Vertikal størrelsesstratifisering av oppdrettslaks i merd

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Er fiskestørrelsene jevnt fordelt i en laksestim?

- Erfarne lakseoppdrettere hevder at den store fisken står dypt i merden.

- Det er for flere stimende arter vist at individer foretrekker nabofisk av lik størrelse.

Størrelsesstratifisering vil ha konsekvenser for uttak av fisk

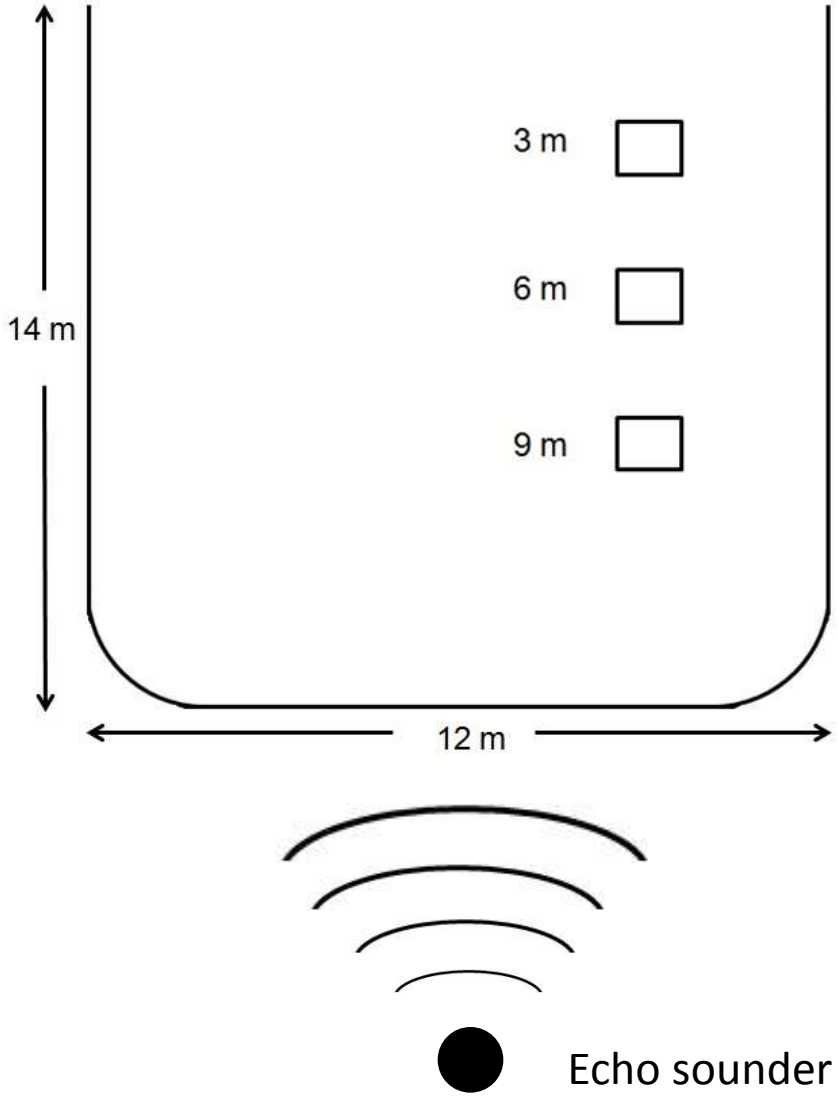
- Beregning av fiskestørrelse
- Lusetelling
- Veterinærinspeksjon
- Fremtidige metoder for sampling av fisk

IMR's cage environment laboratory, Matre, Norway

- Fjord location
- Cages are 12x12 m, 14 m deep

Three frames; 3, 6 and 9 m depth

in the mid-radial horizontal plane



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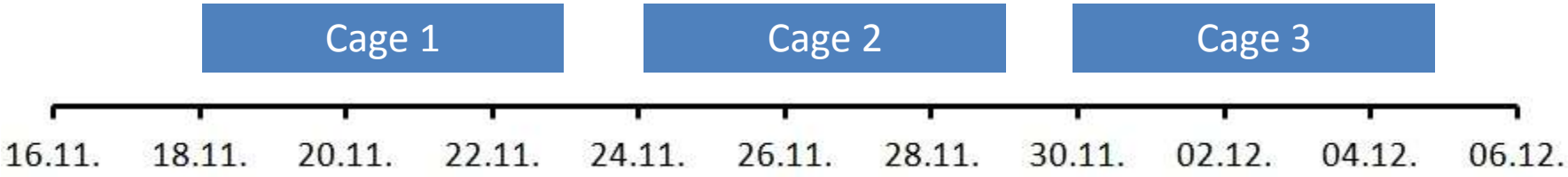
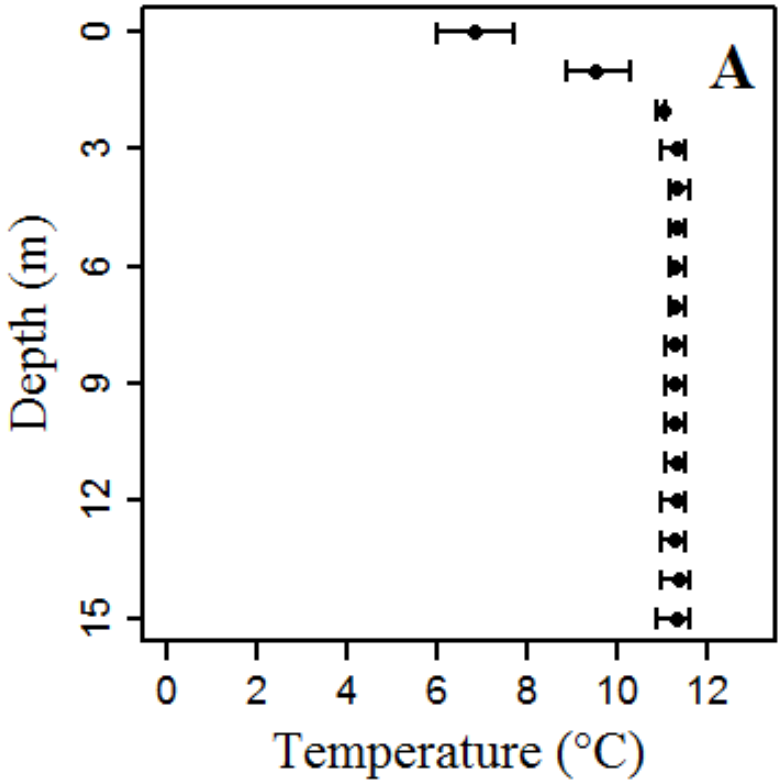
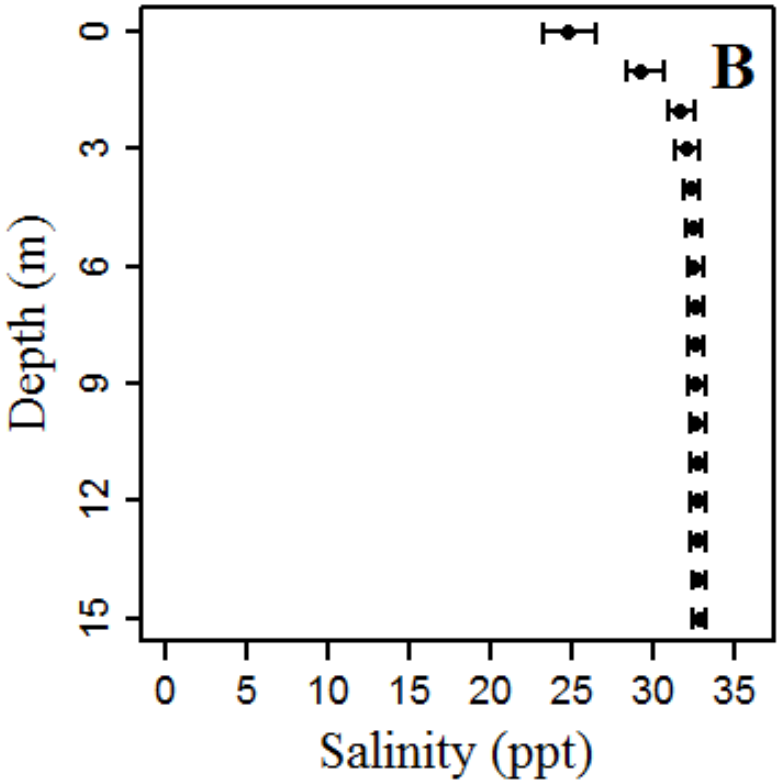
- Triplicate cages in late autumn 2010



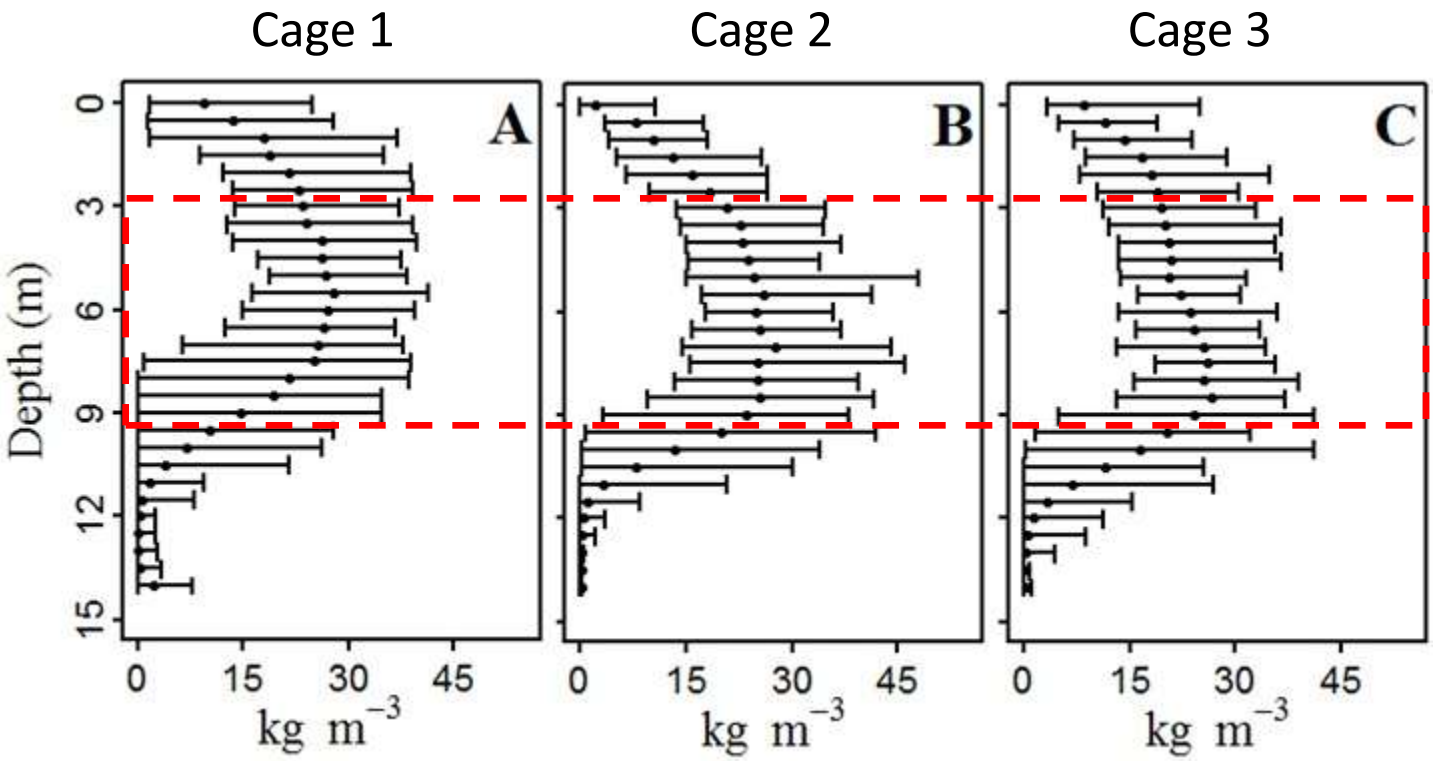
- Ca. 9000 fish per cage, expected weight 4 kg
- Stocking density ca. 16 kg m^{-3}

Environment



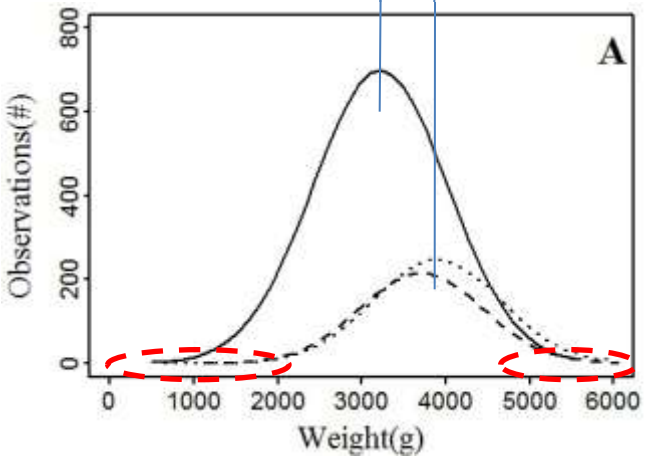


Observed fish density



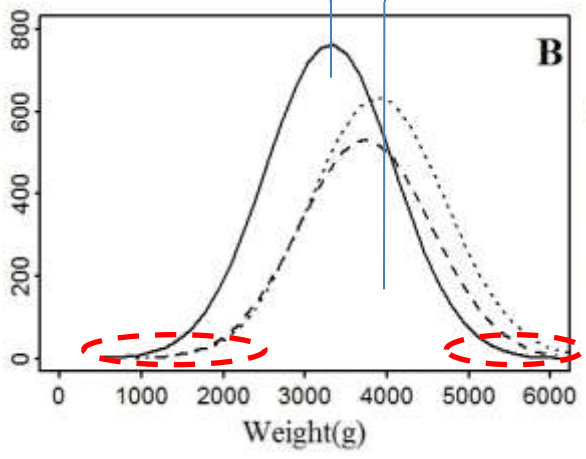
3 m depth 6 m depth 9 m depth

673 g



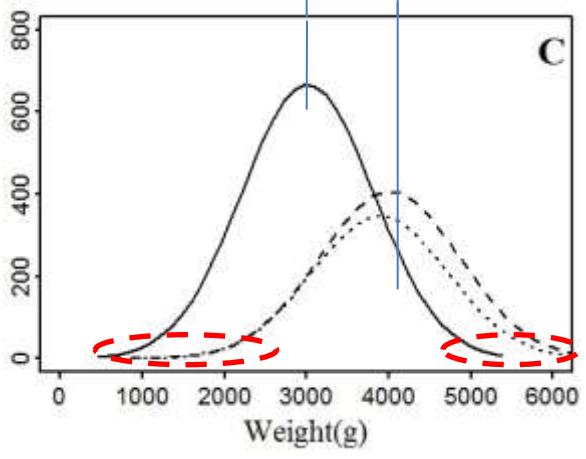
Cage 1

594 g



Cage 2

995 g



Cage 3

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Table 1. Mean values for factor groups. Mean body weight (g) from individual measurements of fish weight by the measuring frames during day, night and combined.

Frame position	Time of day	Cage 1	Cage 2	Cage 3
3 m	Day	3246	3299	3023
	Night	3146	3345	2961
	Combined	3216	3301	3008
6 m	Day	3684	3560	3887
	Night	3736	3888	4286
	Combined	3701	3729	4005
9 m	Day	3828	3773	3690
	Night	4000	4218	4056
	Combined	3889	3895	3887

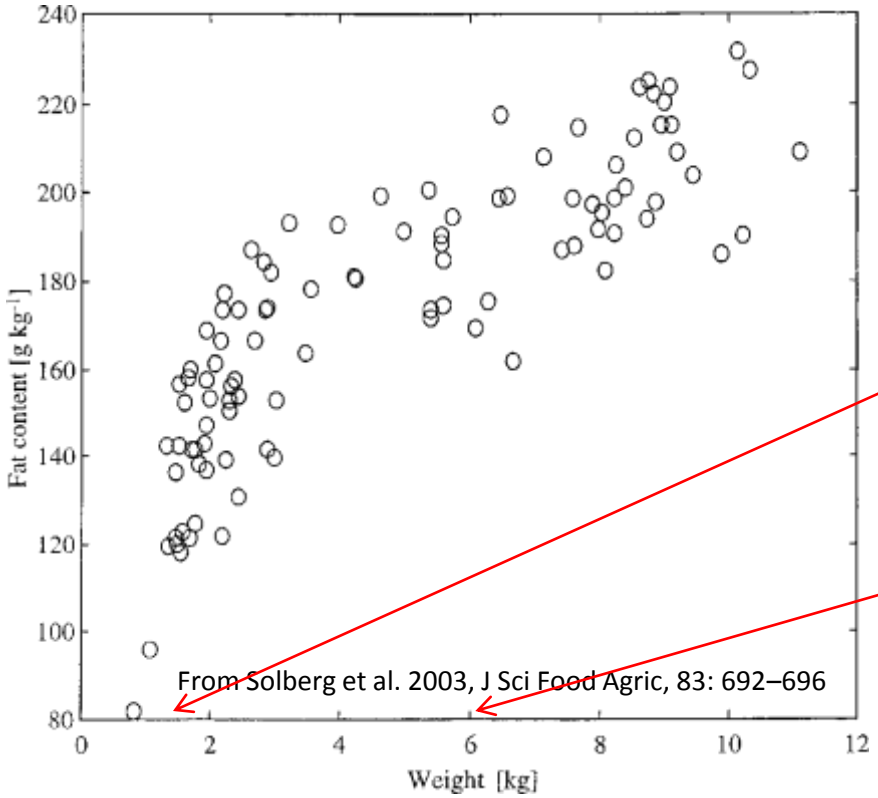
Conclusions

- Depth dependent size stratification
- Largest fish absent at 3 m depth
- Smallest fish absent at 6 and 9 m depth
- Intermediate fish at all registered depths

Why?

- Small fish restricted to shallow water by lower buoyancy?

Depth of neutral buoyancy



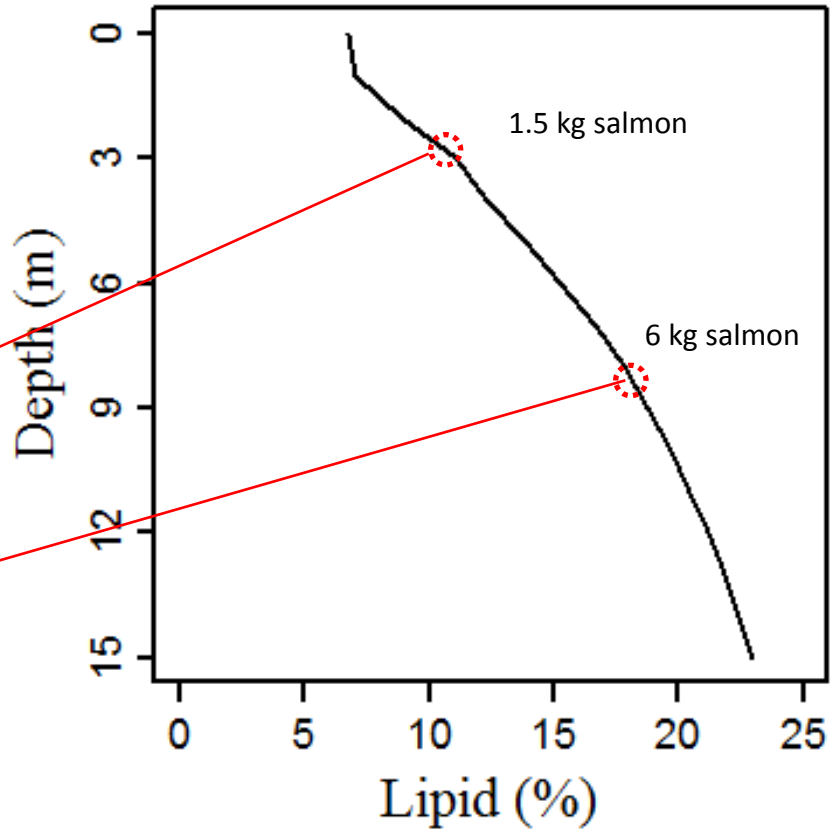


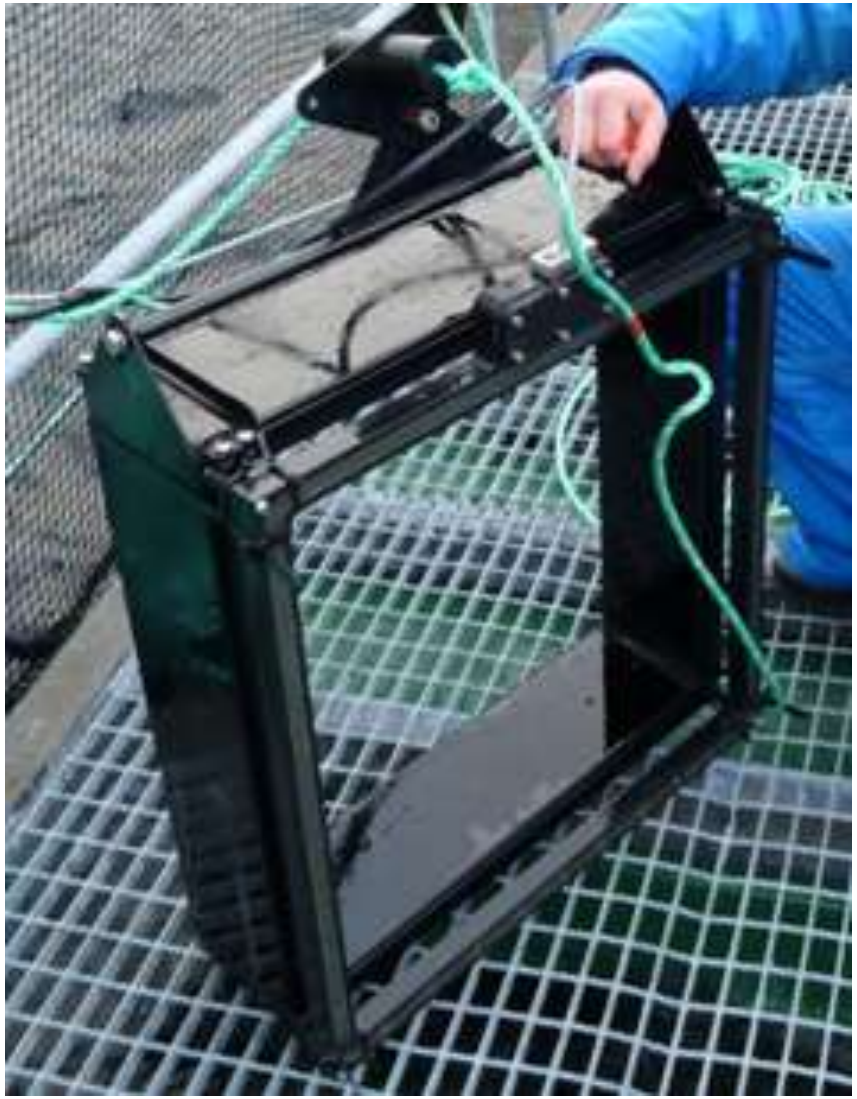
Figure 3. Fat content as a function of whole salmon weight

Densities of fish with different lipid contents with fully inflated swim bladder at surface were calculated with the following assumptions:

- Swimbladder volume = 5% volume (standard volume for marine fishes)
- Density of lipids = 0.93 g ml^{-1}
- Average density of non-lipid tissues = 1.08 g ml^{-1}

Density of water was calculated based on measured salinity and temperature at each depth

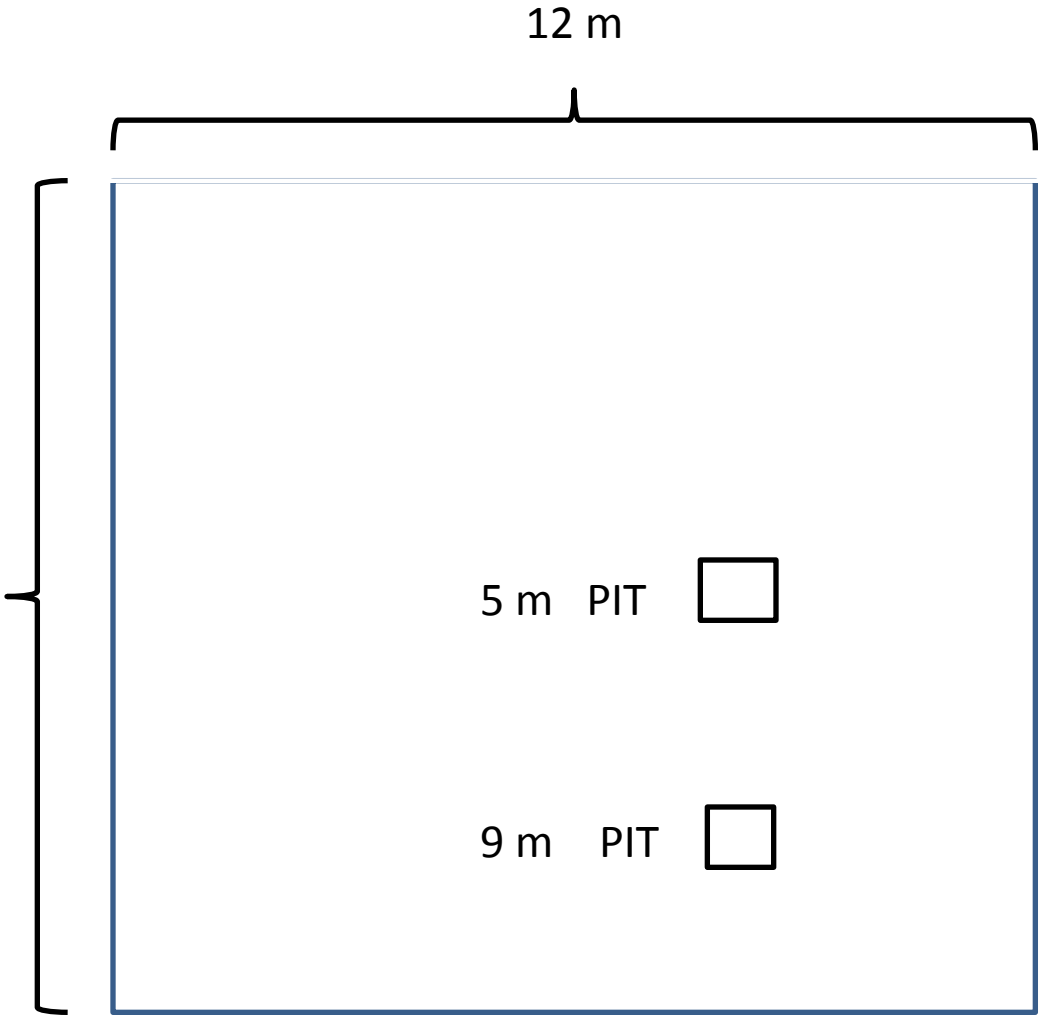
Individuality in depth registrations of tagged Atlantic salmon in a sea cage

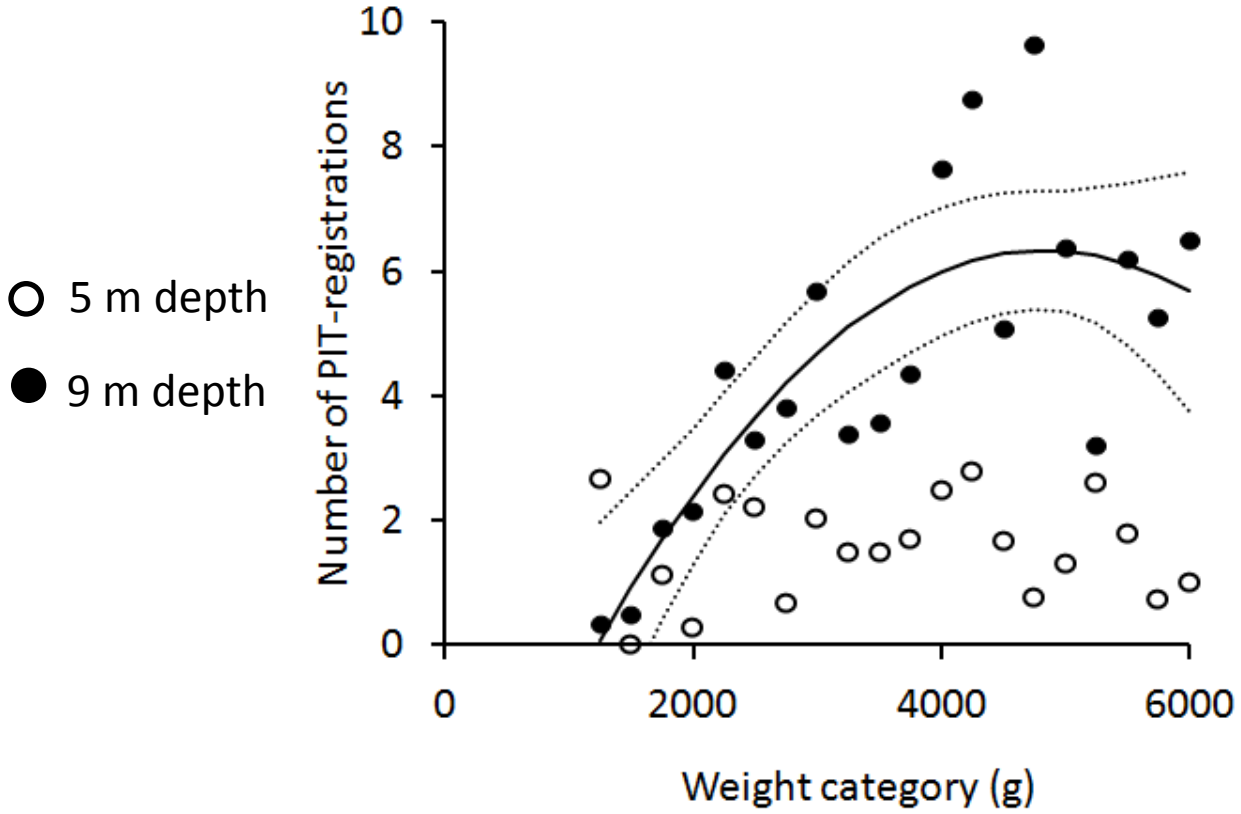


Randomly PIT-tagged 10% of 3750 harvest sized salmon in a sea cage

Fish density:
Ca. 6,5 kg m^{-3}

Recordings over 10 days





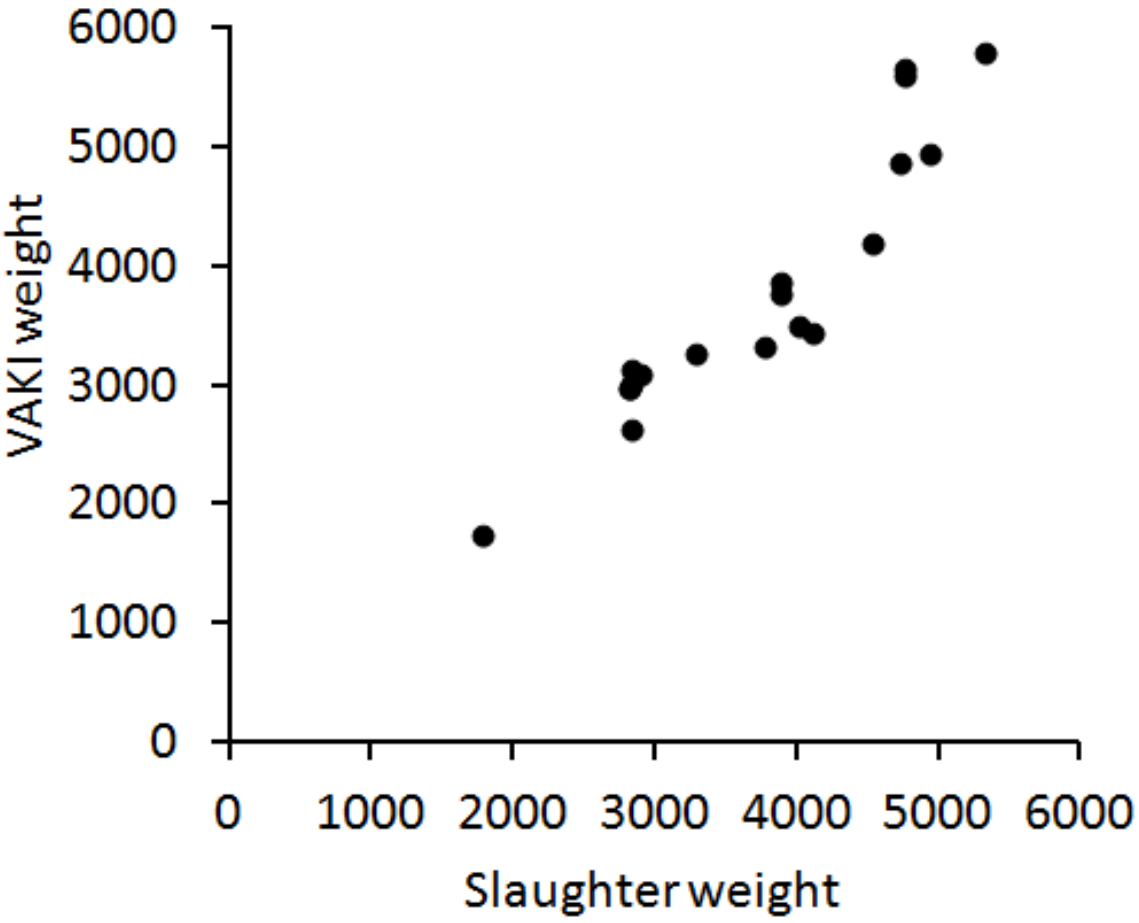
At 9m: Increasing number of PIT registrations with fish size

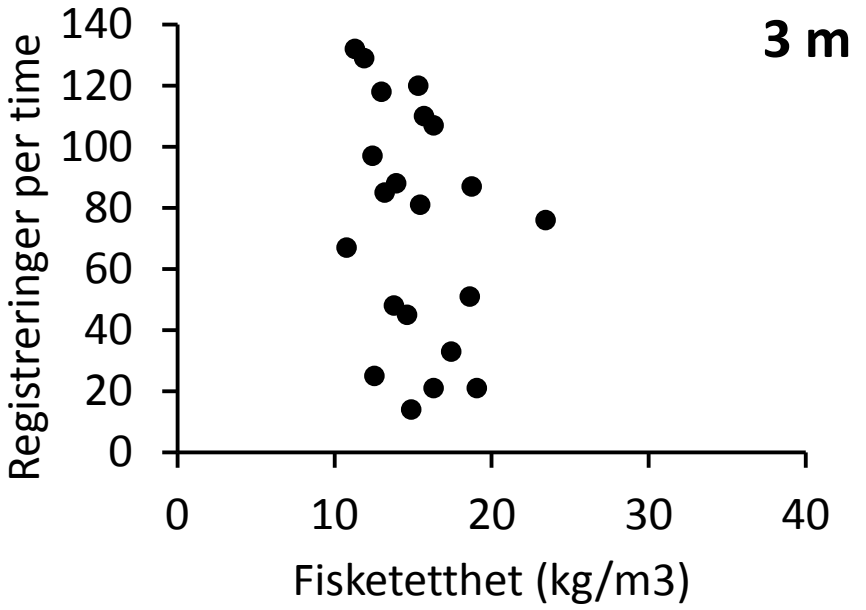
Fig. 1. Average number of PIT-registrations per tagged fish for each 250-g weight category between 1250 to 6000 g. Open circles: 5 m depth; black circles: 9 m depth. The smallest (100-1250 g) and largest (6500-6750 g) were only represented by one individual each, with 9 and 5 registrations at 5 m depth, and 11 and 32 registrations at 9 m depth for the smallest and largest individual, respectively. There was no fish in the 6250-6500 g weight category. The line represents: Number of PIT-registrations at 9 m =-5.063+0.00471*weight-0.0000004868*weight^2. Dotted lines indicate the 95% confidence interval for the line.

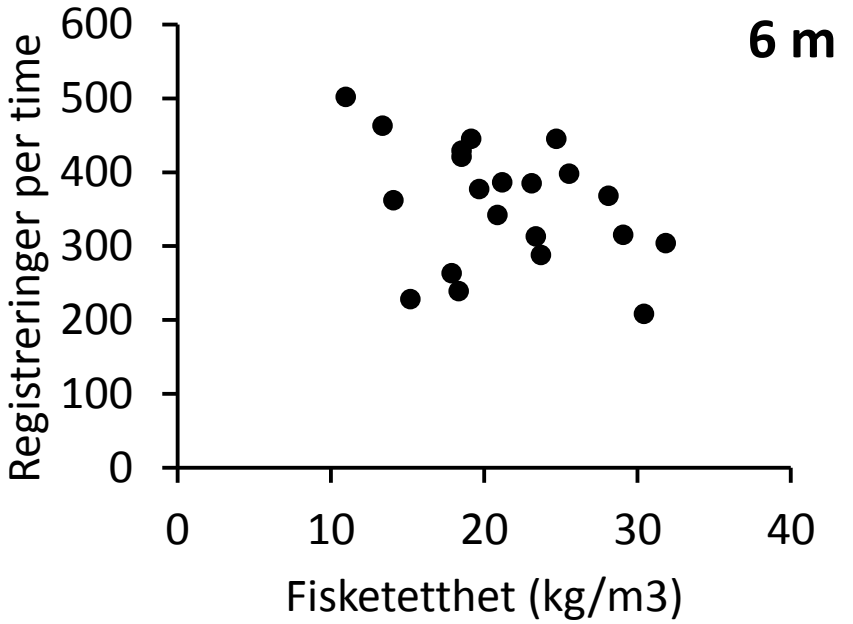
Størrelsesstratifisering bør tas hensyn til ved uttak av fisk

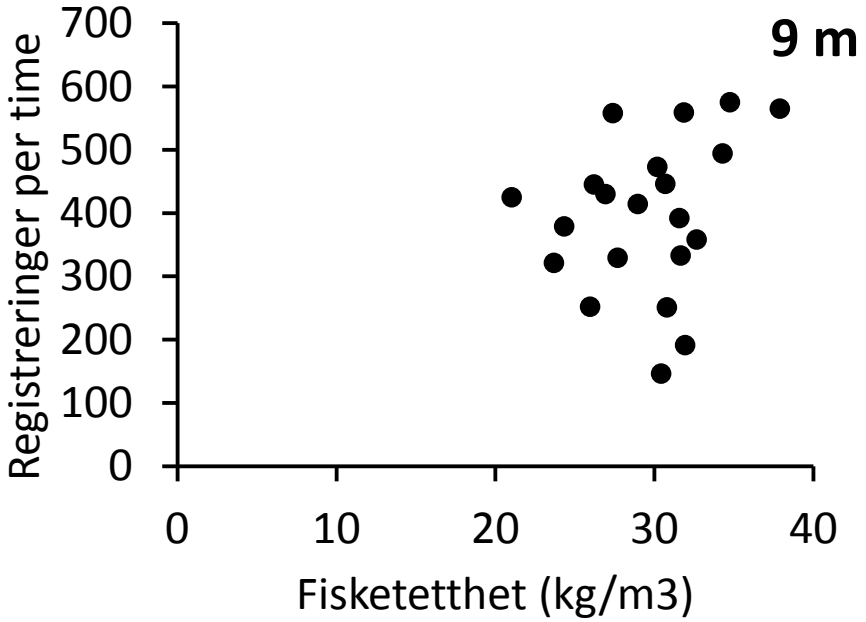
Takk for oppmerksomheten!

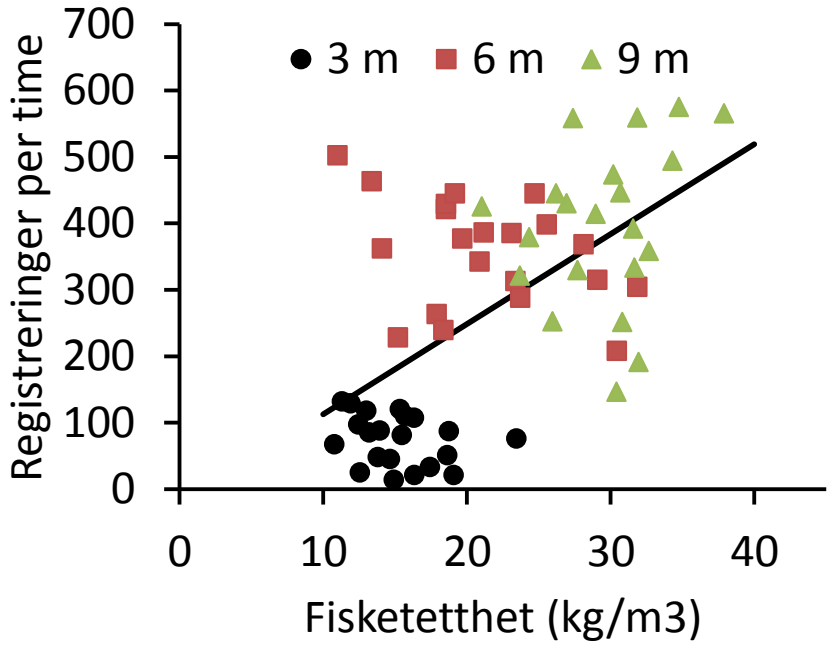
Precision of the frame











Vaki-registrerings-frekvens vs. lokal tetthet (dagtid)