



Juvenile fish habitats

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Coastal zones – important fish habitats

- Marine fish species generally produce numerous small pelagic eggs and have low parental care – there is high mortality of offspring
- Floating eggs and larvae have limited control over habitat choice
- Mortality at the transition to benthic life and post settlement is dependant on density and habitat type
- Many researchers have concluded that year-class strength of marine fishes is set during this critical period

Cod life history

- Adults spawn in particular locations and at specific times perhaps to maximize larval survival and juvenile probability of reaching nursery habitats
- After spawning offspring undergo a series of pelagic stages from egg to larvae to juveniles
- Eggs and larvae drift along predominant currents to nursery areas
- Pelagic cod juveniles settle to bottom habitats at sizes ranging from 25 to 80 mm, and undergo a shift from pelagic to benthic prey

Cod juvenile habitats

- Limited information of the ecology of the benthic life stage and the habitat shifts in Iceland
- Differences in post-settlement mortality rates are important for recruitment and year-class strength
- The shift from pelagic to benthic life stage is connected to extreme mortality rates in juveniles
- Conservation - essential transitional habitats

Potential threats by human activities

- Physical changes to the habitat
 - Increased sediment deposits
 - Changes to current patterns
 - Roads and bridges
 - Large scale industry
- Pollution
- Aquaculture
- Fisheries
- Climate change



Juvenile cod projects of the University of Iceland, Research Centre of the Westfjords

- The UI Research Centre established in November 2007
- Our projects include biology of fish in marine and freshwater environments and aquaculture
- Both applied and theoretical questions
 - Behaviour in the lab and in the wild
 - Feeding ecology, plasticity and specialization
 - Density effects
 - Effect of human activities

In the field





The shift from pelagic to benthic habitat use
in wild cod juveniles

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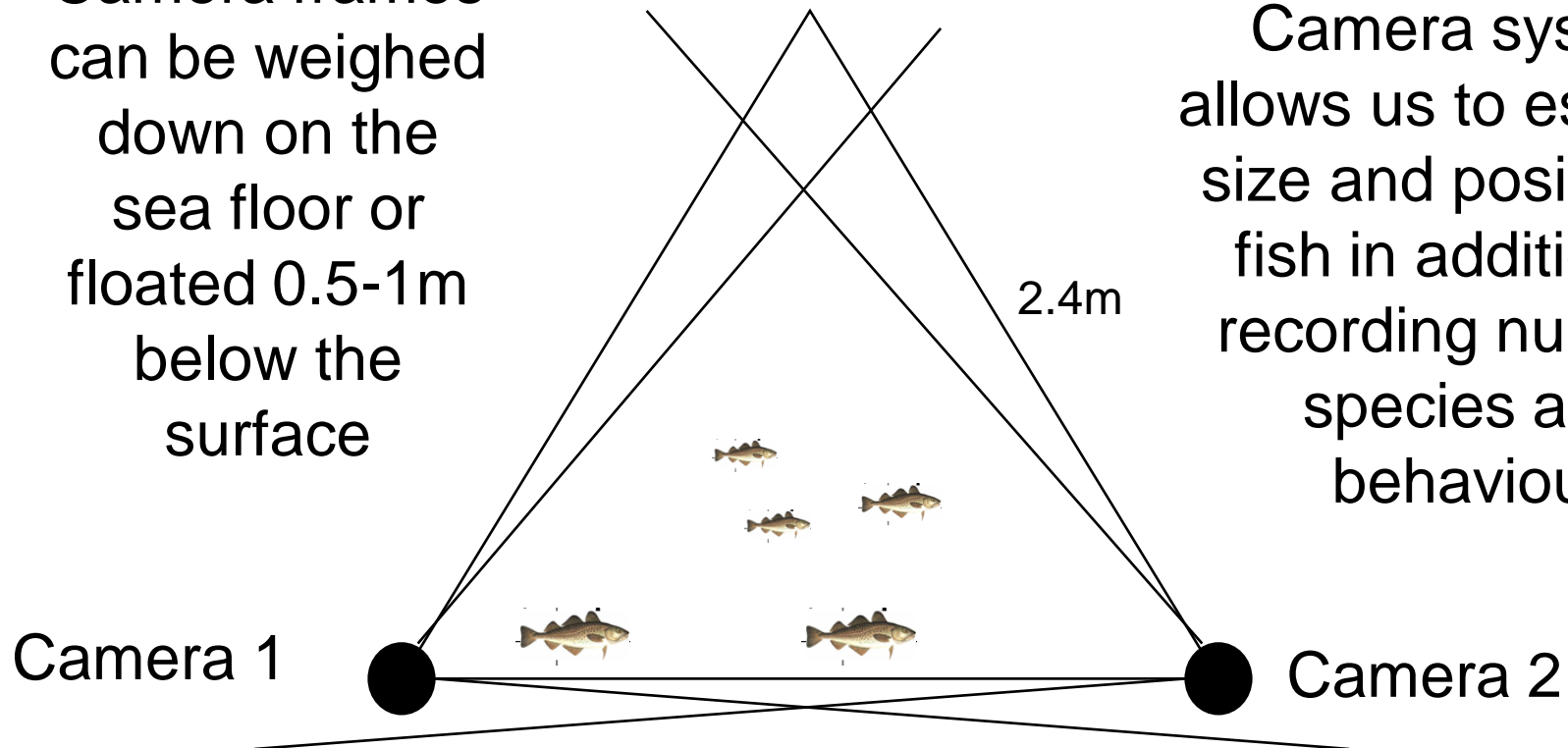
- Camera recordings in the wild
 - Water column and benthic
- Examine the effects of
 - Substrate type
 - Density
 - Intra and interspecific competition (including between cohorts)
 - Current
- Laboratory experiments (commencing 2009)

The shift from pelagic to benthic habitat use in wild cod juveniles

- We observe
 - Aggregation
 - Diel variation in behaviour and position of juveniles
 - Feeding and feeding efficiency
 - Density of juveniles
 - Competition, aggression or dominating interactions

Field methods

Camera frames can be weighed down on the sea floor or floated 0.5-1m below the surface



Camera system allows us to estimate size and position of fish in addition to recording number, species and behaviour

Field protocol



1. Attach cameras to frame
2. Position frame in sea
3. Sit back and enjoy the pictures

Ecological variation – resource use





- Theory predicts that competition may increase individual specialisation
- Flexibility may increase changes of survival in changing environments
- We estimate variation in diet at different levels (within individuals -> among group) in wild caught fish
- We estimate geographical variation and variation related to habitat type
- We estimate flexibility in diet use in laboratory experiments (commencing 2009)

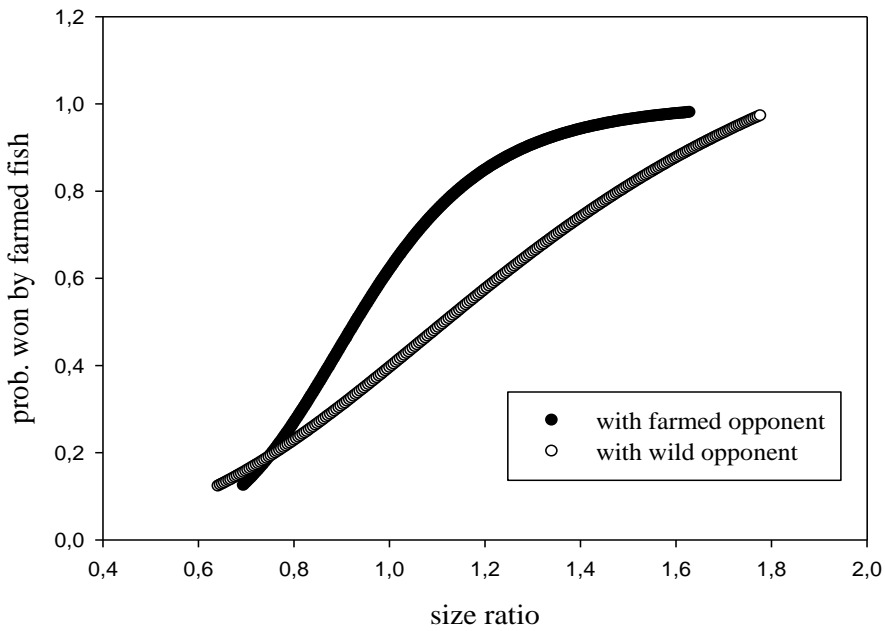
In the lab



Interaction of wild juveniles and farmed cod

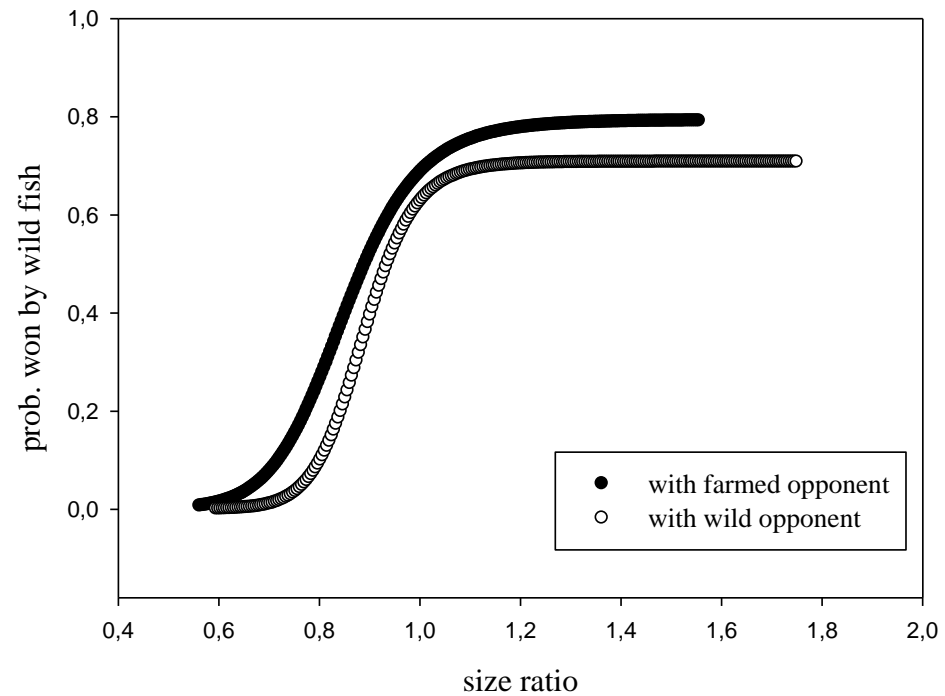
- Territorial contest and aggression of cod juvenile pairs tested in a laboratory setting
- Tested the effect of cod origin (wild or farmed) and size on the likelihood of being dominant

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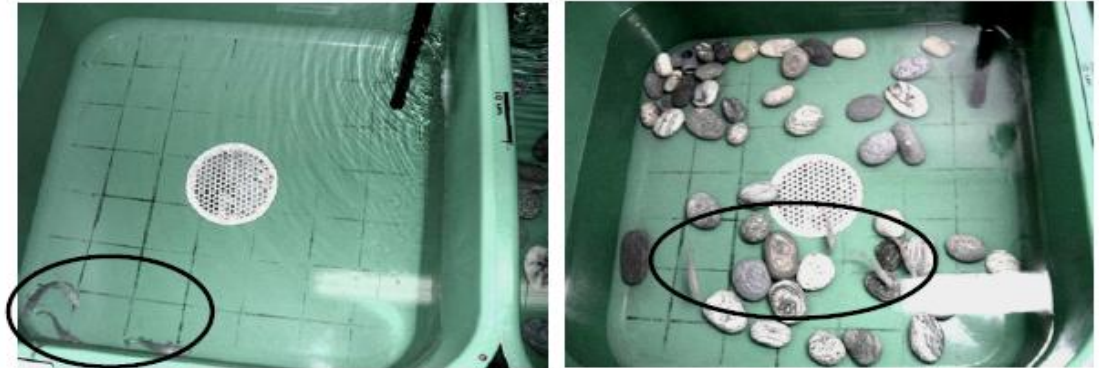


Farmed focal individual

Wild focal individual



Aggregation



- Group behaviour of cod juveniles in an experimental setting
- The effect of
 - Cod origin, wild and farmed
 - Test environment (simple, complex)
- Implication for both conservation of wild cod and aquaculture



Cod personalities

Some individuals are fitter than others

Animal “personality” affects individual and group fitness through competition and aggressive interactions

We examine relationships between different personality traits (aggression, problem solving, boldness) within individuals and variation between individuals

Relevance for conservation of wild cod and developments in aquaculture

Summary - deliverables

- Fundamental understanding of the ecology and behaviour of juvenile cod
 - Plastic resource use
 - Density effects on behaviour and survival
 - Animal personalities
- Applied research will depend on basic understanding of ecological interactions
 - Year class strength
 - Effect of aquaculture
 - Effect of human disturbance on substrate type, currents etc

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