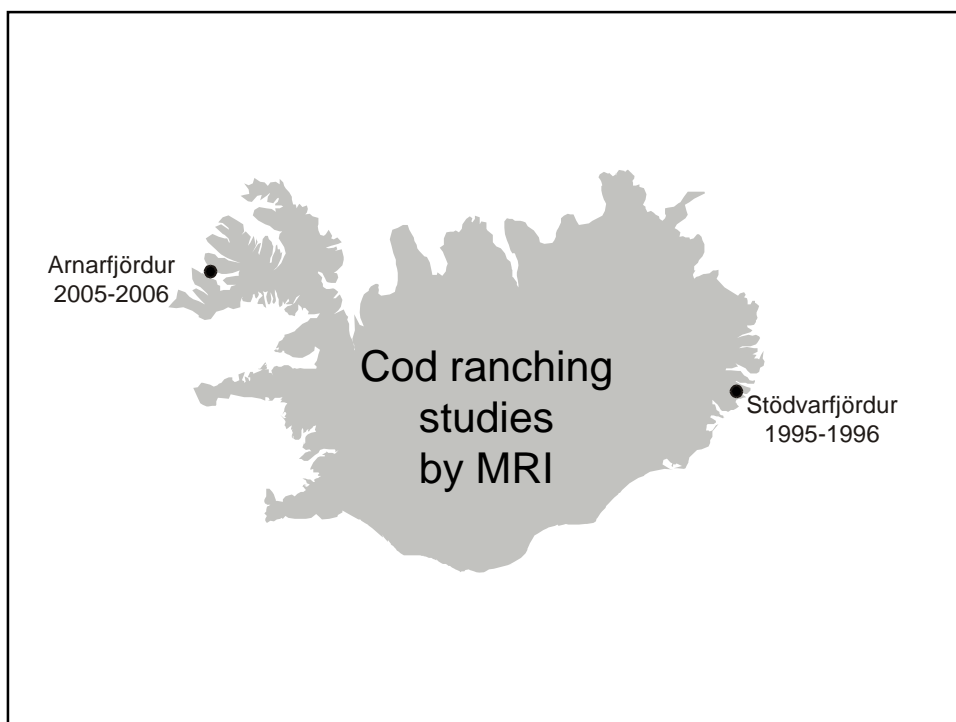


# Cod ranching in Iceland

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Photo:  
Erlendur Bogason



## Why ranching of cod?

- Ongrowing of cod in seacages started 1992
- Fast growth rate (1->2 kg in 4 months)
- Difficulties in capturing cod for ongrowing
- Mortalities involved with capture and transportation
- Cod is an expert in escaping from seacages
- Damages to fish and seacages in rough weather
- Cost of seacages

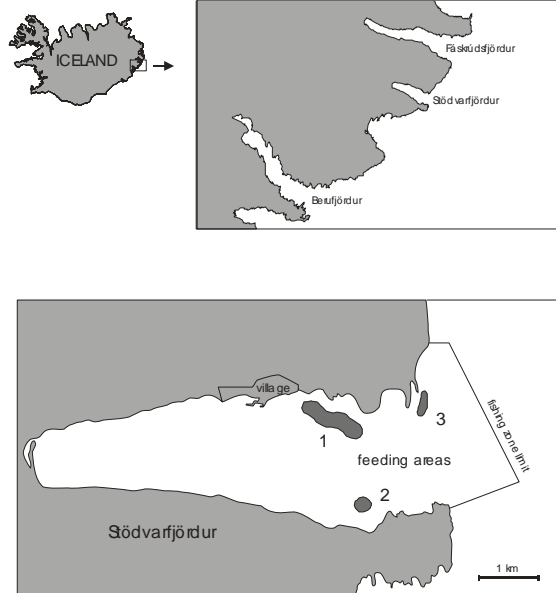
Can free-ranging cod be reared in a protected area without seacages?

A 17 month experiment in Stödvarfjörður 1995-1996

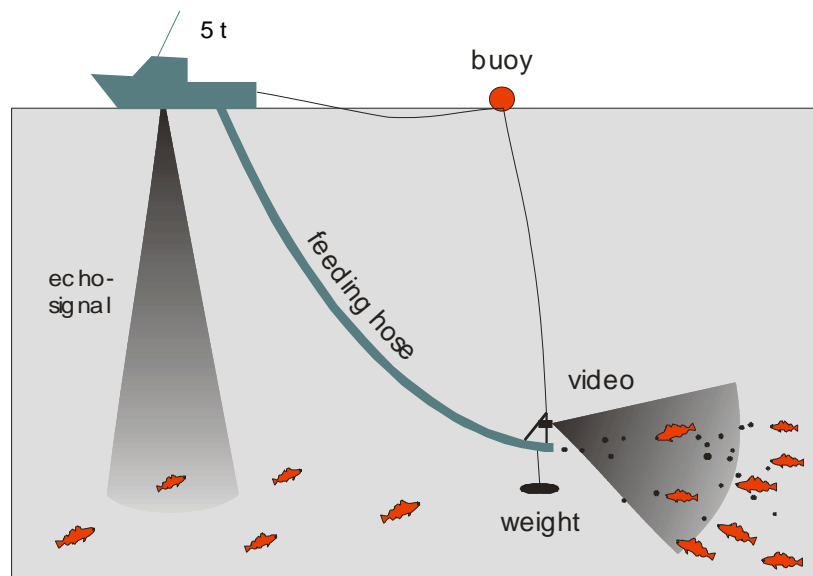
## Stödvarfjörður: research questions:

- Can a suitable feeding method be developed?
- Can regular feeding attract fish to a given area?
- Will the fish remain in the feeding area?
- Can the growth rate be improved?
- Can the cost of fishing be reduced?

## Cod ranching in Stöðvarfjörður



## The feeding technique





## Stödvarfjördur: results

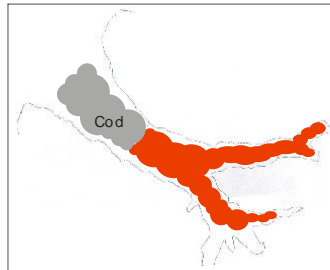
- Thousands of cod gathered in the feeding areas within a few weeks
- High fidelity to the feeding locations
- Liver index and condition factor increased
- Growth rate increased 3-fold (g/year)



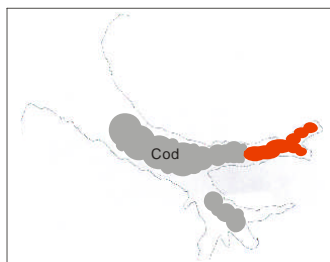
## Arnarfjörður cod ranching 2005-06

- Traditionally six inshore shrimp stocks in Iceland, average catch 7000 tons per year
- Five of the stocks had been wiped out by cod and haddock in the years 2000-2004
- The only stock remaining in Arnarfjörður
- In September 2004 signs of heavy predation by cod

### Distribution of cod and shrimp in Arnarfjörður



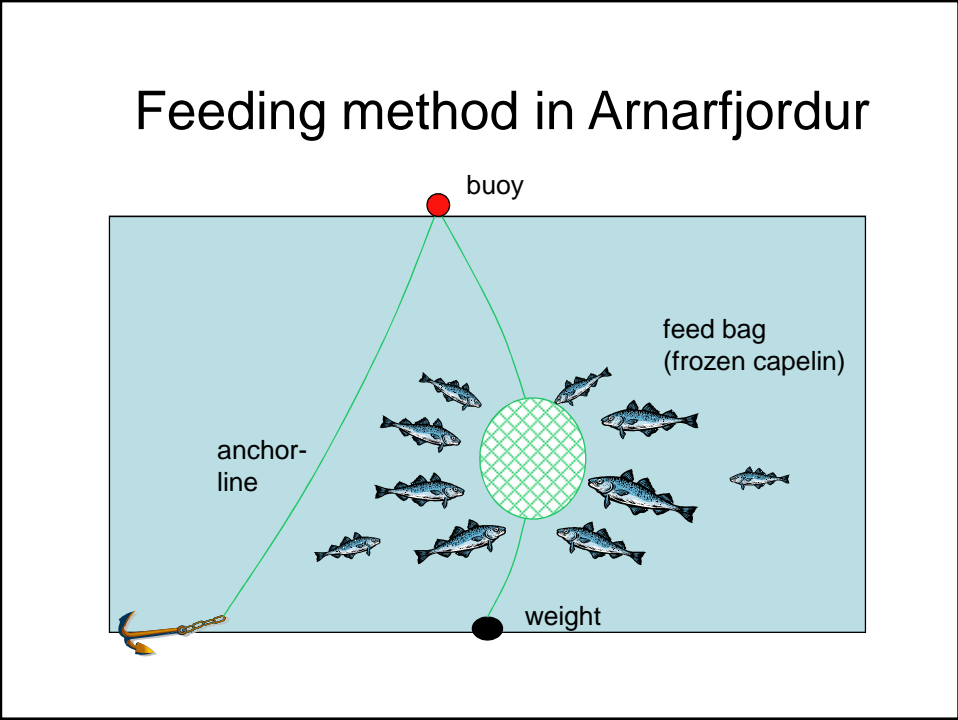
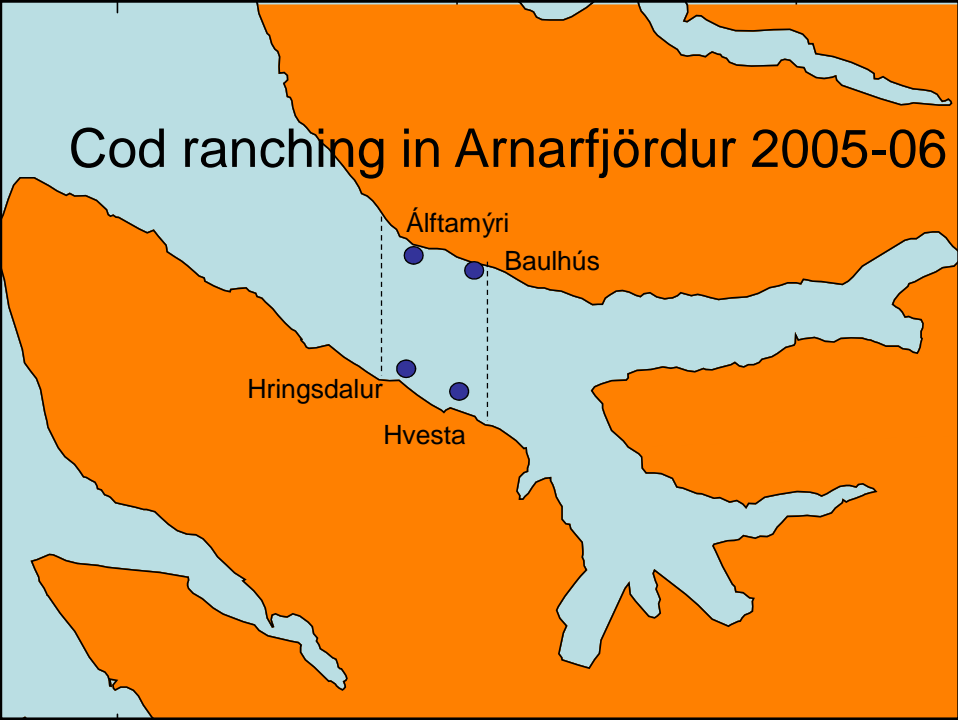
September 2001



September 2004

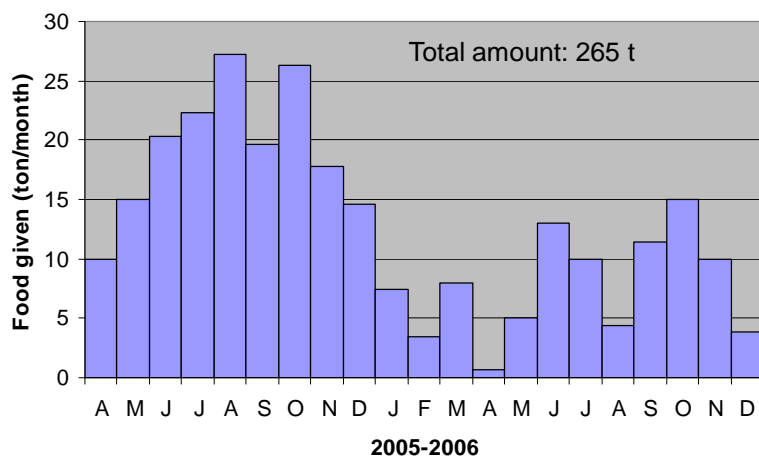
## Arnarfjörður: research questions

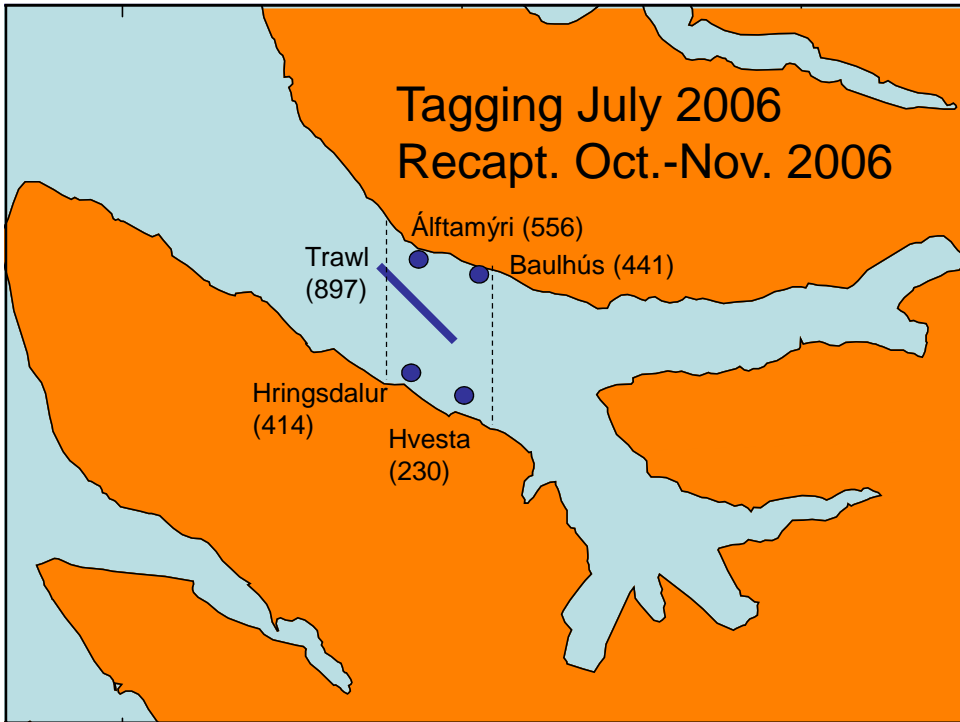
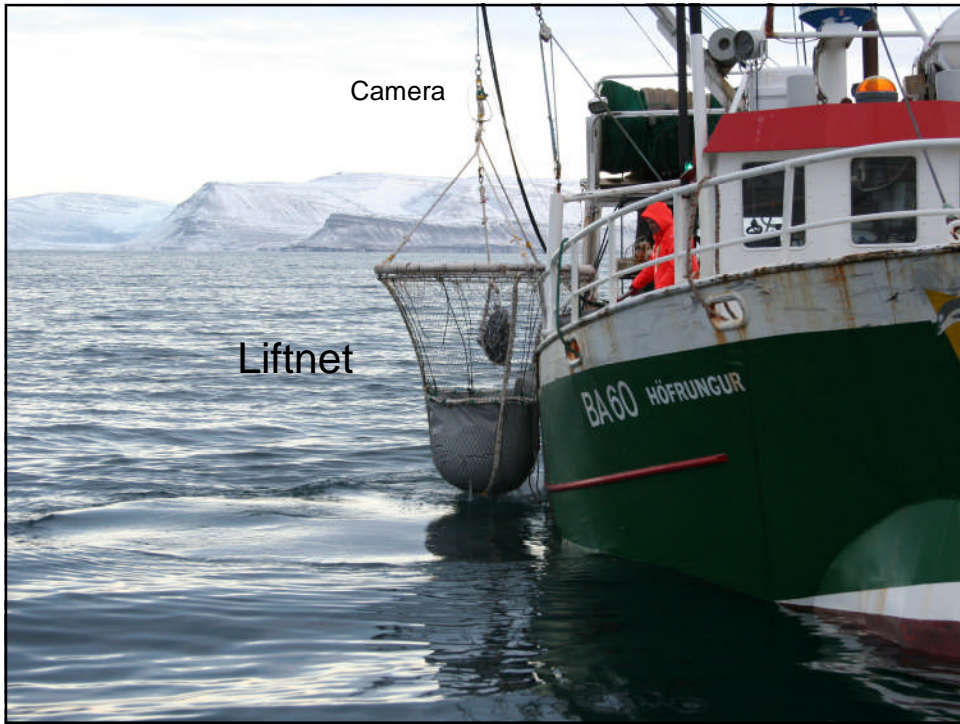
- Can predation of cod on shrimp be reduced by regular feeding?
- Can large “herds” of cod be established?
- Will the cod remain in the herds and eat only the feed provided?
- Will the cod grow faster?
- Are they easy to catch?
- Can the small fish be used for ongrowing?





Amount of food given in Arnarfjordur

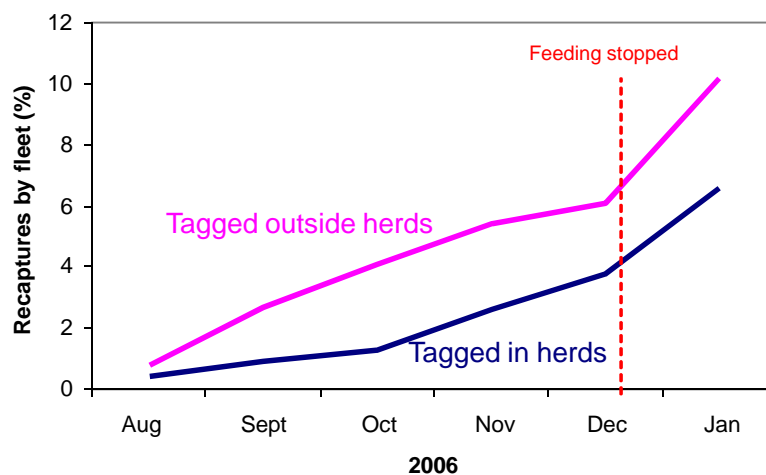




## Enormous growth rate!

- Mean wt. at tagging: 2.7 kg
- Mean wt. at recapture: 4.4 kg
- Growth: 1.7 kg/fish in 103 days (n=188)
- In comparison yearly growth of 5 y old Icelandic cod is 0.9 kg (Ground fish survey).

## Herdfish less vulnerable to fishing



## Fidelity of cod to herds (%)

Recapture area	Tagged at Álftamýri	Tagged at Baulhús	Tagged at Hringsd.	Tagged at Hvesta	Total recapt.
Álftamýri	90.9	6.6	2.5	0.0	121
Baulhús	0.0	90.9	0.0	9.1	11
Hringsd.	8.9	3.6	62.5	25.0	56
Total recapt.	115	20	38	15	188

## Cod ranching in Iceland

Magnitude	Stödvarfjörður	Arnarfjörður
Size of boat (t)	5	30
Number of crew	1	2
Feeding months	17	21
Number of herds	3	4
Feed (t)	99	265
Fish (t)	33	253

## Possible advantages of ranching compared to traditional fishing

- Less cost of fishing in large herds
- Less energy consumption
- Less harmful effects on benthos
- Less killing of small fish and bycatch
- Larger weight, better quality and prices
- Better utilization of quota (initial weight)
- Improved fish welfare

## Advantages of ranching compared to farming in sea cages

- Less cost of sea cages
- No cost of juveniles
- No genetic effect on wild stocks
- Can be carried out in more exposed areas
- Less visual impact
- Herd fish can avoid harmful events such as: wind, waves, extreme temperatures, drift-ice, jelly-fish, poisonous algae

## Economic feasibility?

- Feed price (capelin, herring, blue whiting, mackerel)
- Technology in feeding and fishing (wellboats, purse seine, fishpumps, size-graders)
- Size of herds, number of herds
- Rate of buildup of herds
- Low frequency sound to attract fish?

## Difficulties in developing cod ranching:

- Requirement of large reserve areas (ownership, political, legal and social issues)
- Risk of herds leaving the reserve area
- Scepticism by ship owners and fish farmers
- Uncertainty in supply and cost of feed

## Ranching of cod: conclusions

- Large potential (feasibility unknown)
- Large herds formed by regular feeding
- Great improvements in growth rate
- High fidelity to herds from April-October
- Large reserve areas required (poaching)
- More research required to upscale and optimize the methods

