

#### **Background**

- Traditional salmon farming – in open pens – requires specific management for naturally occurring factors such as water temperatures, oxygen levels, algae as well as pathogens and sea lice. In certain circumstances, these can be variable.
- Variable factors impacting farmed salmon:
  - Water quality – including harmful algae, temperature and dissolved oxygen;
  - Pathogens and pests – sea lice and naturally occurring virus and bacteria found in the ocean;
  - Incidental catch – wild fish entering the farm pens; and
  - Predation – marine mammal interactions with farmed salmon can lead to increased stress for the salmon as well as net damage.
- As farmers, we look to ensure production performance is stable and as predictable as possible.
- Research into other potential farming methods for Cermaq Canada - such as land-based aquaculture – have proven to be less attractive due to cost, environmental impacts, fish welfare concerns, increased carbon footprint and flavour changes.
- The creation of the semi-closed containment system (SCCS) is showing promise as a way to continue to farm in a predictable, stable manner while retaining all of the benefits of ocean farming - with less risk.
- Cermaq is trialing a SCCS in Norway and has completed two generations.
- The trial results from Norway have been very encouraging, as the post-smolt farmed in the SCCS system have experienced overall better growth and did not require treatment for sea lice in comparison to the salmon placed in an adjacent control cage of a conventional farm system.

#### **What is a Semi-Closed Containment System (SCCS)?**

- The SCCS will provide increased levels of control for both the biosecurity and welfare of both farmed and wild salmon.
- A SCCS can be located at existing salmon farm sites, and uses a large, water-pressurized bag system which is made of a flexible polymer material that sits outside of the traditional netting system – creating an impenetrable barrier between the open ocean and the inside of the pen.
- Water is brought into the salmon pen through four screened sea water intakes that are capable of pumping 300 cubic meters of water per minute. This creates constant water circulation through the 12 deep-level screened exit ports.
- Once pumped into the system through the screened intakes, water exchanges within the system in approximately 50 minutes.
- The sea water intakes can be set to match the farms location and conditions – making them tailored to each unique site.
- As the lining maintains constant water pressure and movement thanks to the intake pumps and the lower level exit ports, there is no risk of the bag “deflating”.
- Organic waste exits the pen through a single exit at the bottom of the polymer bag. This creates the opportunity for the collection of solid fish waste in the future as technology become available.

#### What are the benefits of a SCCS?

- The system can be customized to specific sites, based on both physical and biophysical characteristics such as water conditions, depth and dissolved oxygen.
- Algae and sea lice are generally found in the top portion of the water column. By using the sea water intakes, we are able to avoid this water column and thereby, minimize the introduction of algae and sea lice into the system.
- The SCCS greatly reduces the interaction between farmed and wild salmon – which also reduces the transfer of pathogens and sea lice between wild and farmed populations.
- The tensile strength of the system is strong – at 1300/1300 daN/5cm – and can easily withstand storm activity and predator attacks.

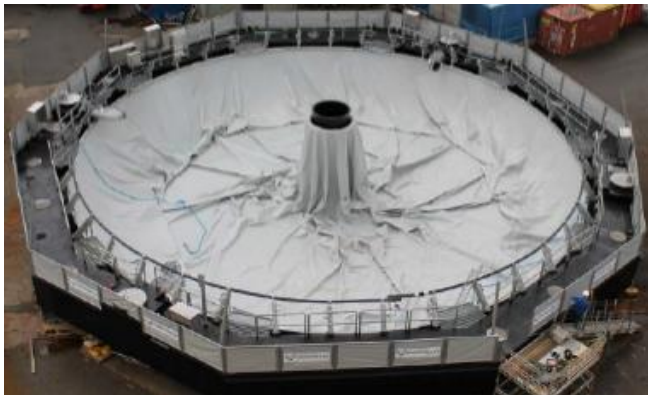
#### What questions will the trial answer?

- Trialing this system will provide a clearer picture on the effectiveness of minimizing interactions (harmful algae, sea lice and pathogens) between the environment and the fish inside the SCCS.
- Understanding how to adequately meet the changing oxygen demands as the fish grow within the SCCS system.
- The cost of the SCCS system is considerably more than traditional farming systems – up to five times more. The system will need to deliver on ecosystem objectives, fish performance and fish welfare measures.

#### Frequently Asked Questions (FAQs)

##### 1.) How big is a SCCS compared to traditional open net pens?

- A. The SCCS is a circular pen – similar to a polar circle type farm, and has a circumference of 120 metres and is 24 metres deep. The pen is capable of holding at least up to 750,000 salmon.



*Left: assembled polymer bag and flotation ring*



*Right: one of the sea water intakes*

# Cermaq's Semi-Closed Containment System

## What is it and what does it do?

### *Quick Facts and Frequently Asked Questions (FAQs)*

*Summer 2020*

#### **2.) Has this technology been tested or proven in local waters?**

A. Cermaq has been trialing a SCCS in Norway, and has completed two generations. The first round of fish placed in the system had overall better growth and health paired with a lower mortality rate, and we are seeing similar success with our second group of fish in the system. With this second batch of fish, there have not been any sea lice in the SCCS, while the reference cage nearby had to be deloused twice. The growth has been very good and the average weight in SCCS was significantly higher than in the reference cage.

#### **3.) What happens if the bag tears?**

A. The bag has a tensile strength of 1300/1300 daN/5cm – and can easily withstand storm activity and predator attacks. In the case this were to occur, there is a secondary barrier – the interior predator net – which would provide secondary protection and prevent potential fish escapes.

#### **4.) Can other fish or mammals enter the system?**

A. This would be very unlikely. The polymer bag is built to withstand predator attacks, and the system has an inner a predator net within the bag. The intake pumps and deep-level port are both screened using a netting similar to the predator nets. This will prevent any accidental by-catch from the intake pumps, and the remote possibility of fish or mammals entering through the deep-level parts. It is important to note that the deep-level exit ports will have continuous strong outflow, making entering through these ports very challenging.



*The Semi-Closed Containment System (SCCS) being trialed in northern Norway*

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*Side view of the Semi-Closed Containment System*

