The role of eel farms in accelerating growth and increasing survival in the wild

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Agenda

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Stichting Duurzame Palingsector Nederland

1. Dupan foundation
2. Project “Sustainable development of the Dutch Eel Sector”
3. The role of farming in accelerating growth and increasing survival in the wild
4. Research project glass eels and eel fingerlings in ponds
5. Mini-documentary on the 2011 project

DUPAN

Foundation set up by the Dutch Eel Sector

1. Eel fishermen
2. Eel farmers
3. Eel traders and processors

DUPAN

Dupan has committed itself to the following goals:

- Sustainable recovery and maintenance of the eel stocks in Dutch inland waters
- Solutions for animal friendly fishing, farming and processing
- Environmental responsible and sustainable production process
- Sustainable conservation of the Dutch Eel Sector, a cultural heritage

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Dupan members established the

“Duurzaam Paling Fonds” = “Sustainable Eel Fund”

with the goal of an “Accelerated more sustainable eel recovery”

by

- Restocking glass eels and eel fingerlings and transferring silver eels to open water (access to sea = “Eels over the dyke”)
- Funding independent research to create a foundation for long term solid recovery of the eel stocks in Dutch water

“Sustainable development of the Dutch Eel Sector”

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1. Inventory of possibilities and limitations of “Decentralized Eel Management plans” in ‘open’ area’s

1.1 Gathering historical and actual data of recruitment, stocking, growth, size distribution and escapement as well as fisheries data.

1.2 Collection of international references on factual EMP’s and literature.

1.3 Integration of data with running project “Pilot project Decentralized Eel management” in Fryslan (NL).

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2. Inventory of mortality factors in example regions in the Netherlands

(a) Collection of regional historical and recent data (Grevelingen, IJsselmeer, NW-Overijssel)

(b) Influence of Cormorant predation

(c) Influence of pump stations, power plants and other waterworks: inventory of numbers, different kinds, effects and potential damage to eel stocks

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3. Develop a zero balance for eel farms in the Netherlands

3.1 (a) Mortality rate between catch in France and stocking in Dutch farms

(b) Data on total elver intake of eel farming sector in NL.

(c) Data on eelpopulation development in 3- 5 eel farms and compare with data from the wild stocks

3.2 Current practice of restocking by eel farms of pre-grown fingerlings and/or glass eels

3.3 Gathering reference values for growth and survival of glass eels and pre-grown fingerlings from eel farms

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Pending questions:

- The faith of glass eels if they are not caught in the major glass eels fisheries around Europe and used for farming instead?
- Total biomass of glass eels arriving in European estuaries?
- Percentages of elvers fished for consumption (farming and human), dying or lost during migration, and colonizing upstream fresh waters?
- Impact of eel farmers on eel stocks in Europe and the Netherlands?

The role of eel farms in accelerating eel recovery

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Best options for eel farmers to compensate for their glass eels extraction from European stocks?

- Eel farms have the ability to grow glass eels to a weight of 5 – 10 grams with a negligible mortality.
- The highest mortality of glass eels after restocking is likely to take place in the first year due to the vulnerability of this life stage.
- Early glass eels (Jan – Feb) are better re-stocked when food situation is optimal (May – June).

The role of eel farms in accelerating eel recovery

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Eel farms may maximize the effectiveness of restocking with limited available glass eels provided that farmed pre-grown eel fingerlings:

- Re-accustom to a “natural environment”
- Re-adjust to intake of natural food
- Show a “normal” response to natural predators such as birds and predatory fish
- Show natural escapement (homing) behavior at silvering stage

Research project glass eels and fingerlings in ponds

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- **Do farm reared fingerlings switch successfully to natural food sources?**

Part 1 setup

- 10 farm pre-grown fingerlings
- 20 glass eels
- 2 aquaria for 47 days at ambient temperature
- fed daily with live food: daphnia's, mosquito larvae, tubifex, and worms (night crawlers).
- Behaviour of the eels was monitored and video taped.

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Results part 1

Aquaria	Stocking		Harvest			Growth		Growth	Growth	
	Average	Average	Number	Average	Average	Average	Average	Days	SGR	SGR
	gram	cm	caught	gram	cm	gram	cm	Average	% gram/day	% cm/day
Fingerlings	9,6	18,4	10	9,89	19,1	0,290	0,70	47	0,06	0,08
Elvers	0,225	6,8	19	0,68	8,4	0,455	1,66	47	2,35	0,47

Aquaria	Stocking		Condition factor	Harvest			Condition factor	Growth	
	Average	Average	Average	Number	Average	Average	Average	Average	Average
	gram	cm	CF= W100/L^3	caught	gram	cm	CF= W100/L^3	gram/day	cm/day
Fingerlings	9,6	18,4	0,154	10	9,89	19,1	0,142	0,01	0,015
Elvers	0,225	6,8	0,073	19	0,68	8,4	0,114	0,01	0,04

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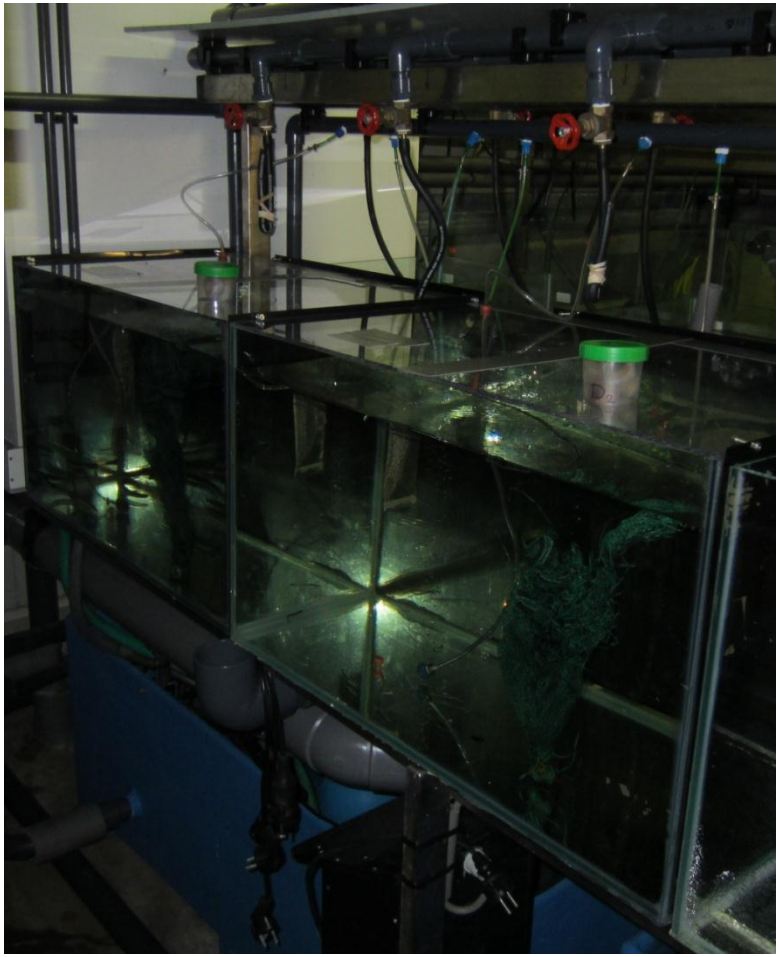

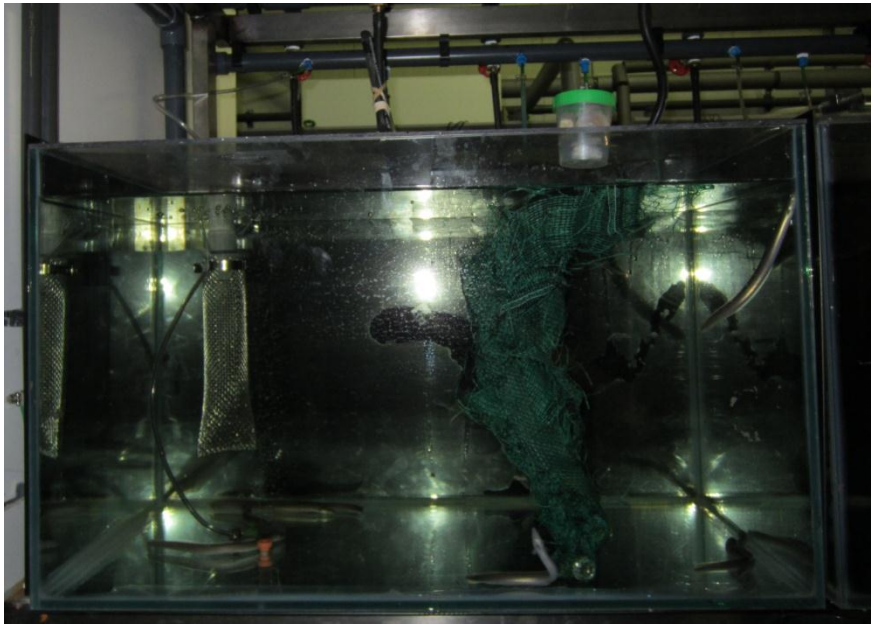

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Results part 1

- Glass eels and farm reared fingerlings responded to the natural food items .
- Glass eels responded quickly to provided food and ate eagerly.
- The fingerlings responded slower and reluctant to eat.
- Behavioural observations (and experience) indicated that the limited growth of the fingerlings in the experimental conditions is a result of social stress due to low population density and hierarchy.

Research project glass eels and fingerlings in ponds

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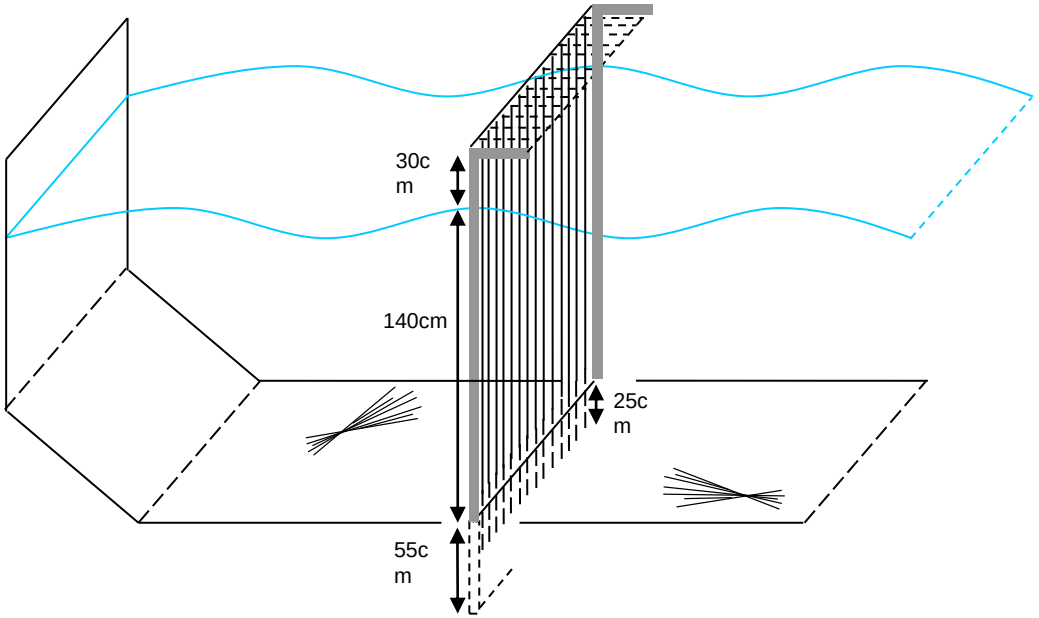
What is the growth and survival of farm reared fingerlings and glass eels under semi-natural conditions in ponds?

Part 2 setup

- Three ponds, covered with wires to prevent bird predation, were divided in equal halves with permeable cloth, thus creating 6 ponds of 0.05 ha each.
- 3 pond sections stocked with 100 glass eels
- 3 pond sections stocked with 100 fingerlings.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Part 2 setup

- Co-stocking of some carp and tench for bio-turbation of the pond bottom and provide fish eggs and fry as food source.
- Biological production stimulated by the moderate addition of fertiliser.
- Mid October harvesting by fyke nets and eel-box-traps.
- End October 100 marked fingerlings stocked in each section to determine survival by a mark-recapture experiment.
- November all sections harvested by electro fishing.

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Results part 2

Pond trials	Stocking		Harvest			Growth		Growth	Growth	
	Average	Average	Number	Average	Average	Average	Average	Days	SGR	SGR
	gram	cm	caught	gram	cm	gram	cm	Average	% gram/day	% cm/day
Elvers	0,225	6,7	217	12,0	19,4	11,8	12,7	183,0	2,17	0,58
Fingerlings	9,13	18,4	262	21,0	23,9	11,9	5,5	178,7	0,47	0,15

Pond trials	Stocking		Condition factor	Harvest			Condition factor	Growth	
	Average	Average	Average	Number	Average	Average	Average	Average	Average
	gram	cm	CF= W100/L^3	caught	gram	cm	CF= W100/L^3	gram/day	cm/day
Elvers	0,225	6,7	0,075	217	12,0	19,4	0,164	0,064	0,070
Fingerlings	9,13	18,4	0,147	262	21,0	23,9	0,15	0,066	0,031

Pond trials	Harvest			Recovery	Survival
	Number	Average	Average	%	%
	caught	gram	cm		
Elvers	217	12,0	19,4	72,3	91,1
Fingerlings	262	21,0	23,9	87,3	96,7

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Results part 2

- High recovery of stocked animals
- High survival and good growth of glass eels and fingerlings
- Survival of fingerlings slightly higher than glass eels
- Growth of glass eels is higher than fingerling as expected
- Growth performance glass eels close to observations in eel farms (optimal temperatures and high energy nutrition).
- Fingerlings slightly lower growth than in farms

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Conclusions

- Pre-grown eel fingerlings of around 10 grams at least the same survival as glass eels after restocking in natural waters.
- Growth rate of fingerlings is lower in natural ponds than in eel farms. glass eels show almost comparable growth rates in ponds compared to farms.
- Glass eels and fingerlings show higher growth and lower mortality than assumed in several eel population models.

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Recommendations for additional research to complete the picture on contributions of eel farms to recovery of the natural eel stocks

- Determine growth and survival of glass eels and fingerlings **in the presence of predators**?
- Find proof that silver eels originating from glass eels and fingerlings display effective **homing behaviour**?

Mini-documentary on the 2011 project

VTS_01_1 - Snelkoppeling.lnk