

Evaluation of three external marking methods for differentiating farmed and wild Atlantic salmon

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Rationale for the study

Farmed Salmon escapes - one million per year

- **Loss to the farmer**
- **Importantly interaction with wild fish.**
 - **Problem with distinguishing wild and farmed fish**

Possible methods

- **Marking and tagging of farmed fish**
- **Developing molecular markers**

**Molecular markers – sophisticated but expensive.
Combined with traditional marking methods, use of molecular marker could become a viable method.**

FHF funded three projects in 2012

- **Evaluation of selected traditional marking/tagging methods for tracking escaped farmed salmon.**
- **Evaluation of the welfare of marked/tagged farmed salmon.**
- **Evaluation of molecular markers and tools to identify the origin of farmed salmon.**

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Goal of our project

- Evaluate the existing marking/tagging methods in terms of
 - Easy implementation
 - Easy detectability
 - Higher retainability
 - Developing effective (automatic) marking methods.

Selected marking methods for our study

- Adipose fin clipping
- Visible Implant Elastomer (VIE)
- Freeze Branding

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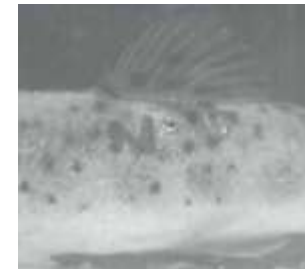
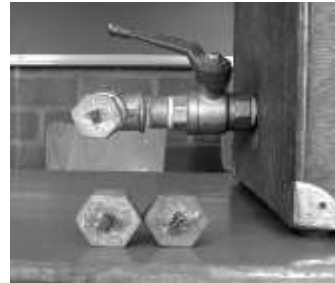
Adipose fin clipping



Visible Implant Elastomer (VIE)



Freeze Branding



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General experimental description

- All fish will be pit tagged (except for pit tag control).
- Two replicate tanks.
- Experiment will start in week 5.
- First 4 months in indoor tanks (freshwater).
- Next 6 months in sea cages (after smoltification).
- Three length weight measurement (0, 4 and 10 months).
- Mark readability and retainability evaluation at 4 and 10 months.

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Work Package 1 - Experiments

Experiment 1

Effects of individual and combined marking methods on growth and survival of the fish and durability and readability of the mark.

Mark/Tag	# of fish
Adipose tissue removal (complete)	100
VIE (Behind eye)	100
Freeze brand (Below dorsal fin)	100
Adipose + VIE	100
Adipose + Freeze brand	100
Total number of fish for Exp. 1	500

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Experiment 2

Effects of location of marking (freeze branding and VIE marking) on growth and survival of the fish and mark retention and readability.

Mark/tag	# of fish
VIE (Below dorsal fin)	100
Freeze brand (Dorsally above head)	100
Total number of fish for Exp. 2	200

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Experiment 3

Partial and complete removal of adipose fin on the growth and survival of the fish and regeneration of the fin.

Mark/tag	# of fish
Adipose (3/4 removal)	100
Total number of fish for Exp. 3	100

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Controls

Types of control	# of fish
Only Pit tag (for experiment 1,2,3)	100
No Pit tag or marks (pit tag control)	100
Total number of fish for control	200

Total number of fish	1000
With replicate	2000

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Start Date: 01 Feb 2012

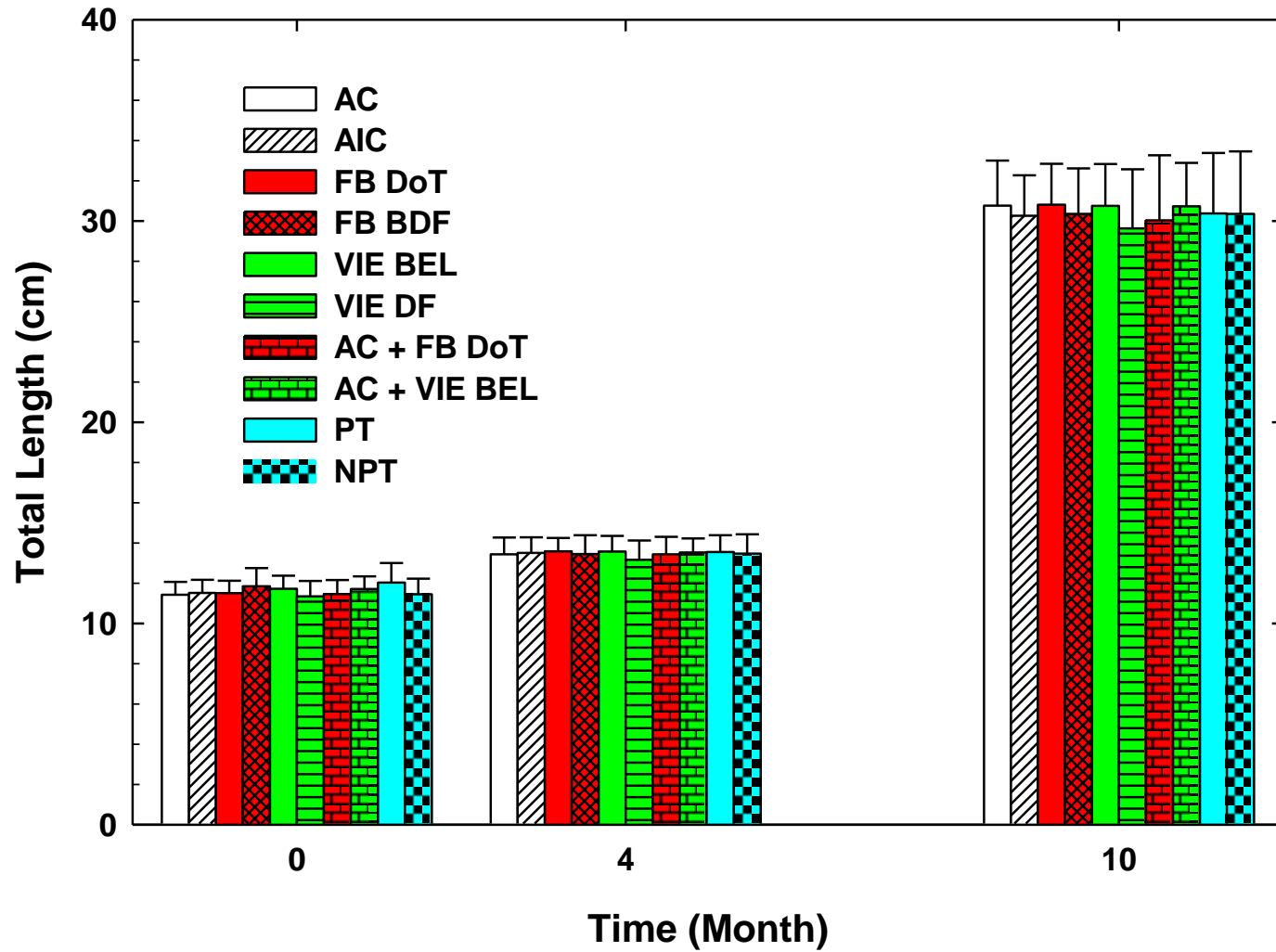
Initial Fish size: 20g

First sampling: 22 May 2012

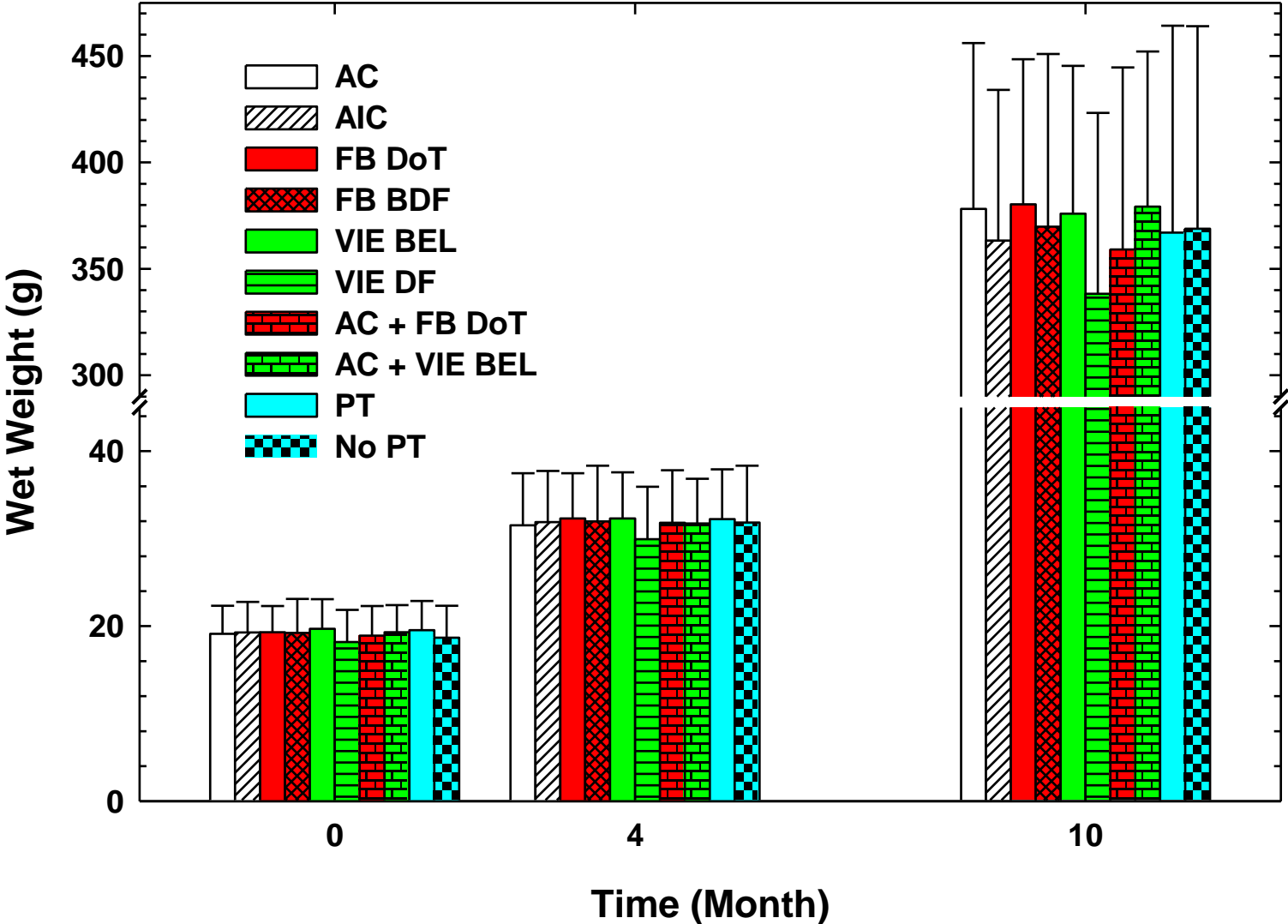
Transfer to sea cage: June 2012

Second sampling date: 12 November 2012

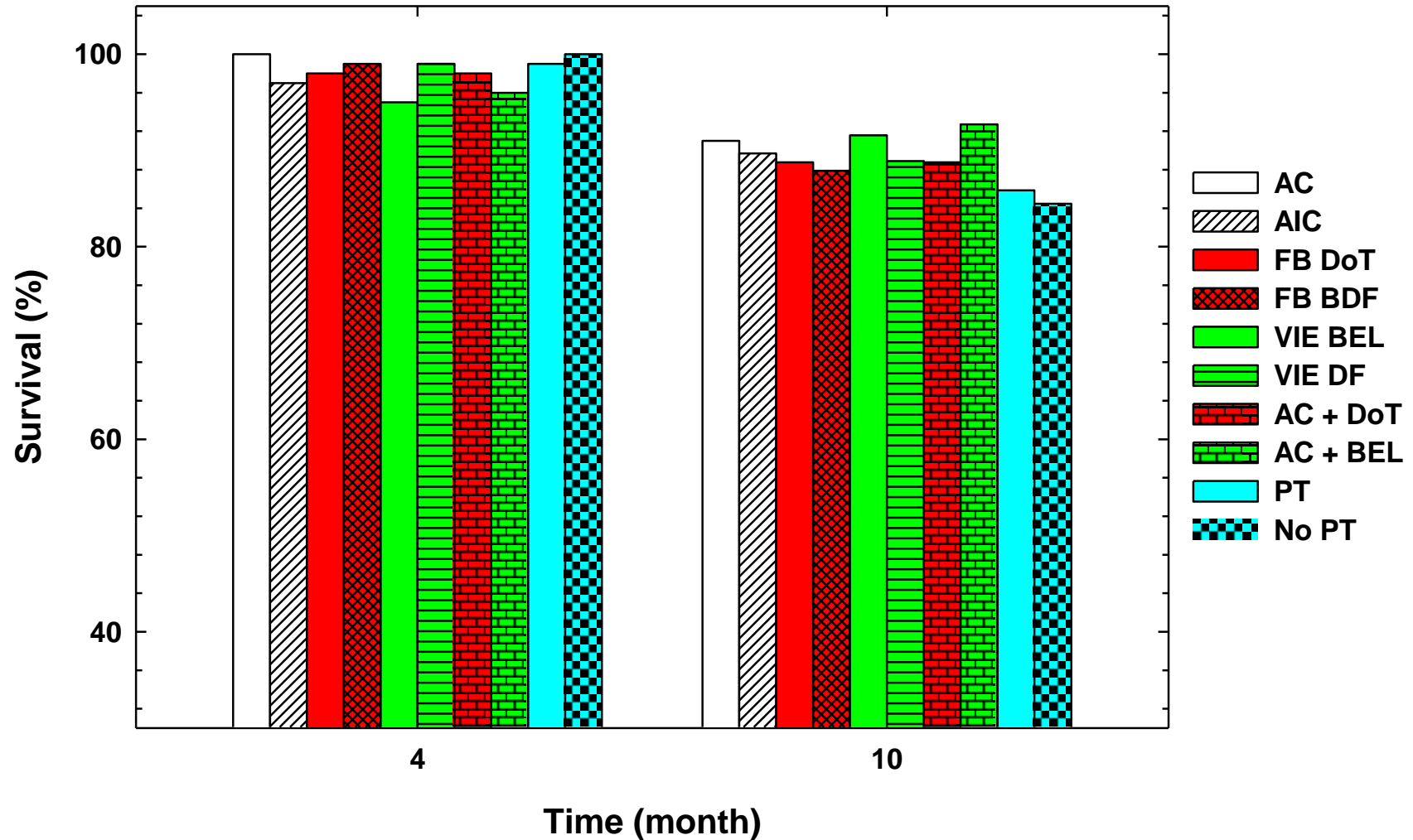
Results - Growth



Results - Growth

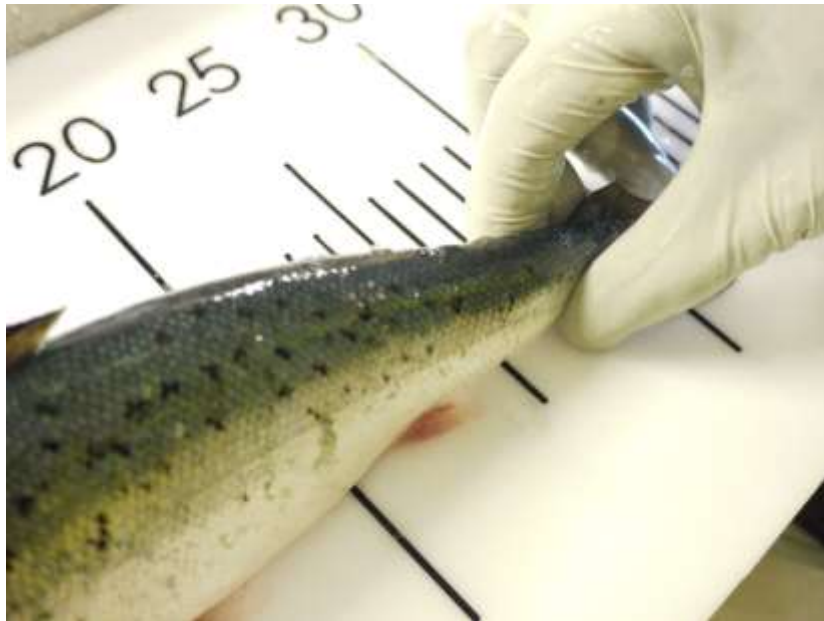


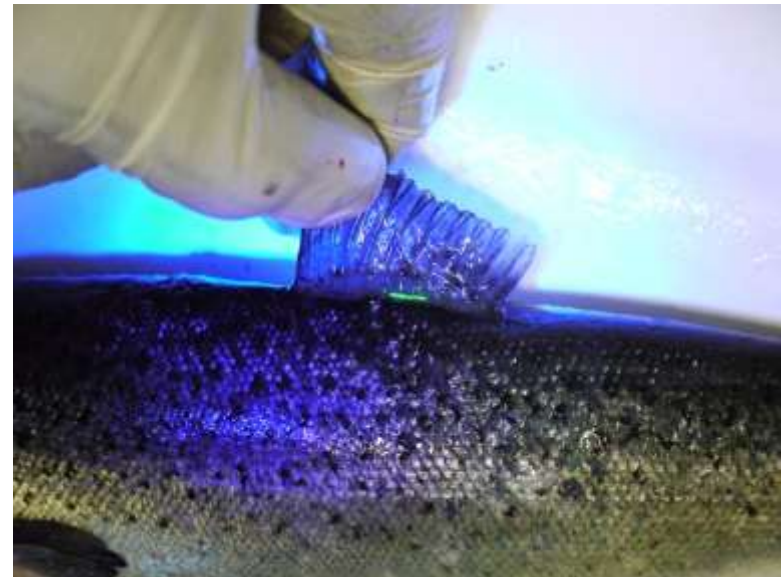
Results - Survival











Experiment 1 - Results

Effects of individual and combined marking methods on durability and readability of the mark.

Category	Marking Methods									
	Adipose Complete		FB Dorsal on Top		VIE Behind Eye Lid		AC + FB DoT		AC + VIE BED	
	4m	10m	4m	10m	4m	10m	4m	10m	4m	10m
0% regeneration (AC)	97	97					100	100	98	98
25% regeneration (AC)	3	3							2	2
Dark Mark (FB)			92				99			
Light Mark (FB)			6				1			
No Mark (FB)			2	100				100		
Readable without light (VIE)					32				58	
Readable with light (VIE)					42	29			29	44
Not readable (VIE)					26	71			13	56

Experiment 2 - Results

Effects of location of marking (freeze branding and VIE marking) mark retention and readability.

Category	Marking Methods							
	FB Dorsal on Top		FB Below Dorsal Fin (mid rib)		VIE Behind Eye Lid		VIE Base of Dorsal Fin	
	4m	10m	4m	10m	4m	10m	4m	10m
Dark Mark (FB)	92		100					
Light Mark (FB)	6			4				
No Mark (FB)	2	100		96				
Readable without light (VIE)					32		71	
Readable with light (VIE)					42	29	28	61
Not readable (VIE)					26	71	1	39

Experiment 3 - Results

Partial and complete removal of adipose fin on regeneration of the fin.

Category	Marking Methods			
	Adipose Complete		Adipose Incomplete (3/4)	
	4m	10m	4m	10m
0% Adipose Fin	97	97		
25% Adipose Fin	3	3	57	46
50% Adipose Fin			42	51
75% Adipose Fin			1	1
100% Adipose Fin				1

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Work Package 2 – Large scale marking

Requirement – Efficient, faster and legally bound.

Manual marking

- Modification of methods that used in vaccination

Automatic marking

- Recent development in automated vaccination

Activities:

- Evaluation of the **3 marking methods** in terms of efficiency and cost for manual and automated marking and labeling in combination with vaccination.
- Identify the development of technical equipment for automated marking.

Deliverable:

- **Ranking of the** suitability of the **different marking methods** in relation to today's and tomorrow's technology for marking fish on a large scale.

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Work Package 3 – Cost Analysis

Cost of the marking method – Important when making a choice.

- **Labour**
- **Capital Investment**
- **Consumables**

Activities:

- Collection of empirical data from large-scale marking.
- Assessment of the cost of manual labeling.
- Assessment of the costs of automated labeling
 - Marking as a separate process
 - Labeling in connection with vaccination

Deliverable:

- Cost Index for the **various marking methods**.

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Work Package 4 – Market Reactions to the different methods

Consumer reaction – Important factor to consider before implimenting

- **Different methods can have different ratings.**
- **Various consumer groups**

Activities:

- Assessment of **marking methods** in relation to the following criteria:
 - Quality - Effects of marking method on the product.
 - Food security.
 - Fish Welfare.
 - Environmental.

Deliverable:

- Ranking of each marking method using the "sum" of suitability in relation to the selected criteria..

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Work Package 5 – Overall Assessment

Inputs for assessment

- Results from WP 1-4.
- Results from Veterinary Institute study on fish welfare and health

Deliverable:

- Advice on the choice of identification method.
- Advice on implementation of the marking in farming

Tentative recommendation

Complete removal of adipose fin.

Automation - Combine with vaccination.

Customer reaction – ongoing

Environmental group reaction - Ongoing

