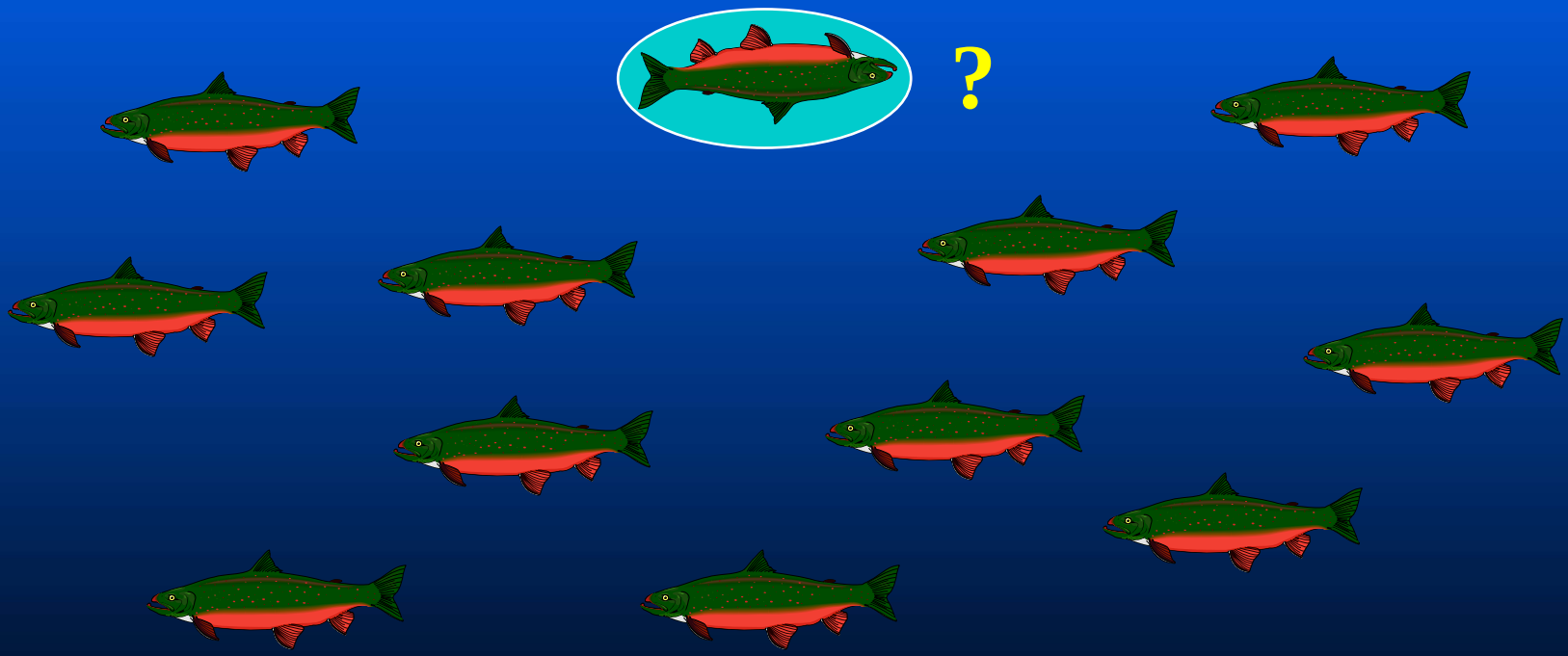

University of Guelph

The Paradox ?

How to explain the ‘fish’ pathway of toxin ingestion in birds which feed exclusively on ‘live’ fish (eg. loons, common and red-breasted mergansers, grebes)

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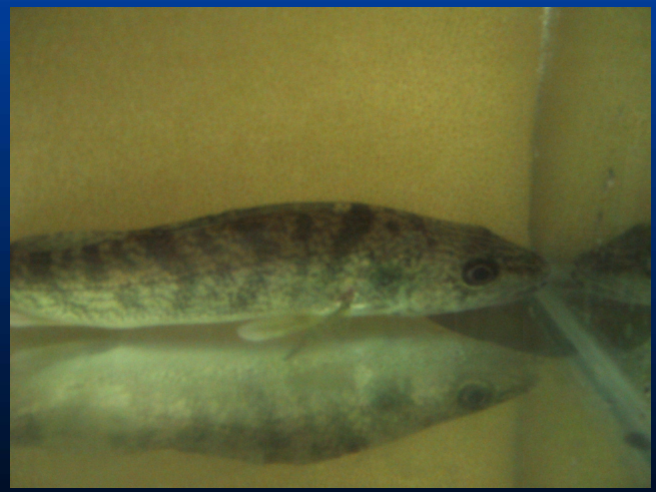
Sediment

Research Summary: Acute Trials

1. Developed a fish botulism exposure model ('FBEM')
2. Tested the sensitivity of several candidate fish species
3. Comparatively analyzed the species
4. Determined toxin availability following death
5. Provide insight into the ecology of BoNT/E in the Great Lakes

Interspecies Comparison



Methods:

-4 treatments used: 0, 800, 1500 and 4000 MLD

-Fish were observed for clinical signs for ten days

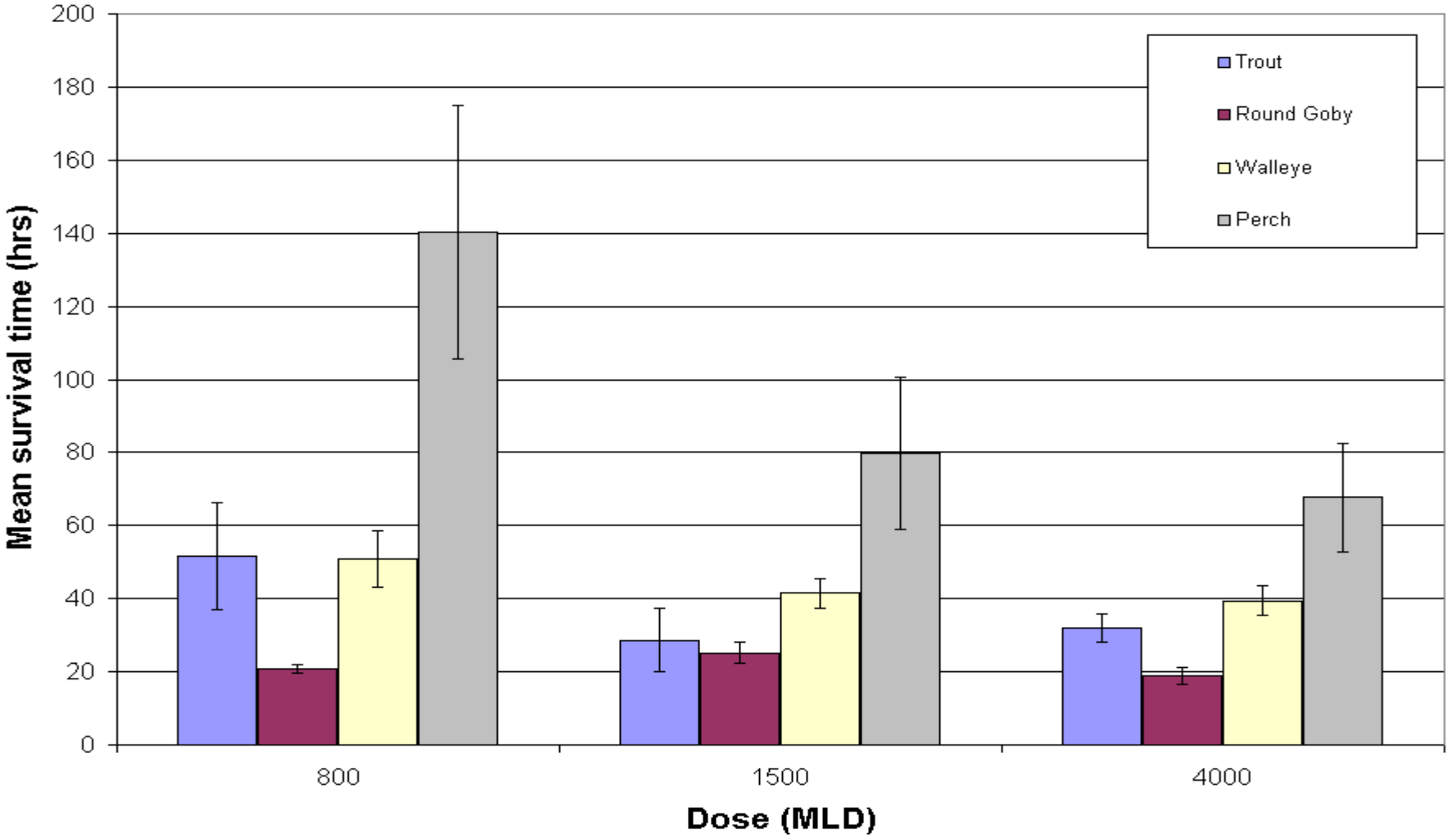
Hyperpigmentation

- Formation of the progressive, pigment ‘band’

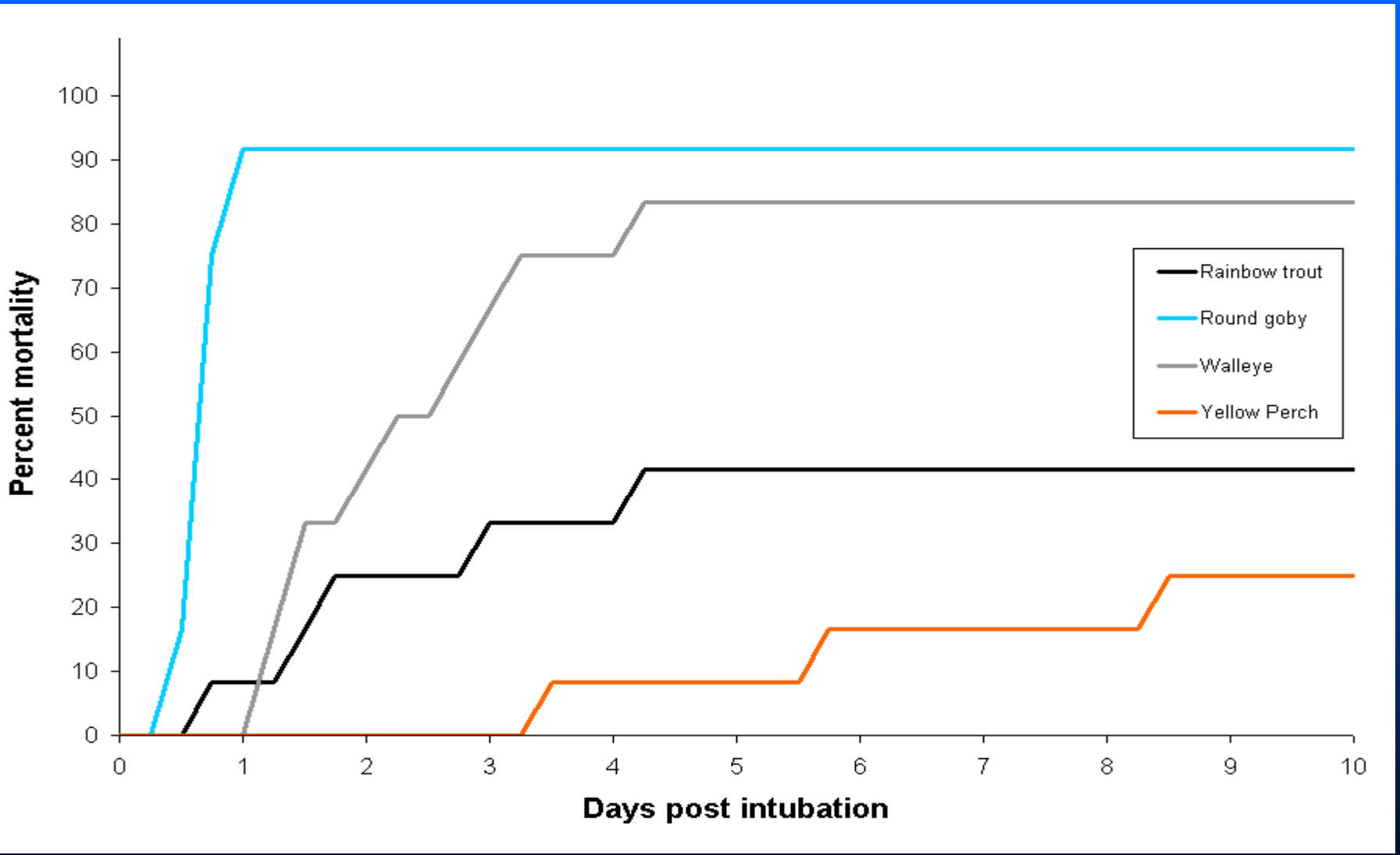
- Complete pigment change followed closely by death

“head up-tail down” orientation

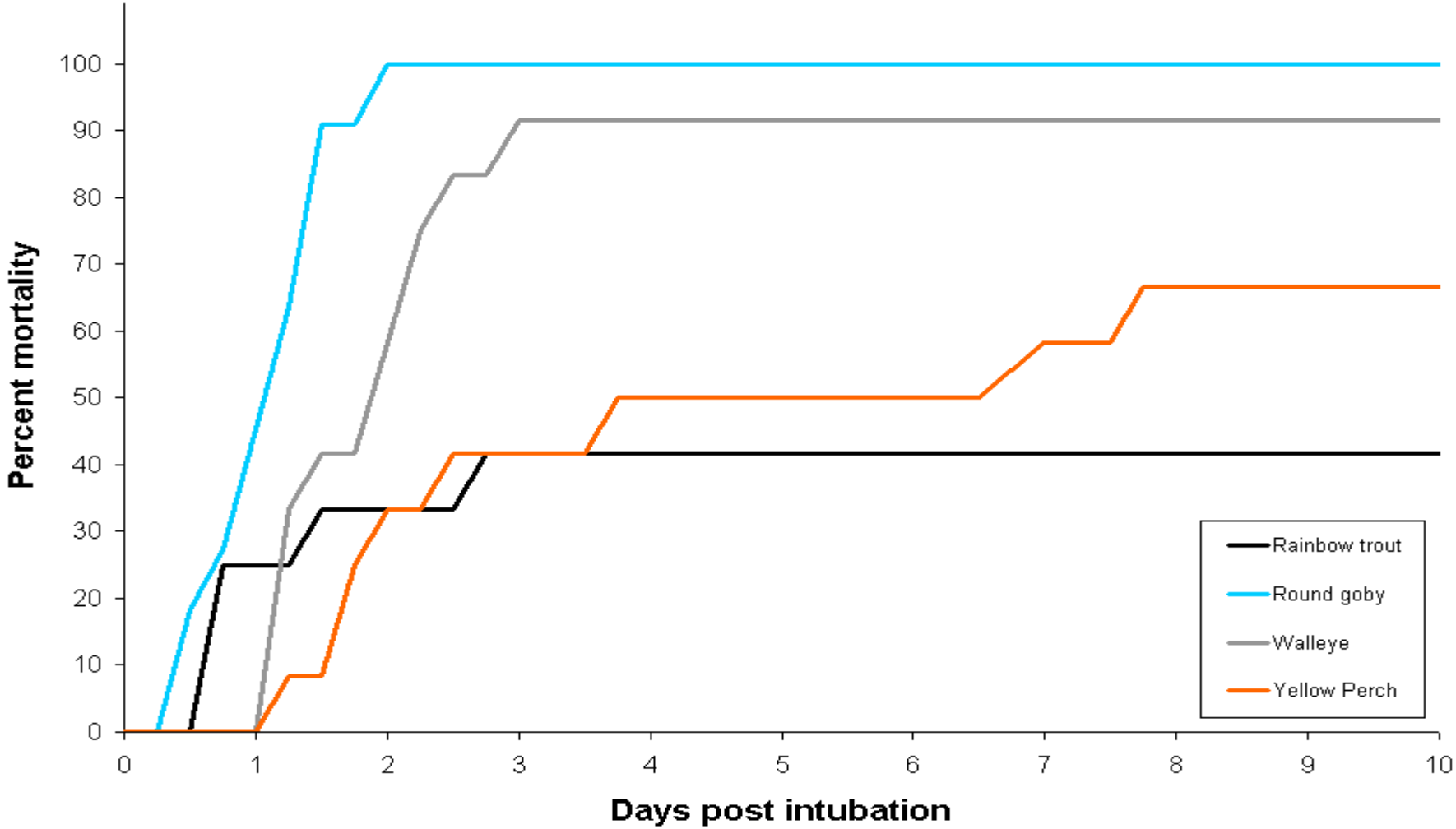
Interspecies Dose Response:



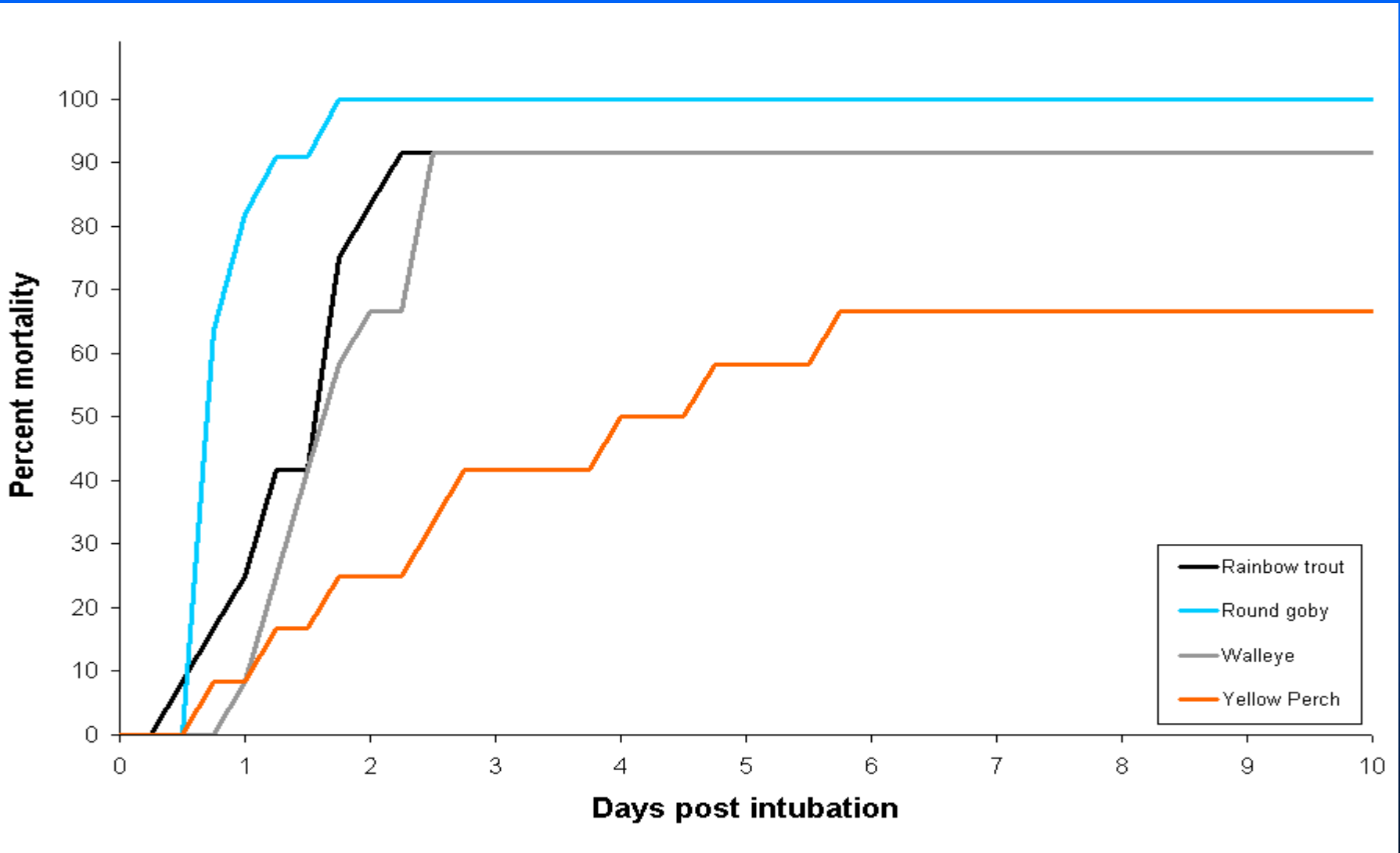
Interspecies Percent Mortality: 800 MLD



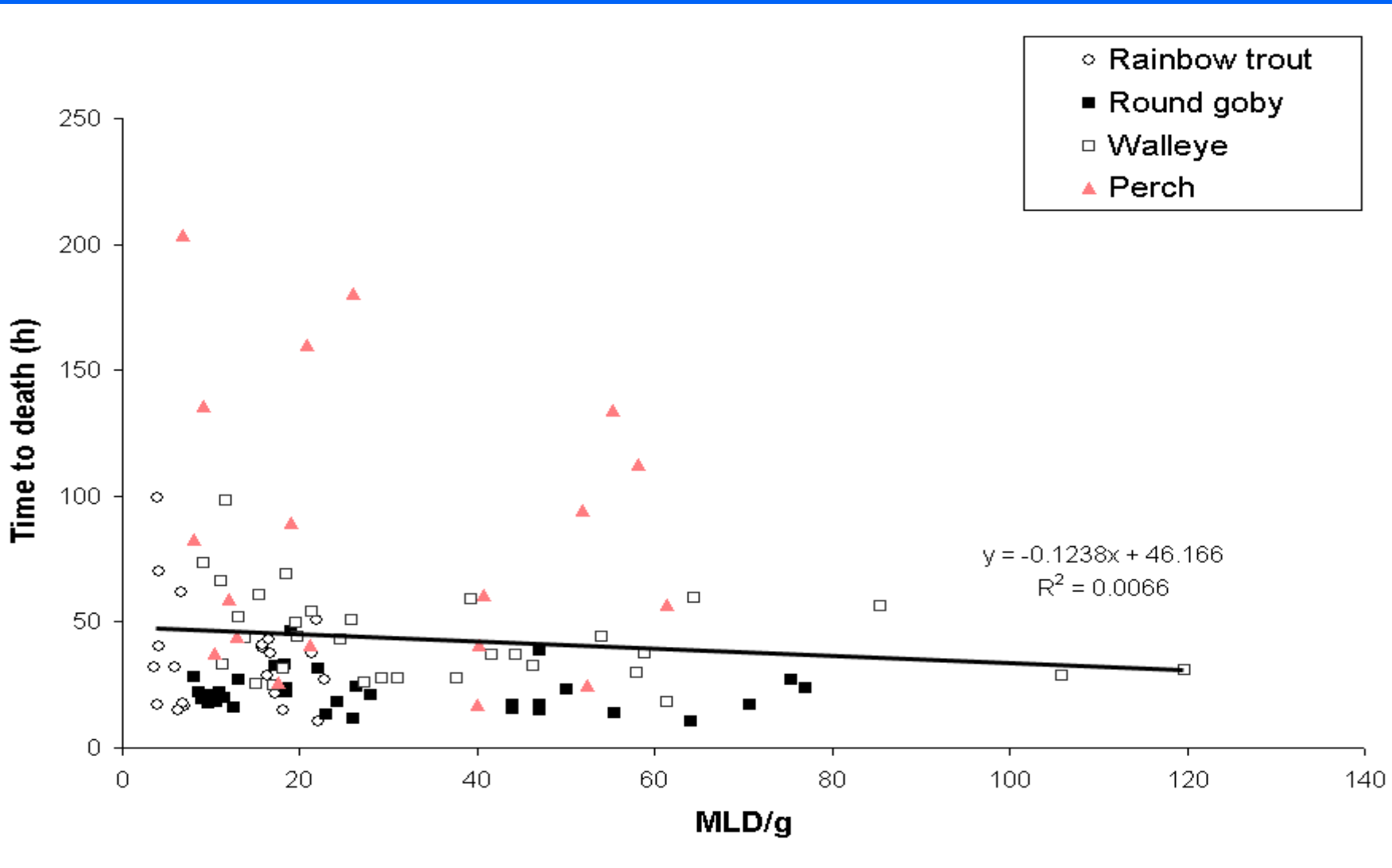
Interspecies Percent Mortality: 1500 MLD



Interspecies Percent Mortality: 4000 MLD



Interspecies MLD/g:



What's Left in a Dead Fish ?!

Post Mortem BoNT/E Results:

Treatment Group	Trout	Goby	Walleye	Perch
Fillet				
800 MLD	0%	0%	0%	0%
1500 MLD	0%	0%	0%	0%
4000 MLD	0%	17%	0%	0%
Viscera				
800 MLD	8%	92%	42%	0%
1500 MLD	17%	75%	67%	22%
4000 MLD	25%	83%	75%	33%

Well, OK…….So What ?

Implications of Results

- Each species shows a unique set of clinical signs
- Behavioral (eg. breaching, erratic swimming) and pigmentation changes in all species could “lure” bird predators to affected fish
- Prolonged moribund state in fish, even with high BoNT/E levels

Implications of Results

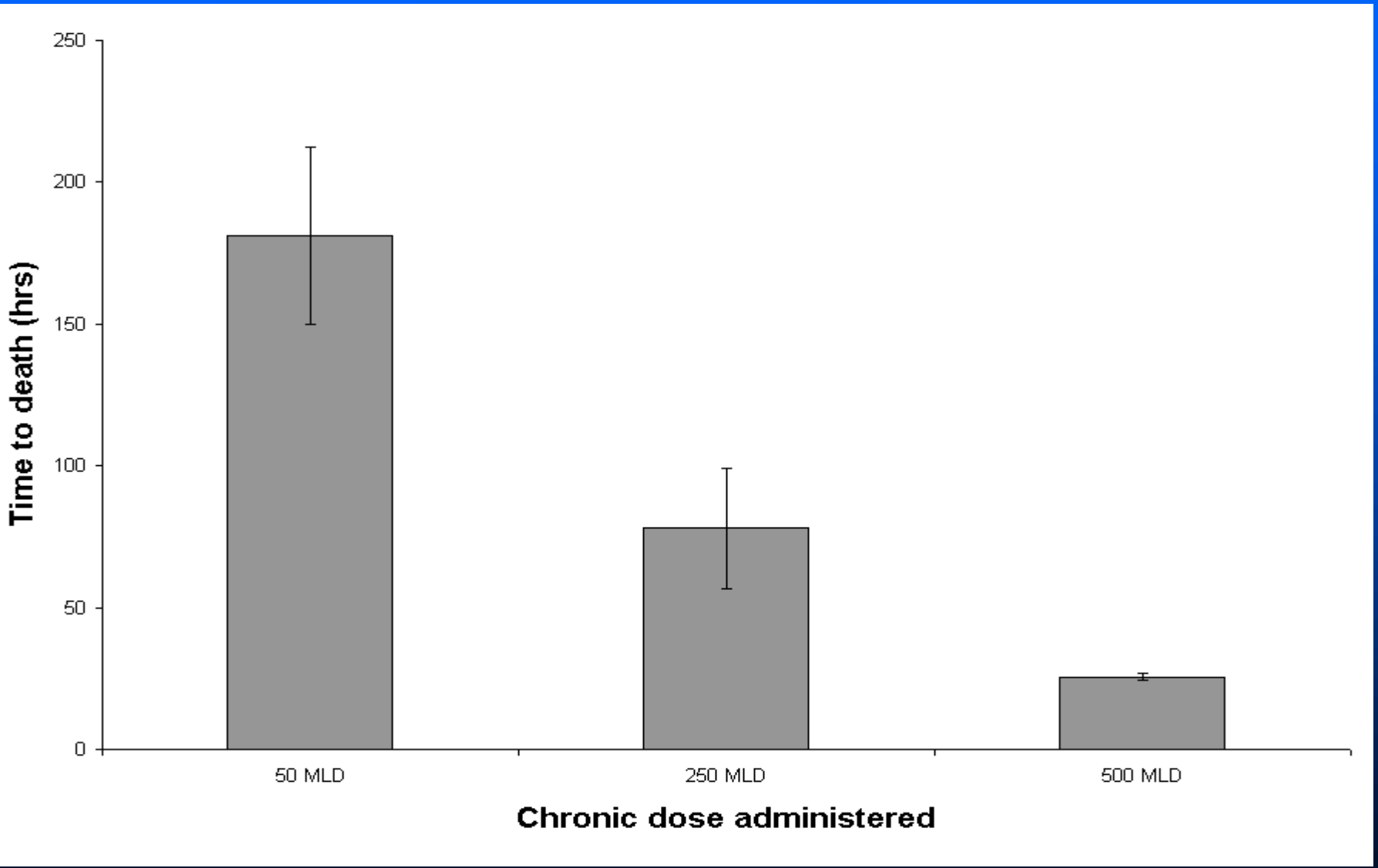
- The round goby is not highly tolerant as was previously hypothesized
- Live fish can be a significant vector for toxin transfer through trophic levels
- Unlikely human health significance to live fish carrying toxin

Chronic BONT/E Trials in the Round Goby

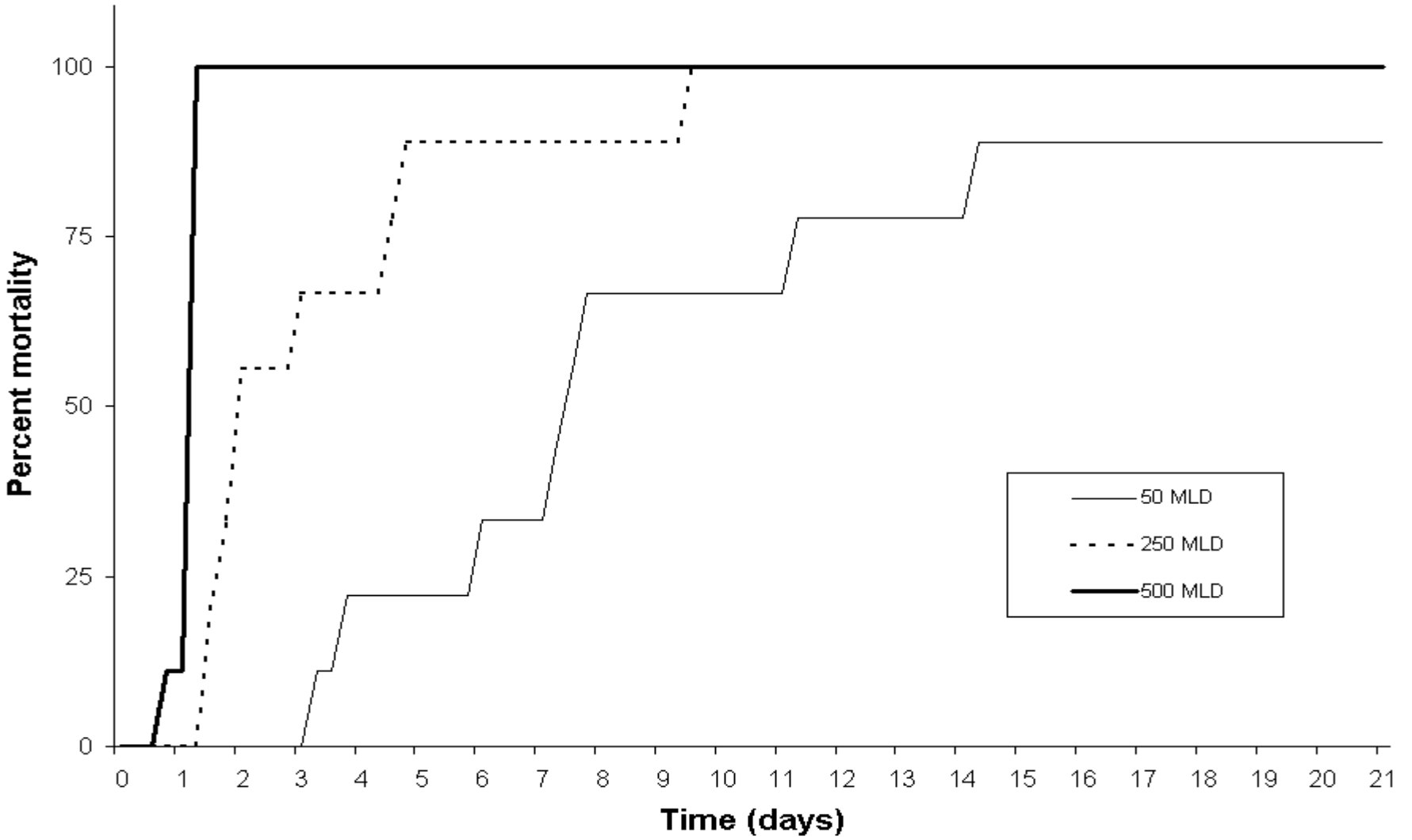
Methods

- 4 treatments used: 0, 50, 250 and 500 MLD
- Surviving fish were intubated every three days for a maximum of 21 days

Dose Response



Percent Mortality



Post Mortem BoNT/E Results:

Treatment Group	Round Goby
Fillet	
50 MLD	0%
250 MLD	0%
500 MLD	0%
Viscera	
50 MLD	0%
250 MLD	11%
500 MLD	22%

Implications of Results

- Round gobies are sensitive to chronic BONT/E exposure
- Results suggest a threshold response
- At low toxin treatments fish can survive for extended periods of time
- Free toxin results raise and interesting question regarding botulism mortalities in fish

Future Research?

Acknowledgements

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QUESTIONS ?

- Type E botulism is considered the primary cause of avian deaths

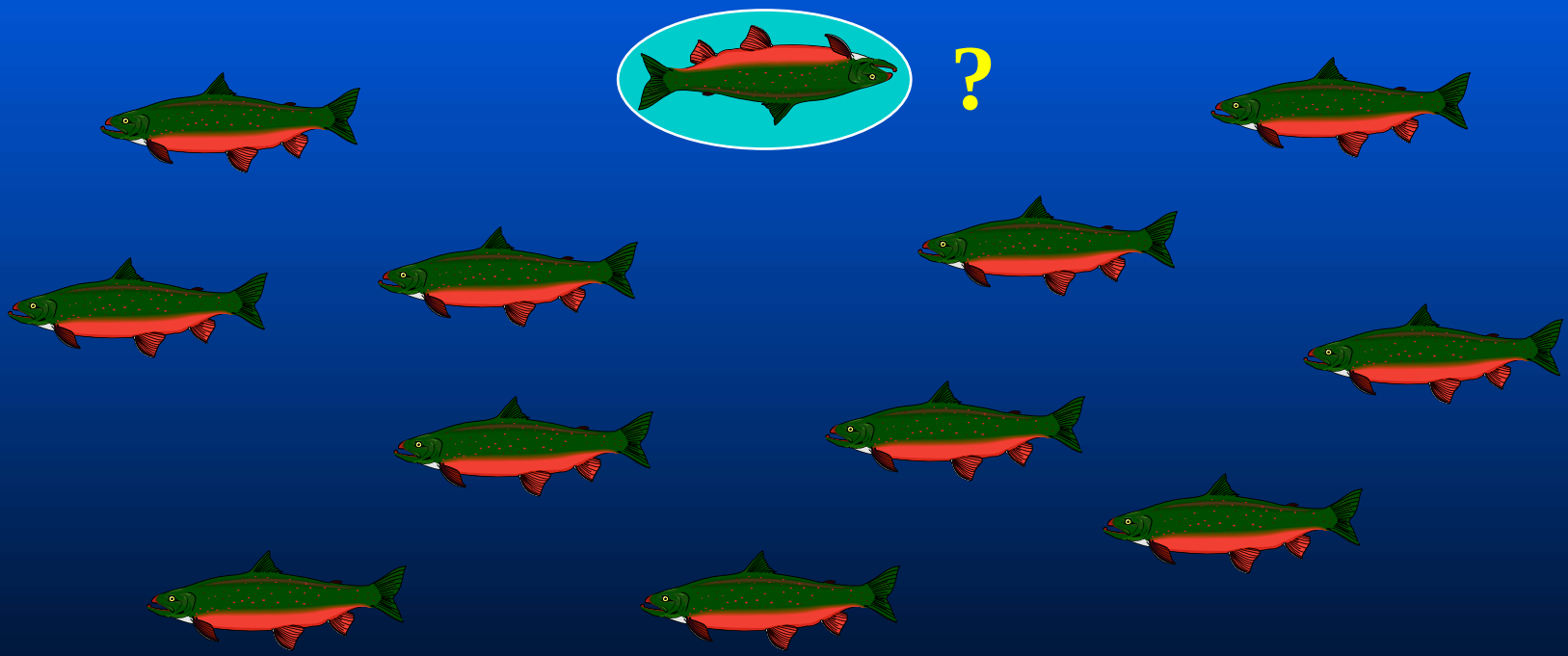
Botulism Type E

- Spores are found everywhere in the environment
- Under suitable conditions spores germinate and produce toxin
- Toxin causes a flaccid paralysis

What Are The Questions ?

- Are ‘living’ fish a reasonable transport mechanism moving Botulinum neurotoxin from point of origin to the bird ?
- Is it plausible that live toxin laden fish are selective prey species ?
- Is there a potential human health hazard to people who consume BoNT/E laden fish ?

Setting Out to Answer One Very Small Piece of the Botulism Ecology Puzzle



Lake Erie Bird Mortalities

- Since 1999 there have been tens of thousands of mortalities of fish-eating water birds