

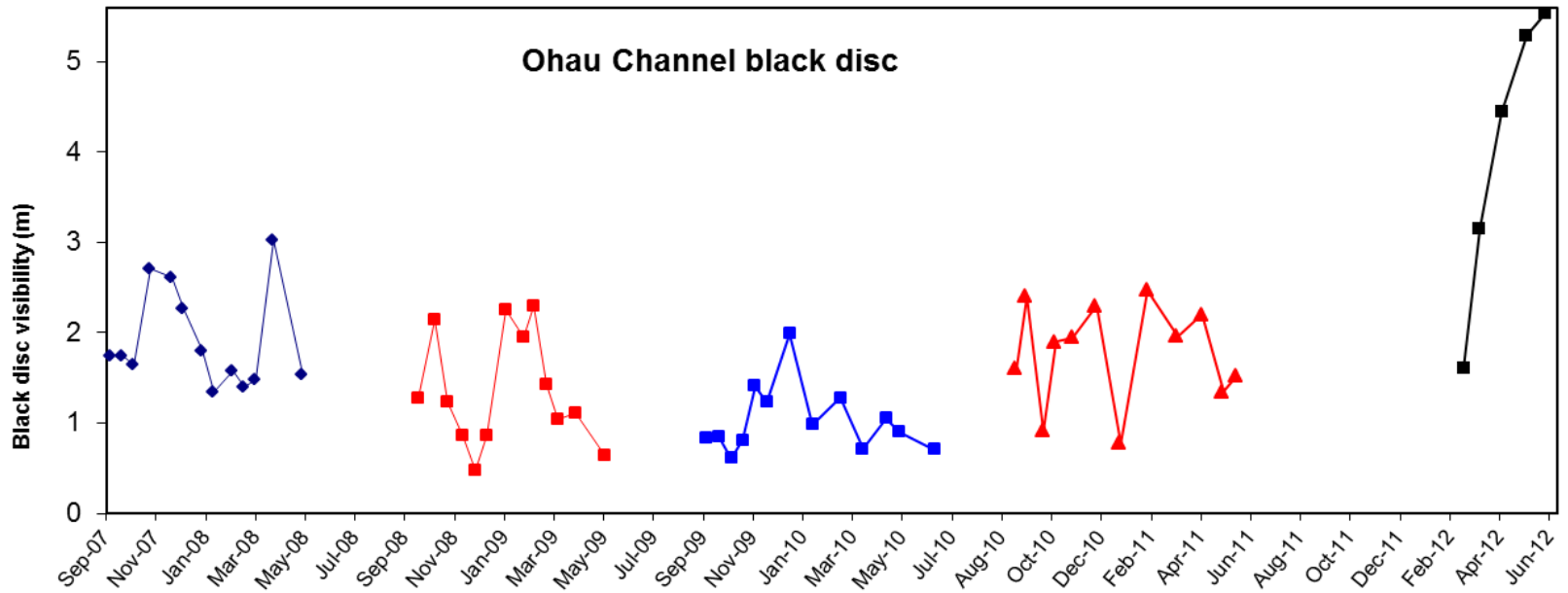
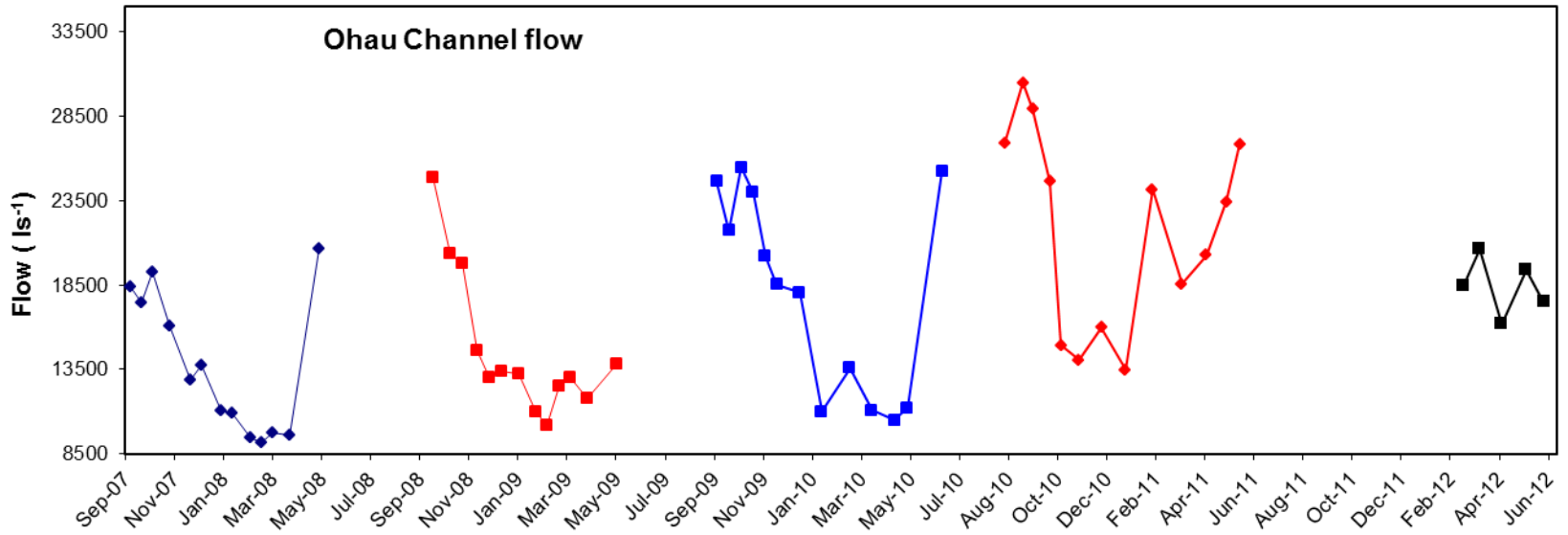


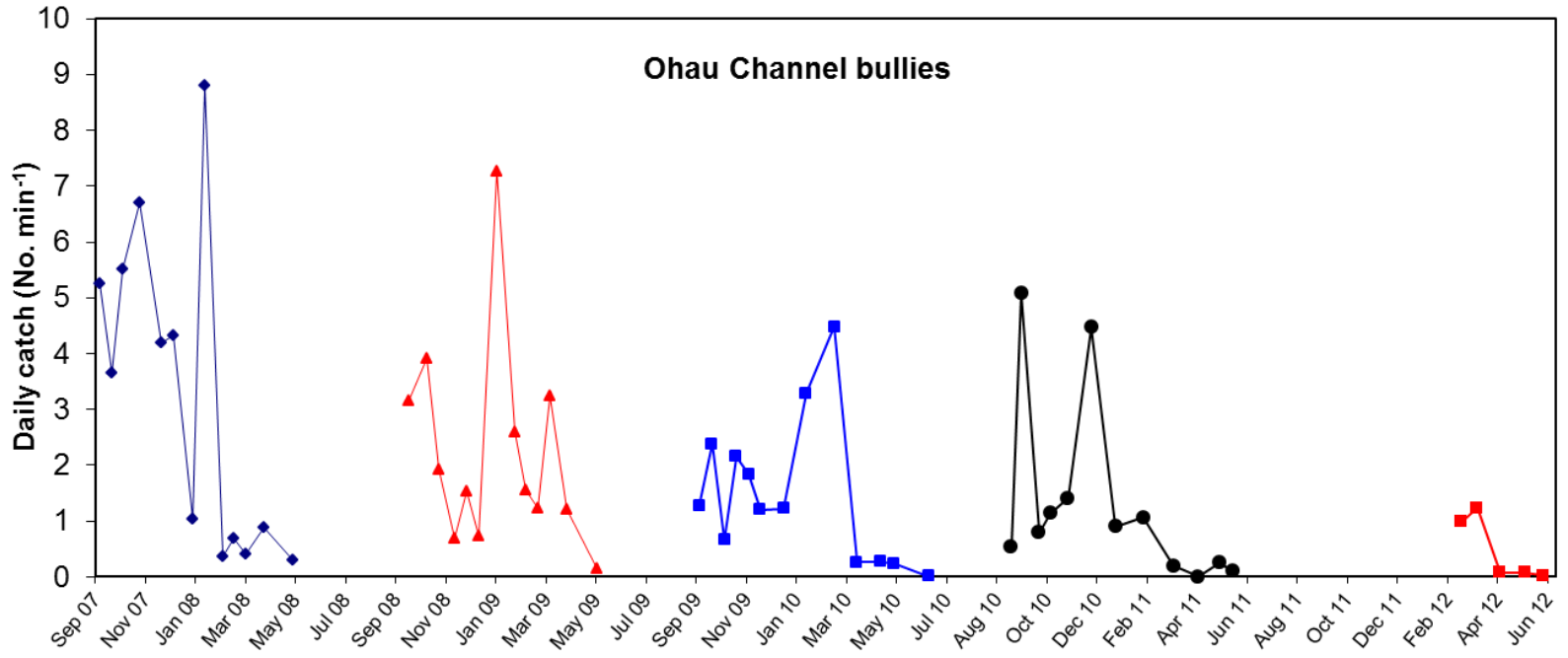
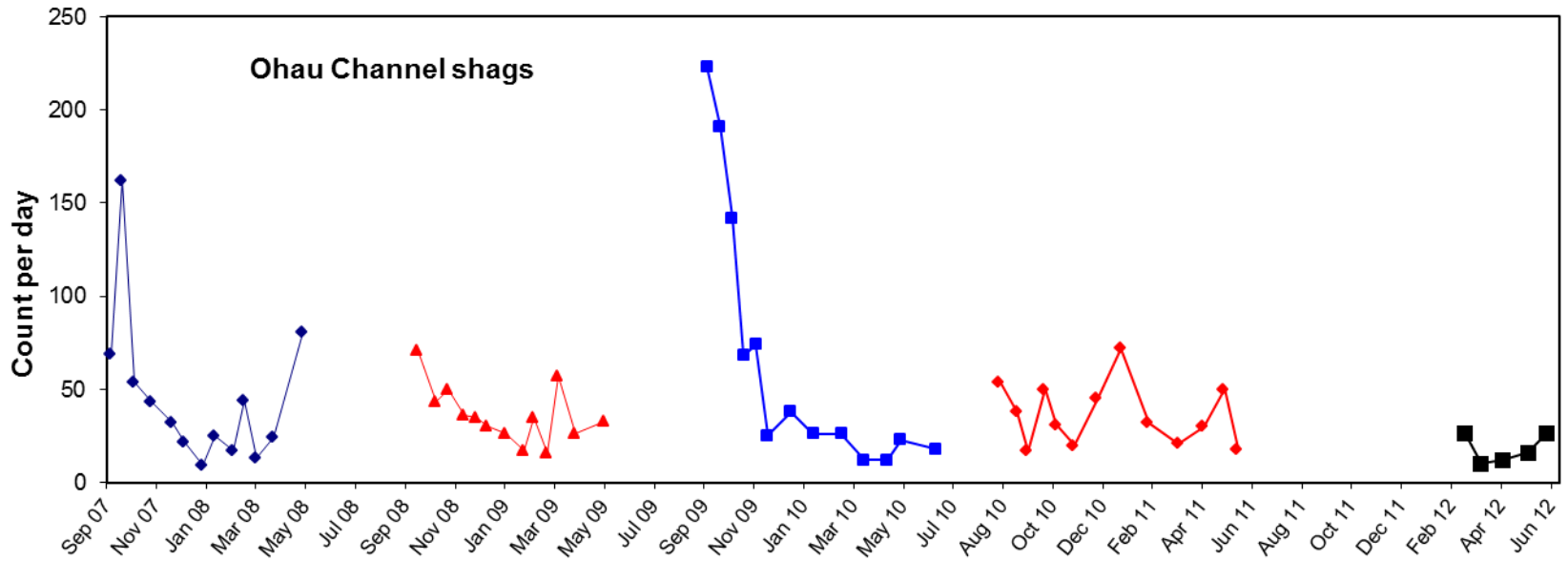
Effects of the Ohau Channel diversion wall on smelt: results for 2011/2012



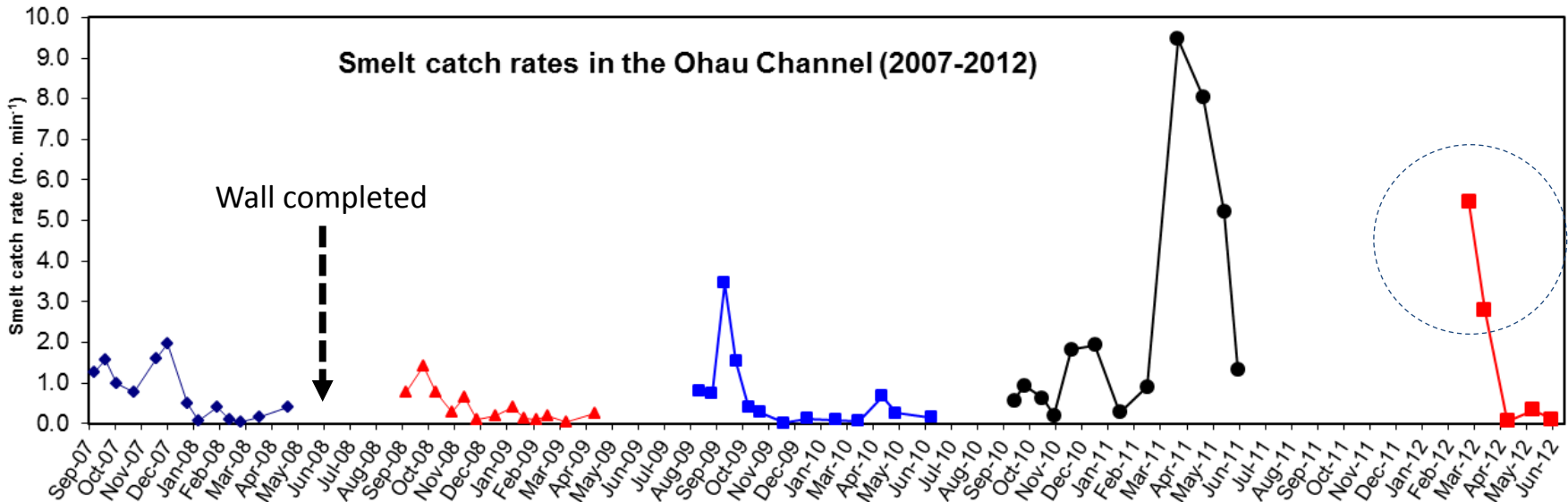
Aims for past year's monitoring:

- Part 1. Continue smelt trapping in the Ohau channel to detect runs (Jan-Jun 2012 at just the 2 top sites)**
- Part 2. Collate and analyse 'daily' information on smelt runs to determine whether water temperature or flow in the channel influences the timing of runs**
- Part 3. Carry out larval smelt surveys in Rotoiti to determine any change in recruitment**





Runs of juvenile smelt occurred in late February/early March 2012

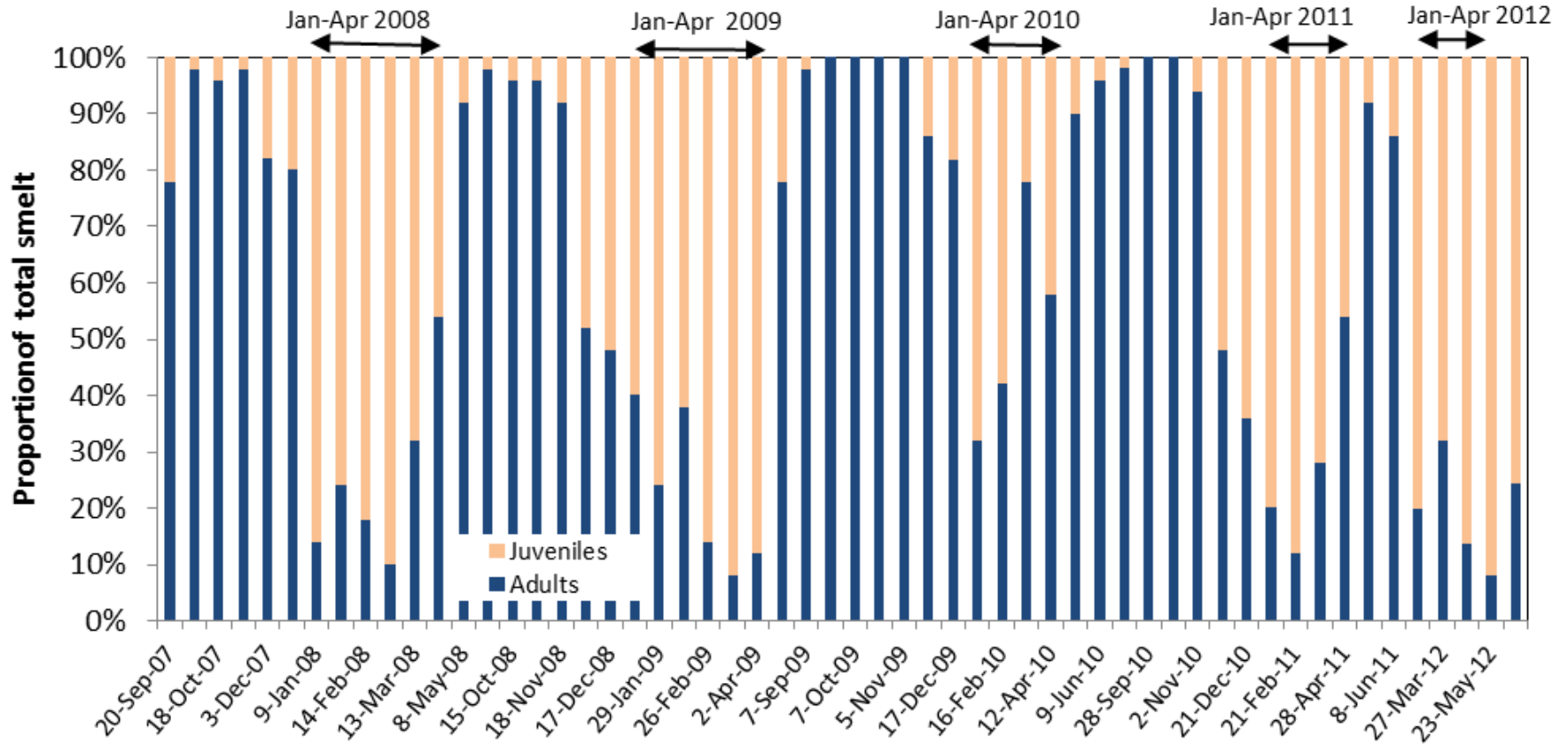


(no monitoring Sep 2011 to Jan 2012)

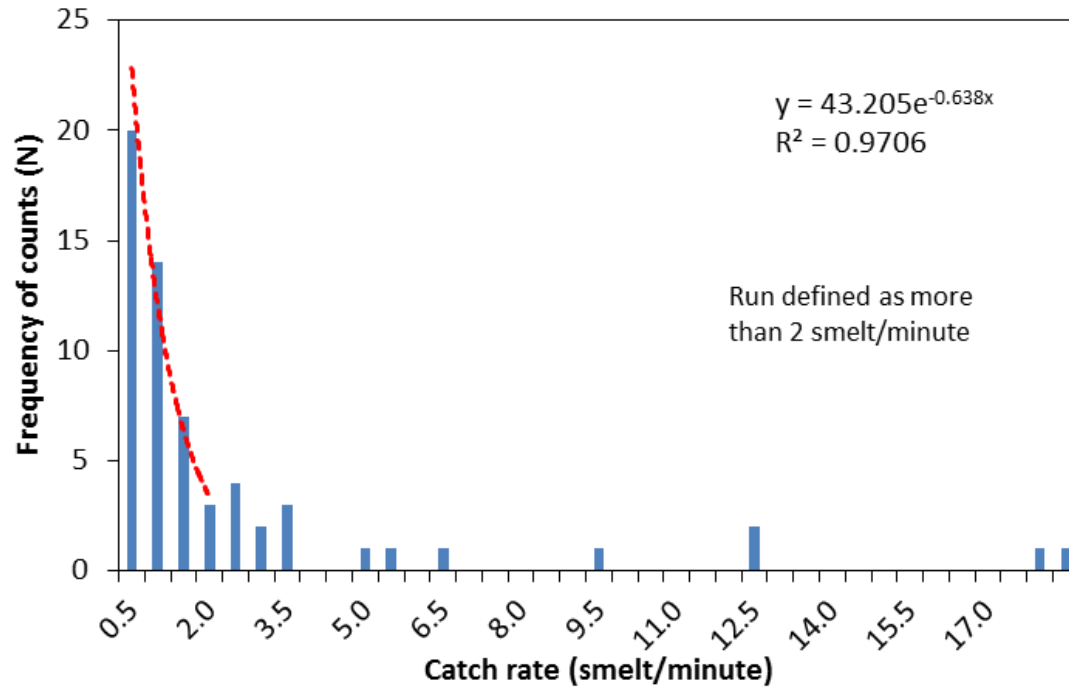
Trapping data backed up by George Proud's daily observations

Date	Observations by George Proud
11/03/2012	7.30am. Shags 10-20, herons 5-10, and many gulls. No smelt seen. No fishermen.
17/03/2012	6.30am. Shags and herons 5-10, gulls 10-20. No smelt seen. Two fishermen and fish caught.
17/03/2012	6.00pm. Shags and gulls 0-5 and herons 5-10. No smelt seen. No fishermen.
18/03/2012	7.00am. Shags 10-20, herons 0-5 and many gulls. A lot of smelt. Two fishermen and fish caught.
25/03/2012	5.30am. Shags 5-10, herons 0-5 and gulls 10-20. No smelt seen. Two fishermen and fish caught.
25/03/2012	7.00pm. Shags and gulls 0-5 and herons 5-10. No smelt seen. No fishermen.
30/03/2012	6.00pm. Shags and herons 10-20, many gulls. A lot of smelt. One fisherman and fish caught.
7/04/2012	7.30am. No shags, 10-20 herons and many gulls. No smelt seen. Five fishermen and fish caught.
7/04/2012	6.00pm. No shags or gulls, 5-10 herons. No smelt seen. Three fishermen, no fish caught.
8/04/2012	7.00am. Shags and herons 0-5, many gulls. No smelt seen. Five fishermen and fish caught.
14/04/2012	6.00am. Shags and herons 0-5, gulls 10-20. No smelt seen. Four fishermen, no fish caught.
14/04/2012	5.45pm. No shags or gulls, herons 5-10. No smelt seen. Two fishermen, no fish caught.
16/04/2012	6.00pm. No shags or gulls, herons 0-5. No smelt seen. No fishermen.
17/04/2012	6.30am. Shags 0-5, herons 5-10 and many gulls. No smelt seen. Six fishermen, no fish caught.
21/04/2012	6.00am. Shags and herons 0-5, and many gulls. No smelt seen. One fisherman, no fish caught.
21/04/2012	5.00pm. Shags 0-5, herons 5-10 and many gulls. No smelt seen. One fisherman and fish caught.
25/04/2012	5.00pm. No shags or herons and 0-5 gulls. No smelt seen. No fishermen.
11/05/2012	6.30am. No shags or gulls, and 0-5 herons. No smelt seen. No fishermen.
19/05/2012	7.30am. Shags and herons 0-5, no gulls. No smelt seen. One fisherman, no fish caught.
28/05/2012	5.30pm. No shags or gulls, herons 0-5. No smelt seen. No fishermen.
2/06/2012	6.35am. Shags and herons 0-5, no gulls. No smelt seen. No fishermen.
10/06/2012	7.30am. Shags and herons 0-5, gulls 10-20. No smelt seen. Ten fisherman and fish caught.
14/06/2012	5.15pm. Shags 5-10, herons 0-5 and no gulls. No smelt seen. Three fishermen, no fish caught.
16/06/2012	7.30am. Shags and herons 0-5 and no gulls. No smelt seen. Two fishermen, no fish caught.

Juvenile smelt (TL<45 mm) tend to predominate in summer (Jan-Apr), adults in spring (Sep-Dec)



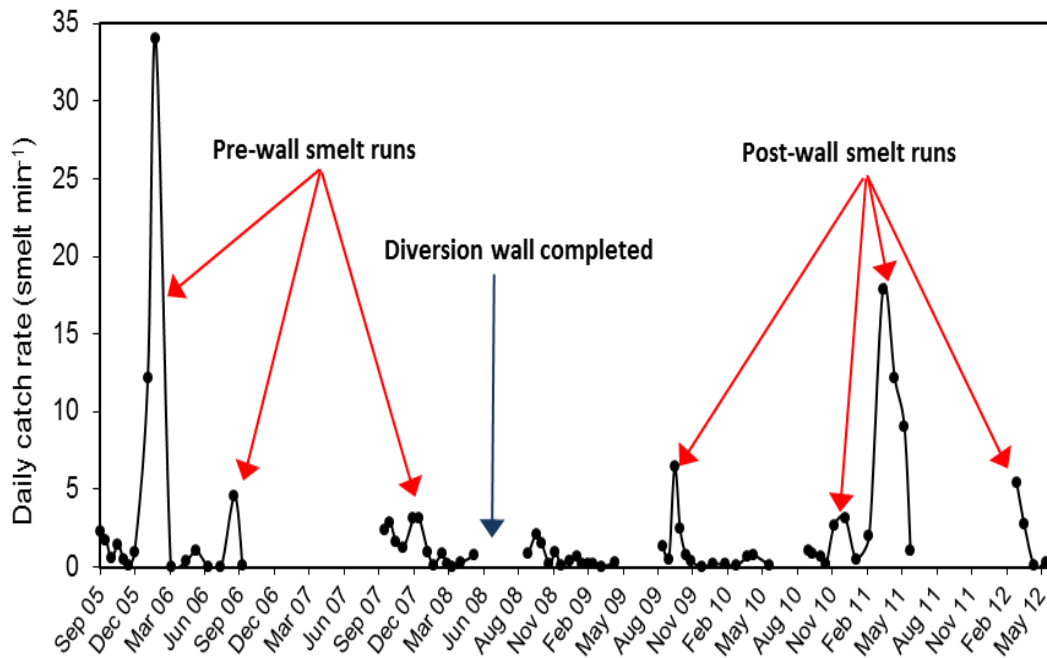
Accumulated trapping data (n = 68 days, from 2006 to 2012) can be used to define a run in the Ohau Channel



Modelling approach agrees with observational data

(Frank Thompson defined a 'slow run' as 3 schools of 40 fish per hour)

Using threshold value of 2 smelt/minute:



June 2005-June 2008 (pre-wall)

- Adult run in spring 2006
- Juvenile runs in summer 2006 & 2007

July 2008-June 2012 (post-wall)

- Adult runs in spring 2009 & 2010
- Juvenile runs in summer 2011 & 2012

Conclusions from trapping data

- **Wall does not prevent upstream movement of smelt**
 - **Smelt runs (adults and juveniles) have occurred post-wall**
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- **Smelt runs may occur on one day but not next, and may also occur over several successive days but frequency and/or size of smelt runs is unknown.**
 - **The frequency and/or size of smelt runs may have been reduced by the wall (or by other coincident factors)**
 - **Identification of factors influencing run timing would help determine whether wall has affected the frequency of runs.**

Part 2. Factors affecting the size/timing of smelt runs

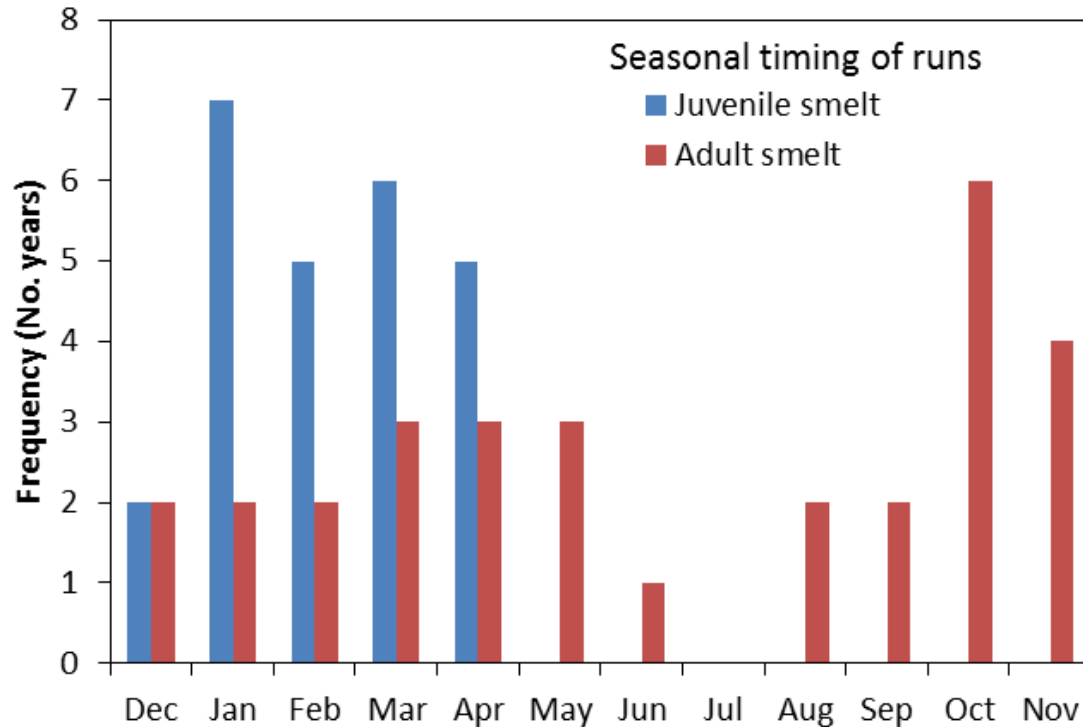
- **Number of smelt in L. Rotoiti (population size)**
- **Physiological factors (size, sex, maturation status, ontogenetic requirements)**
- **Migration cues (rainfall, rising water level, moon phase)**
- **Attractant factors (e.g., water temperature, flow, water chemistry, food)**
- **Deterrent factors (e.g., high temperature, high flow, water quality, toxic algal blooms, predators?)**

Does water temperature, or water velocity in the Ohau Channel influence the timing of smelt runs?

Collated daily data on presence/absence of smelt runs:

- **Frank Thompson – 180 daytime observations between 1994 and 2005**
- **George Proud – 116 daytime observations between 2005 and 2011**
- **NIWA trapping – 68 daytime records between 2005 and 2011**
- **Total of 323 daily observations on presence/absence of smelt runs**

Frequency distribution of runs per month (adults vs juveniles)



- Juvenile smelt runs only occurred in summer months (December to April)
- Adult smelt runs recorded in all months except July
- Peaks in frequency of adult runs in both spring (October) and autumn (March-May)

Effects of water temperature, flow rate, and moon phase on the timing of smelt runs

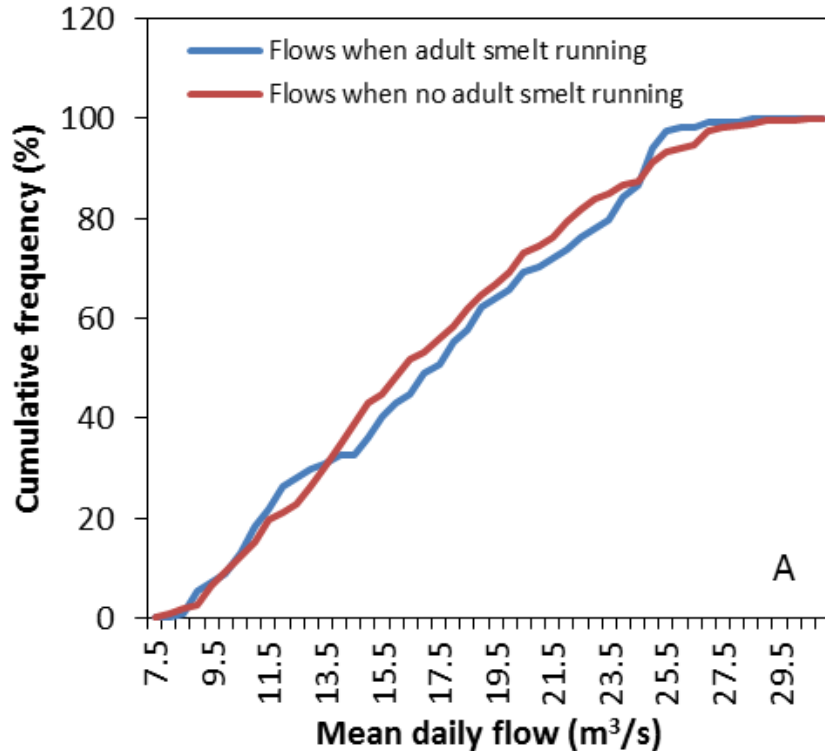
- Identified days when runs of adult smelt and juvenile smelt were recorded and days when no runs of each group recorded
- Obtained daytime water temperature and mean daily flows for these days.

Variable	Juvenile smelt	No juvenile smelt	Adult smelt	No adult smelt
Temperature	54	162	72	144
Flow	82	236	114	205

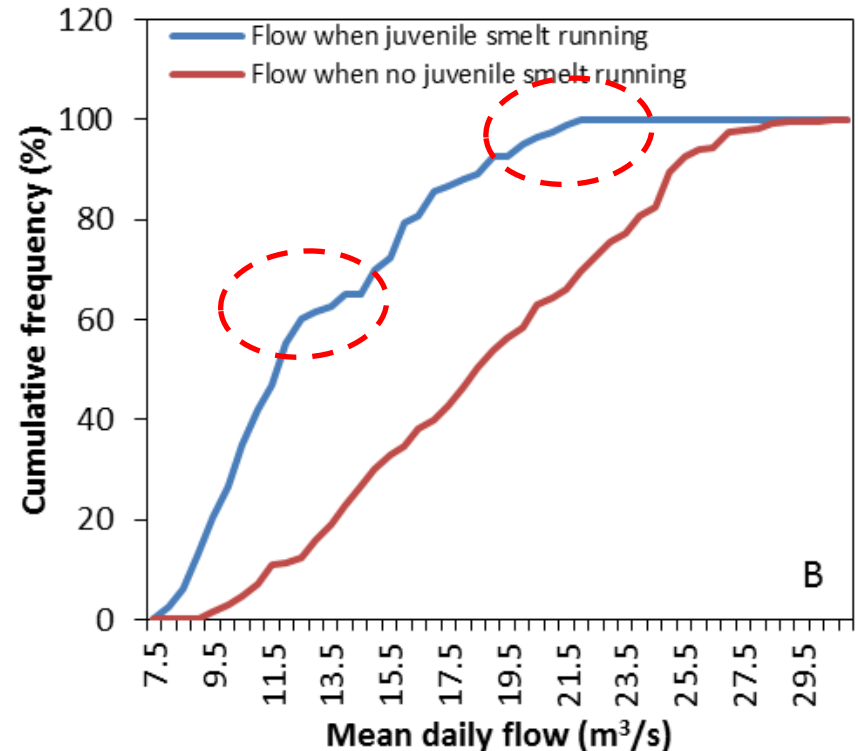
- Calculated frequency distributions for variables on days when runs were present, and compared with distributions for days when runs were absent.
- Also determined frequency of runs for days close to new moon, full moon, and at other times.

Cumulative frequency distributions for flow rates

Adults



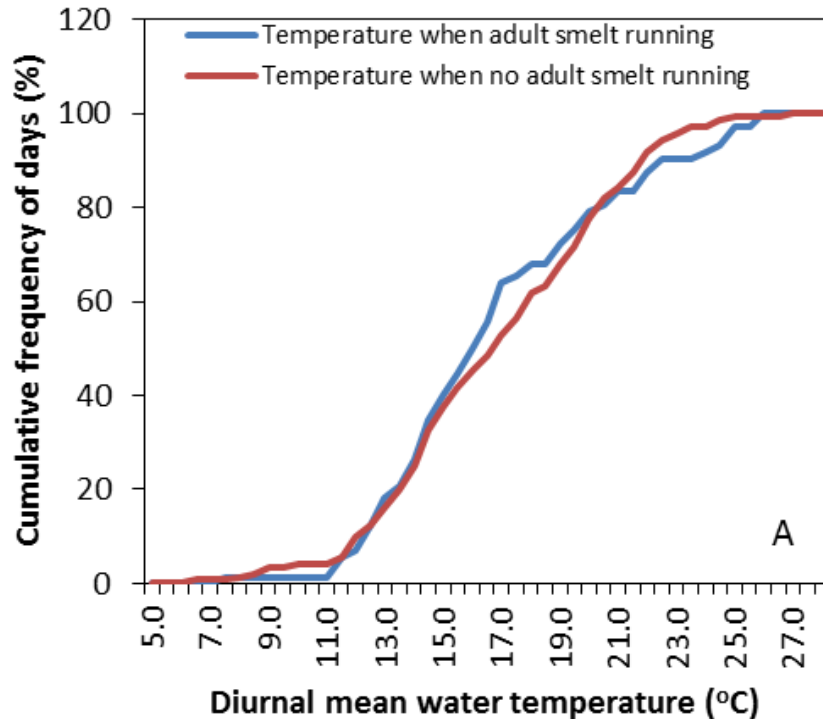
Juveniles



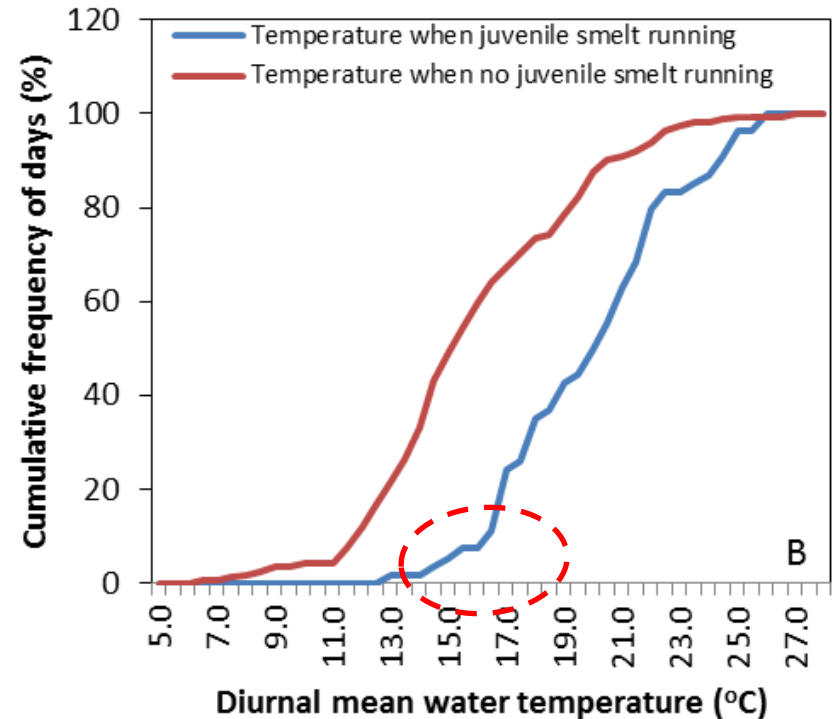
- **Adults: no selection of flow (range 8-25 m³/s)**
- **Juveniles: migrate when flow is low (8-22 m³/s)**

Cumulative frequency distributions for water temperature

Adults

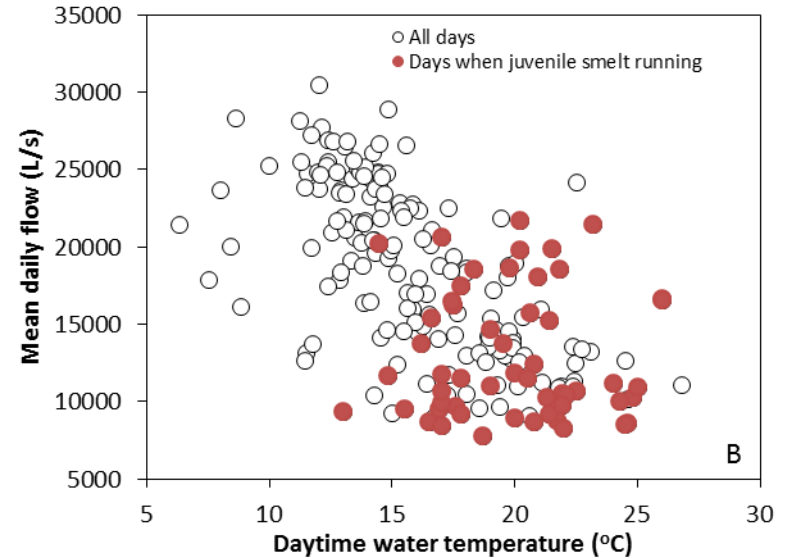
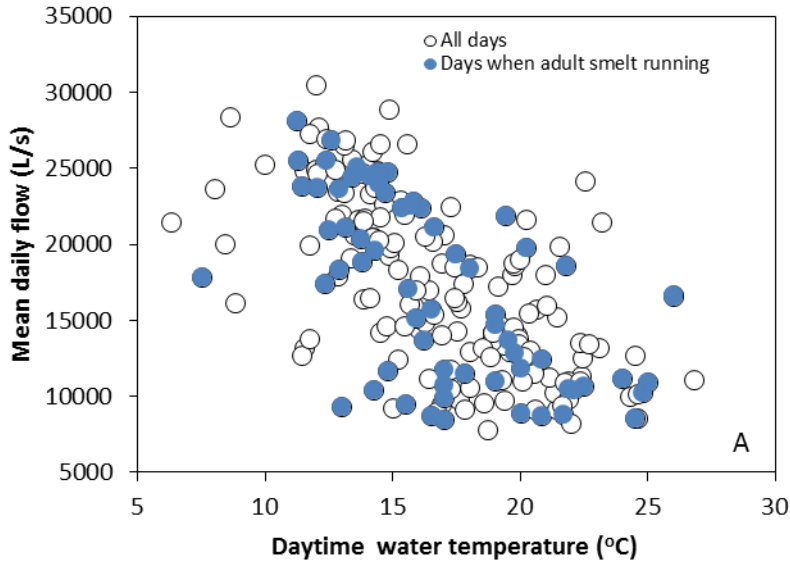


Juveniles

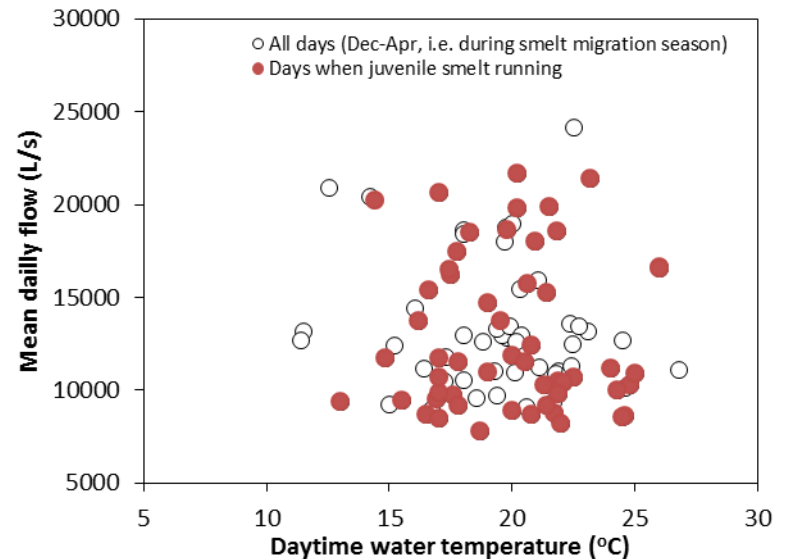


- **Adults: no selection for temperature (in range 9-25°C)**
- **Juveniles: migrate when channel water is warm (16-25°C)**

Scatter plots for temperature and flow on days when runs present and absent



No evidence that timing of smelt runs is influenced by water temperature or flow rate in the Channel.



Moon phase

Moon phase	Frequency of adult smelt runs	Frequency of juvenile smelt runs
Near new	0.15	0.14
Near full	0.15	0.14
In between	0.70	0.72

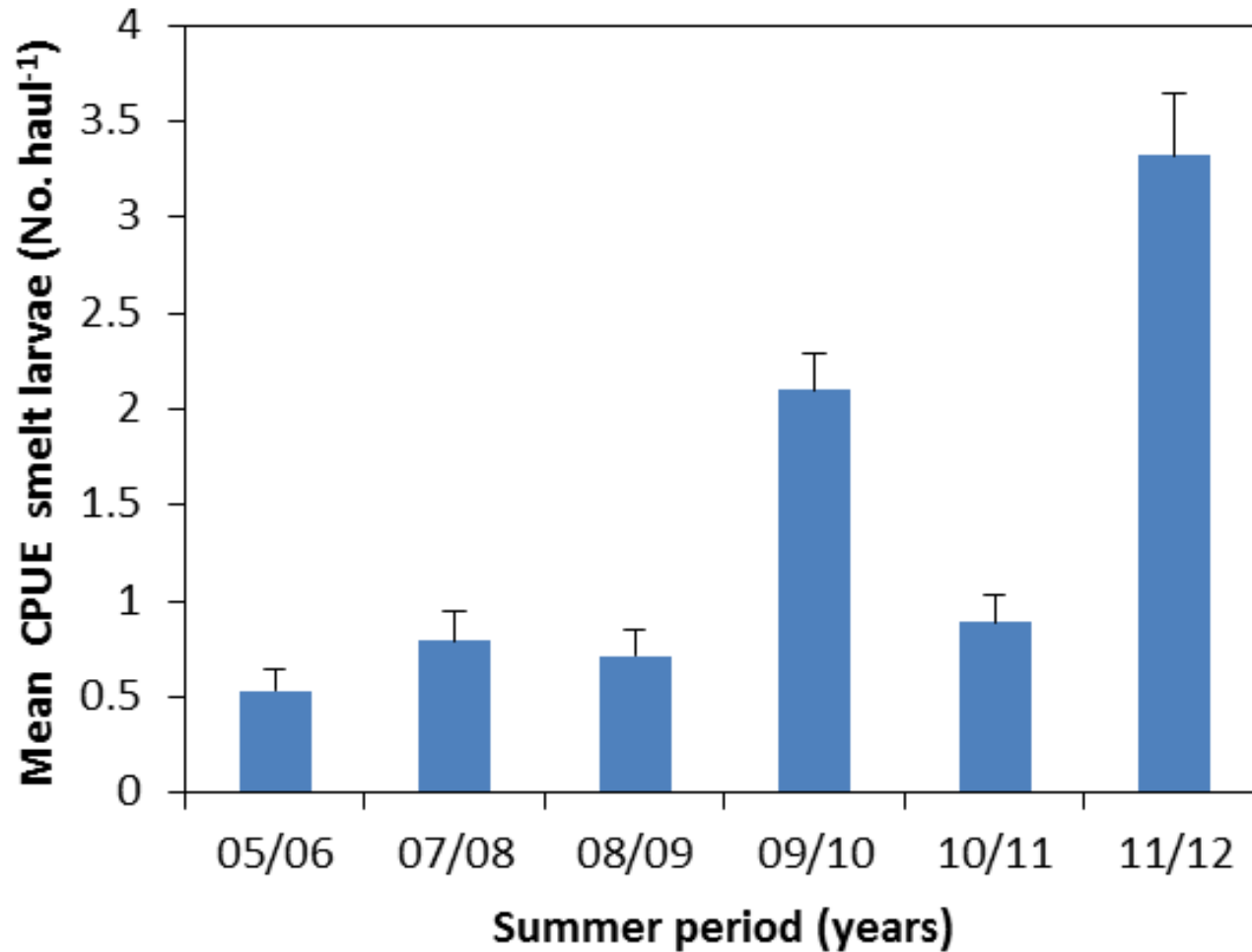
No apparent selection for new or full moon phases

(NB. runs only recorded during daylight hours .
Moon phase may influence nocturnal migrations - if they occur)

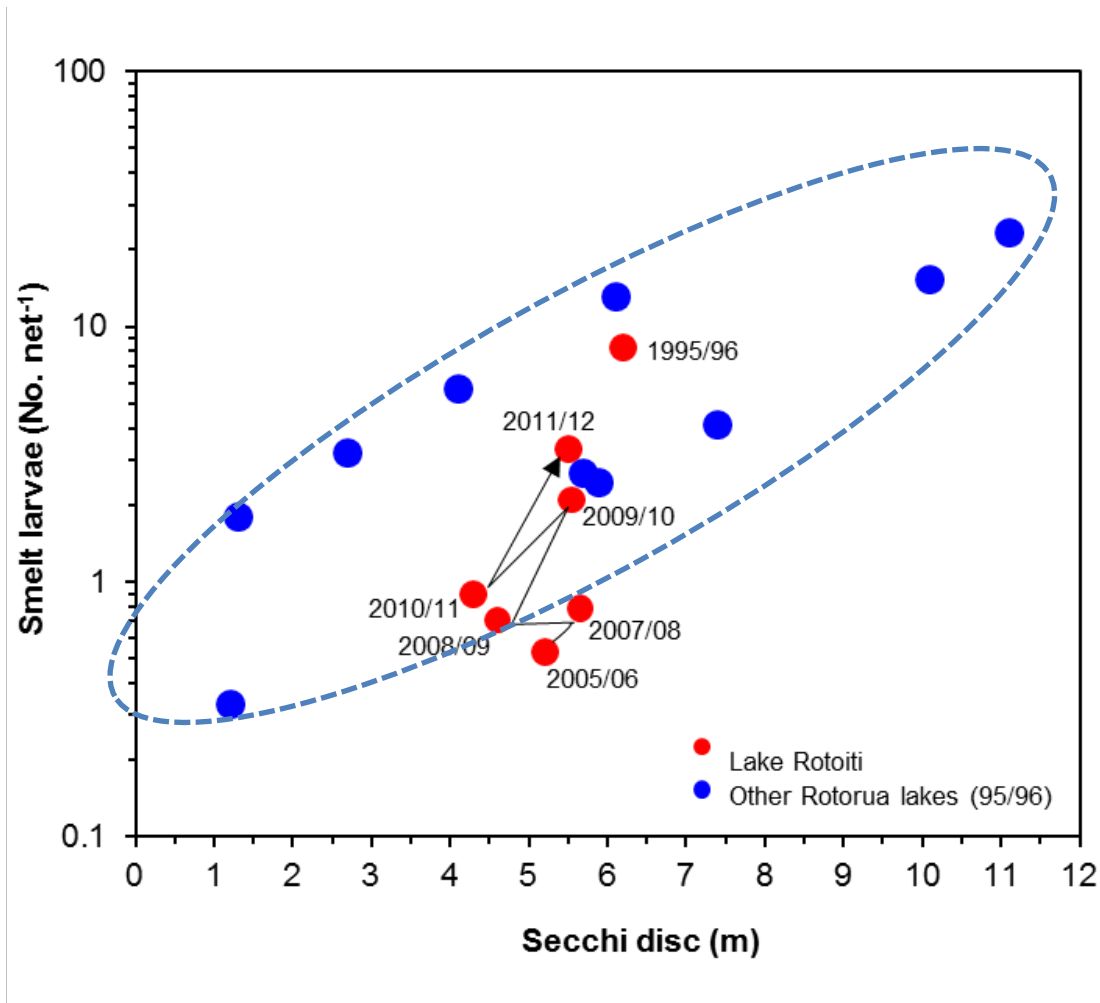
Part 3: Larval smelt density in Lake Rotoiti

Summer season	Status of diversion wall	No. of net hauls	December mean (n/net)	April mean (n/net)	Overall mean (n/net)
2005/06	No wall	15	0.60	0.47	0.53
2006/07	No wall	-	-	-	-
2007/08	Under construction	30	0.65	0.94	0.79
2008/09	Completed	30	1.00	0.42	0.71
2009/10	Completed	30	2.52	1.68	2.10
2010/11	Completed	30	0.81	0.97	0.89
2011/12	Completed	30	4.07	2.58	3.32

Annual changes in larval smelt abundance in L. Rotoiti



Larval smelt density vs. water transparency



Long term increase in smelt recruitment depends on improvement in L. Rotoiti's water clarity, unless weed growth coupled with lake level control reduces smelt spawning habitat

Conclusions

- 1. Adult and juvenile smelt can migrate up the Ohau Channel to Lake Rotorua (wall does not prevent upstream movement).**
- 2. Wall may reduce size/frequency of runs if it reduces attractant cues or increases avoidance factors, but no indication that temperature and flow involved.**
- 3. There has been no long-term decline in larval smelt abundance (recruitment) in L. Rotoiti since the wall was constructed.**