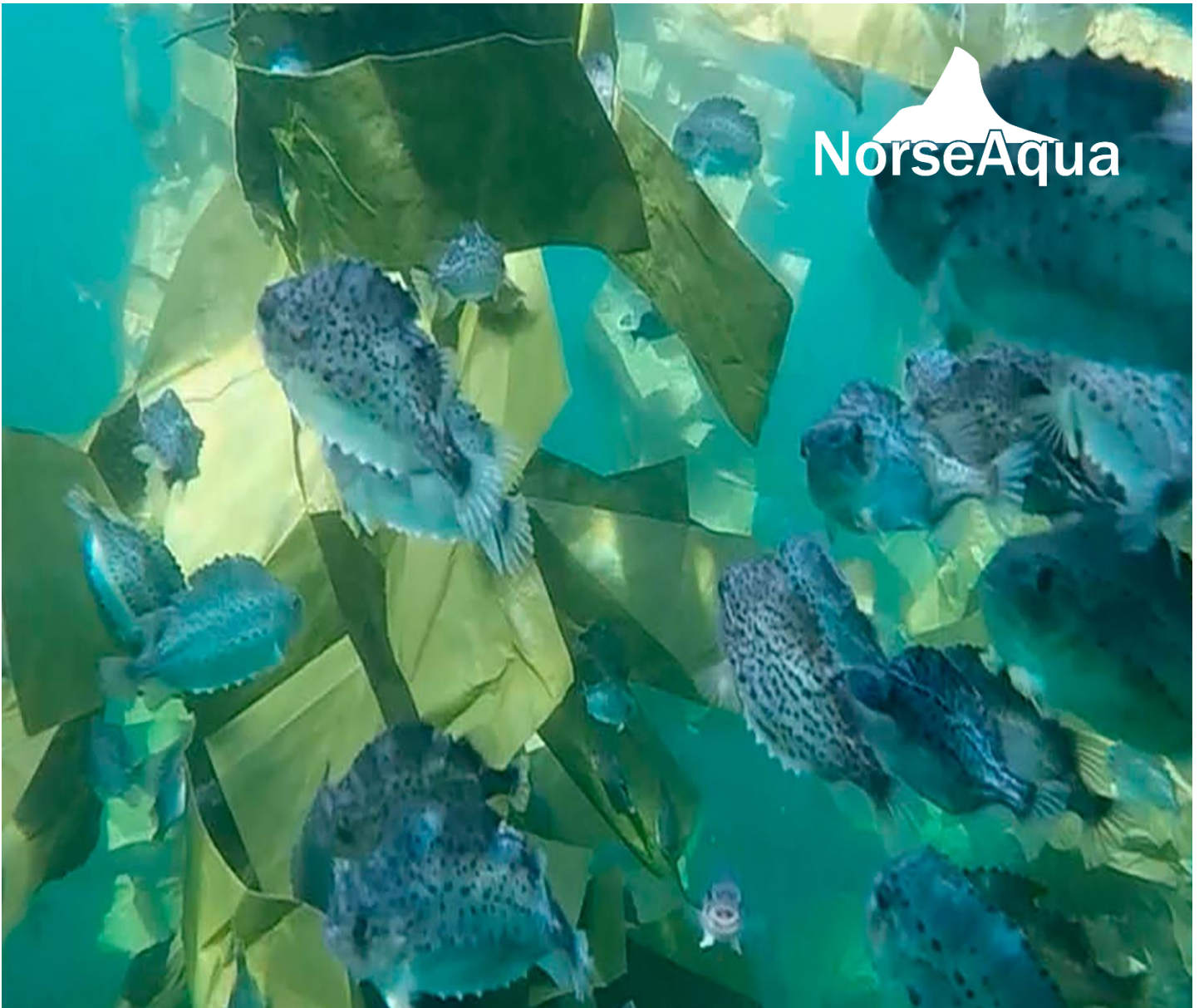




NorseAqua



Cleanerfish hides

User manual

1 TABLE OF CONTENTS

2	<i>INTRODUCTION</i>	3
3	<i>SAFETY</i>	3
3.1	General safety	3
3.2	Receiving new equipment	4
3.3	Disinfecting equipment	4
3.4	Safety for personnel	4
3.5	Bad Weather	4
4	<i>ABOUT NORSEAQUA AS</i>	4
4.1	Contact Information	5
5	<i>ABOUT THE PRODUCT</i>	6
5.1	Terminology	6
5.1.1	General terminology for hiding kelps	6
5.1.2	Curtain kelp terminology	7
5.1.3	Crane kelp terminology – What is what?	8
5.1.4	Panel	9
5.2	About Cleaning Fish Hides	9
5.3	Materials	10
5.4	Recommendations For Volume	11
5.4.1	Definition of square meters – For lumpfish (<i>Cyclopterus Lumpus</i>)	11
5.4.2	Definition of cradle length – For ballan wrasse (<i>Labrus bergelyta</i>)	11
5.4.3	Available squaremeters	11
5.4.4	Recommendations	12
5.5	Types of hides	12
5.6	Properties	13
5.6.1	Product identification	13
5.6.2	Expected life	13

5.6.3	Limits for use	13
5.6.4	Strength calculations	14
5.7	Risk evaluation for escaped fish from add-on equipment	15
5.7.1	This is how we calculate risk for escapes	15
5.7.2	Riskmatrix – Risk for escapes	15
6	INSTALLATION	17
6.1	Installation time	17
6.2	Instruction video	17
6.3	placement in cage	17
6.4	Safety distance	18
6.4.1	Circular angled pens	18
6.4.2	Straight-walled pen	19
6.4.3	Ovalisation at strong currents and high waves	19
6.5	Qualifications and instructions	19
6.6	Curtainkelp deployment	19
6.7	Drying	23
6.8	Installing Cranekelp	24
7	MAINTENANCE	26
7.1	Regular inspection/maintenance	26
8	TRANSPORT	27
9	STORAGE	27
10	TROUBLESHOOTING	27
10.1	Spare parts and service	27
10.2	Tracking information	27
11	DISPOSAL	28

2 INTRODUCTION

This product is engineered and produced according to "Nytek" regulations and NS9415 "legg inn beskrivelse av nytek og Ns9415?»

User manual helps you with the following:

Product description

- Limitations
- Risk assessment

Installation

Use

Maintenance

Transport

Storing

Troubleshooting

Disposal

Our goal is to give the products user most possible value during its lifespan, with as low security risk as possible. There is no need for any special knowledge to use this product or its user manual. Please contact Norse aqua if there are any questions to the product or its manual.

3 SAFETY

3.1 GENERAL SAFETY

This user manual describes safe usage of the product. Tasks not described in the user manual are only to be performed by Norse aqua personnel, or with written approval from Norse aqua. The owner of the site, where products are installed, are responsible for ensuring that national, state, and municipal laws and regulations are followed. The owner is also responsible for necessary safety equipment and routines for protecting personnel. Those that are going to use the product should be familiar with:

- How the hide works functions and how it should be used.
- How the product works together with the rest of the fish farm.
- Which safety measures that must be taken during use and maintenance.
- How to maintain the hide following procedures mentioned in this user manual.

3.2 RECEIVING NEW EQUIPMENT

Check that all parts listed in the packing list are delivered. If the delivery have anything missing, or if any parts have been damaged during transport, please contact NorseAqua.

3.3 DISINFECTING EQUIPMENT

If equipment, ropes and other related equipment be moved from one locality to another it is required by law to disinfect everything to prevent spread of disease. We recommend rinsing all equipment with freshwater after disinfection as the disinfection chemicals are usually very strong and can damage surface materials.

3.4 SAFETY FOR PERSONNEL

Anyone who is going to use the product must gain and understanding for how the equipment are to be used, and gain knowledge on the dangers of faulty use. Owner and site manager at the fish farm is responsible for all workers having understood the contents of this user manual. Protective gear like anti-slip foot gear and lifevests are mandatory when working at the fish cage, for example in connection with installation or maintenance. To avoid personnel injuries or equipment damage during installation, maintenance and repairs it is important to follow all instructions given by NorseAqua in this user manual, and also follow the rules and regulations of the country where the equipment is installed.

3.5 BAD WEATHER

Check all equipment after storm and bad weather. If any damage has occurred on equipment it has to be corrected immediately. Contact NorseAqua as soon as possible if assistance is needed in such cases.

4 ABOUT NORSEAQUA AS

NorseAqua's mission is to be an important player on the road towards 5 million tonnes of sustainably produced seafood in 2050.

NorseAqua is therefore working to find solutions on the biggest challenges in aquaculture.

And we are therefore grateful for feedback about us and the equipment we deliver. We would love to hear from you if you are experiencing challenges that we together can find solutions for. NorseAqua's boss is the customer, so we always seek feedback.

4.1 CONTACT INFORMATION

Company
NorseAqua AS
Tel: +47 473 68 943
post@norseaqua.no
Sørfjordveien 5
7980 Terråk
Norway
Organization number:
916 547 358 MVA

Product Manager
Martin Munkeby
+47 484 10 290
martin@norsequa.no

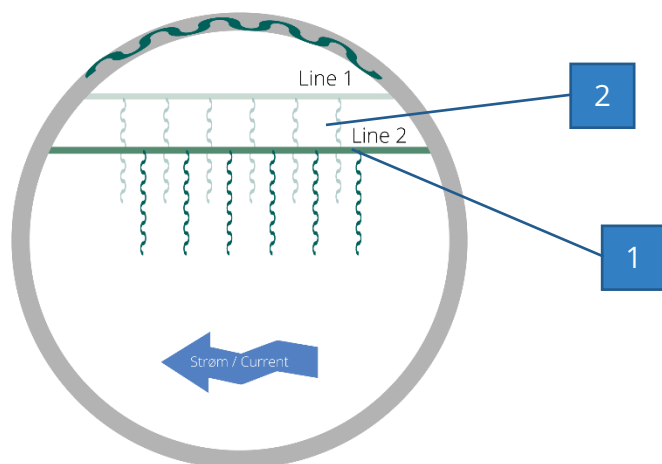
Sales Lead
Haakon Lund
+47 473 68 943
haakon@norseaqua.no

Marketing Executive
Simon Kveinå
+47 480 48 314
simon@norseaqua.no

5 ABOUT THE PRODUCT

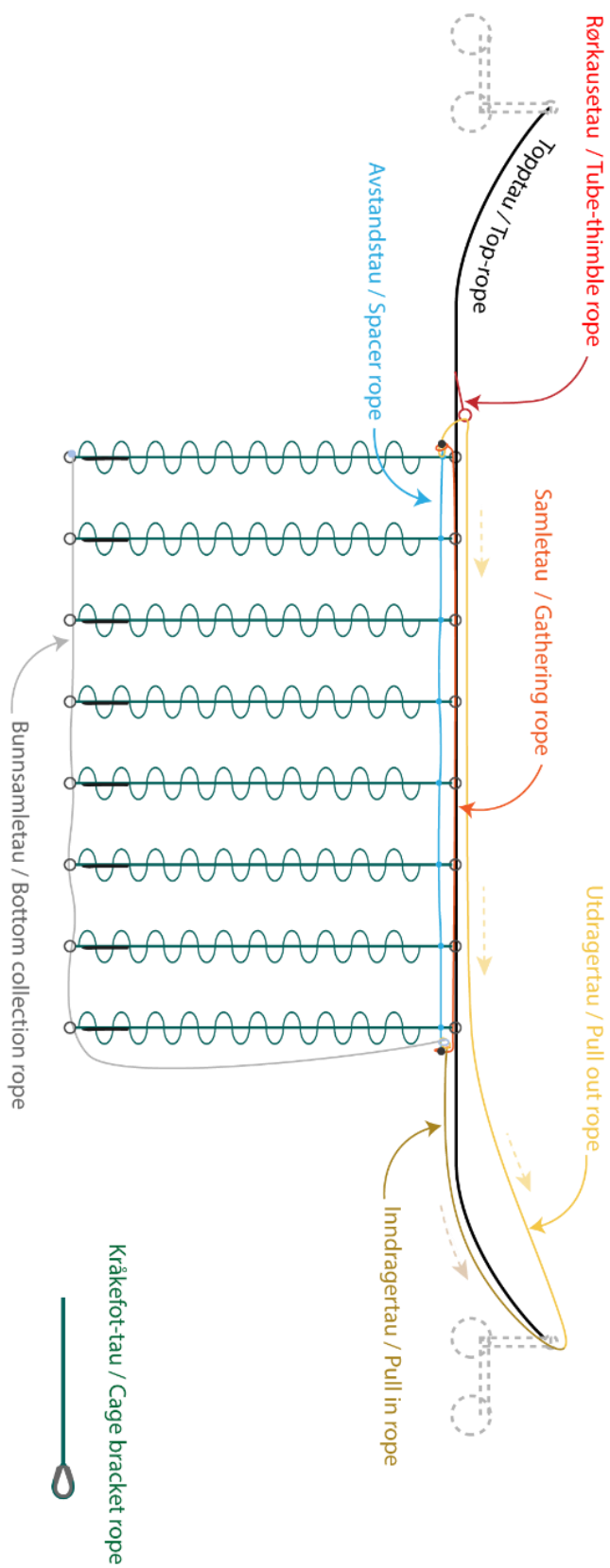
5.1 TERMINOLOGY

5.1.1 General terminology for hiding kelps

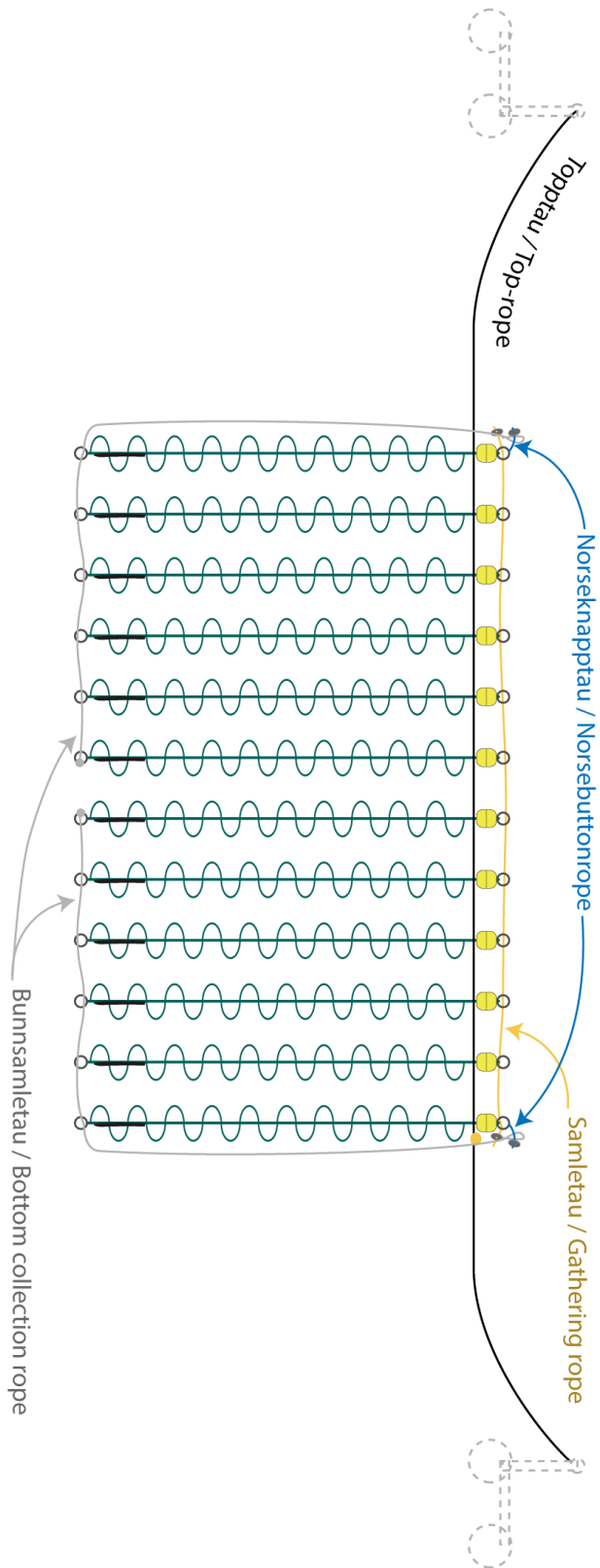


Norsk			English	
Punkt	Navn	Forklaring	Name	Explanation
1	Tarelinje	En enhet. Inkluderer alle komponentene som henger sammen.	Kelp line	One unit. Includes all components.
2	Rensegater	Området, eller gaten, som dannes mellom to tarelinjer-	Cleaner lane	The space between kelp lines.

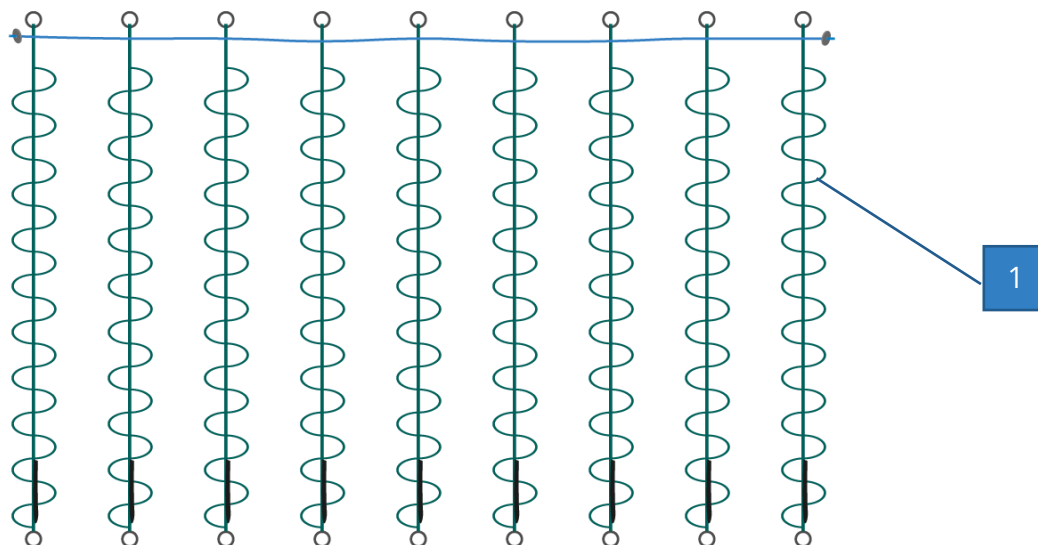
5.1.2 Curtain kelp terminology



5.1.3 Cranehelp terminology – What is what?

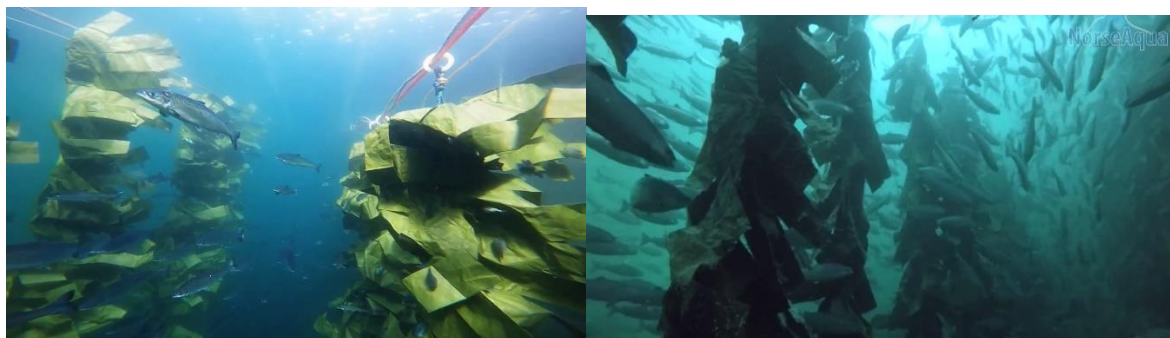


5.1.4 Panel



	Norsk		English	
Punkt	Navn	Forklaring	Name	Explanation
1	Panel	Tarestrenger som er satt sammen i en enhet.	Panel	Kelpstrings fastened together.

5.2 ABOUT CLEANING FISH HIDES



The purpose of artificial kelp is to simulate the natural habitat of the cleaning fish. We know that the hide functions as a place not only for rest and protection, but also as a zone for interaction between salmon and cleaning fish where lice can be eaten.

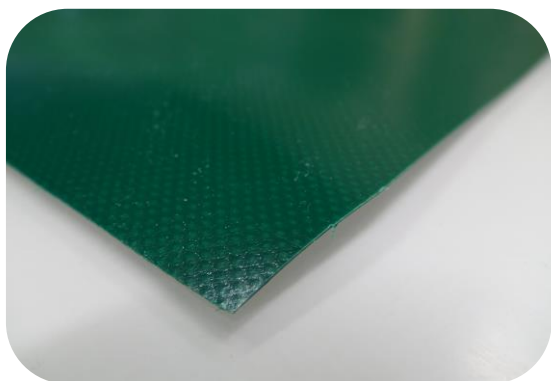
The hide works like a cleaner station. The salmon slows down and swims between the kelp strings to get cleaned by the cleaning fish. This behavior is also observed on wild salmon when it goes into fjords from the open seas and have lice that it wants to get rid off.

Conditions on the location like current, type of cage, type of nets, etc., are important when deciding what hide to use.

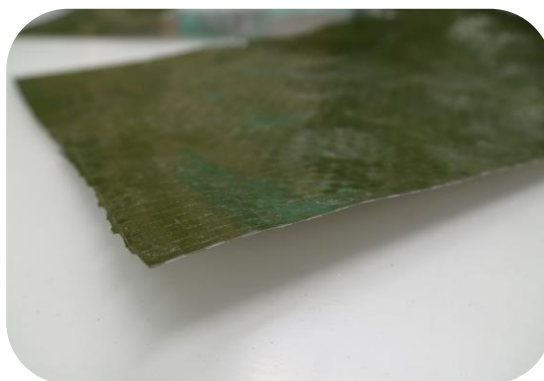
NorseAqua have several types of hides that are developed together with fish farmers to provide the best solutions. In addition we can offered tailored hides that will be ideal for your fish farm.

5.3 MATERIALS

The cleaning fish hides are made in high-density polyethylene (HDPE) or/and PVC which have different properties and fit different uses. The material is smooth to avoid biofouling and for easier cleaning.



PVC



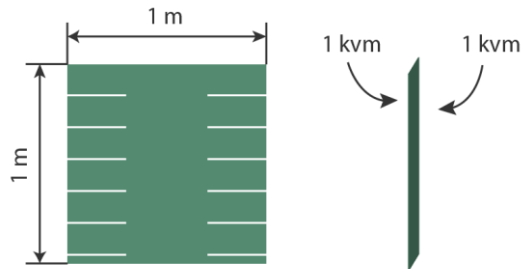
HDPE

Figure 1: Different types of materials

5.4 RECOMMENDATIONS FOR VOLUME

5.4.1 Definition of square meters – For lumpfish (*Cyclopterus Lumpus*)

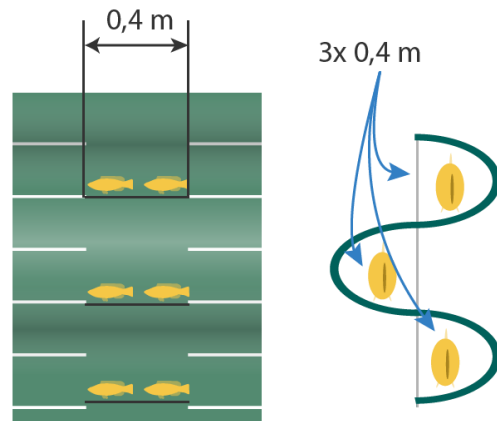
How large surface is available for the lumpfish to attach to?



Area is measured on flat surface. Both sides are included.

5.4.2 Definition of cradle length – For ballan wrasse (*Labrus bergeylta*)

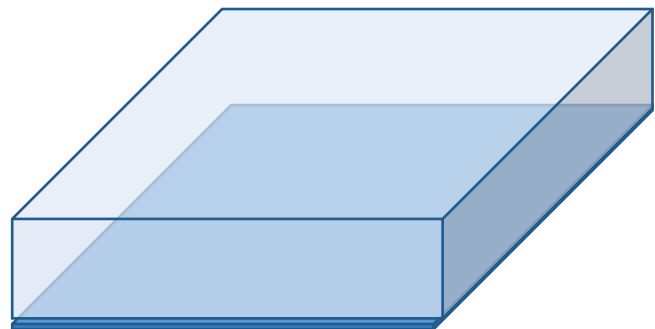
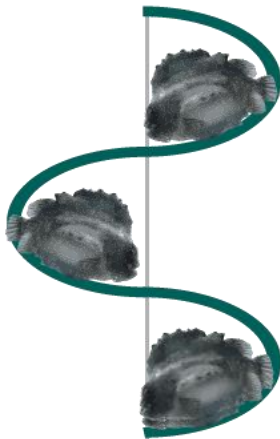
How long cradle space is available for the wrasse?



The cradle length is measured between the uncut part of the kelp in each fold.


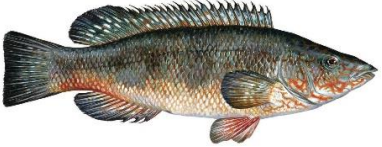

5.4.3 Available squaremeters

Every squaremeter of hide must have enough clearance to fit lumpfish.



If the hide is too dense, the tall-bodied lumpfish cannot fit.

5.4.4 Recommendations

<i>Fish type</i>	<i>Recommended and realistic amount of hide.</i>	<i>Ideal amount of hide</i>
 <i>Lumpfish</i>	10x pr sqm	5x pr sqm
 <i>Large wrasse (> 14 cm)</i>	12 cm cradle per fish	25 cm cradle per fish
 <i>Small wrasse (< 14 cm)</i>	5 cm cradle per fish	15 cm cradle per fish

Photos from Store norske leksikon. Snl.no

The recommendations are a result of operational experience where limits like cleaning and fish tending is considered. It doesn't help to have large amounts of hides if you cannot prevent biofouling.

Ideal amount of hides means that all fish at all times will be able to fit in the hide. In reality there will always be some fish that are swimming around in the cage.

5.5 TYPES OF HIDES

NorseAqua supplies in two types of hiding kelps. It is also possible to combine the two systems.



Curtainkelp

- Easy to maintain by hand.



Crane kelp

- Requires crane
- Less manual work.

5.6 PROPERTIES

5.6.1 Product identification

The product is labeled at the end of the top-rope.

5.6.2 Expected life

The hides are expected to work for at least 18 months in the ocean.

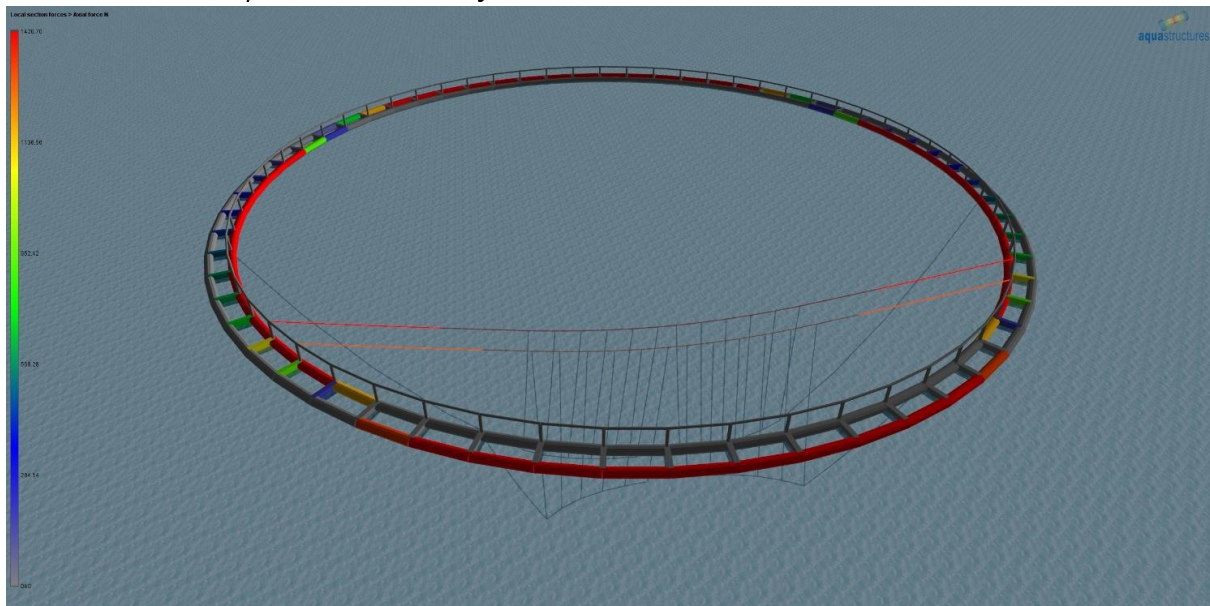
5.6.3 Limits for use

	Curtainkelp	Crane kelp	Comments
<i>Significant waveheight (H_s)</i>	4,5	4,5	Hides can be used in higher waves under special circumstances.
<i>Current (m/s)</i>	1,2	1,2	Lumpfish is a weak swimmer and will be of limited use on locations with strong currents.
<i>Wind (m/s)</i>	-	-	Irrelevant
<i>Ice (cm/døgn)</i>	-	-	Irrelevant

These limits assume correct installation and use.

5.6.4 Strength calculations

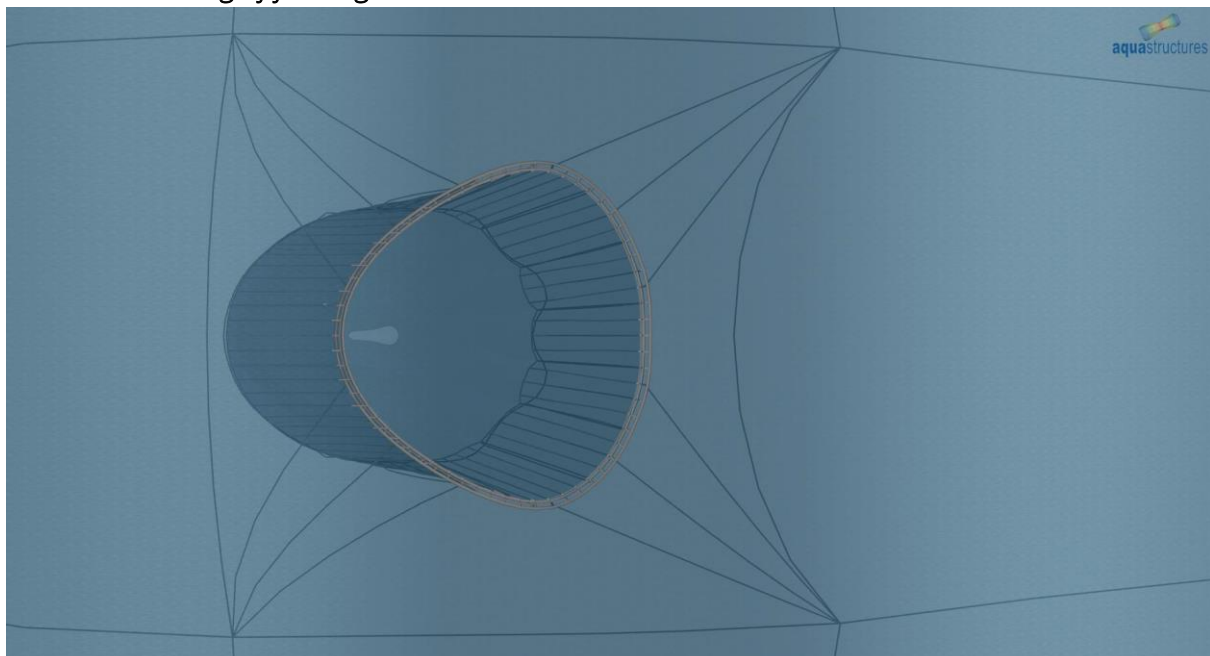
5.6.4.1 Curtainkelp in HDPE without floats



The picture shows a simulation of static load from curtain kelp.

Static load is approximately 165kg. With HS=3m the biggest load is about 400kg. We assume that hides equipped with floats have a lower load as the floats reduces some of the weight.

5.6.4.2 Ovalizing of fish cage



The picture shows a simulation of a fish cage with $\varnothing 500$ tubes, circumference of 160m, 1.2m/s and Hs-6m. Picture from AKVA Group.

The simulation on the picture indicates that the distance across the fish cage could get stretched by up to 1.88m.

See section on safety distances for more information.

5.7 RISK EVALUATION FOR ESCAPED FISH FROM ADD-ON EQUIPMENT

5.7.1 This is how we calculate risk for escapes

Points	How likely is it that the incidence will happen?		What is the consequence if there is an incidence?	
		Example		Example
5	Most likely	Monthly	Very serious	Escapes from whole location may happen.
4	Very likely	Once a year or more often.	Serious	Escapes from individual cages may happen in special cases.
3	Likely	Once every 5 years.	Moderate	Individuals may escape.
2	Less likely	Once every 10 years.	Potential	Individuals may escape in special cases.
1	Not likely	Less frequent than once every 10 years	Insignificant	Insignificant risk.

5.7.2 Riskmatrix – Risk for escapes

Item	Danger	Cause of danger	Probability	Consequence	Risk	Preventive Steps
1	Wear on net	The hide is touching the net in the current.	5	2	10	Correct installation and inspection with underwater cameras.

2	Tear in net	The hide is hooked into the net.	1	3	6	Correct installation and inspection with underwater cameras.
3	Hide falls into net, left hanging against the net.	The hides top-rope is cut, or the knots are loosened.	2	3	6	Correct installation and inspection.
4	Deformation of main components (holder, attachment)	Top-rope is too tight.	3	2	8	Correct attachment and inspection.
5	Secondary damage on main component	-	0	0	0	
6	Short circuit and fire (net and fish cage)	-	0	0	0	
7	Waterintrusion (components in electric cabinet)	-	0	0	0	
8	Icing dangers	Icing on ropes above water.	1	4	4	Breakage/melting of ice.
9	Corrosion, loss of strength.	Negligible weakening of top-rope caused by UV from sun in the lifetime of the product.	1	4	4	Inspection
10	Production problems, material weaknesses	Weights or other components in the hide can loosen due to manufacturing problems.	2	3	6	Correct attachment and inspection with underwater camera.
11	Differing usage for installation and use.	Increases the probability of the dangers listed above.	3	4	12	Good user manual. Offer help on installation.
12	Doesn't see or report incidences.	Increases the probability of the dangers listed above.	3	4	12	Good user manual. Offer help on installation.

6 INSTALLATION

6.1 INSTALLATION TIME

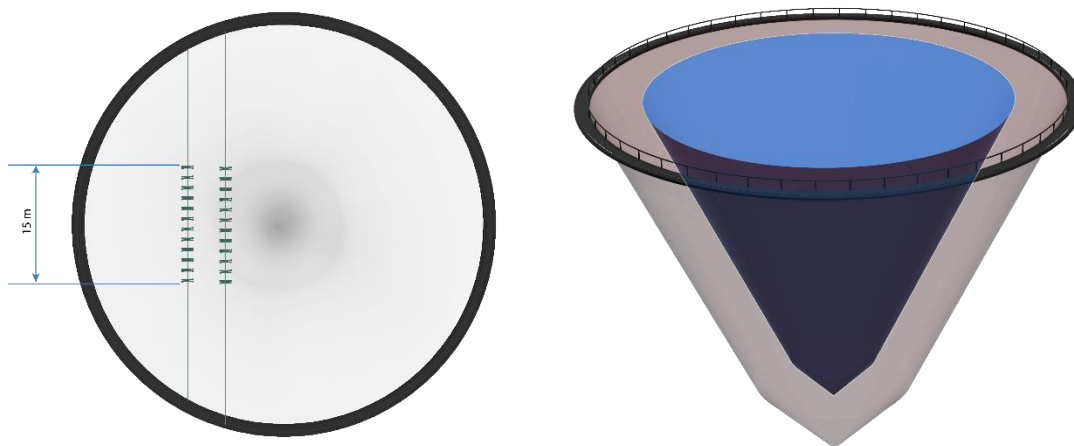
The user must estimate 1-3 hours installation time per kelp line.

6.2 INSTRUCTION VIDEO

- <https://norseaqua.com/products/curtainkelp/>
 - Lang versjon - <https://www.youtube.com/watch?v=ApOeSc88fb4>
- <https://norseaqua.com/products/crane-kelp/>

Please contact NorseAqua if you have questions about the installation

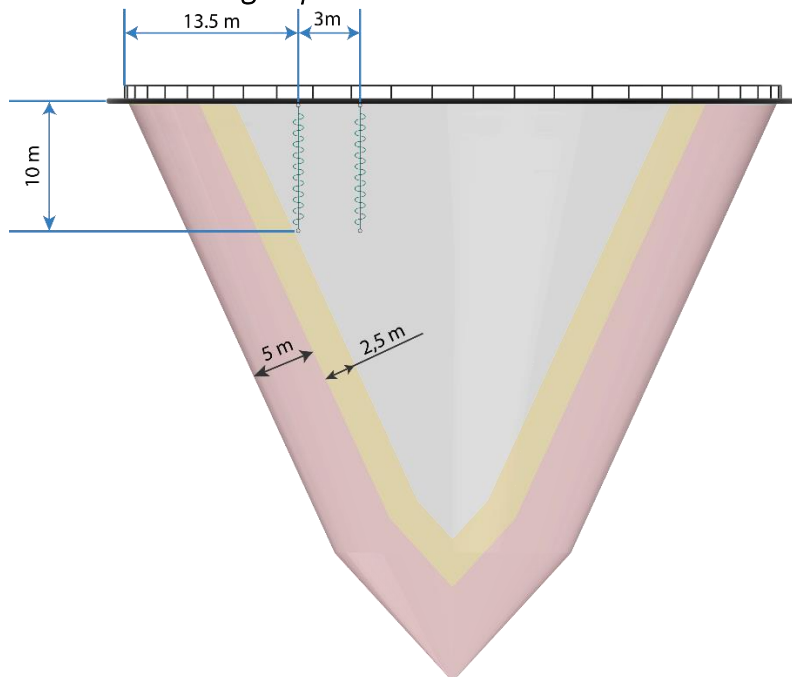
6.3 PLACEMENT IN CAGE



Assuming there are 15 meters/49ft kelp line placed in the middle of the cage.

6.4 SAFETY DISTANCE

6.4.1 Circular angled pens

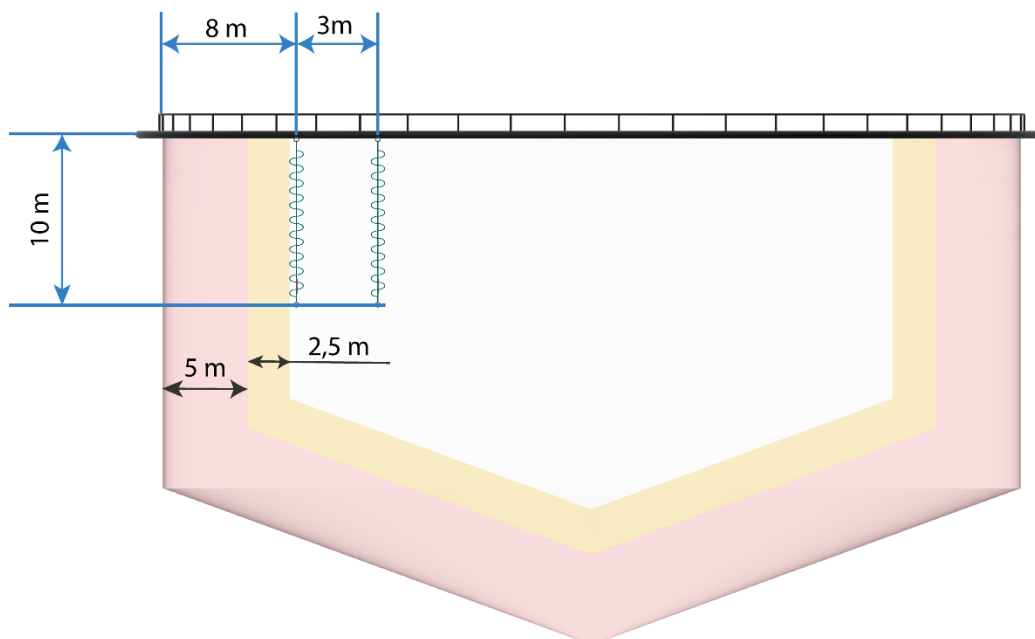


160m cage with circular angled pen (for example ENCC 160 354555 60).

Legend:

- Red area: 0 to 5 meters from net wall
- Yellow area: 5 to 7.5 meters from net wall surface.

6.4.2 Straight-walled pen



160m cage with straight-walled pen (for example ENC 160 3040 60).

6.4.3 Ovalisation at strong currents and high waves

- If you experience current above 0.8m/s or waves above 3m H_s you must:
 - Add another 2 meters of loosened top-rope
 - Move the hides 2 meters towards the center.

6.5 QUALIFICATIONS AND INSTRUCTIONS

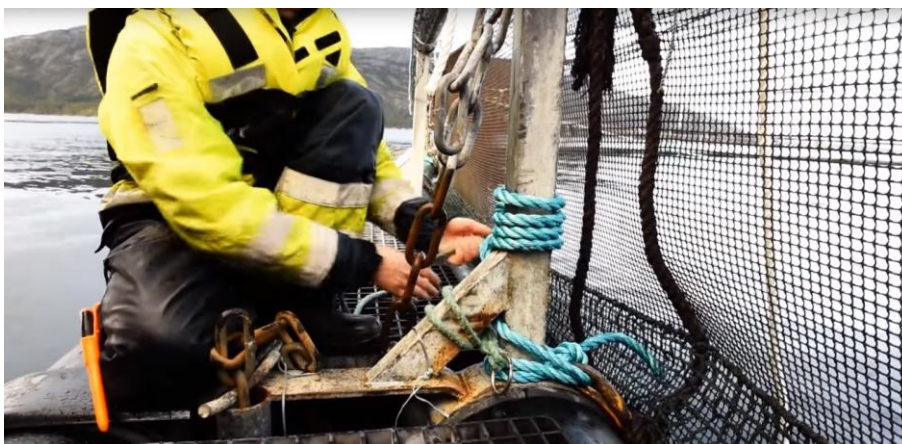
Instructed and skilled personnel can deploy cleanerfish hides. Additional training/skills/information, other than this user manual is not required for using cleanerfish hides from NorseAqua.

6.6 CURTAINKELP DEPLOYMENT

1. Position the boat.
2. Find the hoisting line. Cut the packaging strips and dispose of the packaging according to your company guidelines.
3. Tie top-rope at a post. Make sure that there is no wear and tear on the rope.
4. Walk over to the opposite side of the cage. Tighten and tie the rope. Ensure the hide has enough distance from the net.



- a.
5. On the lifting rope there is a coil for the bottom collection rope. Cut it loose and walk to a pole.
 - a. 10m deep hide = 4 poles away.
 - b. 7,3m deep hide = 3 poles away.
 6. Tie the rope end with thimble at the bottom of the pole. Get the thimble as low as possible.



- a.
7. Thread the bottom collection rope over the edge and through the thimble. Tie the end in the cage wall.



a.

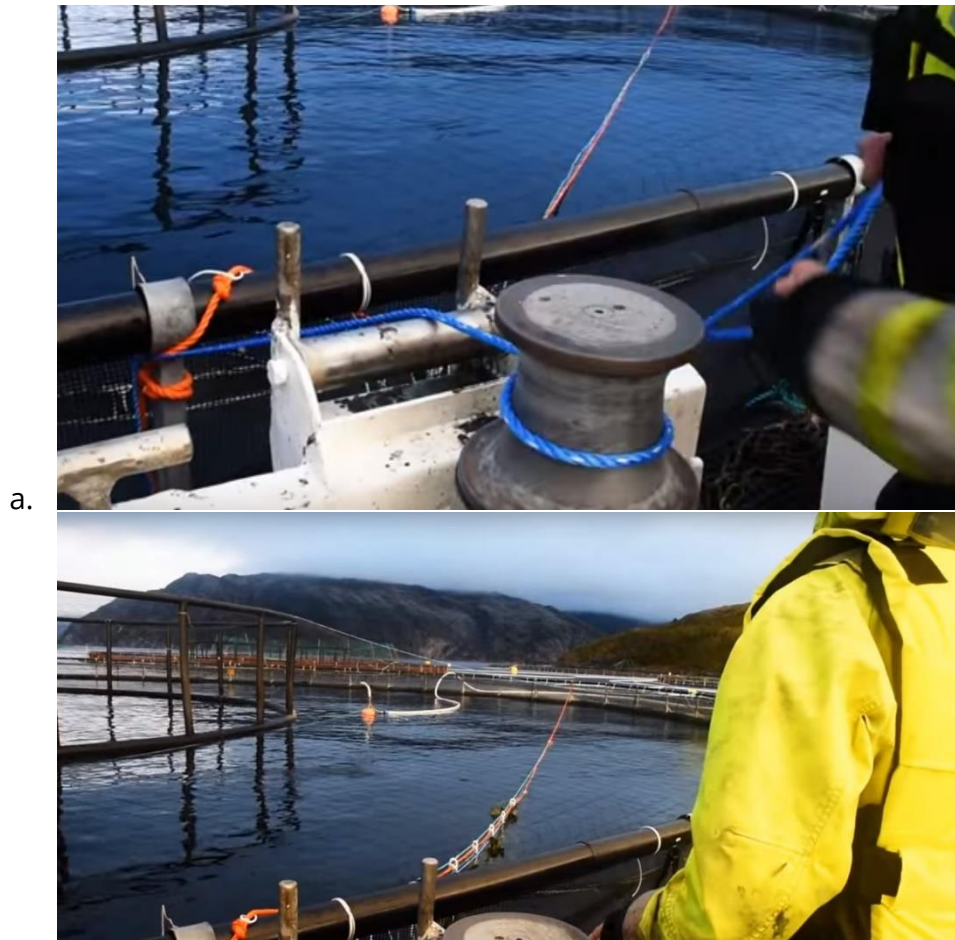
8. Loosen and hold the weights. Walk 3 meters to the back before you let go of the weights to avoid tangling.



- a.
9. Cut the rope



- a.
10. Take the top-rope and pull out the hide with capstan.



11. Inspect the hides with camera to ensure they are not in conflict with the net or other equipment below the current.

6.7 DRYING

12. Pull the hides in with the capstan



a.

13. Grab the bottom collection rope.



a.

14. Pull in the bottom collection rope with the capstan.



a.

15. Fasten the bottom collection rope.

a. Adjust the top rope if necessary.



6.8 *INSTALLING CRANEKELP*

1. Position yourself with in boat equipped with crane.
2. Attach the lifting rope in the crane.



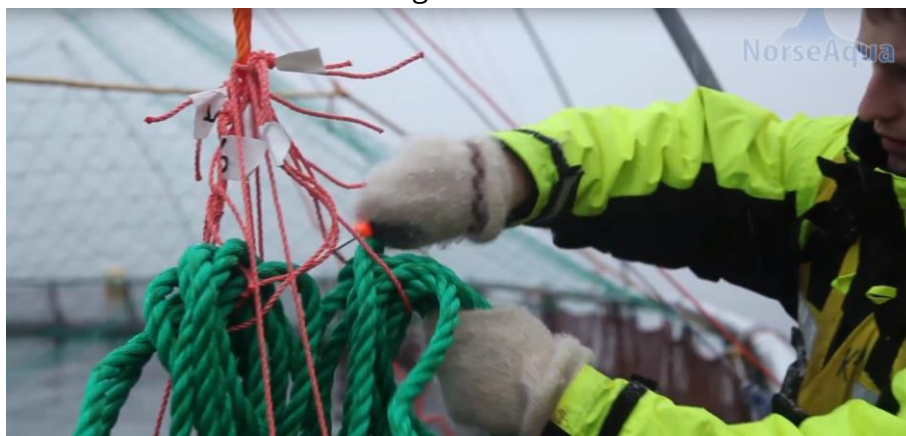
3. Place the crane kelp where you want it to be.
4. Remove the plastic bag.



5. Loosen all packing bands that keep the kelp together.



- 6. Cut rope numbered 2. Tie it to the cage wall.



- 7. Cut ropes 3 to 6. Avoid twisting kelp strings.

8. Walk with the top rope to the other side. Tie the rope. Ensure the hide has enough distance from the net wall.



9. Inspect the hides with camera to ensure they are not in conflict with the net or other equipment taking into consideration the current.

7 MAINTENANCE

7.1 REGULAR INSPECTION/MAINTENANCE

		Daily	Weekly	Monthly	Generation	Estimated time required per week in hours.
Wash	Drying		X			3
	Hosing		X			2
Icing	Deicing	X				0
Inspection	Check for wear on the top rope.	X				0,1
	Check for wear and damage on kelp strings.			X		0,2

8 TRANSPORT

The product must always be lifted by lifting rope.

Transport guidance:

- The product can be lifted on and off the edge of the cage by crane.
- If the product is to be moved between sites it must be disinfected according to the procedure of your company.

9 STORAGE

Guidance:

- The hides are best kept in a dark location away from the sun to increase their life-span.

10 TROUBLESHOOTING

Contact NorseAqua if there are irregularities.

Problem	Cause	Root Cause	Solution
The kelp is too close to the net wall.	The current moves the hide.	The hide is attached too close to the net wall.	<ol style="list-style-type: none"> 1. Move the hide further into the cage. 2. Tighten the top rope. 3. Make the hide shorter. 4. Add more weight.

10.1 SPARE PARTS AND SERVICE

Contact NorseAqua to order spare parts and service.

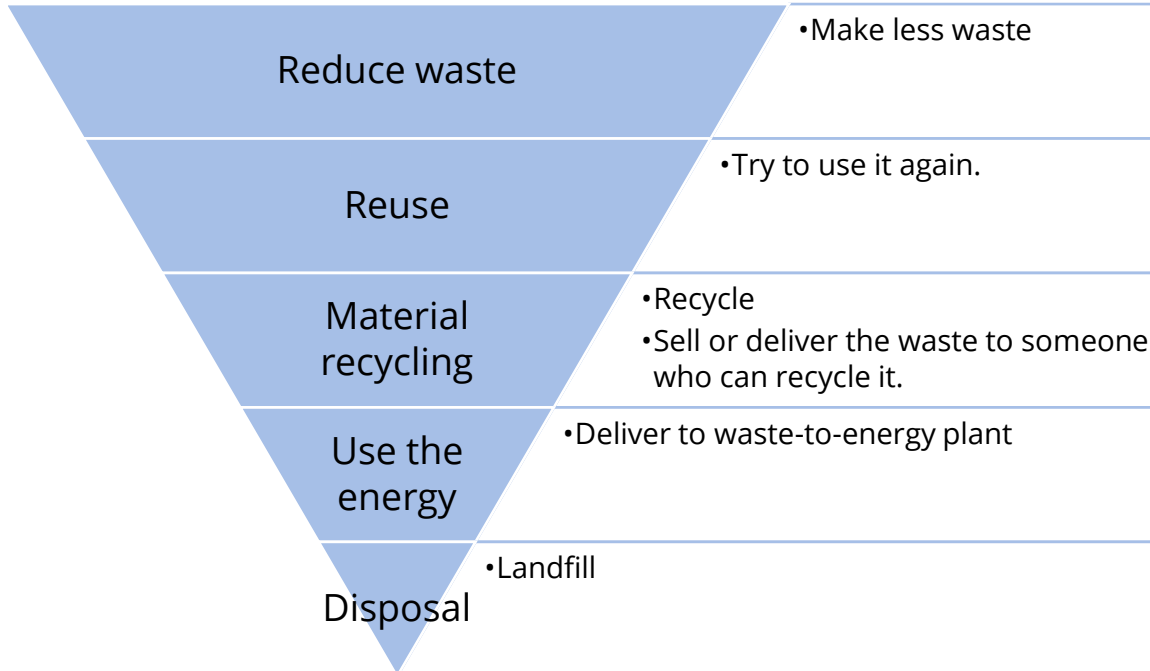
10.2 TRACKING INFORMATION

Contact NorseAqua. We can track the product from its description.

11 DISPOSAL

Contact us for assistance with disposal.

We refer to the disposal pyramid for guidance on how to dispose of our products.



Appendix – Irregularity Report

Copy this form before you write in it. Deliver according to your routine for reporting irregularities, and/or send to NorseAqua on post@norseaqua.no

Product/Service	Supplier	Productnr/ serialnumber	Year of Purchase

Experienced problem

What has happened, what problems did you experience because of this?

Your suggestion for corrective measures.

(Reduces the influence of the problem when it has happened).

Your suggestion for preventive measures

(Reduces the chance that it will happen again later).

Date	Your name