# 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.
  - o Problem with distingishing wild and farmed fish

Possible methods
- ➤ Marking and tagging of farmed fish
- ➤ Developing molecular markers

Molecular markers – sophisticated but expensive.
Combined with tranditional 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.
- ➤ Evauation of molecular markers and tools to identify the origin of farmed salmon.
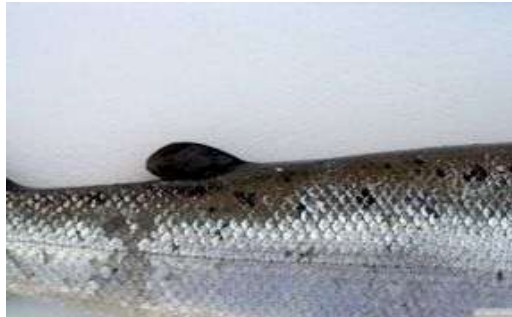
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**Goal of our project**

> ➢ **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
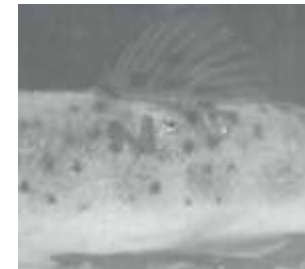


¾ back adipose removal

Complete adipose removal

## 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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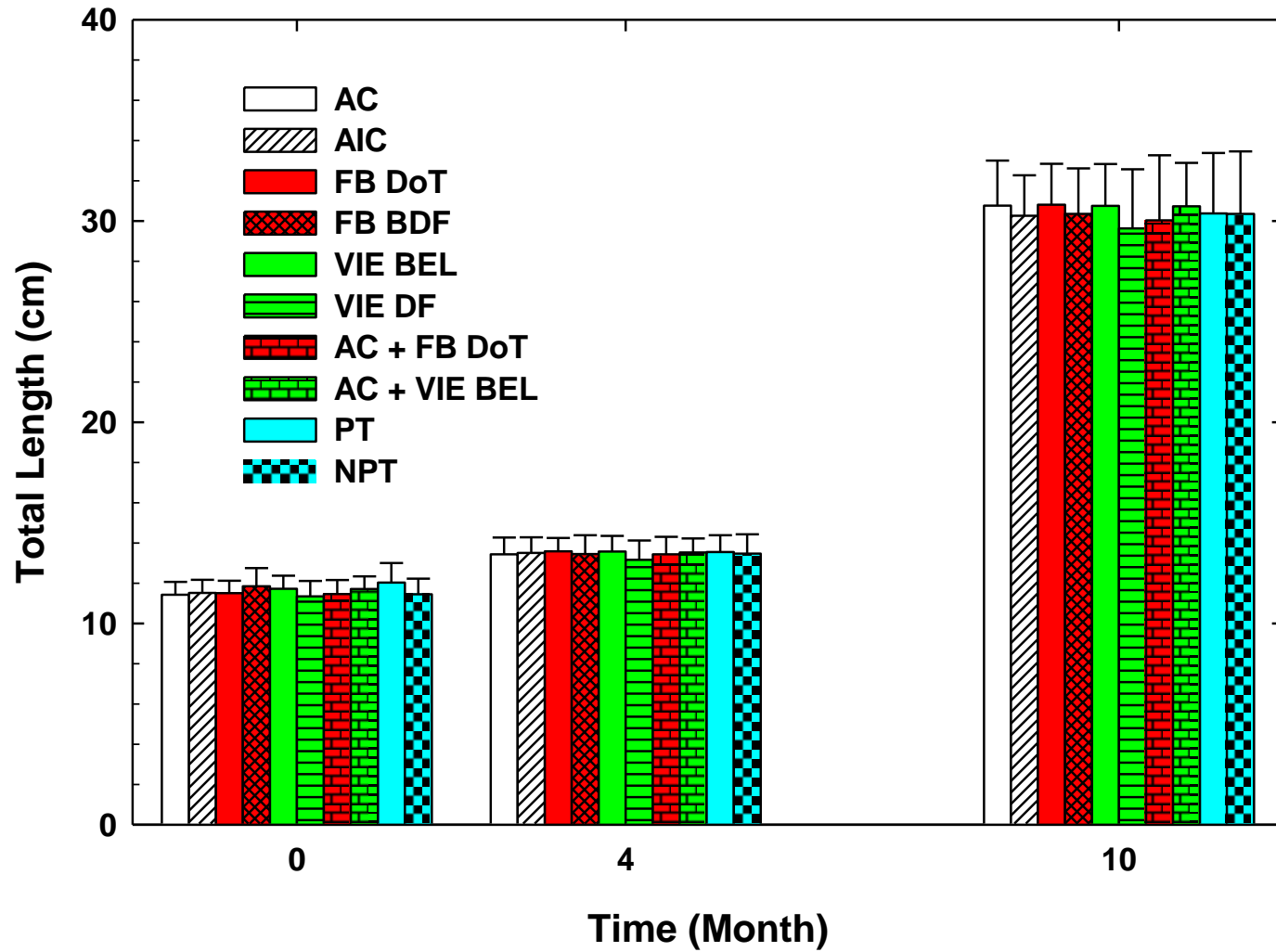# <span style="color:red">**Sporlaks**</span>

Start Date: 01 Feb 2012
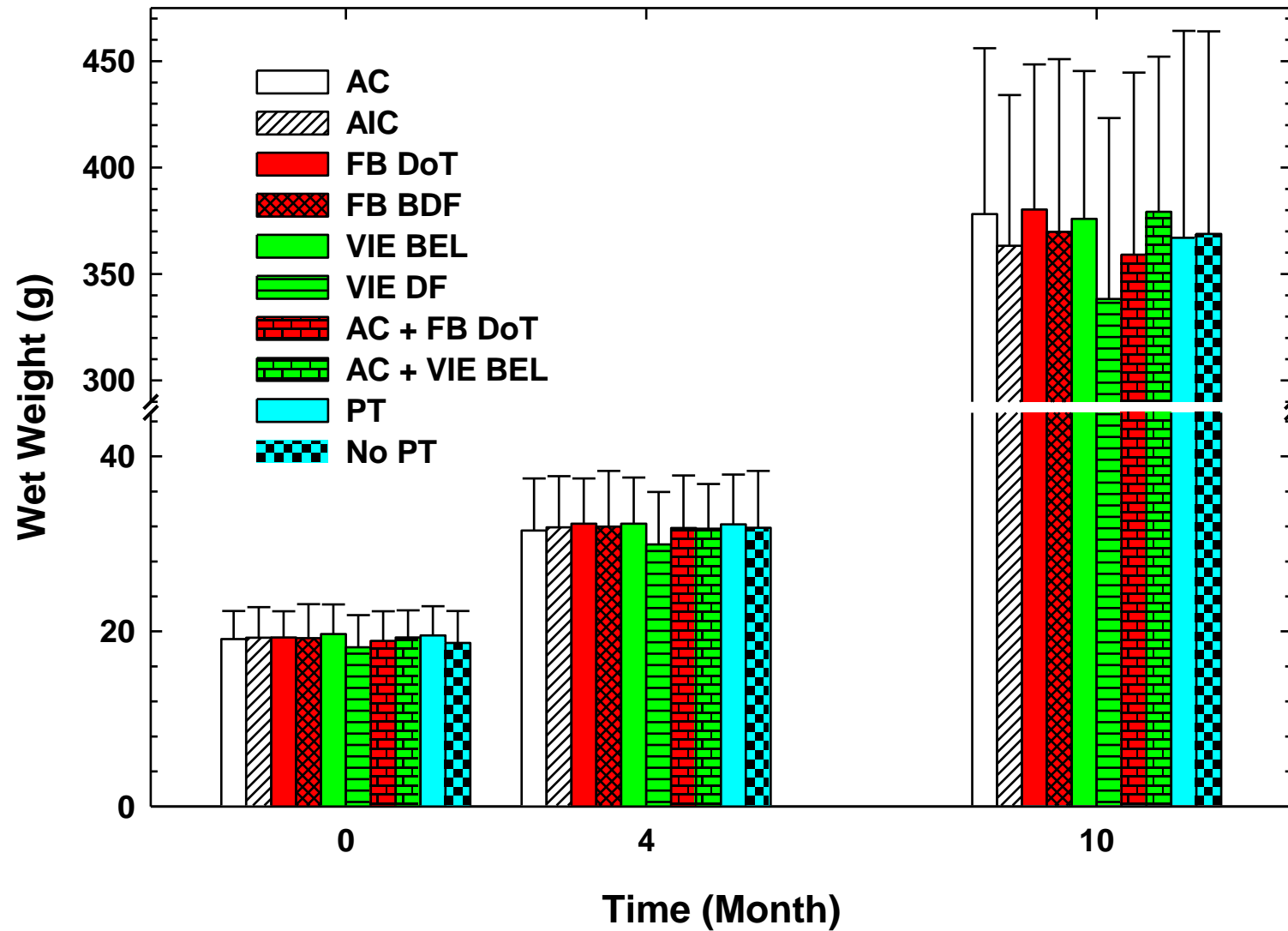Initial Fish size: 20g

First sampling: 22 May 2012

Transfer to sea cage: June 2012

Second sampling date: 12 November 2012

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# Results - Growth

# Results - Growth

# Results - Survival



Survival (%) vs Time (month). Bar chart comparing survival percentages at 4 and 10 months across treatment groups: AC, AIC, FB DoT, FB BDF, VIE BEL, VIE DF, AC + DoT, AC + BEL, PT, No PT.

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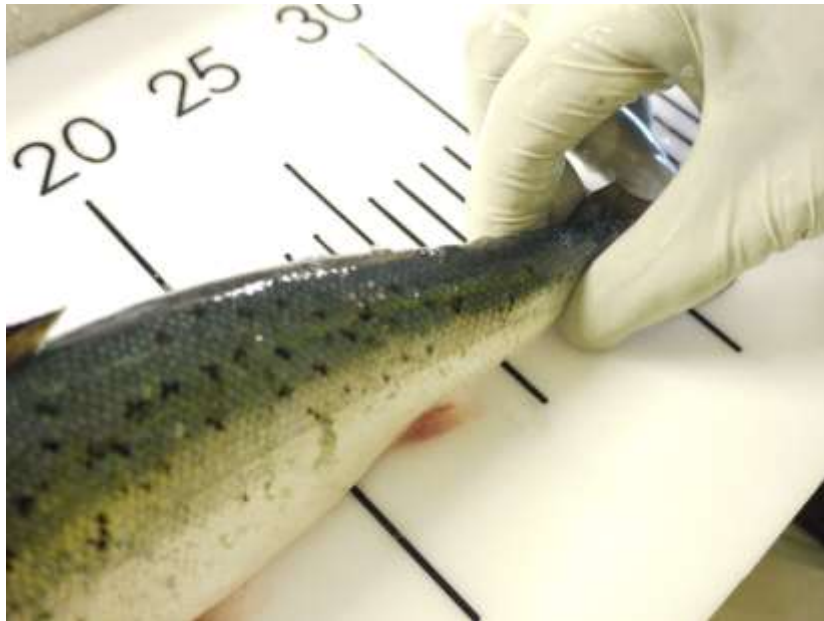Nofima
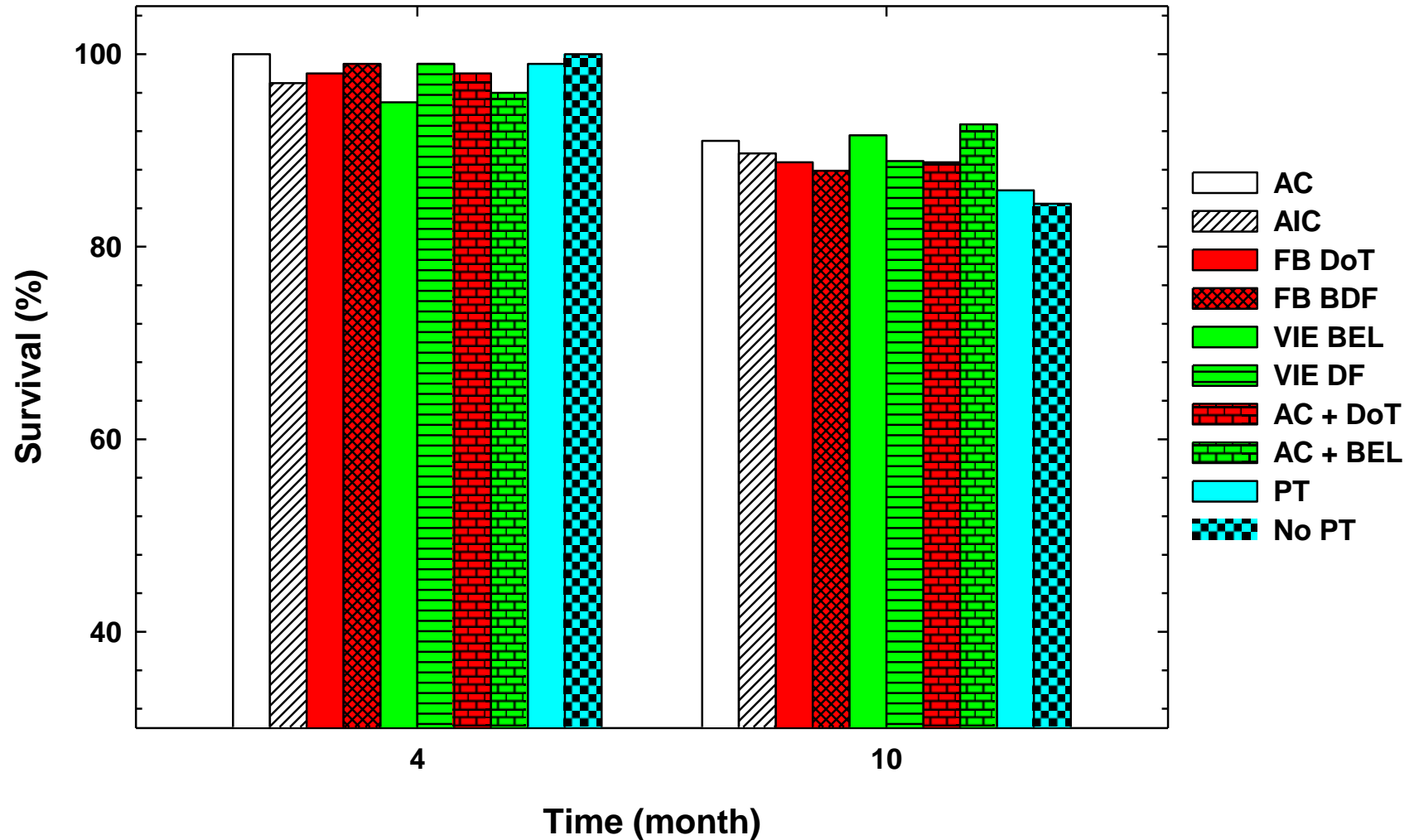
# Experiment 1 - Results

## 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 |

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# 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 |

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# 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.
    - o Food security.
    - o Fish Welfare.
    - o 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 asseessment**
- ➢ **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

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# Tentative recommendation

Complete removal of adipose fin.

Automation - Combine with vaccination.

Customer reaction – ongoing

Environmental group reaction - Ongoing