INSTALLATION PROCEDURE AND VOLUME ESTIMATION OF TARPAULIN FOR CHEMICAL TREATMENT OF FISH IN FLOATING CAGES

SINTEF

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Infestation of salmon lice (Lepeophtheirus salmonis) is, together with escape, currently the main challenge in the salmon aquaculture industry in Norway. Use of chemicals has chased death of fish up to 300 metric tons, probably because of high concentration. To obtain correct dosage, it is crucial to calculate the exact water volume trapped by the tarpaulin. These uncertainties in estimating the water volume of the tarpaulin together with deformation during installation, caused by current forces, has prompted the necessity to study the different procedures used when installing the delousing tarpaulin. In this work, the procedures have been replicated in model experiments under different current conditions using scaled models of a cage (1:17) and tarpaulin. The project was founded by The Norwegian Seafood Research Fund (FHF) pr.nr. 901011.

The experiments were conducted in June 2014 at the SINTEF Flume Tank in Hirtshals, at the North Sea Centre, Denmark. The tank is a vertical circular water channel, driven by four impellers. The experimental section in the tank is 21.3 m long, 2.7 m deep and 8 m wide, and the maximum water current speed is 1 m/s.

The experiments involved installing a delousing tarpaulin around a fish cage, a Polarcircle type cage (1:17 scale model) with a cylindrical shaped net (conical bottom) and a sinker tube lifted to 5m depth (Fig. 1). The test cage was placed in a crowfoot-mooring configuration in the tank.

Fig. 1.

Four different tarpaulin shapes (bags) were investigated:
a) flat-, b) conical-, c) spherical- and d) conical section tarpaulin (Fig. 2). All the shapes were equipped with a reduction band that runs around the circumference of the bag a distance underneath the rim (indicated by the green line in Fig. 2). There are mainly two different ways to install a tarpaulin: Installing it against the ambient current or installing it normal to the current. In order to get the tarpaulin down and around the cage, it is necessary to use weights for the tarpaulin to sink, since the tarpaulin itself is more or less naturally buoyant.

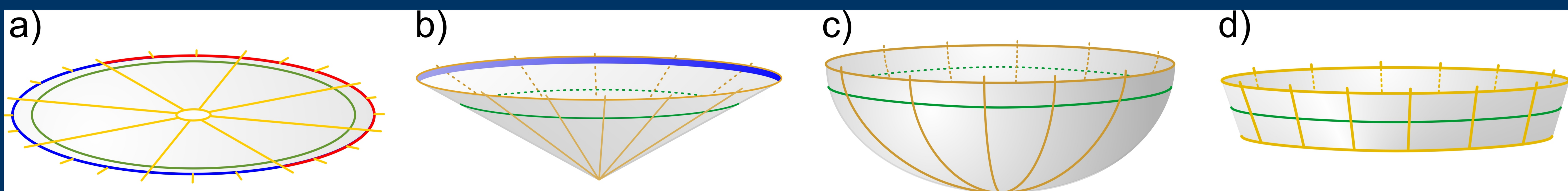

Fig. 2.

Table 1. Measurements of the water volume after tarpaulin installation (55 runs) for different tarpaulin shape and combinations of volume reduction (yes/no), installation direction and current velocity.

Tarpaulin shape	Installation procedure: Volume reduction	Installation procedure: Installation direction wrt current	Estimated volume [dm^3]	Measured water volume [dm^3] after installation of tarpauline and relative deviation from estimated volume [%] — Current during installation (full scale values in brackets): 0 cm/s		2 cm/s (8.3 cm/s)		5 cm/s (20.6 cm/s)		10 cm/s (41.2 cm/s)	
Flat	No	Normal	3327			2040	-39 %			2158	-35 %
		Against						2682	-19 %	3090	-7 %
	Yes	Against	1914	2058	8 %	2279	19 %	2301	20 %		
Conical	No	Normal	2336	1940	-17 %	2334	0 %				
		Against				2084	-11 %	2417	3 %	2819	21 %
	Yes	Against	1719	1382	-20 %	1943	13 %	2070	20 %		
Spherical	No	Normal	3376	2231	-34 %	2913	-14 %			3648	8 %
		Against				3616	7 %	3634	8 %		
	Yes	Against	2039	2738	34 %	2747	35 %	2889	42 %		
Conical section	No	Normal	3950							3667	-7 %
		Against				3968	0 %	4015	2 %	4193	6 %
	Yes	Against	2602	2566	-1 %	2790	7 %	2715	4 %	3667	-7 %

The main conclusion from the presented results is that the accuracy of the volume estimation for the delousing tarpaulin is low (root mean square (RMS) = 21%). This accuracy is significantly lower than what is considered satisfactory (< 5% for delousing agents and 1 % for H_2O_2). There are significant differences in the accuracy for different tarpaulin shapes and current velocities. The tarpaulin shape with the best accuracy in volume estimation is the conical section (RMS = 9%), and the results indicate that the volume estimation becomes more accurate for increasing current velocities.

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