

INITIATING A NORTH ATLANTIC NETWORK ON SUSTAINABLE HOLOTHURIAN TECHNOLOGY AND INNOVATION



AQUACULTURE FOR THE NA SPECIES STATUS AND OPPORTUNITIES

GYDA CHRISTOPHERSEN | HOLOSUSTAIN workshop | 8. October 2020







MØREFORSKING AS - R&D ALONG THE SUPPLY CHAIN



ONGOING ACTIVITIES AT MØREFORSKING AS

- Emerging species for sea cucumber aquaculture (Norwegian & South African research councils)
- Reduced environmental footprint and area use - sea cucumbers possible species in IMTA (Møre&Romsdal region)
- Marine species in aquaculture (Trøndelag region)
- Other logistics/processing/fishing gear projects assigned by industry
- Applications submitted

 aquaculture & fisheries



Photo: Møreforsking2020



THE NORA-AREA VS THE NORTH ATLANTIC VS THE WORLD





NORTH ATLANTIC SEA CUCUMBER AQUACULTURE – FACT OR FICTION?

- No commercial sea cucumber producers in Europe at present
- There is currently no aquaculture of *C. frondosa* on the Atlantic side
- Several research initiatives to establish breeding protocols
 - Holothuria spp., P. tremulus, C. frondosa and others
- There has been some hatchery attempts
 - Spain, Portugal and countries bordering the Meditteranean

Constraints

- Irregular spawning
- High mortality rate in early life
- Small scale juvenile production
- Investment needs
- Adjustment of legislation



WHY SUCH A HIGH DEMAND FROM ASIA?

- High Chinese domestic market demand
- Overexploitation of species in tropical waters



Figure 3. Global prevalence of threatened sea cucumbers. Number of sea cucumber species within the order Aspidochirotida that were classed as EN or VU among locations worldwide.

From: Purcell SW, Polidoro BA, Hamel J-F, Gamboa RU, Mercier A. 2014. The cost of being valuable: predictors of extinction risk in marine invertebrates exploited as luxury seafood. Proc. R. Soc. B 281:20133296. http://dx.doi.org/10.1098/rspb.2013.3296



ACCESS TO RAW MATERIAL IS CRUCIAL

Options in the NORA-area and the North Atlantic:

- Bycatch or targeted fisheries
- Capture based aquaculture
- Intensive aquaculture
- Co-cultivation
- Sea ranching
- Integrated multitrophic aquaculture (IMTA)



SEA CUCUMBER AQUACULTURE CAN BE THE SOLUTION



Figure 1 Global wild captures and aquaculture production of sea cucumbers over time; in metric tonnes (t). Source FAO Fishstat, with correction: data for aquaculture production and wild captures of *Apostichopus japonicus* (China, Japan, Korea) refer to fresh animal weights, so these were converted to dried weight using a conversion factor of 0.04, based on other *Stichopus* species (<u>Skewes</u> *et al.* 2004).

From: Purcell et al 2013. Sea cucumber fisheries. global analysis of stocks, management measures and drivers of overfishing. F I SH and F I SHERI E S 14:34–59.

- ~20 thousand tonnes global capture & culture
- Aquaculture 20-30% of total world production
- Aquaculture mainly in China (large scale)
- Species Apostichopus japonicus
- Large potential for novel species



NORTH ATLANTIC SPECIES OF COMMERCIAL INTEREST

Wtihin the NORA-area -

two species considered potential aquaculture candidates

Norwegian red sea cucumber (*Parastichopus tremulus*)



Orange footed sea cucumber (*Cucamaria frondosa*)





AQUACULTURE - WHAT IS NEEDED ?





CUCUMARIA FRONDOSA

FIGURE 3 Cucumaria frondosa in its natural habitat (left) and a group of freshly fertilized eggs (right)



Hamel, J.-E.; Mercier, A. 2008. Population status, fisheries and trade of sea cucumbers in temperate areas of the Northern Hemisphere. In V. Toral-Granda, A. Lovatelli and M. Vasconcellos (eds). Sea cucumbers. A global review of fisheries and trade. *FAO Fisheries and Aquaculture Technical Paper*. No. 516. Rome, FAO. pp. 257-291.

| Vol. 12: 139–151, 2020 https://doi.org/10.3354/aei00356 | AQUACULTURE ENVIRONMENT INTERACTIONS Aquacult Environ Interact | Published April 9 |
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Growth, health and biochemical composition of the sea cucumber *Cucumaria frondosa* after multi-year holding in effluent waters of land-based salmon culture

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A Review of the Northern Sea Cucumber *Cucumaria frondosa* (Gunnerus, 1767) as a Potential Aquaculture Species

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Has potential, but slow growth rate and low value are limitations



Triggers of spawning and oocyte maturation in the commercial sea cucumber *Cucumaria frondosa*

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PARASTICHOPUS TREMULUS





Photo: Møreforsking2020

Christophersen et al. 2020





NORWEGIAN PERSPECTIVES

Møreforsking Anthology 2019

Atlantic sea cucumber species in the spotlight – prospects for Norwegian aquaculture

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Keywords: Parastichopus tremulus, Cucumaria frondosa, sea cucumber, aquaculture, IMTA, reproduction





MARINE BIOLOGY RESEARCH https://doi.org/10.1080/17451000.2020.1781188



Check for updates

REPORT

Reproductive cycle of the red sea cucumber, *Parastichopus tremulus* (Gunnerus, 1767), from western Norway

Gyda Christophersen, Ingebrigt Bjørkevoll, Snorre Bakke and Margareth Kjerstad Møreforsking AS, Ålesund, Norway





Emerging species for sea cucumber aquaculture

The process for bringing a new sea cucumber species to commercial cultivation

Following a modified cultivation protocol



The mariculture protocol is (modified from Sloan (1985) (translated from Levin 1982).



COMMON R&D CHALLENGES

to ensure building an environmental friendly and sustainable industry

- •Advance the biological knowledge of new species
 - Life history parameters
 - Performance in aquaculture conditions
 - Population dynamics in a changing environment
- Optimise hatchery production of juveniles
- •Develop effective production systems
 - Land or sea based
 - Mono, co, or integrated culture
- Product development and food safety
- •Knowledge about established and new markets



WE HAVE A DREAM...!



