

Semislutna fiskodlingsssystem i sjöar och hav -tekniska lösningar

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CtrlAQUA

Norge driver på utvecklingen



Idag finns ca 23 olika system i produktion eller på ritbordet

Varför utvecklas halvslutna system?

Drivkrafter:

- Rymningar/rymlingar
- Laxe-lus
- Mortalitet
- Närsaltsutsläpp

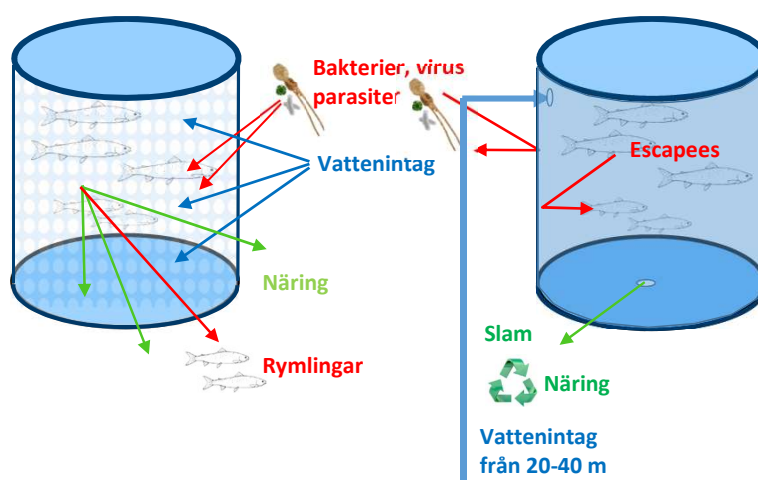
==> Ökad barriär mellan den odlade fisken och omgivande vatten

Halvslutna system i sjöar & hav

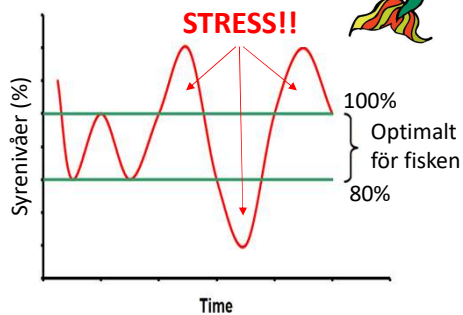
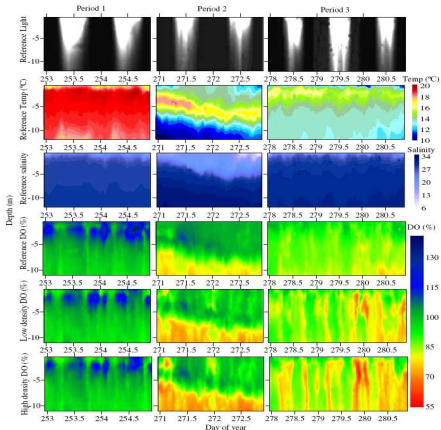
Öppna

vs

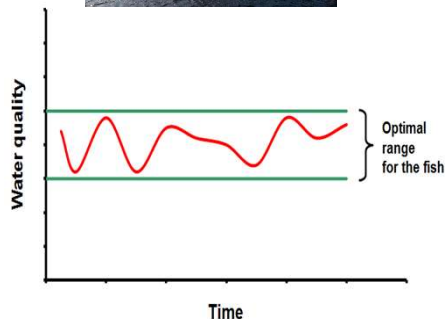
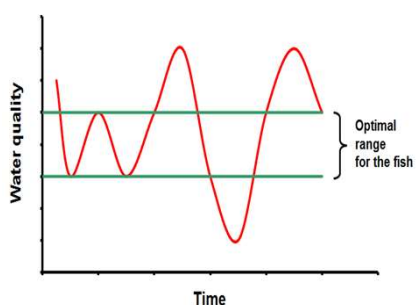
halvslutna



Dålig kontroll över miljön i öppna system ökar risken för stress.



Slutna system – kontrollera miljön inom fiskens villkor



Exempel på "hårdskaligt", havsbaserat system (Neptun 3)



Ex. Aquafarm - NE



Mowi to release 600,000 smolts in the "Neptun 3" in October

News by editorial staff - 9 September 2019

For six years, Mowi and Aquafarm Equipment have tested post smolt production in the semi-closed cage "Neptun" at Skånevik, Western Norway. Soon, a new release of fish is ready, and the first commercial delivery agreement will be in place.

It is the third generation of the research cage "Neptun", which is now in use. The cage is 40 meters in diameter on the inside, and 126 meters in circumference. The cage is 22 meters deep and holds 21,000 cubic meters of water.

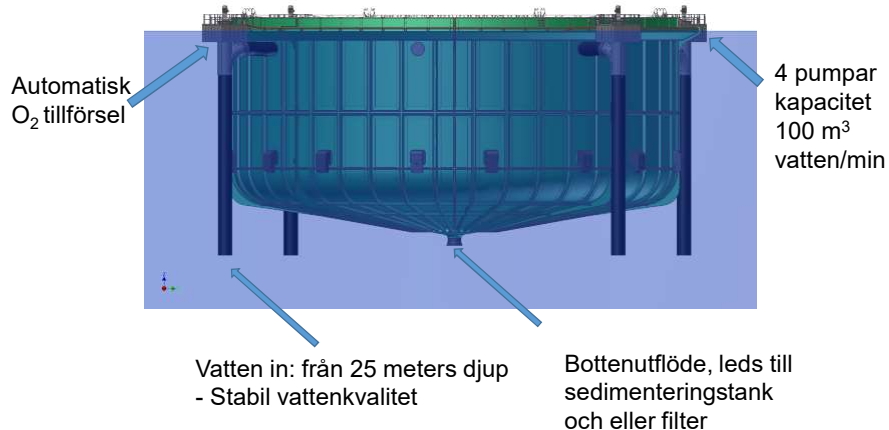
"Neptun" is designed to produce up to one million smolts. In October, it is ready for the sixth release of fish when 600,000 smolt will enter the cage.

"The results so far are promising. There are less lice on the fish, less algae, fewer diseases and slightly higher survival rate in the cage than what the post-smolt normally has in the first six months," said Trond Rosten, who works in Mowi's research and development department and who heads the project in the group, to the newspaper *Grannar*.

He nevertheless emphasizes that there are normally small challenges in this phase also in traditional cages, but that the post-smolt production in this tank is an attempt to make things even better.

Principen för semislutna system

40 m i diameter & 20 m djup ==> ca 21 000 m³



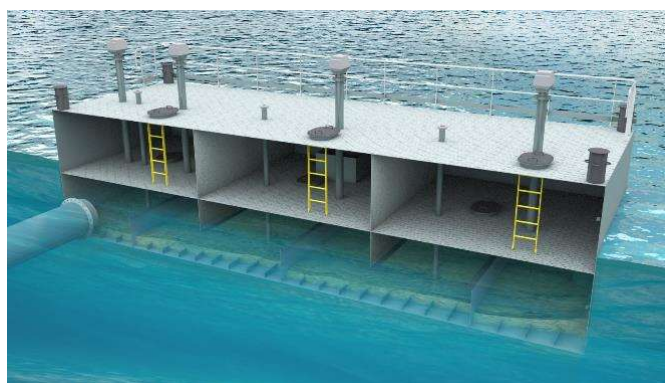
Teknisk data Neptun 3



Technical data:

- Inside diameter: $\varnothing 40$ m
- Circumference: 126 m
- Cage Depth: 22 m
- Gross Volume: 21.000 m³
- Significant Wave Height: $H_s = 1,0$ m
- Max Wave Height: $H_{Max} = 1,8$ m
- Design Wind : $v = 30$ m/s (Severe Storm)
- Current: 0,75 m/s
- Lifetime: 25 years
- Certified design and construction according to NS9415:2009 and NYTEK

Neptun – Sedimentfälla



60-80% av partikulärt material samlas upp

Sedimenthantering

Trumfilter

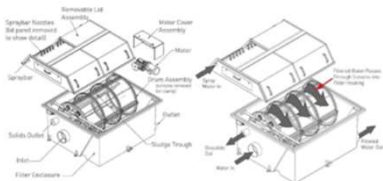


Figure A5.1: Diagram of the components and operation of a rotary drum filter. Source: Pentair 2018 (<http://pawater.com/pr-aqua-drum-filter.html>).

Vortex

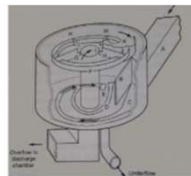


Figure A5.2: Diagram of swirl separator aka hydrocyclone operation. Source: (Metcalf & Eddy Inc. 2004).

”Dekanter centrifug”

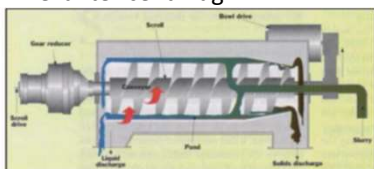


Figure A5.3: Diagram of decanter centrifuge operation. Source: (US EPA 2000a).

Tork



Figure A5.5: Image of Watropur Inc.'s Watromat standard batch sludge dryer. Source: <http://www.watropur.com/products/standard-sludge-dryer.html>.

Havsbaserad betongkasse



Salmon Home No. 1, Smøla



Lusefri postsmoltproduksjon i betongmerd på Smøla

Nyheter av Elisabeth Høiland - 10 november 2015

«Vi har testet ut flere ulike teknologier med gode resultater og basert oss på den beste løsningen. I juni signerte vi samarbeid med utvillingsselskapet Fiskefarming Innovation AS og produsent Bøtormmat AS den første pilotmerda laget av foting med en størrelse 1,200 m3, forteller Høiland i en pressemelding.

polarcirkel
Sterkere
Smartere
Sikrere

>>>

Havsbaserad nätkasse med stålväggar



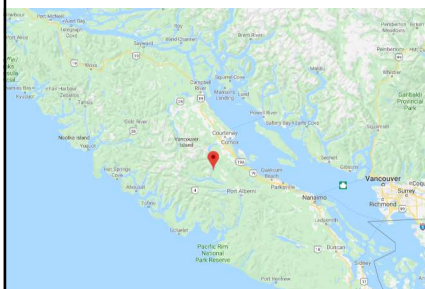
Ex. Seafarming systems Aquatraz in Eiterfjord.

Havsbaserad nätkasse? med stålväggar



Ex. Hydra Pioneer

Insjöbaserat hårdskaligt system

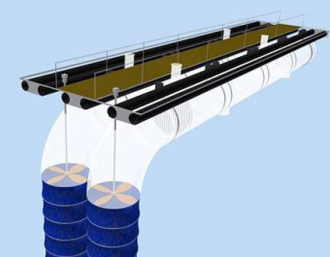


LOIS LAKE STEELHEAD

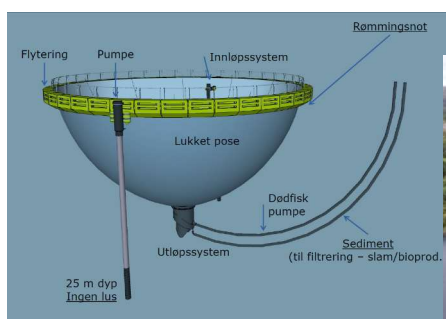
Our healthy and beautiful Steelhead are native to the Pacific Northwest and are renowned for their taste everywhere. Steelhead are characterized by their bright red colored flesh, soft buttery flavor, and firm, moist texture. Lois Lake Steelhead is high in omega-3 fatty acids, making them an excellent choice for the health-conscious consumer.

Ex. Agrimarine, Lois Lake, Vancouver island.

Rörformade hårda Ex. PRELINE, Lerøy



Exempel på mjukskalig, halvsluten anläggning



Beroende på filtrering och uppsamling av utgående vatten,
Rapporterade värden:

Partikulärt material: 80 – 90%

Kväve: 16 – 20%

Fosfor: 65 – 85%

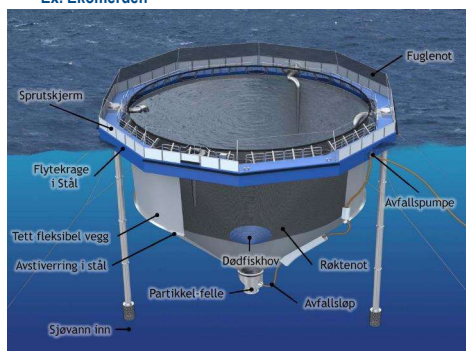
Ex. AKVAFUTURE



Ex. AKVADESIGN/AKVAFUTURE, Brønnøysund, Norway
and AgriMarine S-CCS Gulklakken, Smøla.
many other design tested and on the drawing board

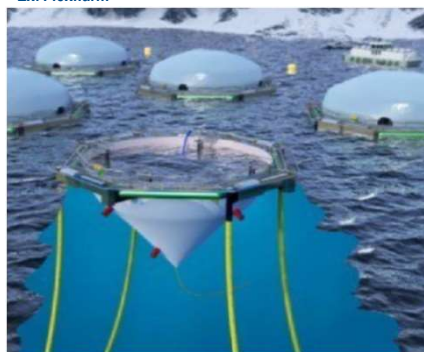
Exempel på mjukskalig, halvsluten anläggning

Ex. Ekomerden



<https://www.ecomerden.no/merden.html>

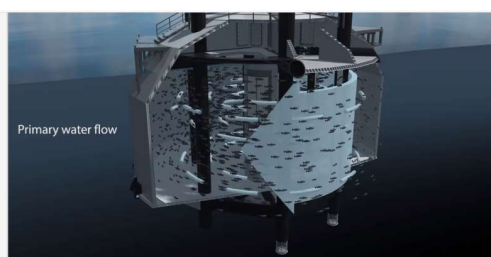
Ex. Flexifarm



Odlings-skeppet



”Slutna” semislutna system



FishGLOBE V3

FoU

Størrelse: 80 kbm
Kapazität: 3 tonn fisk
Diameter/høyde: 5 m

Bruksområde:
FoU-stasjon, sjøvann
Støttfisk, feriskvann
Settefisk, feriskvann
Rensetfisk



FishGLOBE V4

Settefisk

Størrelse: 600 kbm
Kapazität: 90 tonn fisk
Diameter/høyde: 11 m

Bruksområde:
FoU-stasjon, sjøvann
Støttfisk, feriskvann
Settefisk, feriskvann
Settefisk, sjøvann
Rensetfisk

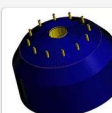


FishGLOBE V5

Postsmolt

Størrelse: 3 500 kbm
Kapazität: 200 tonn fisk
Diameter/høyde: 19 m
H₀ > 2.0 m / >1.25 m/s

Bruksområde:
Postsmolt
Behandling
Ferskvannbehandling
Slaktevann



FishGLOBE V6

Matfisk

Størrelse: 31 000 kbm
Kapazität: 2 300 tonn fisk
Diameter/høyde: 43/16 m
H₀ > 2.3 m / >0.5 m/s

Bruksområde:
Matfisk

Egget

Ett framtidsscenario, inte testat ännu. Hårskaligt, slutet system



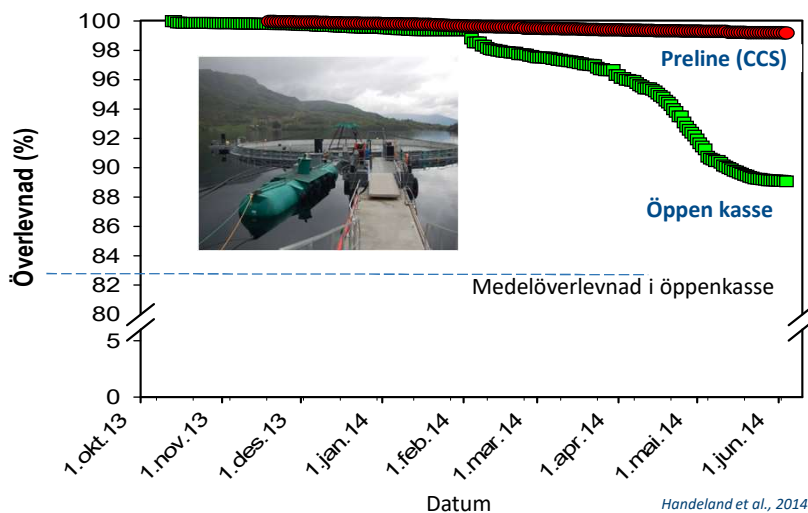
Nio olika slutna system i drift i Norge idag

Name	Material
Agrimarine	Glass-reinforced plastic
Akvadesign	Flexible fabric
AquaDome	Glass-reinforced plastic
Ecomerden	Flexible fabric
FishGlobe	Polyetylen
HDN	Flexible fabric
Neptun	Glass-reinforced plastic
Preline	Glass-reinforced plastic
SalmonHome no.1	Concrete

Haaland, 2017

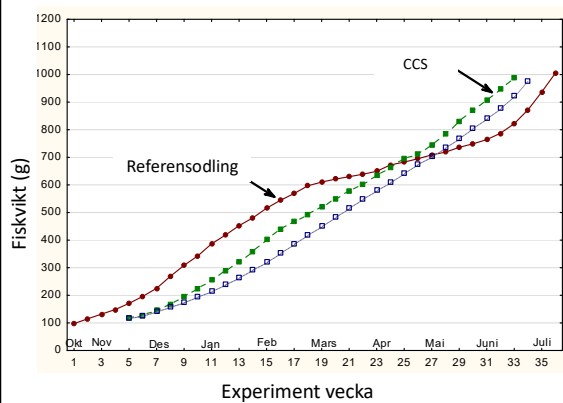
Fiskens hälsa och välfärd i CCS

Överlevnad



Fiskens hälsa och välfärd i CCS

Tillväxt

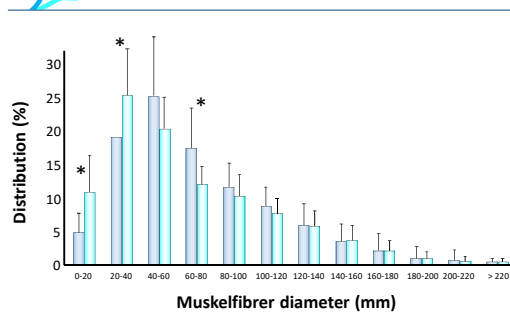
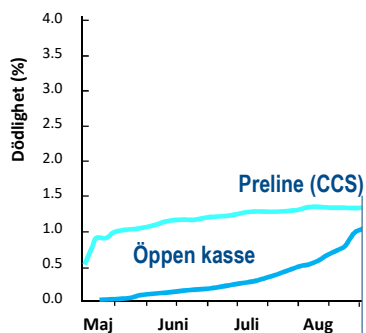


Referensodling:
97 till 1005 g på 36v

Neptun (CCS):
118 till 986 g på 29v

Fiskens hälsa och välfärd i CCS

Tillväxt



Källor

SARFSP011 - Technical Considerations of closed containment sea pen production for some life stages of salmonids



A REPORT COMMISSIONED BY SARF AND PREPARED BY

The Institute of Aquaculture, University of Stirling

Semi-closed containment systems in Atlantic salmon production

Comparative analysis of production strategies

Simen Aleksander Haaland

Marine Technology
 Submission date: June 2017
 Supervisor: Bjørn Egil Asbjørnslett, IMT
 Co-supervisor: Astrid Buran Holan, NDFIMA
 Thomas Meyn, IWM

Norwegian University of Science and Technology
 Department of Marine Technology