


Trondheim, November 2013
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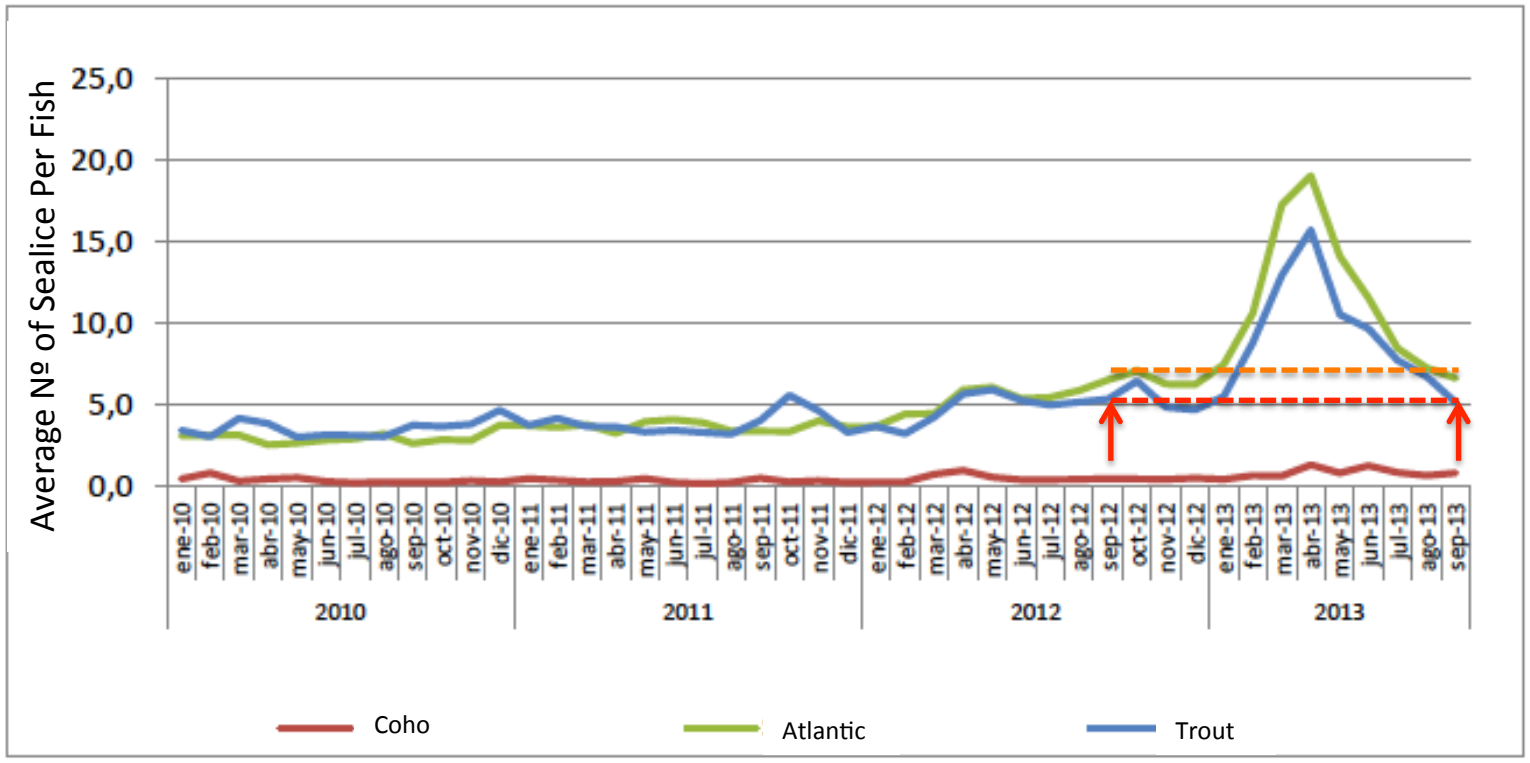
OCEA Delouser®, an innovative Delousing Technology

1- Background

SEALICE TENDENCY IN CHILE

Sealice Per Specie



Source: Sernapesca

Comment: It is possible to see that, despite current situation is relatively "normal" we are facing the same scenario than 2012 which finished in a dramatic situation from February to June 2013

1- Background

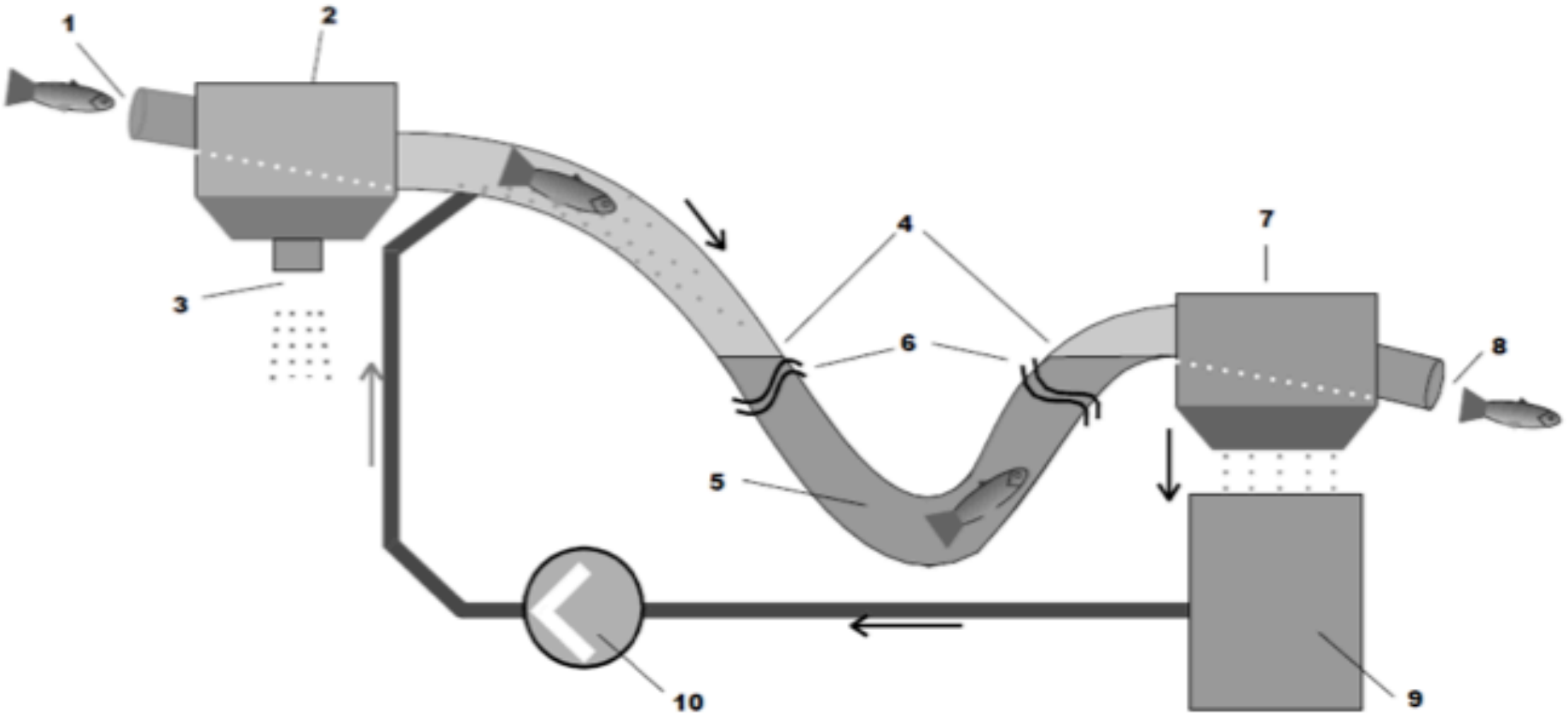
- By the end of 2011 and beginning of 2012, OCEA A/S started a trial process using a new technology based on slightly warm seawater for sealice treatment. OCEA built a system called OCEA Delouser®, based on this technology.
- Considering that in Chile the *Caligus Rogercresseyi* (Chilean Sea Lice) situation was quite dramatic, in July 2012 the company decided to move the system to Chile, starting a trial process on December 2012.
- From December 2012 to date, more than 1,2 million fish has been treated with **excellent results regarding delousing effect** and **reaching optimal levels of post-treatment mortality**.
- Current challenge is to **increase the capacity** of the system as well as do **market introduction** of this innovative solution.

2- Principle

Exposure of Caligus to slightly warm seawater (28 to 35 Celsius Degrees) for Approx. 20 - 30 seconds removes and kills more than 98% of adult lice from the fish and Approx. 40% of juvenile lice.

2- Principle

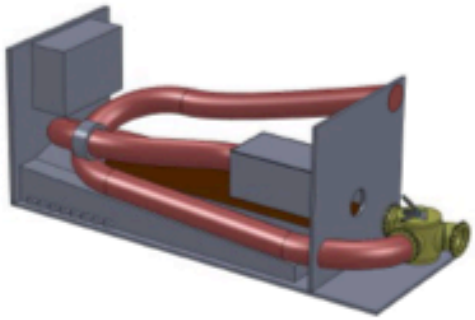
1. Fish is pumped in. 2. Separation fish and water. 3. Cold water outlet. 4. The fish are flushed with warm water. 5. The fish are pumped with warm water in a v-shaped tube. 6. Solid water surface. 7. Separation warm water and fish. 8. Fish is pumped out. 9. Warm water is lead into a tank and reheated to correct temperature. 10. Treatment water is pumped back to treatment tube.

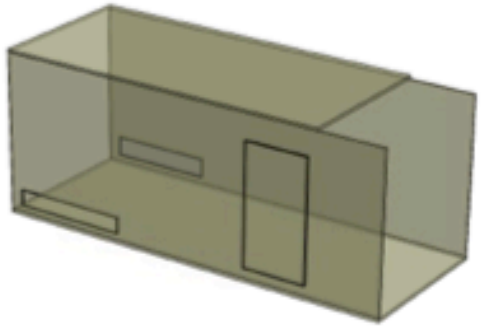


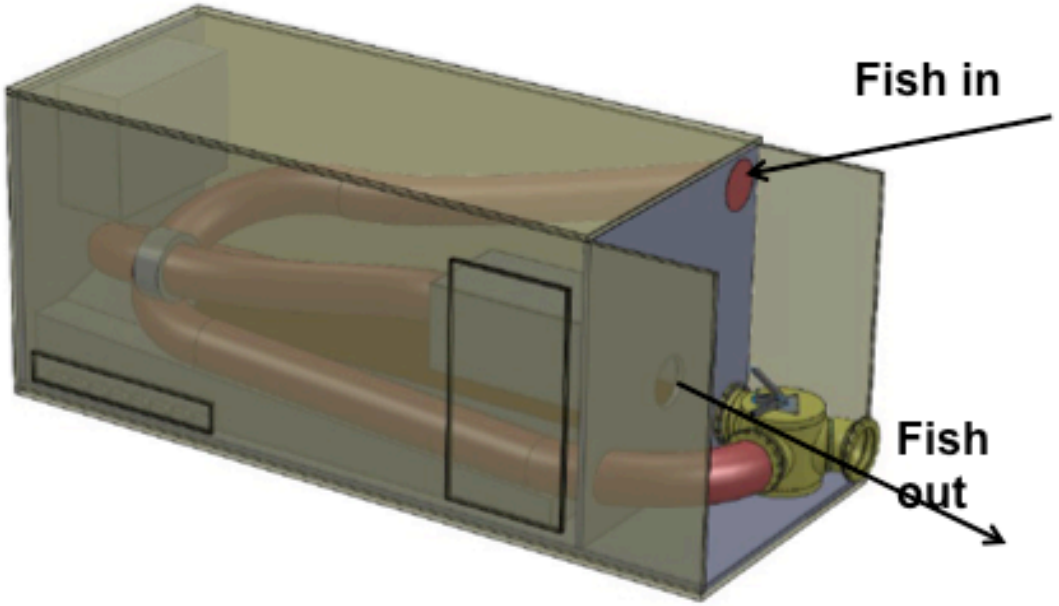
3- OCEA Delouser® - The Machine

2013 Delouser

- Focus on welfare
- Increased heat capacity
- Development of control and instrumentation







3- OCEA Delouser® - The Machine

3- OCEA Delouser® - The Process

Pumping fish to the Delouser

Inlet to the Delouser

Drain of external water

Collecting fish using a net

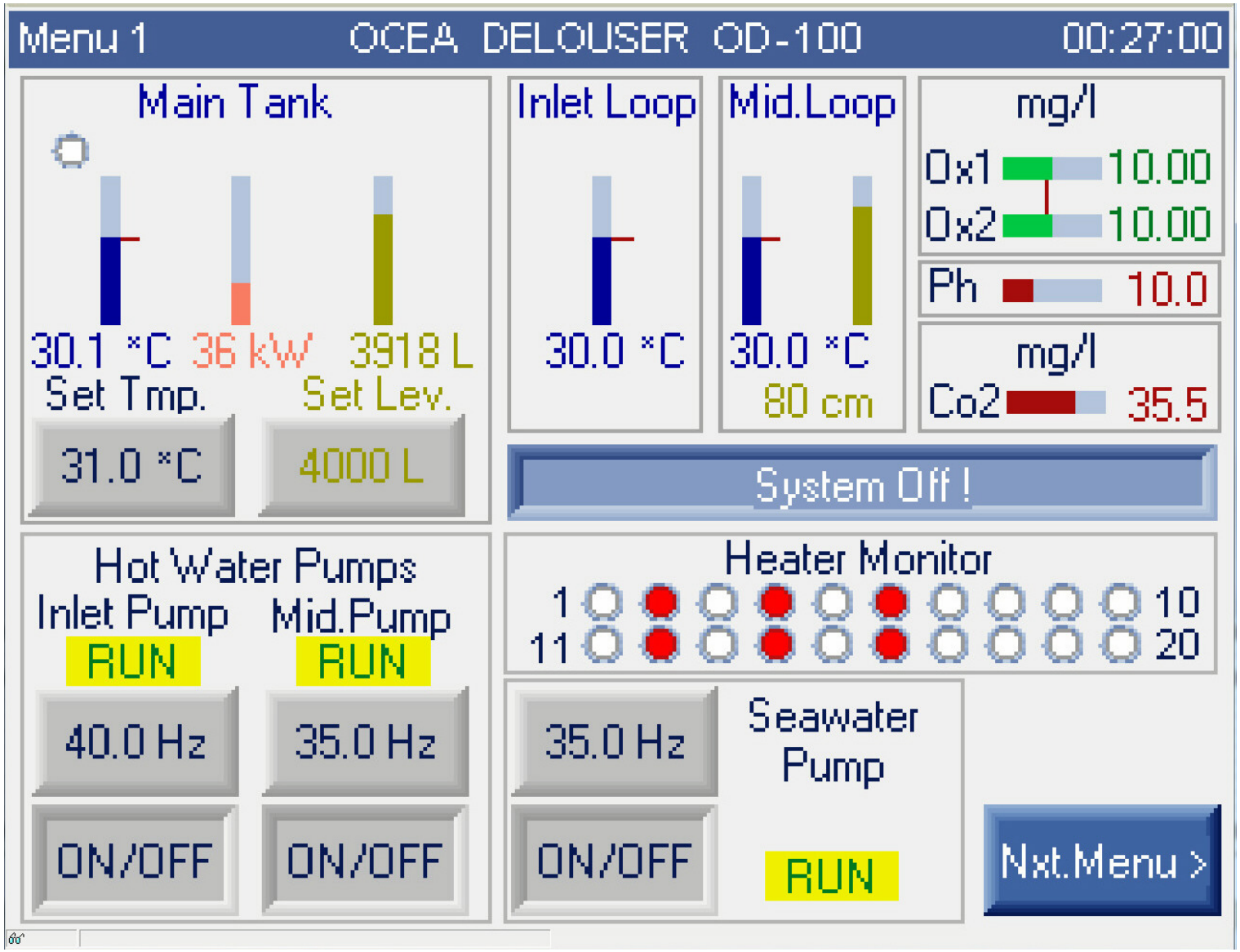
Fish with lice

CLEAN FISH

Delouser operating

Outlet back to the cage

3- OCEA Delouser® - The Control



4- Comparison Between Methods

OCEA DELOUSER® AND ALTERNATIVE METHODS COMPARISON

	ORAL TREATMENTS	BATH TREATMENT WITH PYRETHROIDS	BATH TREATMENT WITH AZAMETIFOS	DELOUSER
PROCEDURE	Addition of medicine in the food	Bath using a closed tarpaulin where a chemical is added	Bath using a closed tarpaulin where a chemical is added	Bath using heated sea water in a controlled closed system
ADVANTAGES	Easy to give	Effective in small fish	Effectiveness	Effectiveness Environmentally friendly Possibility to Count & Weight the Fish Sealice is killed and collected **DOES NOT PRODUCE RESISTANCE** Cost
DISADVANTAGES	Effectiveness Limitations because of pharmaceutical residues	Effectiveness in fish bigger than 1,5 Kgs- Eliminates in average 50% of adult sealice Use of chemical Cost Increasing resistance of parasite to the chemical Sealice remains in the environment Stress in fish		System must be proven during at least 12 months in order to validate performance Fish handling Capacity for big fish

5- Results

FIRST STEP - OBJECTIVE: SEA FISH BEHAVIOR AND HEATED WATER EFFECT

COMPANY	SITE	CAGE	SPECIE	DATE	Nº of Fish	Average Weight	Treatment Effectiveness (Sealice Removal)			Mortality 3 Days After Treatment
						Kgs	juvenile %	adults %	female %	%
[redacted]		ND	Trout	Nov. 12	250	2,8	No Measured			No Measured
		ND	Trout	Nov. 12	750	2,8	No Measured			No Measured
		ND	Trout	Nov. 12	1.700	2,8	No Measured			No Measured
		ND	Trout	Jan 13	500	1,2	No Measured	100%	No Measued	10,00%
		ND	Atlantic	Jan 13	47.677	0,8	No Measured	100%	No Measued	1,56%
		ND	Atlantic	Jan 13	23.174	1,0	No Measured	100%	No Measued	2,24%
				TOTAL	**74.051**	**0,9**		**100%**		**1,84%**

MAIN IMPROVEMENT: Oxygen Addition after Treatment

SECOND STEP TRIALS - OBJECTIVE: FIRST IMPROVEMENT FOR MORTALITY DECREASE

COMPANY	SITE	CAGE	SPECIE	DATE	Nº of Fish	Average Weight	Treatment Effectiveness (Sealice Removal)			Mortality 3 Days After Treatment
						Kgs	juvenile %	adults %	female %	%
[redacted]		ND	Atlantic	March 13	34.085	0,6	No Measured	100%	No Measured	0,46%
		ND	Trout	March 13	31.620	0,5	No Measured	99%	No Measured	0,54%
		ND	Trout	March 13	11.620	0,5	No Measured	98%	No Measured	0,54%
		ND	Atlantic	March 13	2.564	5,0	No Measured	99%	No Measured	2,85%
		ND	Atlantic	March 13	35.000	1,2	No Measured	99%	No Measured	1,29%
		ND	Atlantic	March 13	47.621	1,6	No Measured	99%	No Measured	0,61%
		ND	Atlantic	March 13	50.850	1,6	No Measured	99%	No Measured	0,35%
		ND	Atlantic	June 13	45.088	1,4	No Measured	93%	No Measured	1,14%
				TOTAL	**258.448**	**1,2**		**98%**		**0,73%**

5- Results

MAIN IMPROVEMENT: Extra recirculation pumping in order to avoid that fish remain in the system more than 30 [sec] and degasification system for recirculating water.

THIRD STEP TRIALS - OBJECTIVE: SECOND IMPROVEMENT FOR MORTALITY DECREASE								
COMPANY	SITE	CAGE	SPECIE	DATE	N° of fish	Average Weight	Treatment Effectiveness (Sealice removal)		Mortality 3 Days After Treatment
						Kg	Adult / Female %	Juvenile %	%
			Atlantic	ago-13	45.135	1,6	94%	69%	0,02%
			Atlantic	ago-13	44.337	1,9	99%	60%	0,16%
			Atlantic	ago-13	47.002	1,7	99%	40%	0,06%
			Atlantic	ago-13	45.835	1,9	98%	50%	0,04%
			Atlantic	ago-13	47.686	1,9	99%	61%	0,03%
			Atlantic	ago-13	42.499	1,8	99%	57%	0,06%
			Atlantic	oct-13	36.212	1,1	97%	77%	0,09%
			Atlantic	oct-13	35.129	1,1	100%	66%	0,09%
			Atlantic	oct-13	43.769	2,5	100%	39%	0,08%
			Atlantic	oct-13	45.416	2,5	99%	28%	0,02%
			Atlantic	oct-13	45.520	2,4	99%	41%	0,60%
			Atlantic	oct-13	46.684	2,3	100%	40%	0,05%
			Atlantic	oct-13	45.008	2,1	100%	58%	0,06%
			Atlantic	oct-13	47.551	2,5	100%	-25%	0,02%
			Atlantic	oct-13	38.967	2,4	97%	37%	0,08%
			Atlantic	oct-13	42.214	2,3	100%	46%	0,02%
			Atlantic	oct-13	33.385	2,7	100%	32%	0,04%
			Atlantic	oct-13	48.723	2,4	95%	5%	0,07%
			Atlantic	oct-13	44.018	2,7	96%	35%	0,10%
			Atlantic	oct-13	43.855	0,5	94%	15%	0,08%
			Atlantic	oct-13	43.532	0,5	97%	9%	[illegible]
				TOTAL	**912.477**	**2,0**	**98%**	**39%**	**0,09%**

6- Current Challenges

CAPACITY

Current Situation	Challenges / Tasks
• System's capacity is 30 [ton/h]. • Pumping method (mammut pump). • Enough heating capacity for 30 [ton/h].	• Desirable capacity is 100 [ton/h]. • Replace the pumping system by a direct one able to pump directly the fish from the cage. • Include an additional heating system.

Going from 30 to 100 [ton/h] is just matter of pumping and heating capacity. This issue can be addressed using larger pumps, larger pipes and more heaters, OR work with two (or three or "N") machines in parallel mounted on a boat. The customer decides…

8- Questions? / Comments?