Trout growth and smelt dynamics in Lake Rotoiti

Jennifer Blair

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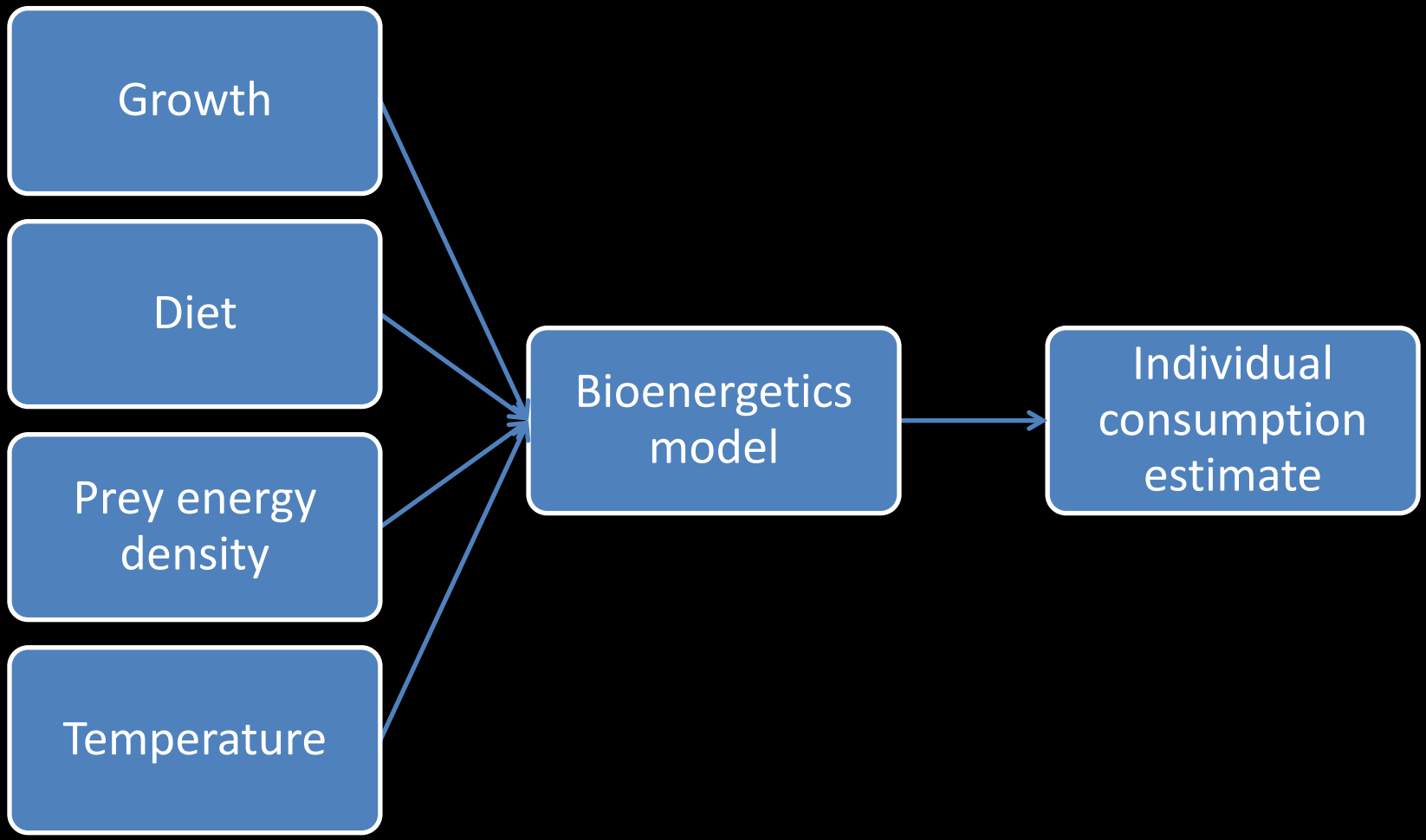
Rotorua, November 16 2011

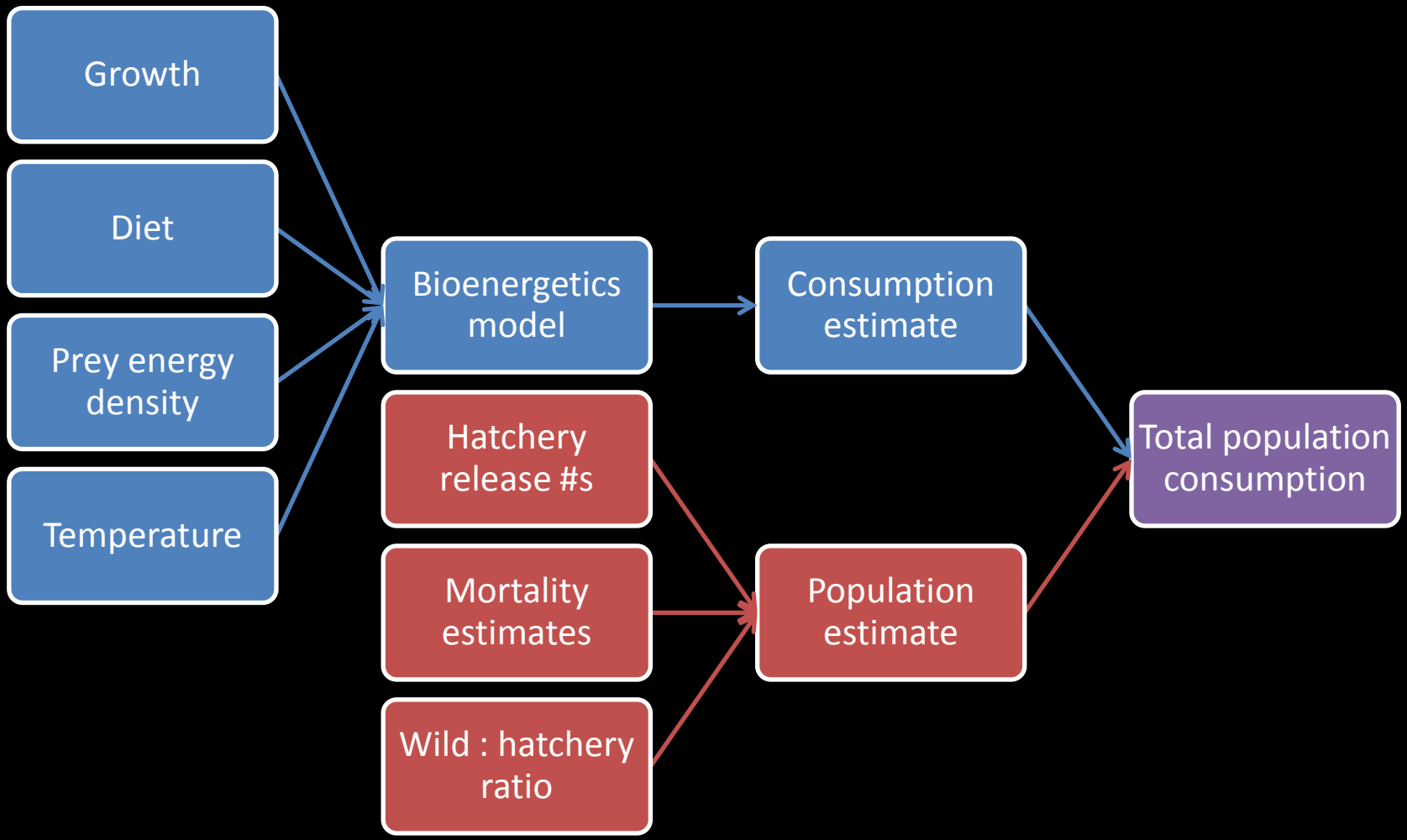
PhD: Factors controlling common smelt abundance and trout production in the Rotorua lakes, New Zealand

- Objectives:
  - To determine the dynamics of the abundance of common smelt,
  - To determine the relationship between smelt production and trout production,
  - To determine the factors that control smelt production,
  - To recommend how to enhance smelt populations and mitigate potential detrimental effects of the Ohau wall installation.

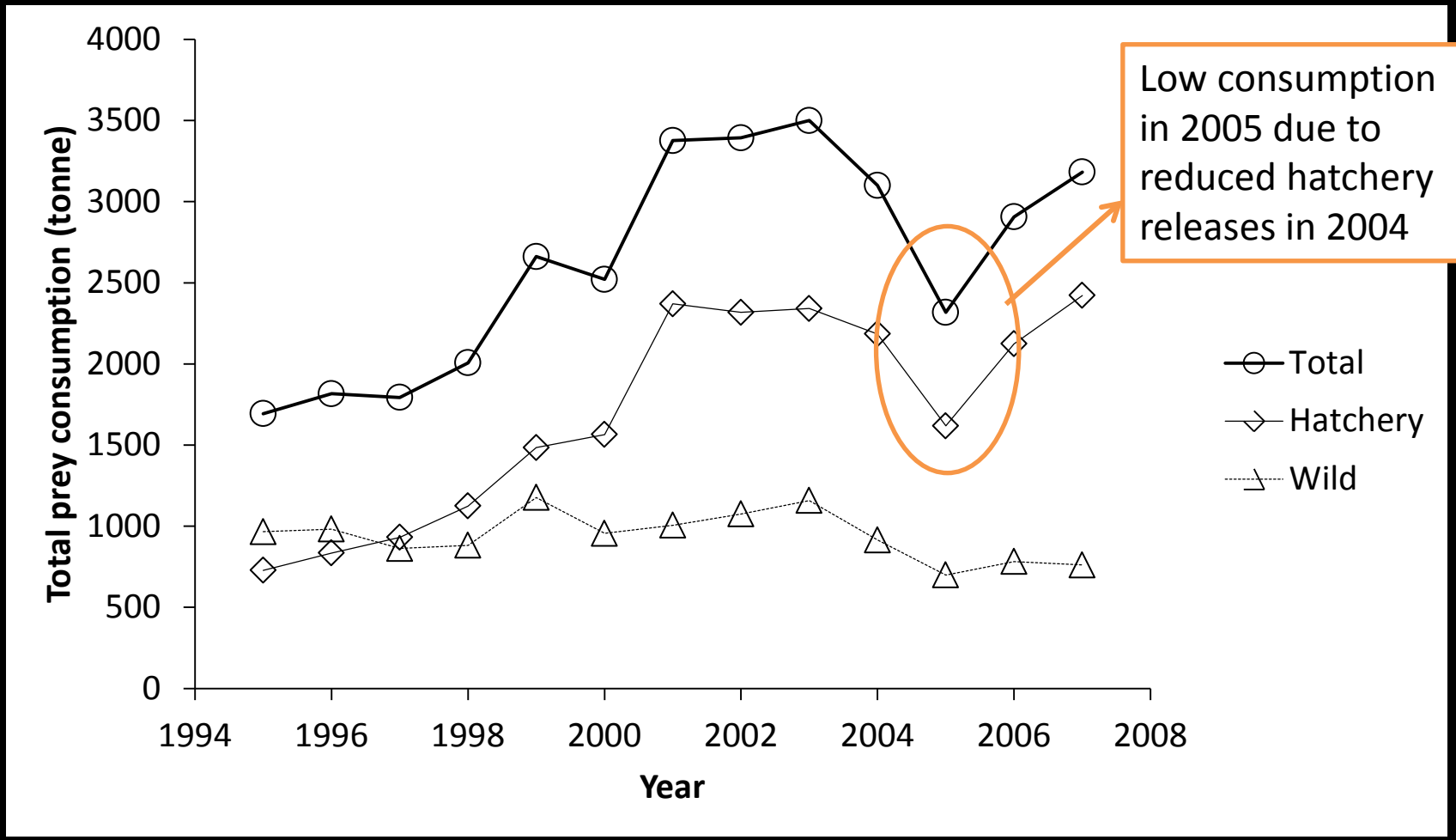
Bioenergetics modelling approach



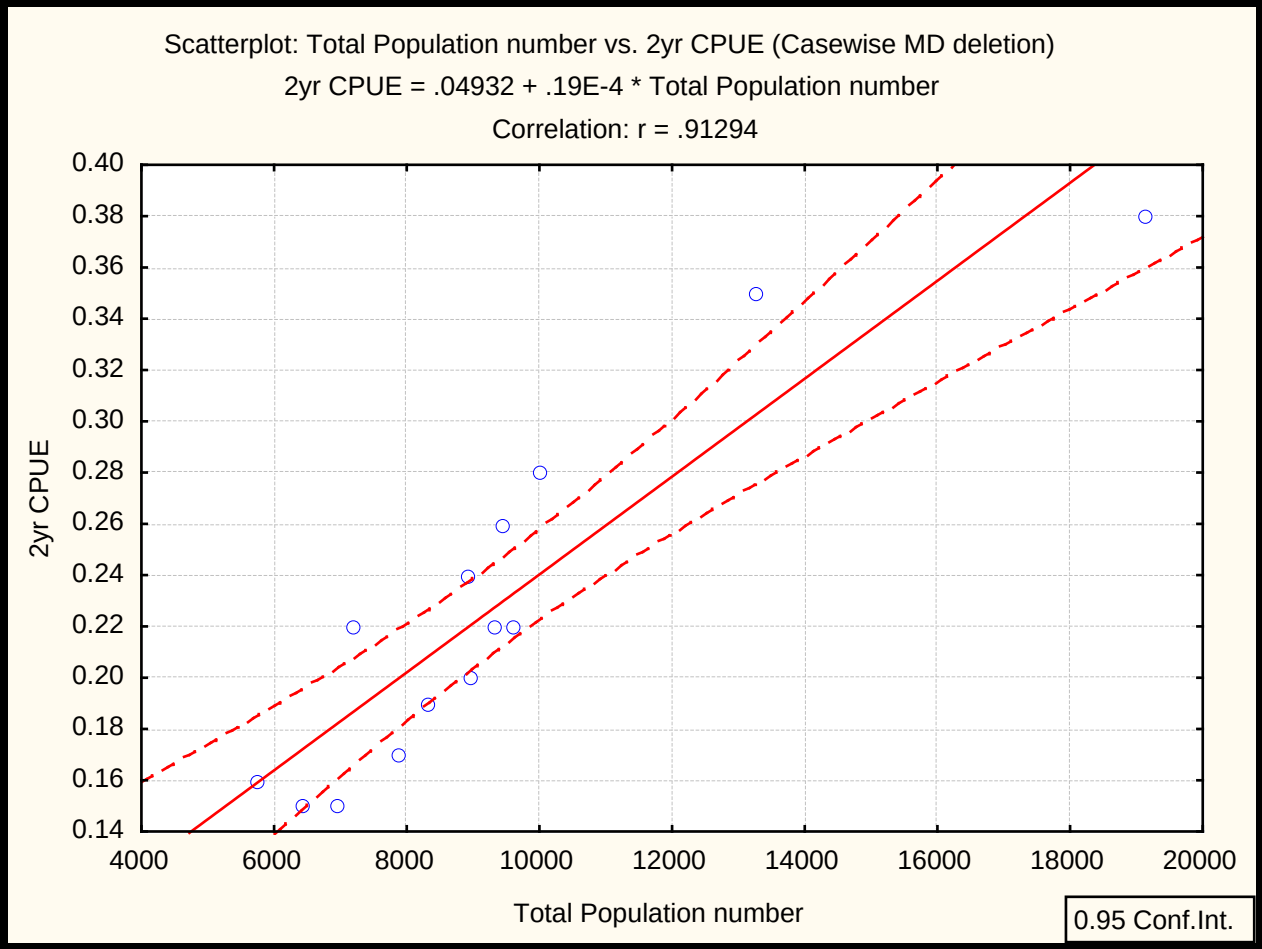
Bioenergetics modelling approach: Extrapolating to population



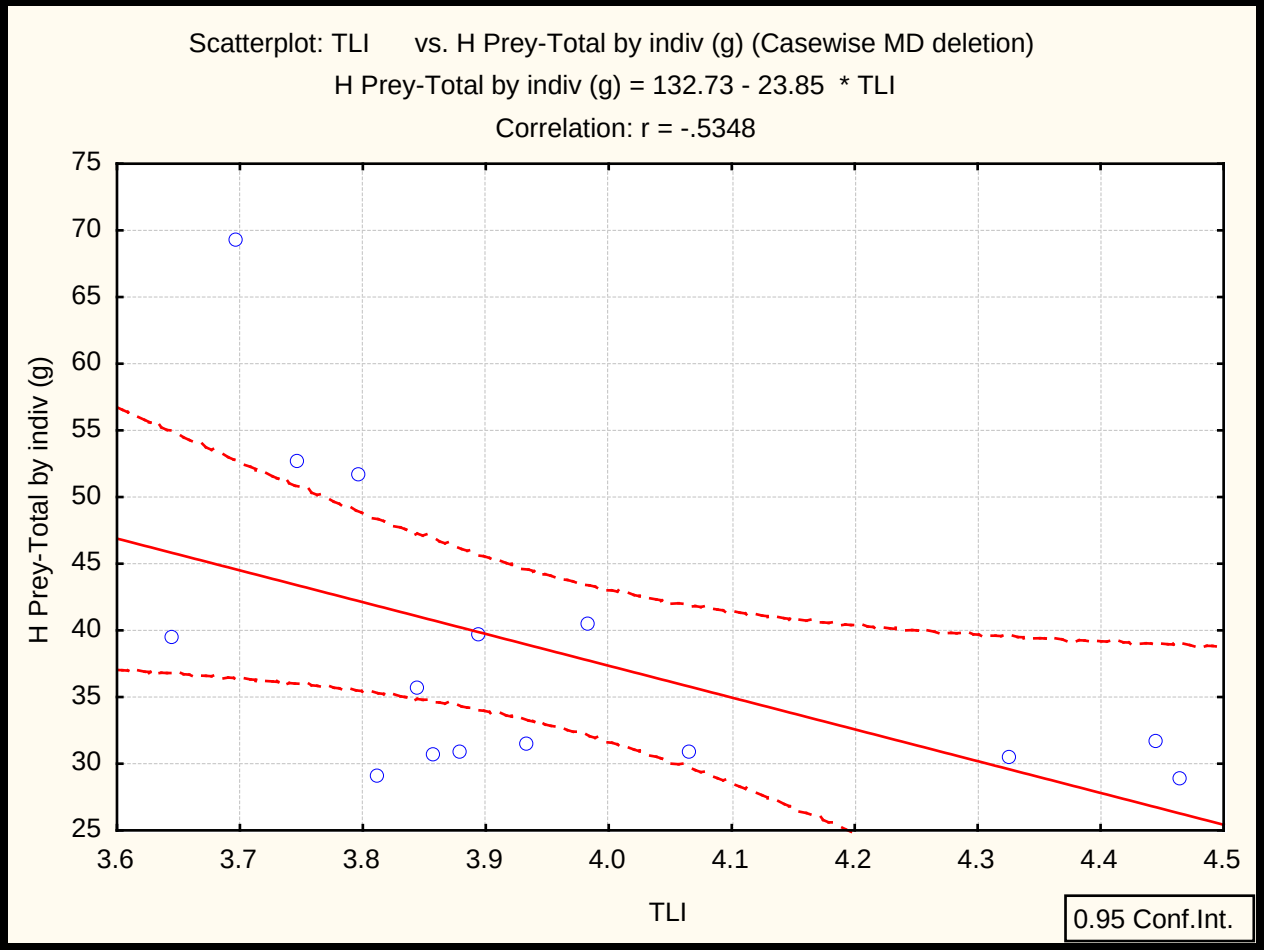
Total prey consumption by Lake Rotoiti rainbow trout, 1995-2007



Modelled trout population # vs. Open Day CPUE

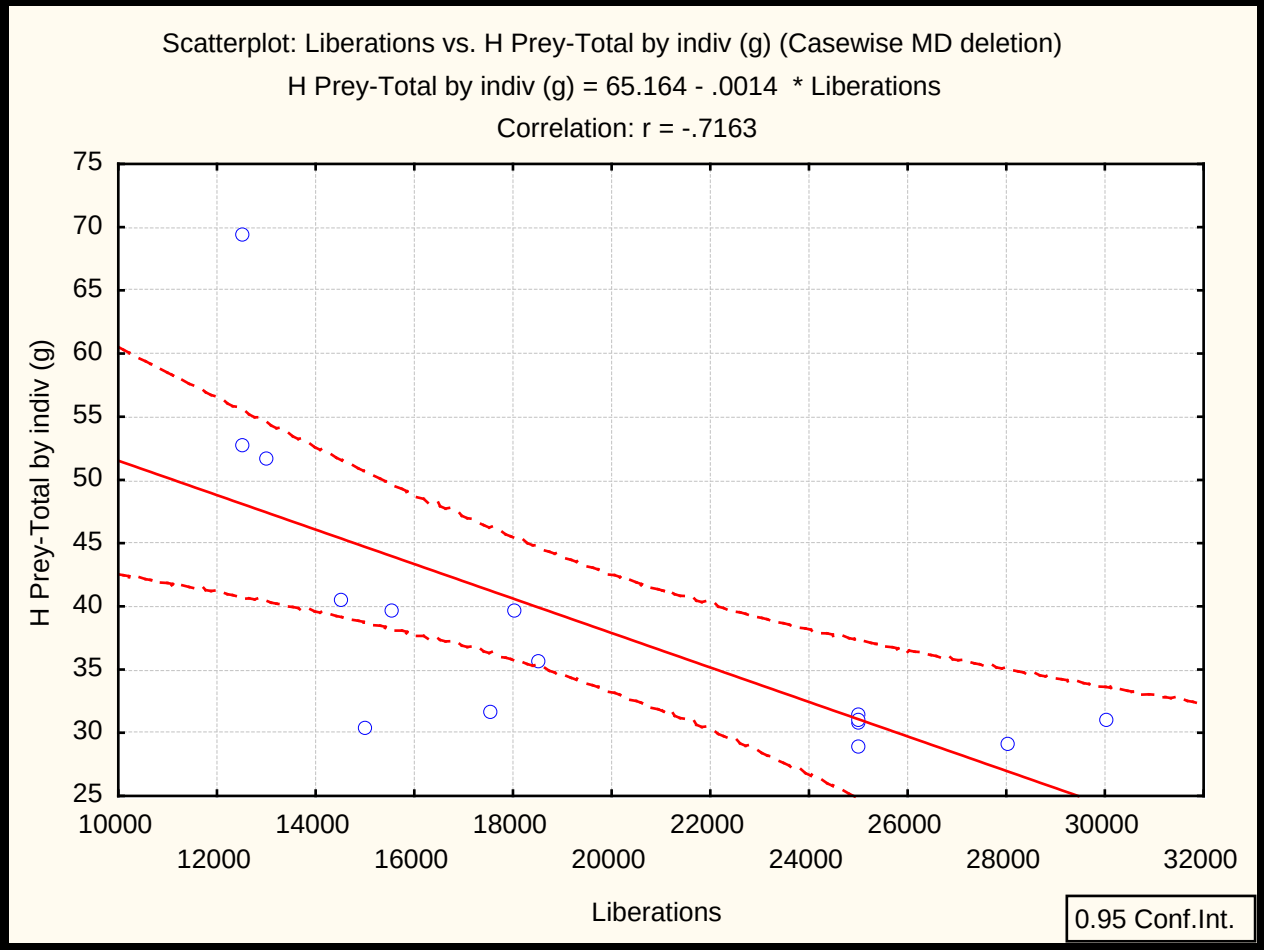


TLI vs. individual prey consumption



BUT total prey consumption by population NOT correlated with TLI....

of trout liberated vs. individual prey consumption



Conclusions

- Predation heavily dependent on number of trout released from hatchery
- Decrease in individual consumption with increasing TLI
- Evidence of density dependence?

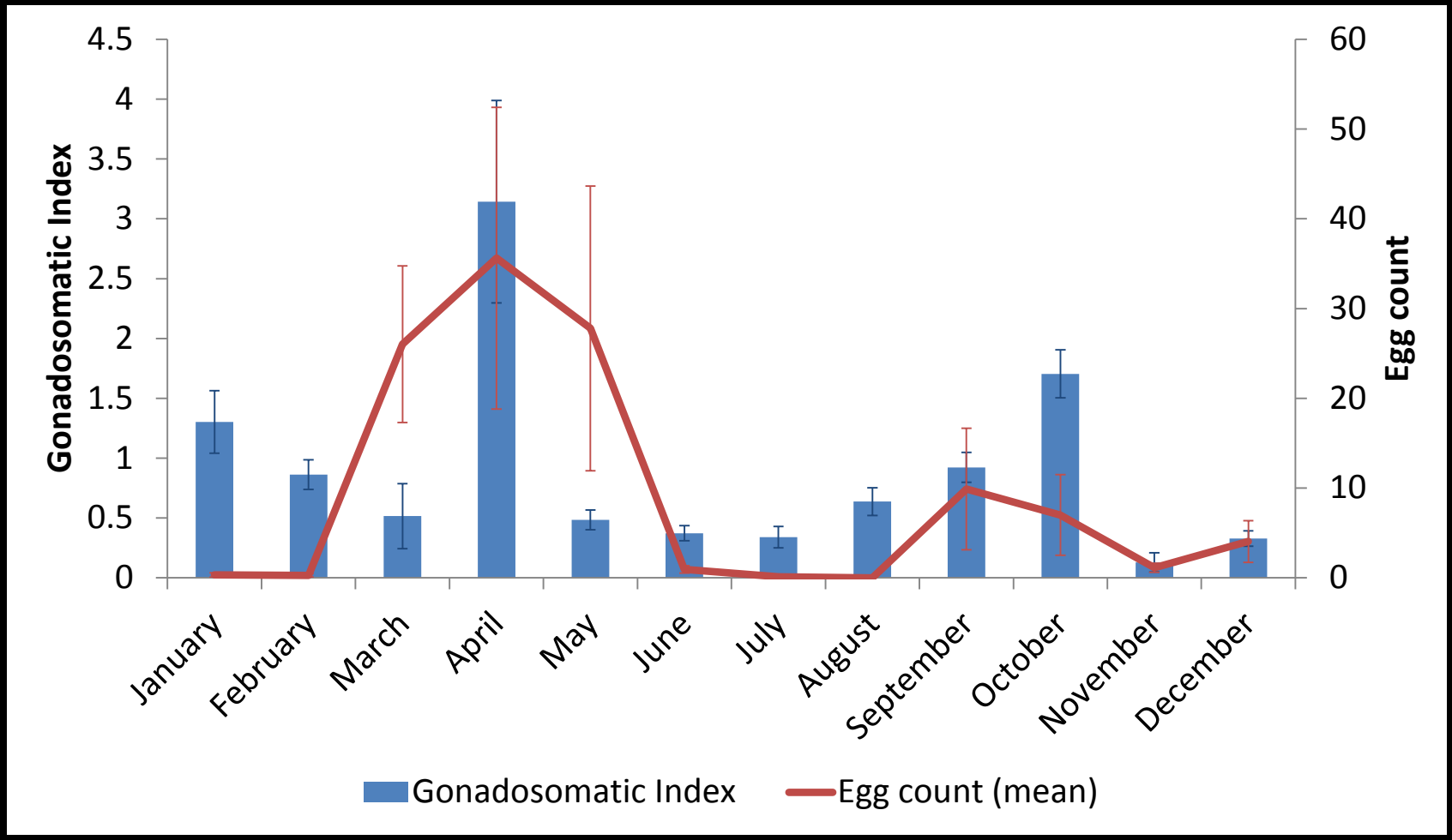
Smelt ecology in Lake Rotoiti

- Reproduction
  - Gonad growth
  - Spawning
- Abundance
  - Spatial patterns
- Growth
- Diet

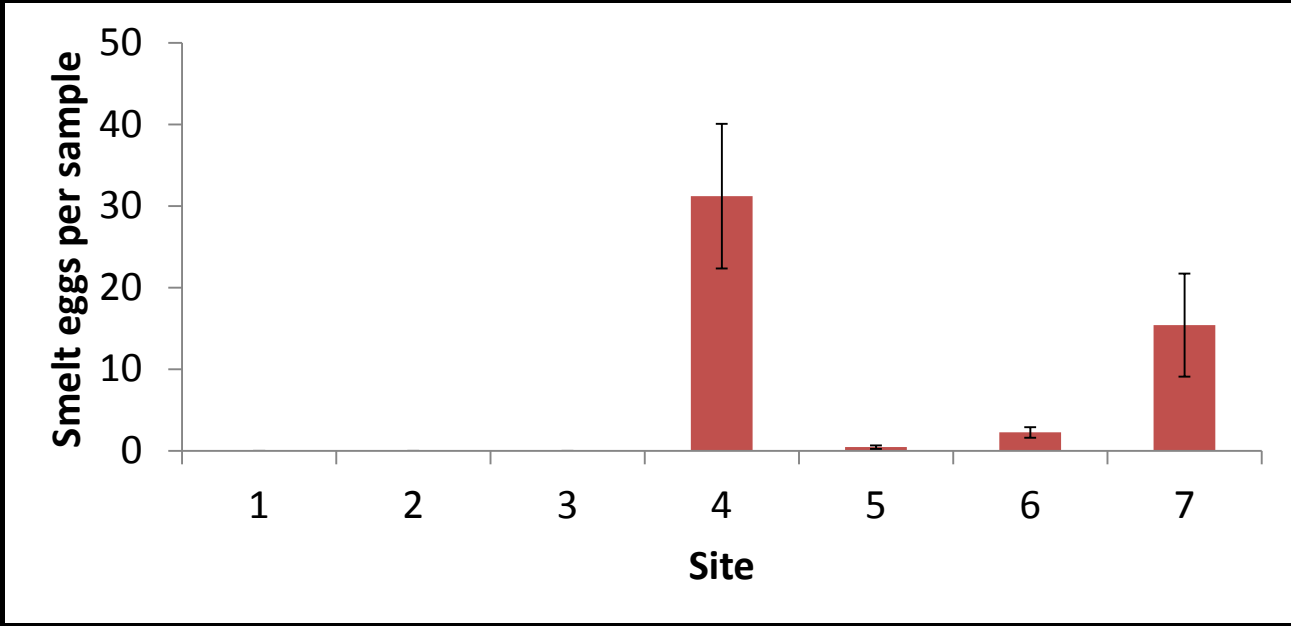
Reproduction

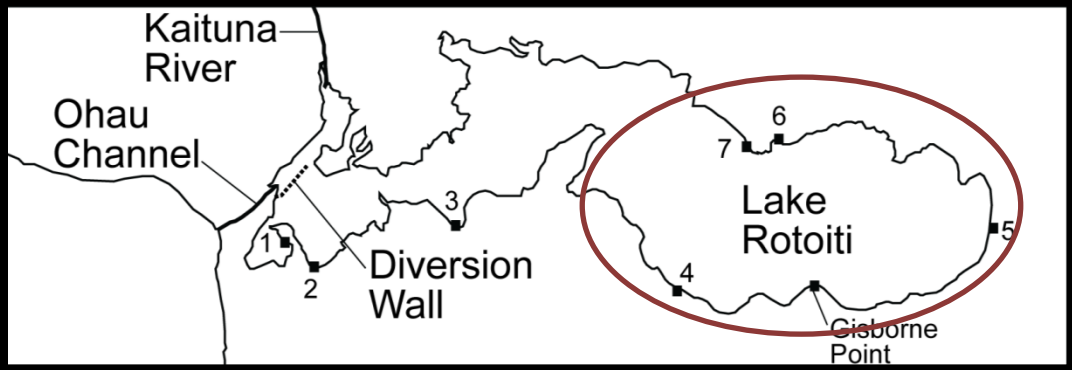
- 2 methods:
  - Gonadosomatic index
    - gonad weight as a percentage of total body weight
    - Monthly samples
  - Sampling of smelt eggs on beaches using sweep net
    - Sampled fortnightly at 2 sites and monthly at 7 sites

When does spawning occur?

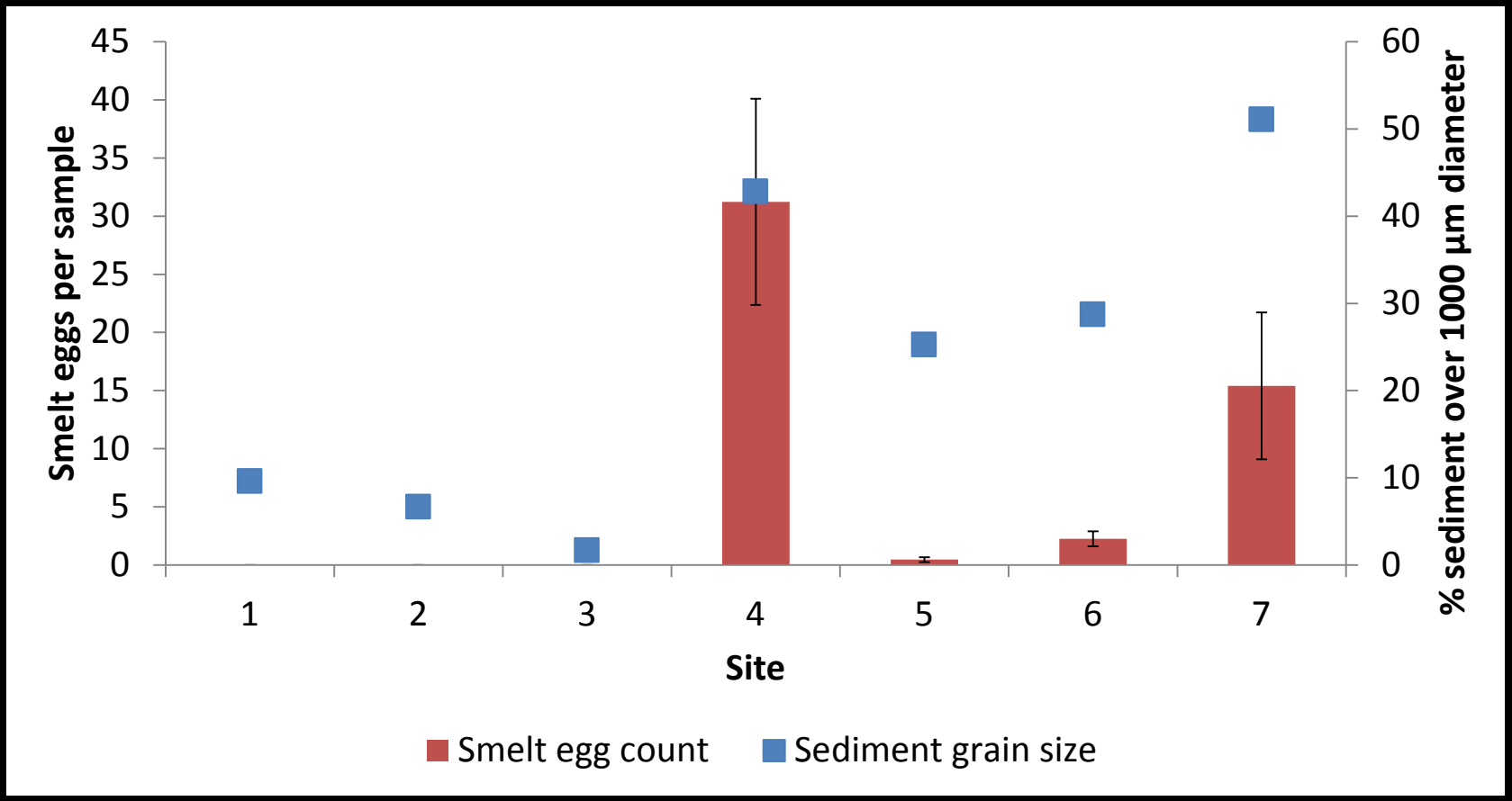


Where does spawning occur?

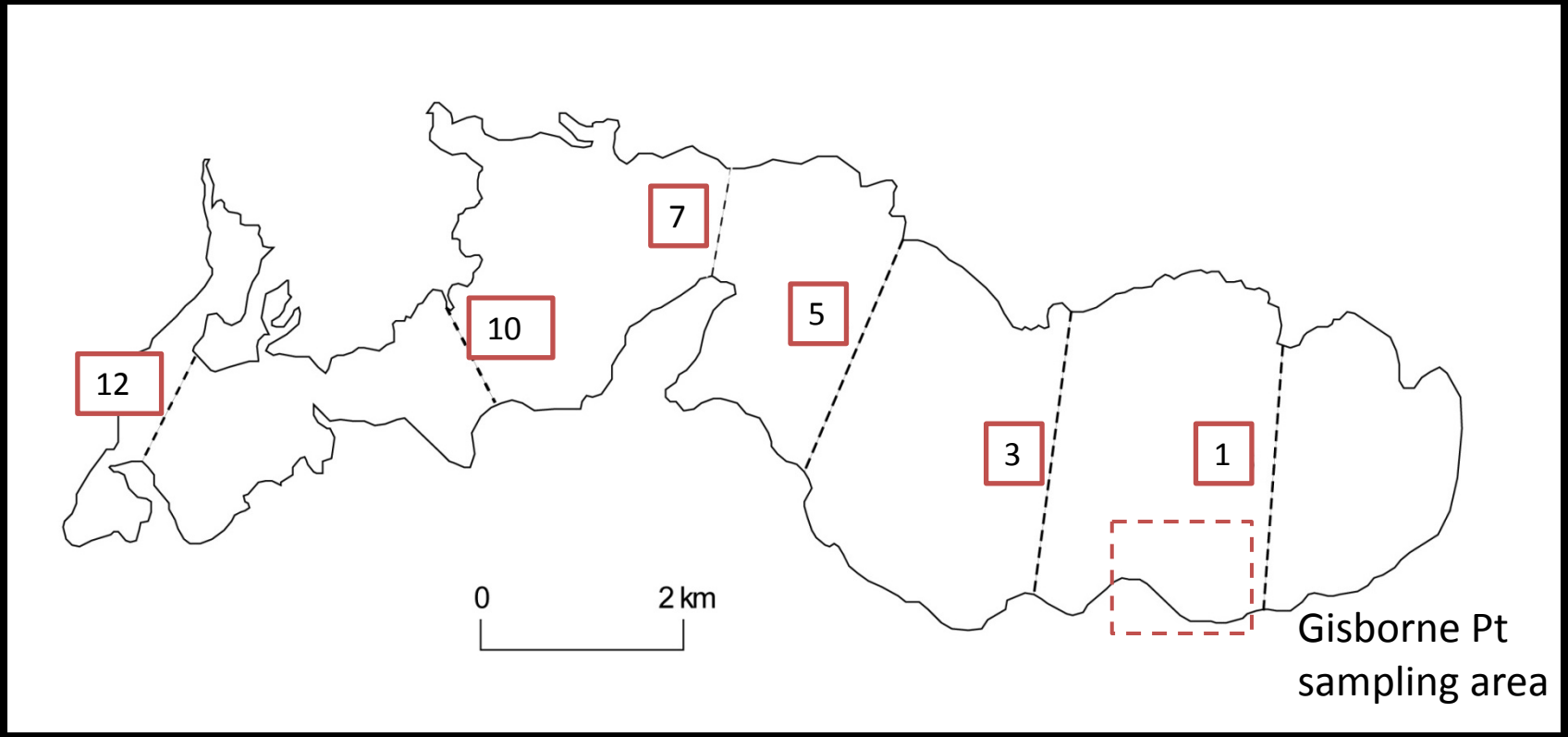




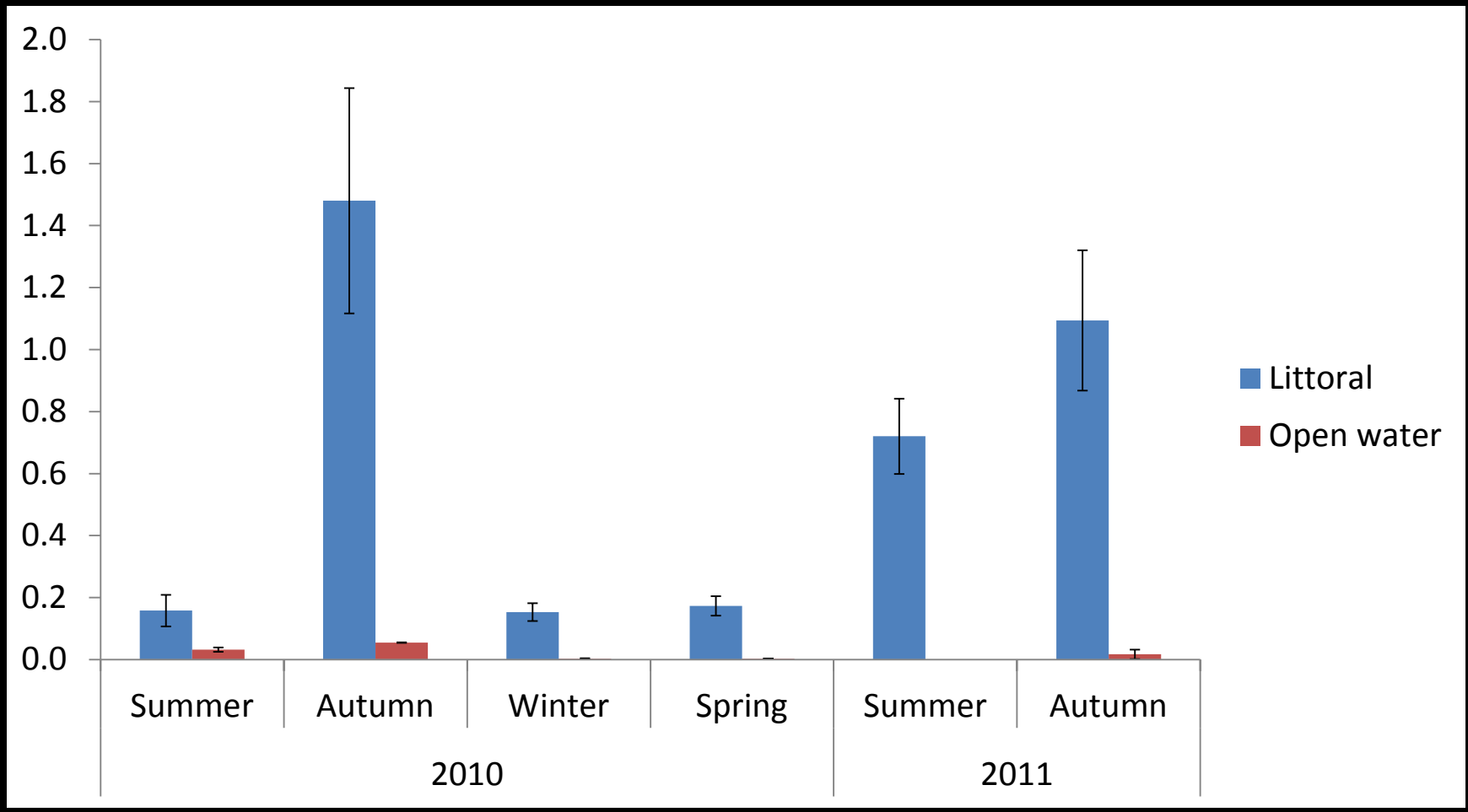
Egg numbers versus sediment grain size



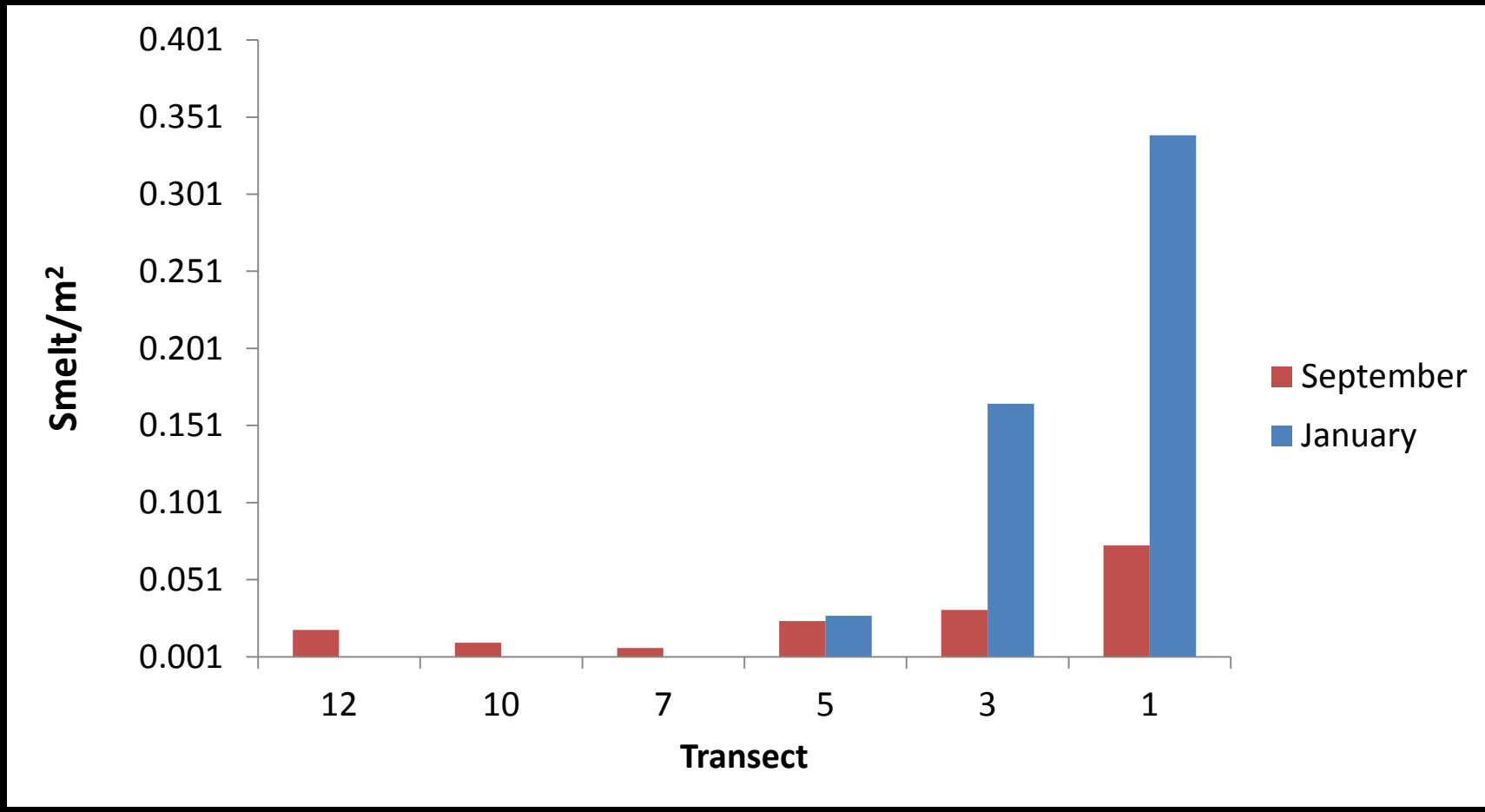
Assessing changes in smelt abundance using boat electrofishing



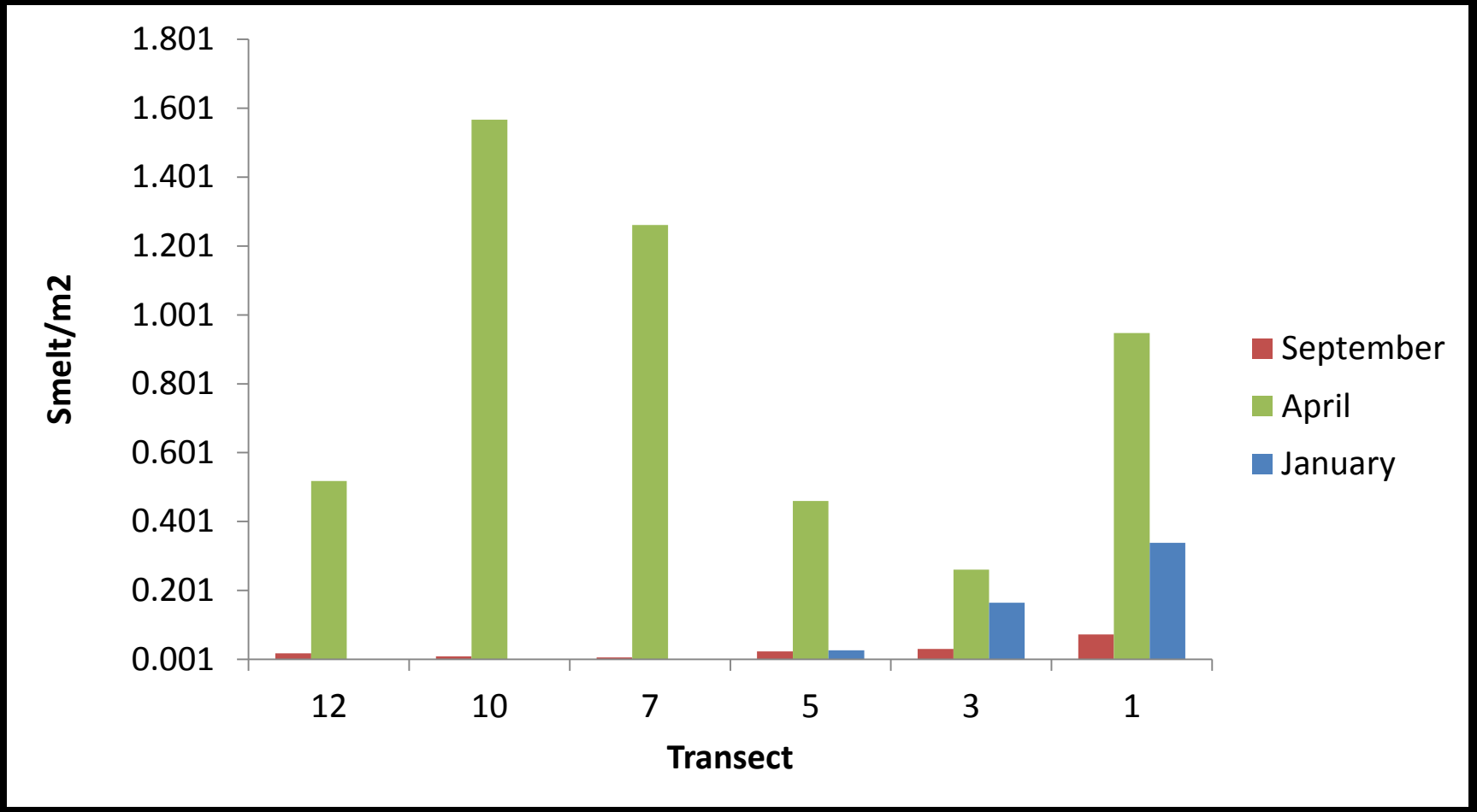
Changes in smelt abundance, Gisborne Pt



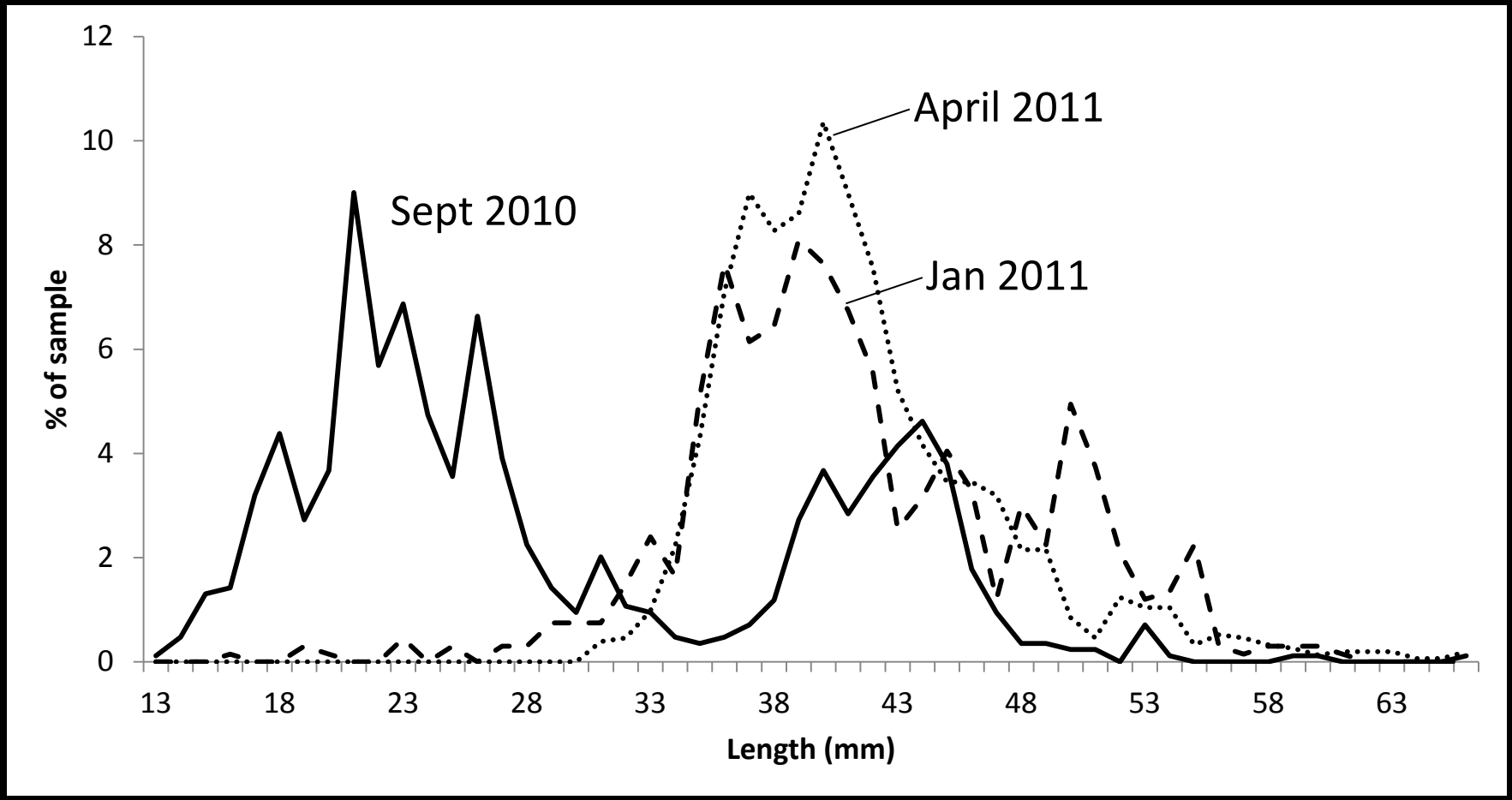
Limnetic smelt density : Sep 2010, Jan 2011



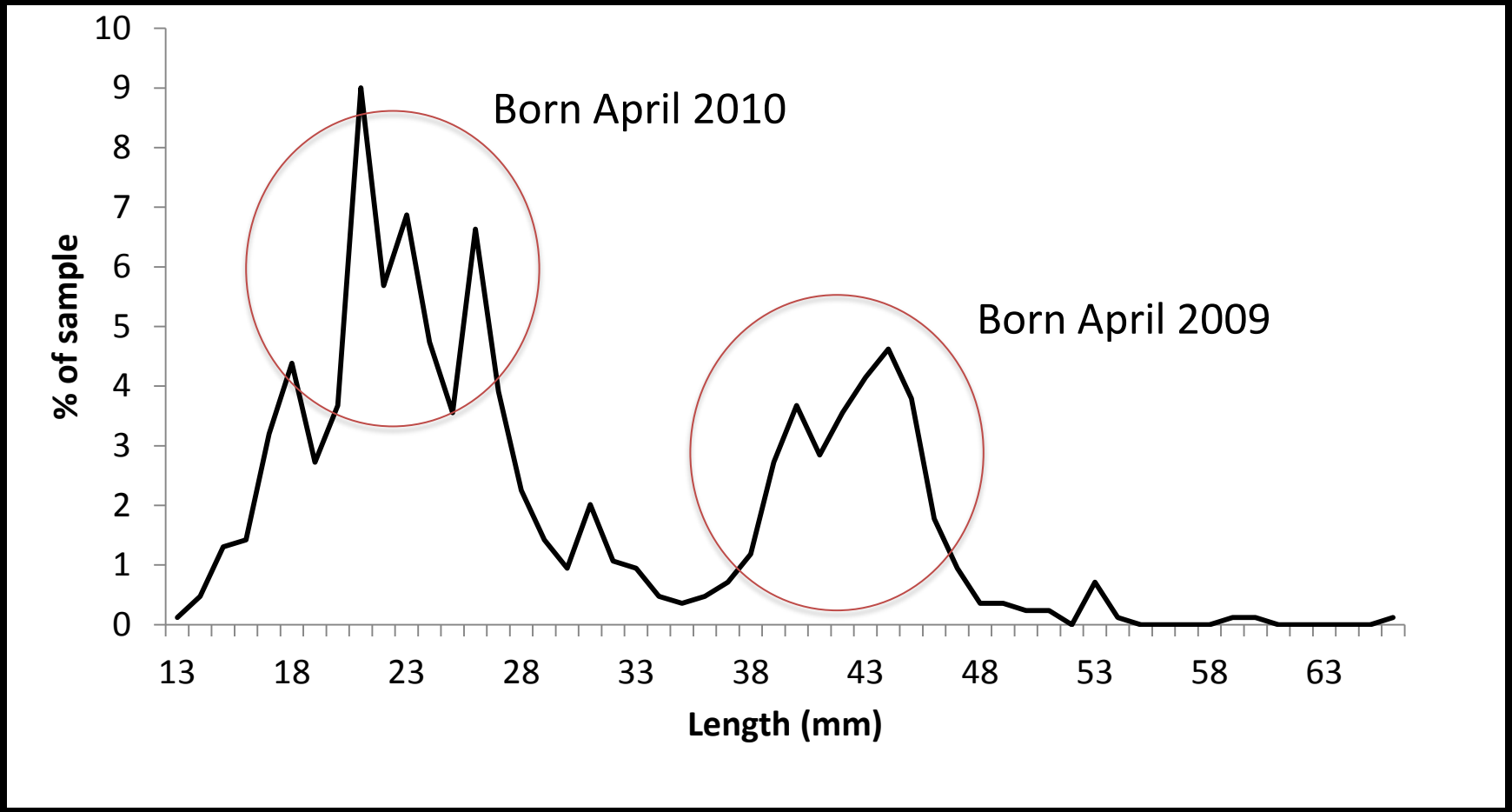
Limnetic smelt density
Sep 2010, Jan and April 2011



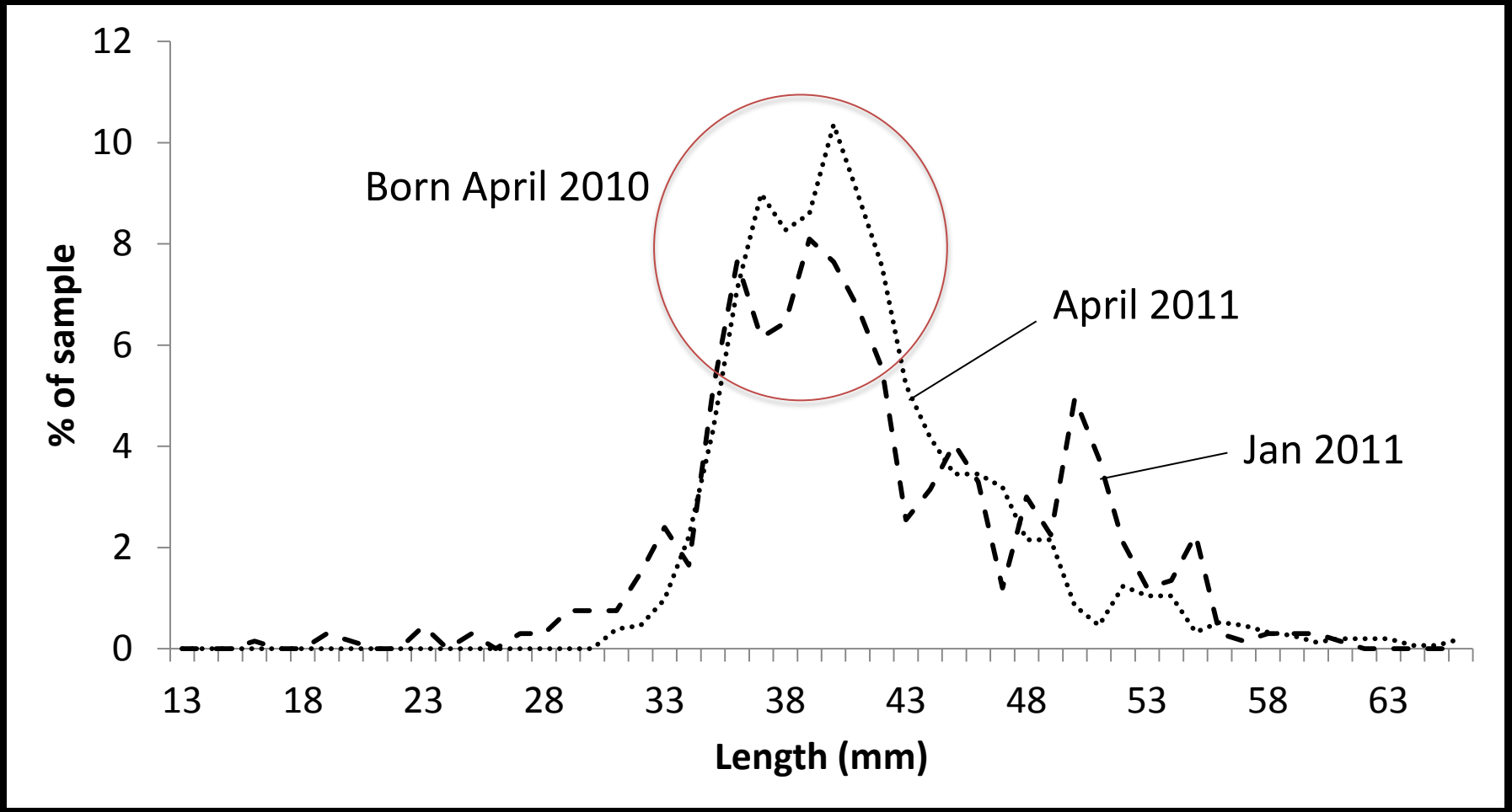
Length-frequency of smelt: Long transects



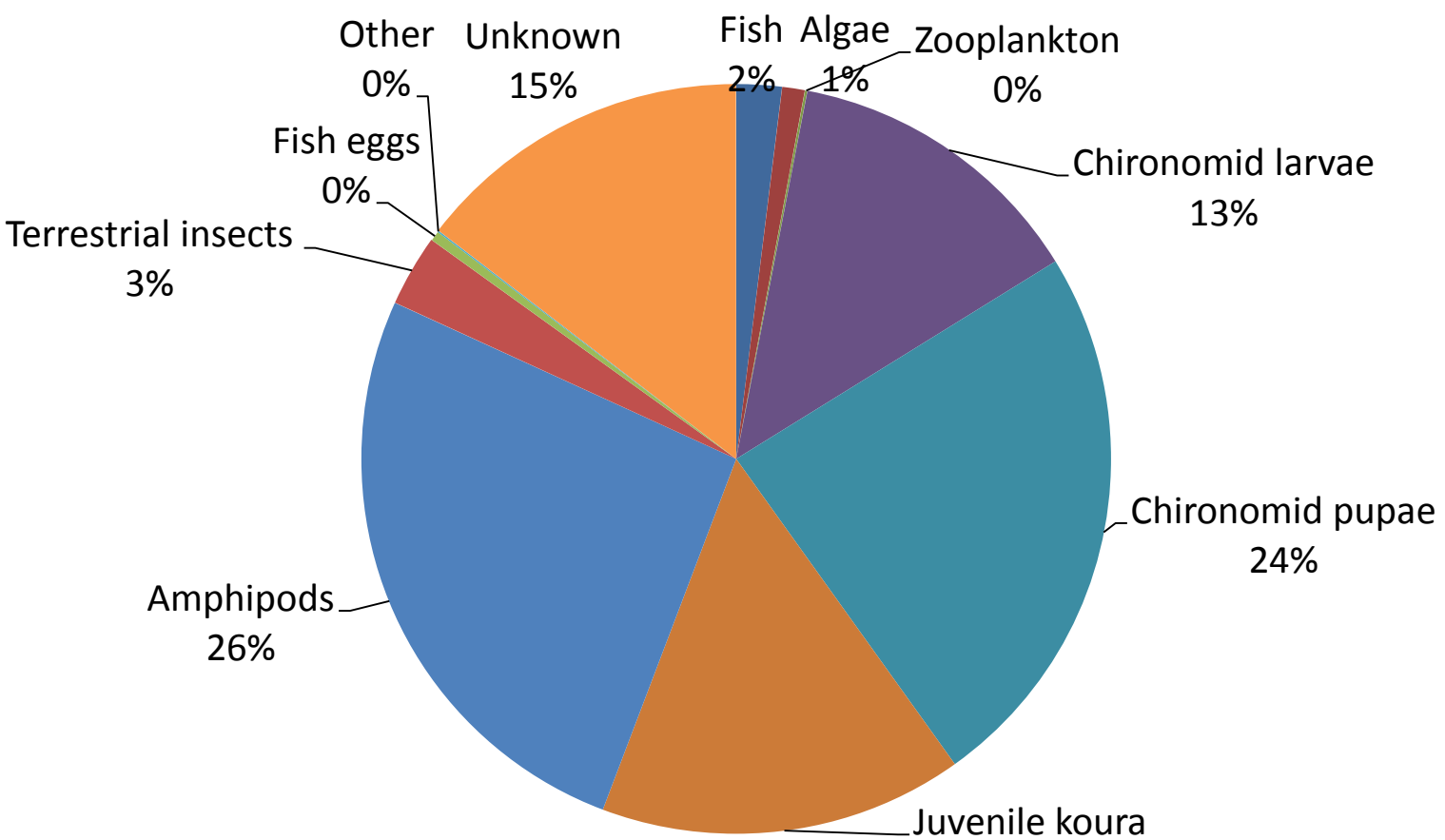
Sept 2010


Born April 2010
Born April 2009
% of sample
Length (mm)
0
1
2
3
4
5
6
7
8
9
10
13
18
23
28
33
38
43
48
53
58
63

Jan-April 2011

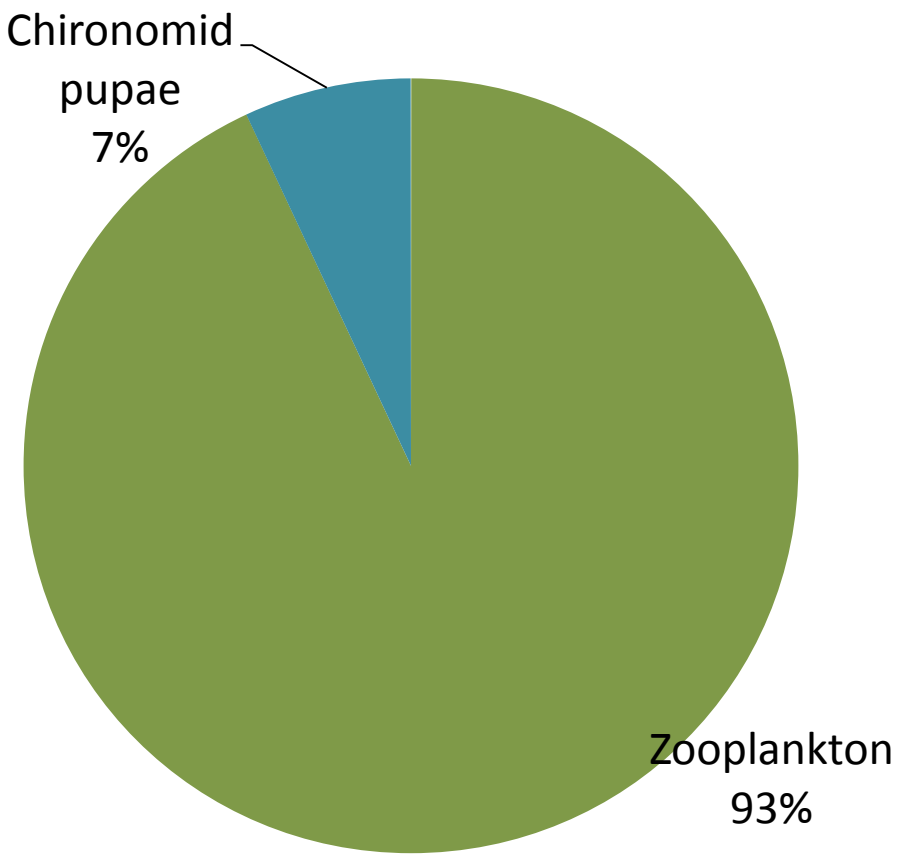


Smelt diet- littoral zone, day



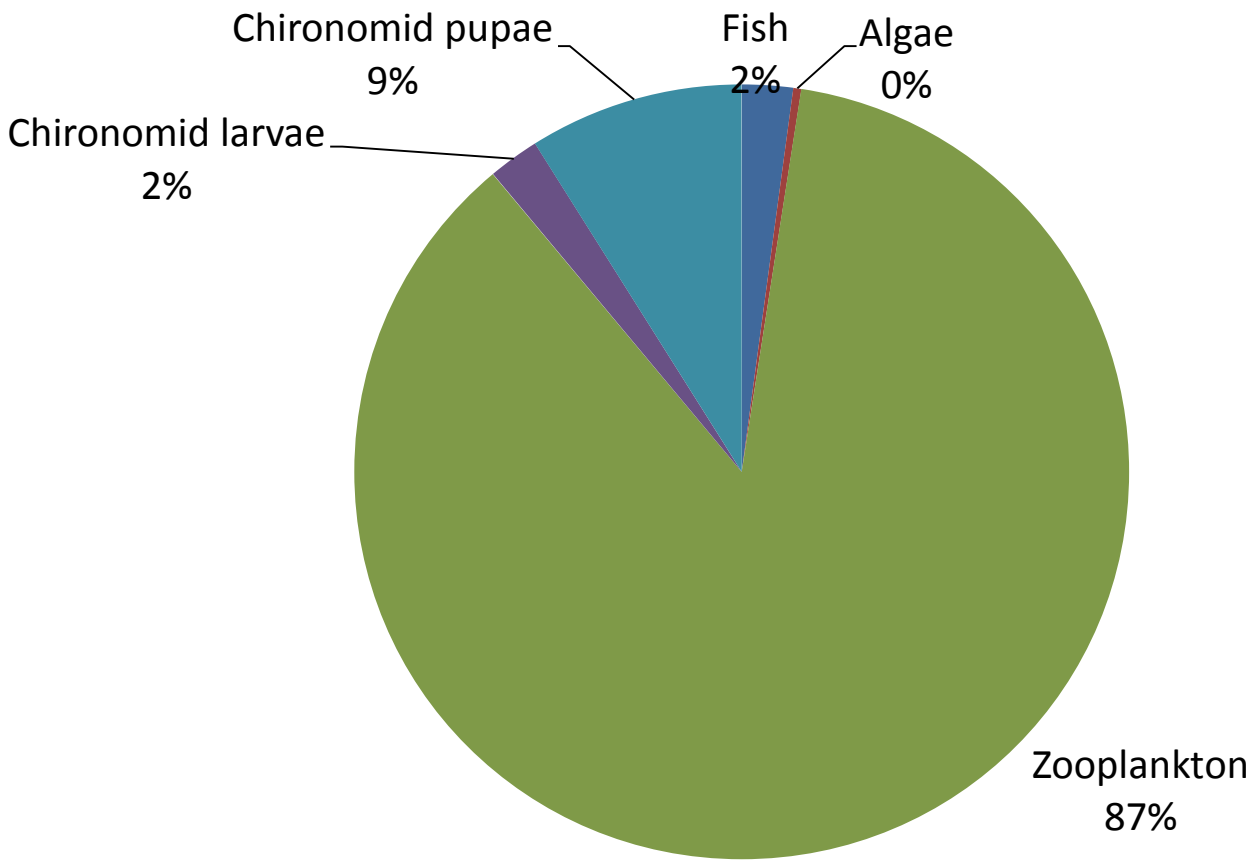
Mean % diet composition by weight, Dec-Jan. N = 51.

Smelt diet- littoral zone, night



Mean % diet composition by weight, April. N = 43.

Smelt diet- limnetic zone, night



Mean % diet composition by weight, Jan, April. N = 47.

Conclusions

- Smelt are abundant in Lake Rotoiti and reproduce locally
- Beaches in the eastern basin are important for spawning
- All areas of the lake are used by smelt
- Smelt likely reach spawning age at 1 year old, survival to 2 years possible but uncommon

Next....

- Compare production of smelt in littoral and limnetic zones
- Improve smelt growth rate estimate using length-frequency data