

DRIVERS FOR TECHNOLOGY DEVELOPMENT IN NORWEGIAN AQUACULTURE

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A rare rate of innovation in Norwegian aquaculture



Illustration: Bulandet Miljøfisk



Illustration: NRS/Aker

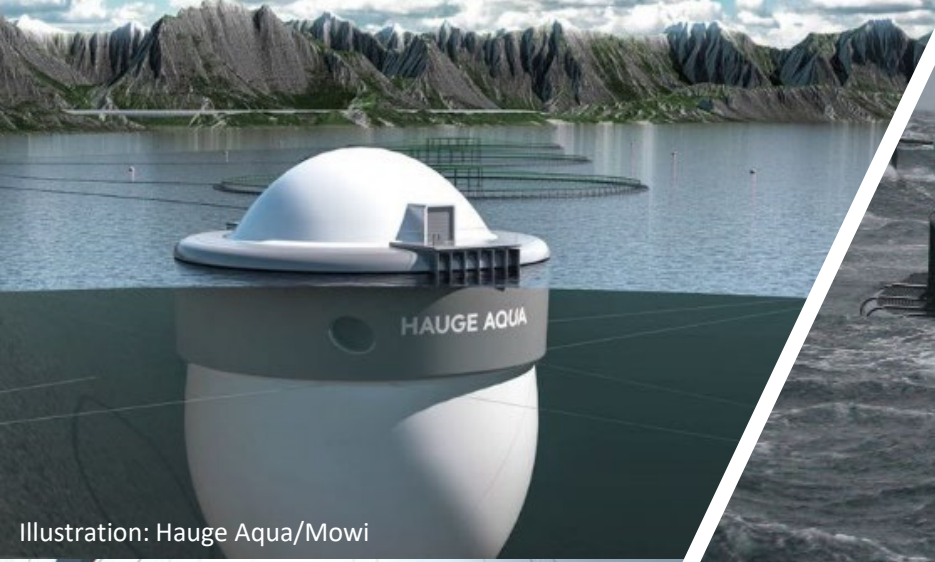


Illustration: Hauge Aqua/Mowi



Photo: Marius Dahle Olsen



Illustration: Aqualine



Photo: Aquafarm Equipments/MOWI



Photo: Salmar



Illustration: Nordlaks

Risk dimensions



 SINTEF



Material assets



Personnel



Environment



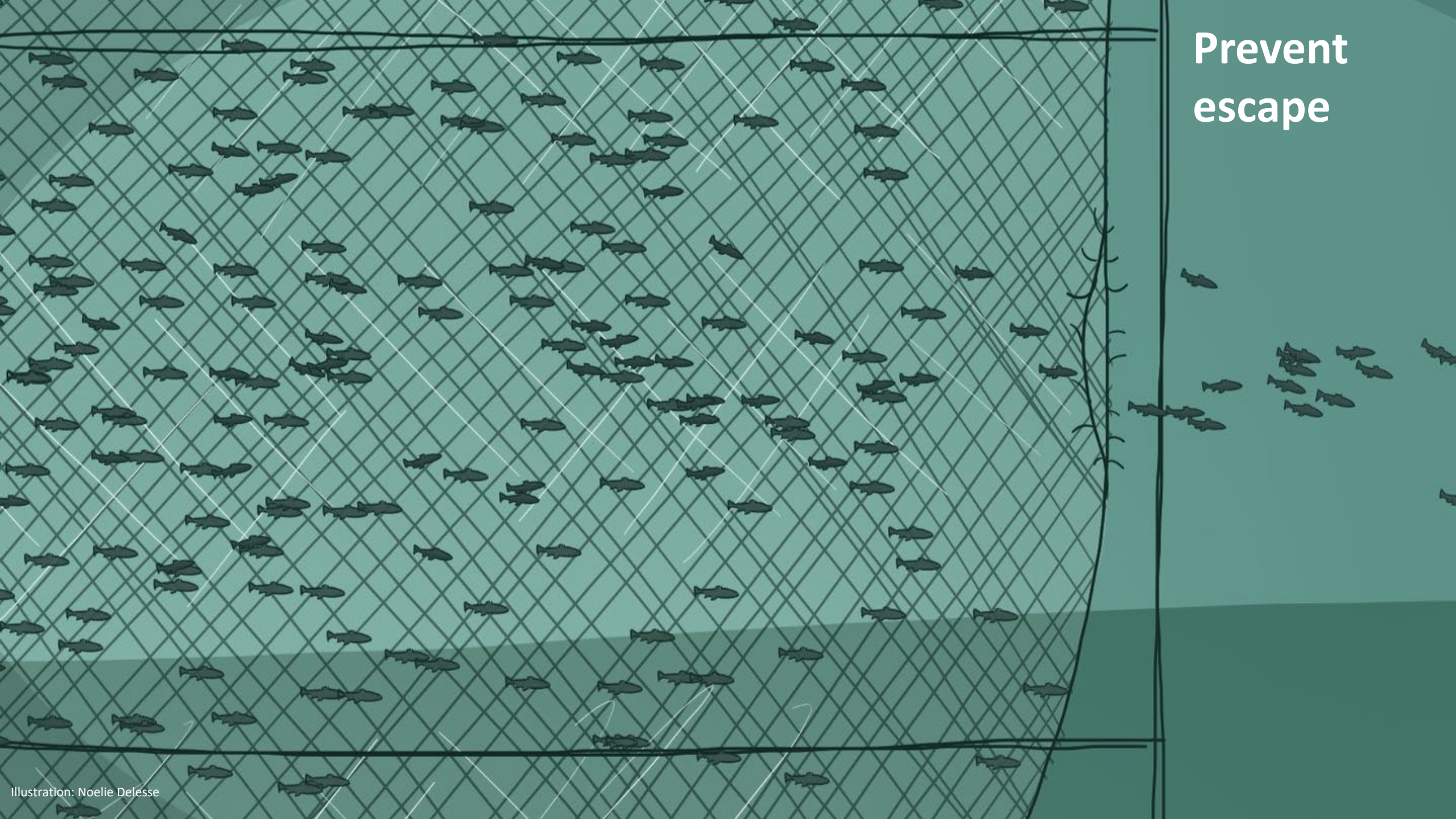
Fish welfare



Food safety

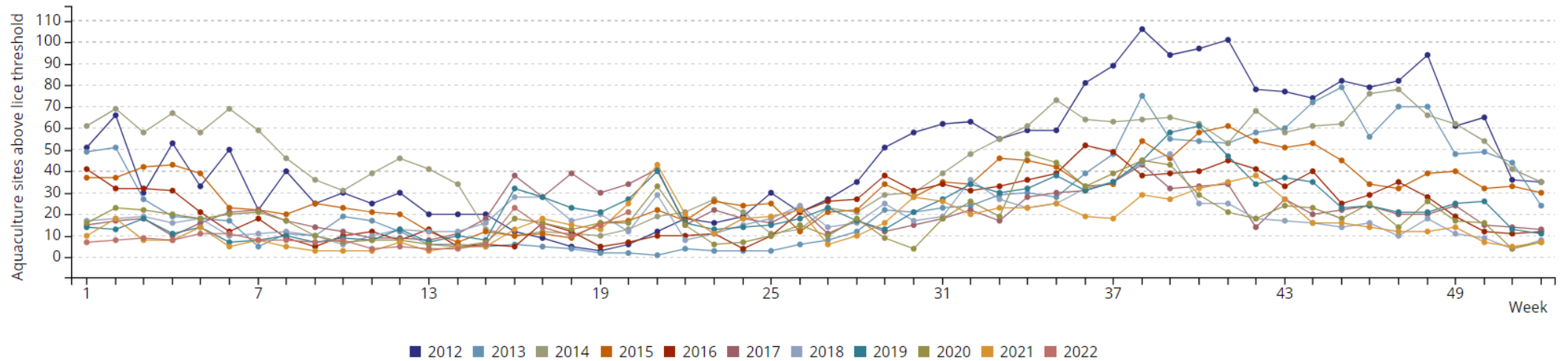
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Prevent
escape



Salmon lice levels – Traffic light system

Number of aquaculture sites above the louse threshold per week throughout the year





New areas and production systems

- Open ocean aquaculture
- Closed and semi-closed systems
- Land based systems

Technology push policy – Development Licenses

- Prevent sea lice
- Environmental impact (escape, waste)
- New areas
- Innovation and investments
- Promote and measure fish welfare



Development licenses

Which technological directions are prominent in development license applications and awarded licenses?

Aquaculture Reports 24 (2022) 101115

Contents lists available at [ScienceDirect](#)

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Aquaculture Reports

journal homepage: www.elsevier.com/locate/aqrep

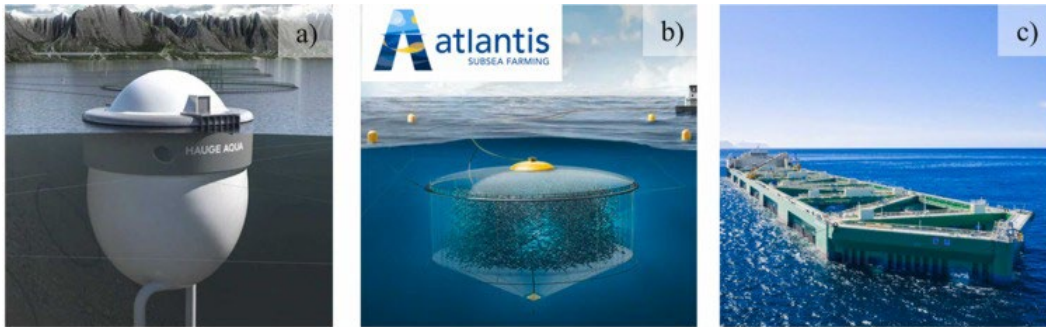


Technological innovations promoting sustainable salmon (*Salmo salar*) aquaculture in Norway

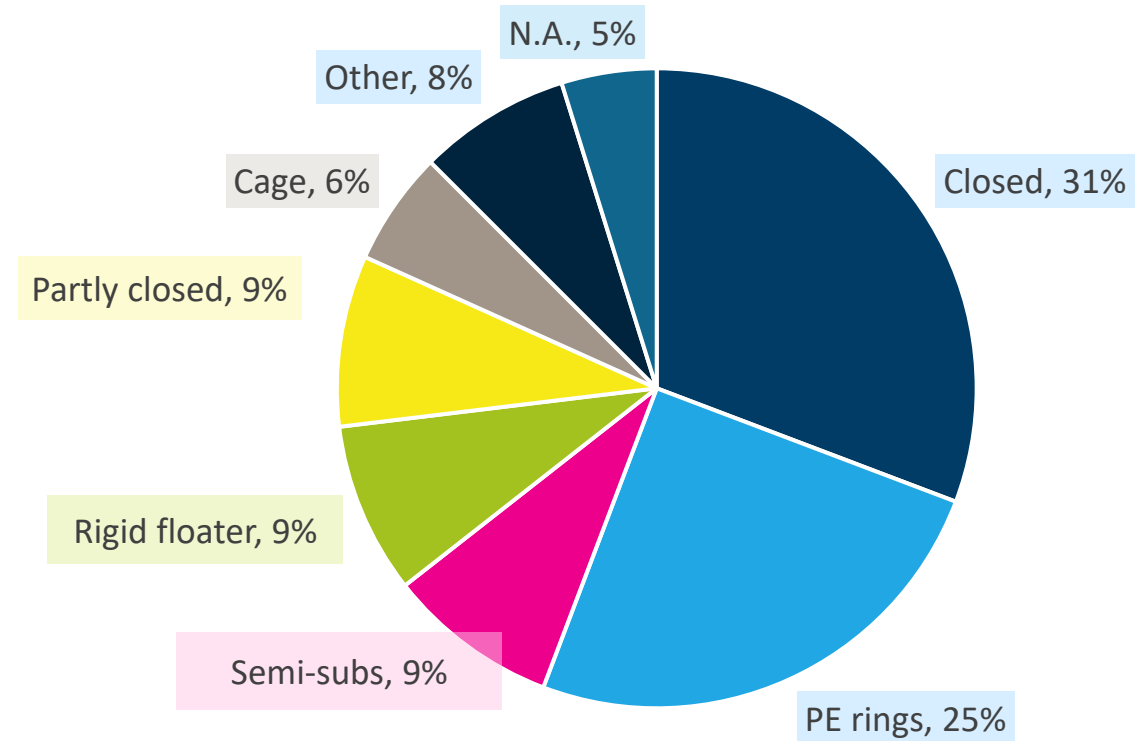
Heidi Moe Føre ^{a,*}, Trine Thorvaldsen ^a, Tonje C. Osmundsen ^b, Frank Asche ^{c,d}, Ragnar Tveterås ^e, Jan Tore Fagertun ^a, Hans V. Bjelland ^a

Farm concepts in applications

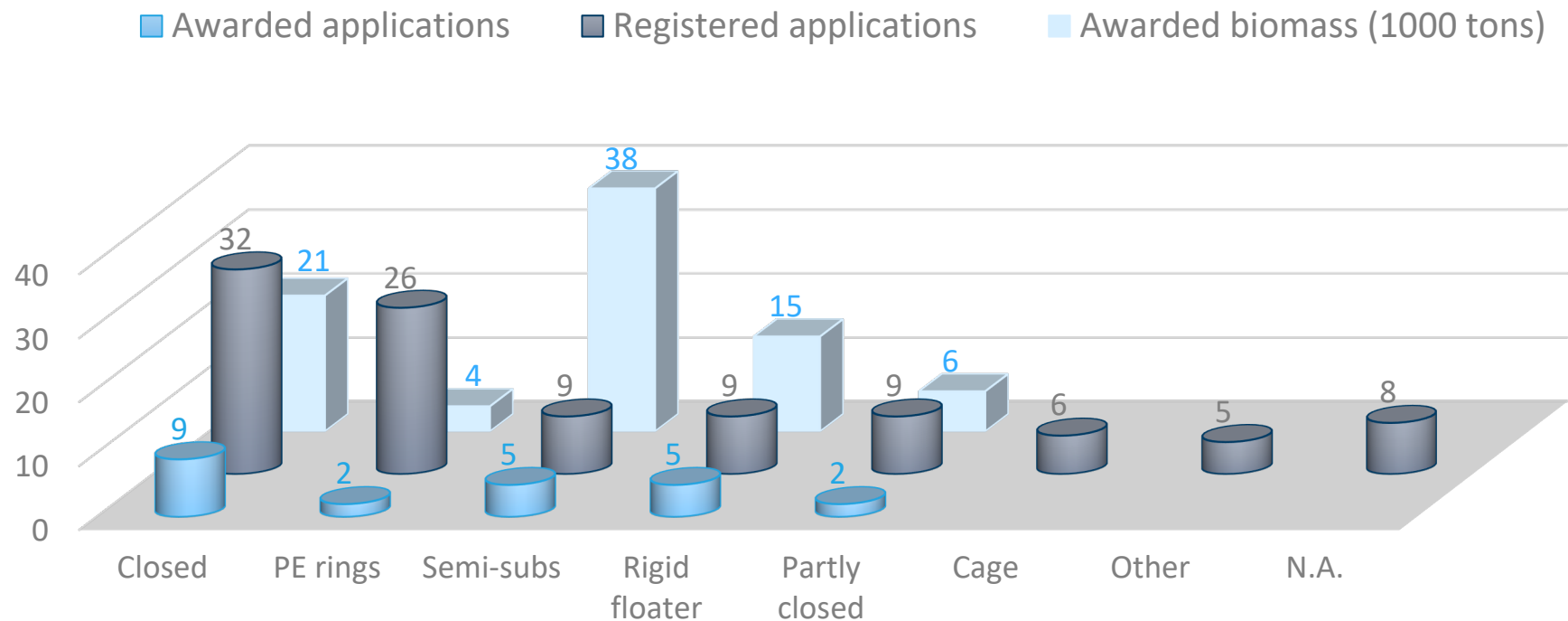
a) closed "The egg" b) submersible PE-rings "Atlantis" c) semi-sub "Havfarm"



d) semi-sub "Ocean Farm" e) rigid floater "Øymerd" f) partly closed farm "Aquatraz"

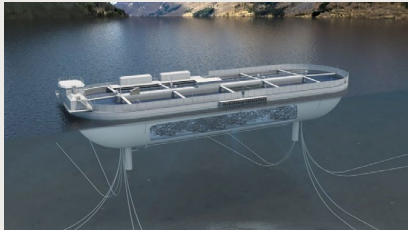


Registered and awarded



- Most applications: Closed and PE rings
- Highest success-rate: Semi-subs and rigid floaters

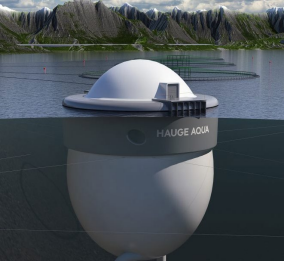
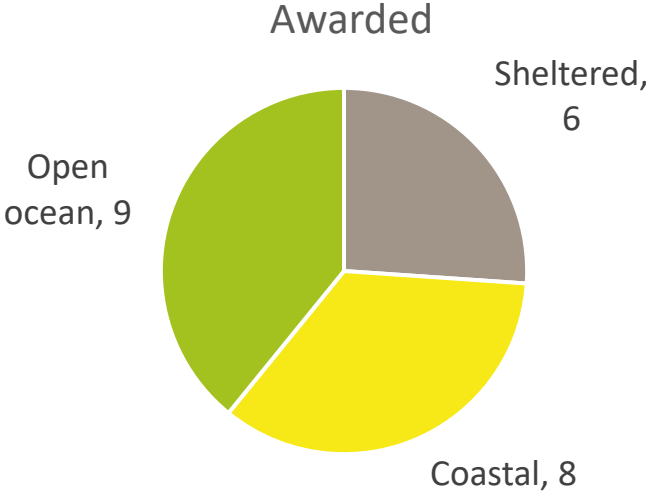
Designed for a specific location



Closed containers (impermeable)



Withstand loads from waves and currents



Reduced environmental interactions

Technologies for sustainable production

- Prevent sea lice infections (100% of awarded)
 - Shielding and inlet water control
- Prevent escape (91 %)
 - Stronger enclosures and structures
- Collect waste (43 %)
- Promote fish welfare (70 %)
 - Provide beneficial conditions for fish



Foto: T. Thorvaldsen



Drivers for technology development moving forward