

# THE EFFECT OF PYRETHROIDS ON LOBSTER POST-LARVAE (*HOMARUS AMERICANUS*)

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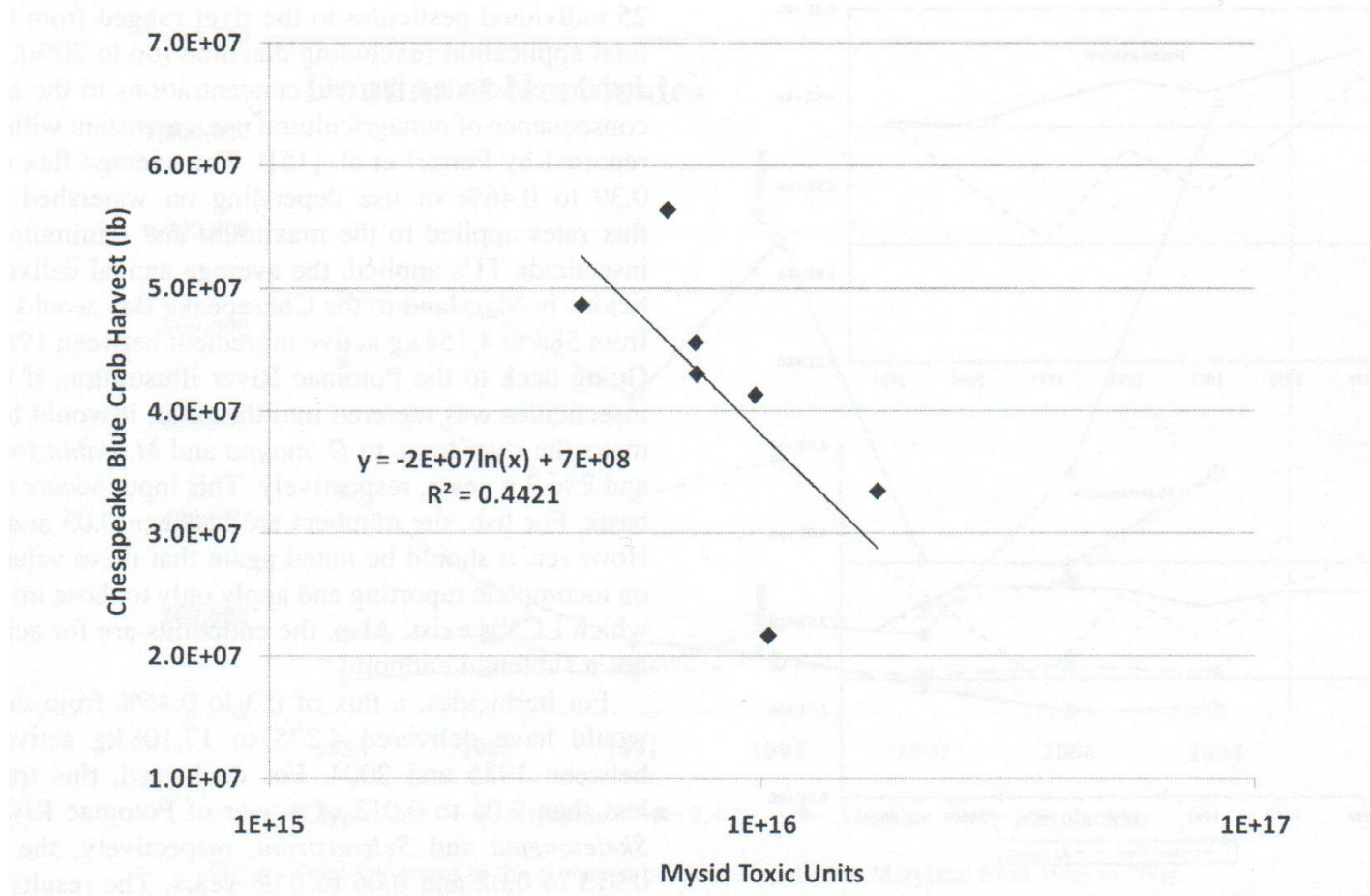
# Pesticides - Why a concern to fishing industry?

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- There was a huge die off of lobster in Long Island Sound that was co-incident with the arrival of West Nile virus and the insecticide spray program
- Some of the recent workshops are now wondering if a synthetic pyrethroid insecticide could have been a contributor
- These events have received wide media and industry attention
- In reaction to decreasing lobster landings in some areas, increase interest for studies on factors affecting lobsters in southern Gulf of St Lawrence
- History fish kills in Prince Edward Island streams since 1994 related to pesticide applications and subsequent runoff into streams
- Can contaminants be a factor (causal, added stress) in the incidence of lobster shell disease? Or influencing low benthic recruitment in the Northumberland Strait ?

# Pesticides (example) - Interesting link !

## Relation pesticide in water - blue crab abundance



Plot of blue crab (*Callinectes sapidus*) harvest in Maryland versus toxic insecticides applied, calculated for *Mysidopsis bahia* between 1985 and 2004 (Hartwell 2011)

# Pesticides - Multidisciplinary approaches



**Pesticide**

## Physiology:

- Histology
- Metabolism
- Biochemistry

## Molecular level:

- cDNA Microarray
- Quantigene Plex Assay (QGP)
- Quantitative Polymerase Chain Reaction (QPCR)

Stages I to IV  
Stages IV and V

Acute (24-96h),  
Pulse (1h) and  
chronic exposures  
in water  
Chronic exposures  
on sediments

## Survival/Development:

- $LC_{50}$  and  $EC_{50}$
- Molt delays
- Moulting increments

## Behavior:

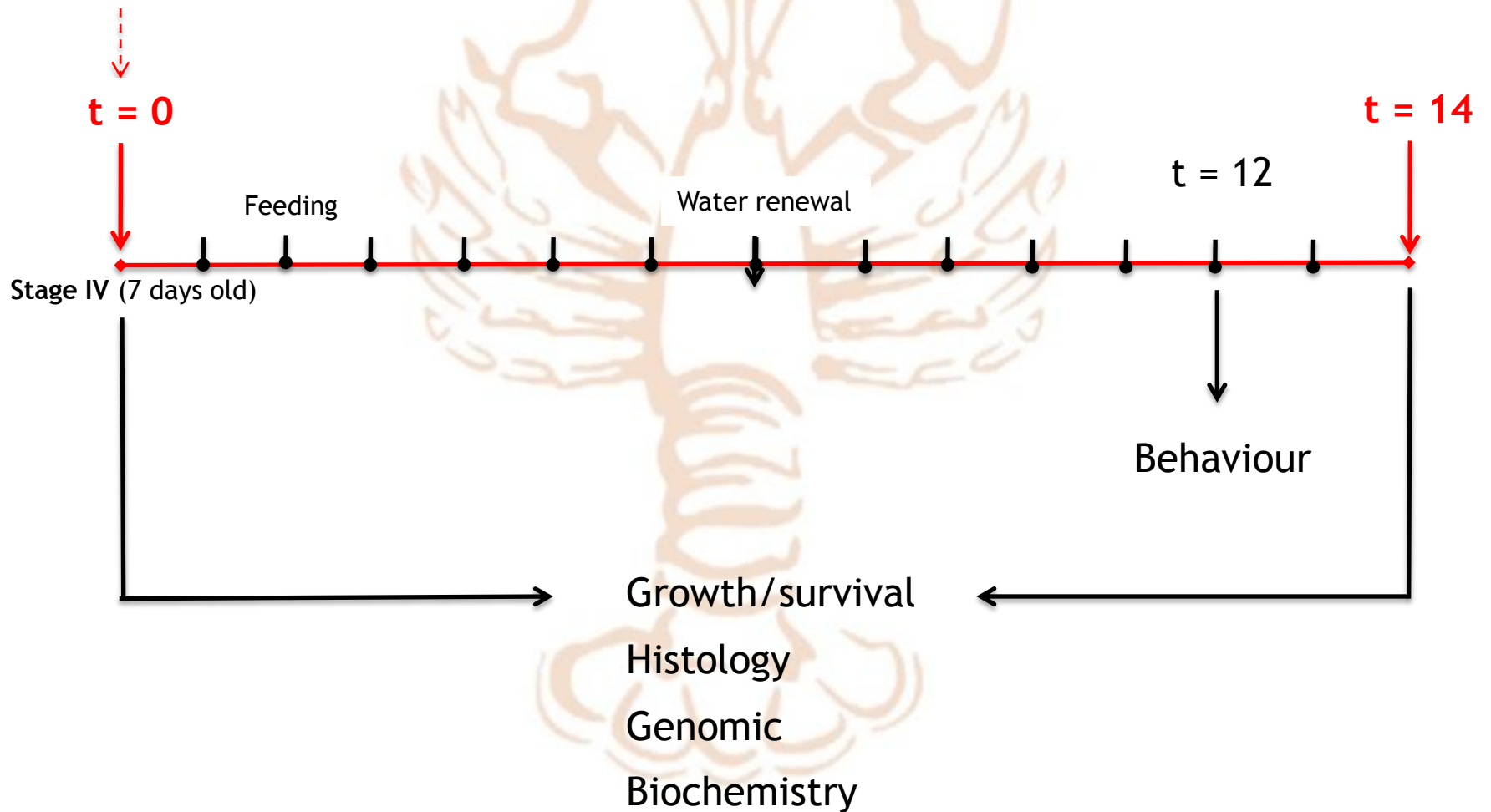
- Cryptic
- Swimming abilities

## Tools development:

- Interspecific studies
- Lobster: a model of pollutant sensitive species ?

# Pyrethroids - 2012 experiments

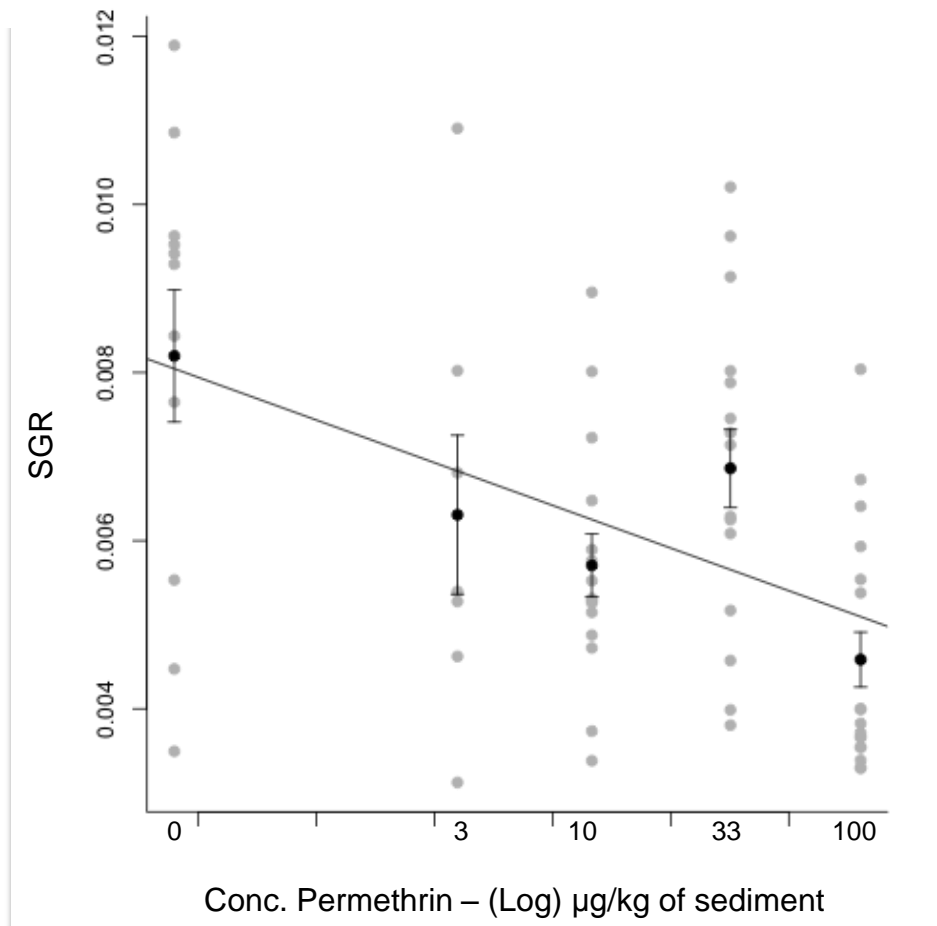
Permethrin = control + 4 conc.



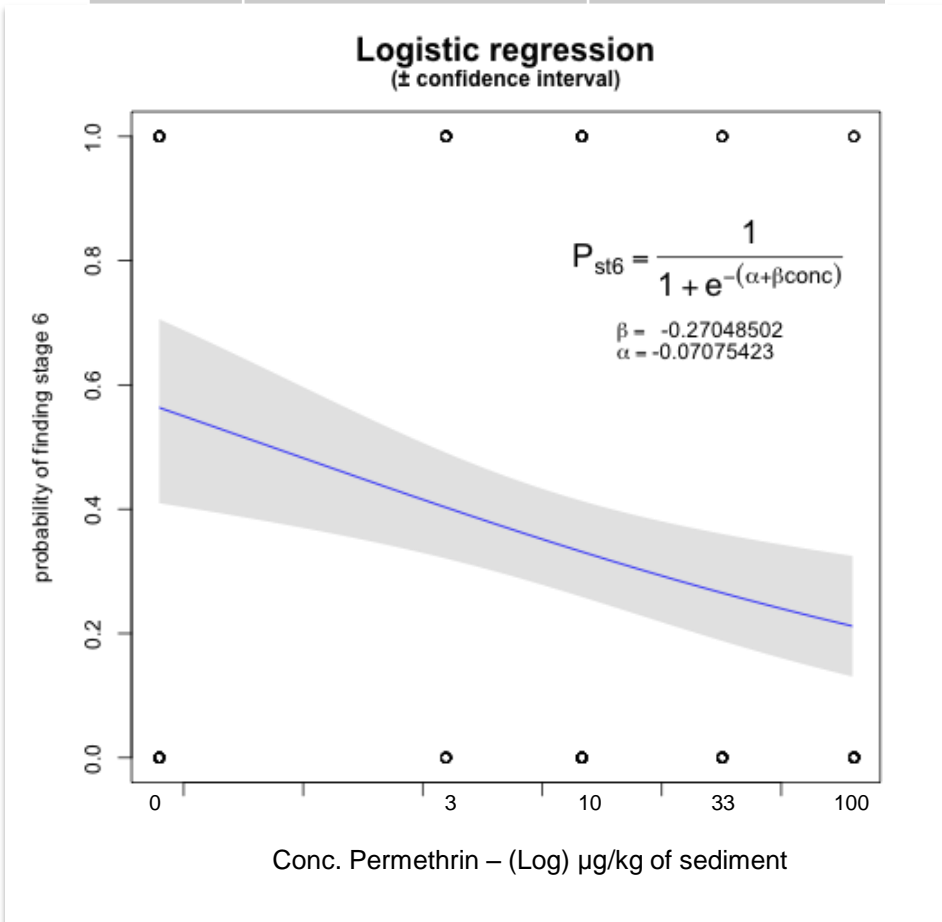
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**GROWTH**

Permethrin	IP (days)		MIS (% initial CL)		SGR	
Conc. in sediments	Mean	SE	Mean	SE	Mean	SE
0 µg/kg	11.79 (14)	0.11	23.51 (15)	2.38	0.00836 (11)	0.00083
3 µg/kg	13.64 (11)	0.64	21.93 (7)	3.21	0.00631 (7)	0.00097
10 µg/kg	15.05 (20)	0.77	21.82 (16)	1.69	0.00570 (15)	0.00038
33 µg/kg	13.69 (23)	0.47	25.12 (17)	1.62	0.00686 (16)	0.00047
100 µg/kg	17.26 (27)	0.49	18.01 (15)	0.49	0.00458 (18)	0.00033



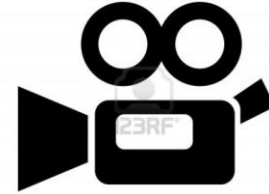
Perm µg/kg	Min-Max days IV to V	Max days IV to VI
0	11-12	21
3	12-17	21
10	11-20	21
33	12-19	21
100	12-20	21



# Observed malformations







Videoreccords were taken after shelter introduction at t=12:  
2 stage V from each condition



Observations every 15 min for 1hr on 15-20 post-larvae:  
In or under the shelter  
How long it takes to enter the shelter for the 1<sup>st</sup> time

No significant differences were observed but a small tendency for the control to be in shelter.

<u>Control:</u>	<u>33 µg/kg :</u>	<u>100 µg/kg :</u>
Shelter used by both lobsters	Shelter used by 1 lobster for 12 min, then lobster was hiding under, digging a lot	None of the lobster used shelter.

Higher N would be needed.

## PERMETHRIN

- **Growth & Survival**

- Almost 100% survival = all concentrations are sublethal !
- Growth delayed with increasing concentrations of Permethrin
- IP more affected than MI

- **Histology**

- The general shape of lobsters seems to be the most affected parameter
- R-, B- and F- cells doesn't seem particularly affected by contaminants.

Neither the shape of the cuticle

- Histology seems to be related more to moult stage than to contaminant exposure concentrations

- **Biochemistry/Metabolism**

- Techniques set-up for 2013's experiments

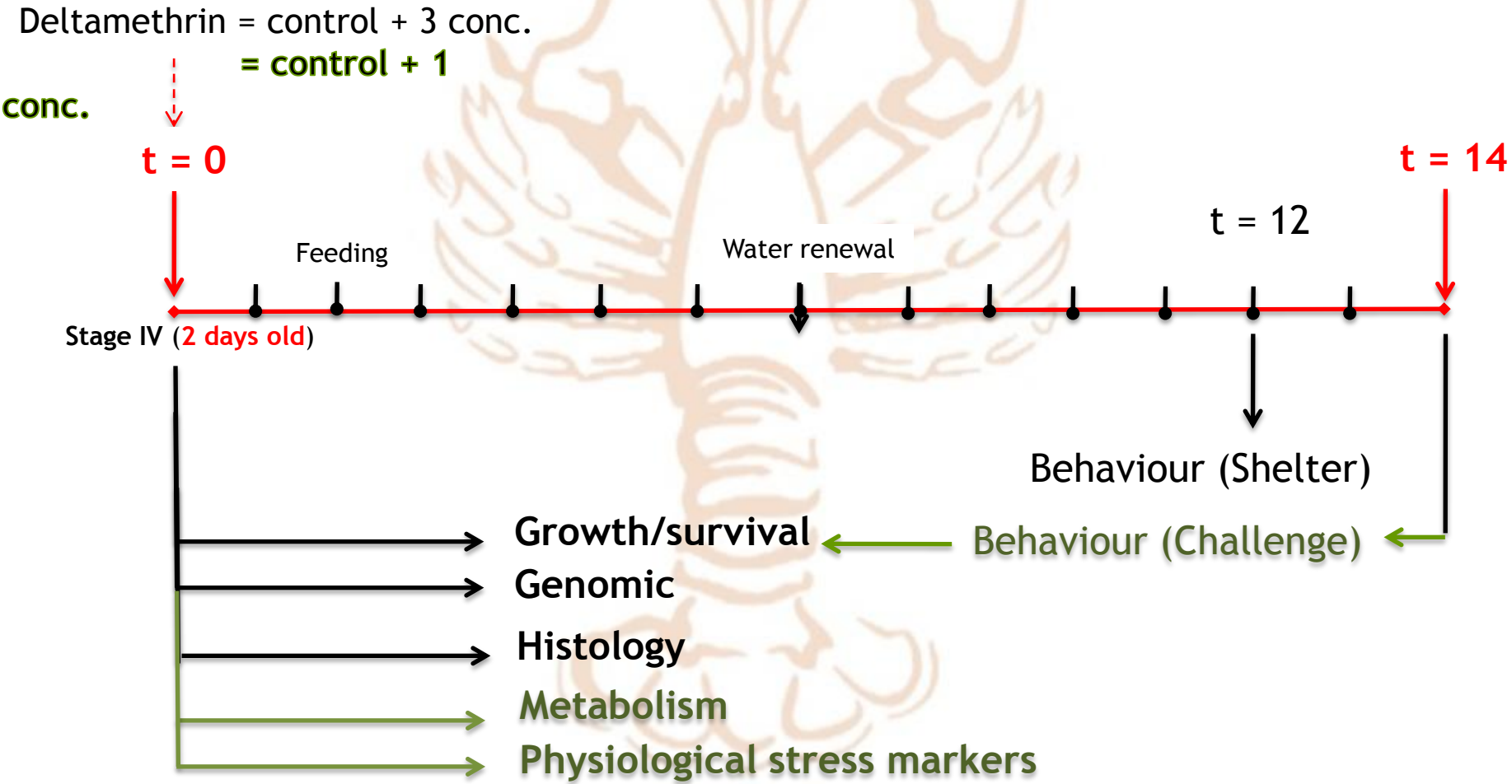
- **Behaviour**

- No specific tendency was revealed after the observations carried out.
- However, personal observations tend to reveal that lobsters exposed to the higher concentrations seem to be unable to burrow

- Video observations seems to show that highly-permethrin exposed lobsters tend not to use their shelter compared to the control ones But

N is too low to conclude for now

# Pyrethroids - 2013 experiments



# Pesticides - Thank you

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Environment Canada  
Fisheries and Oceans Canada  
Université de Moncton  
AVC Lobster Science Centre

The Maritime Fishermen's Union  
Fundy North Fishermen's Association  
Gulf Nova Scotia Fishermen's Coalition  
PEI Fishermen's Association LTD



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# Pesticides - Conclusions

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- Toxicological screening of pesticides of concern in our region has generated a number of significant results for biological effects on lobster larvae.
- In our limited screening we have seen compounds that affect survival, moulting, timing of development, histology, metabolism and behaviour.
- Chemicals chosen for these studies are used on land adjacent Northumberland Strait. Regional environmental samples from freshwater have found measurable concentrations of pesticides.
- While there is nothing definitive to indicate a link between lobster population levels in the Northumberland Strait, and contaminants in the environment, there is certainly enough information now available to ask good questions.