SEAWEED BIOSECURITY

Prof Elizabeth J Cottier-Cook

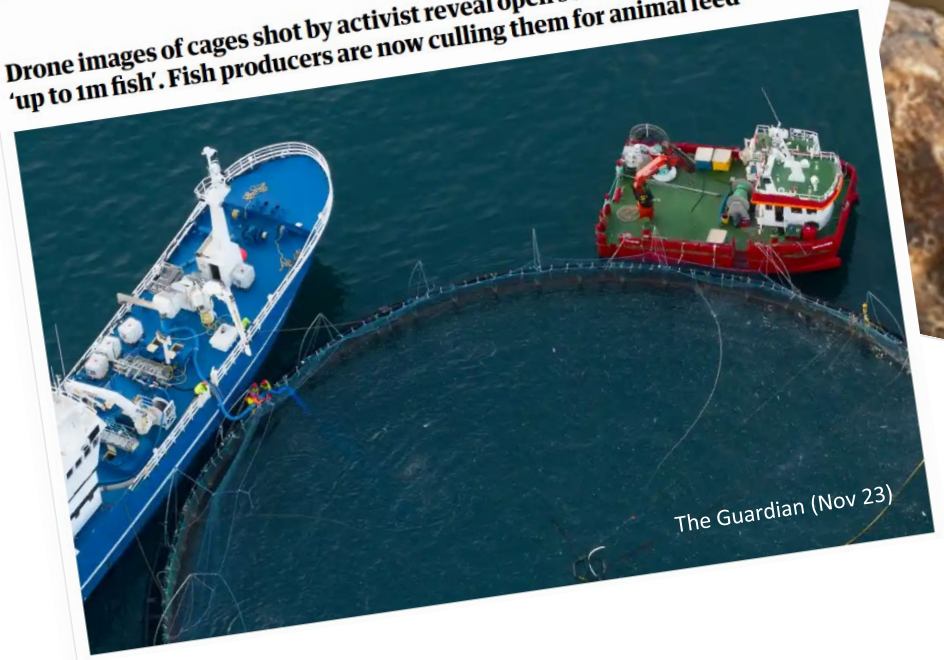
Scottish Association for Marine Science
ejc@sams.ac.uk

SSIA Conference – Oban – 14 Nov 2023

The importance of biosecurity...

Sea-lice outbreak on Icelandic salmon farm a 'welfare disaster', footage shows

Drone images of cages shot by activist reveal open sores affecting 'up to 1m fish'. Fish producers are now culling them for animal feed



The Guardian (Nov 23)

Killer oyster virus on River Exe for first time

1 October

BBC News (1 Oct 23)

News

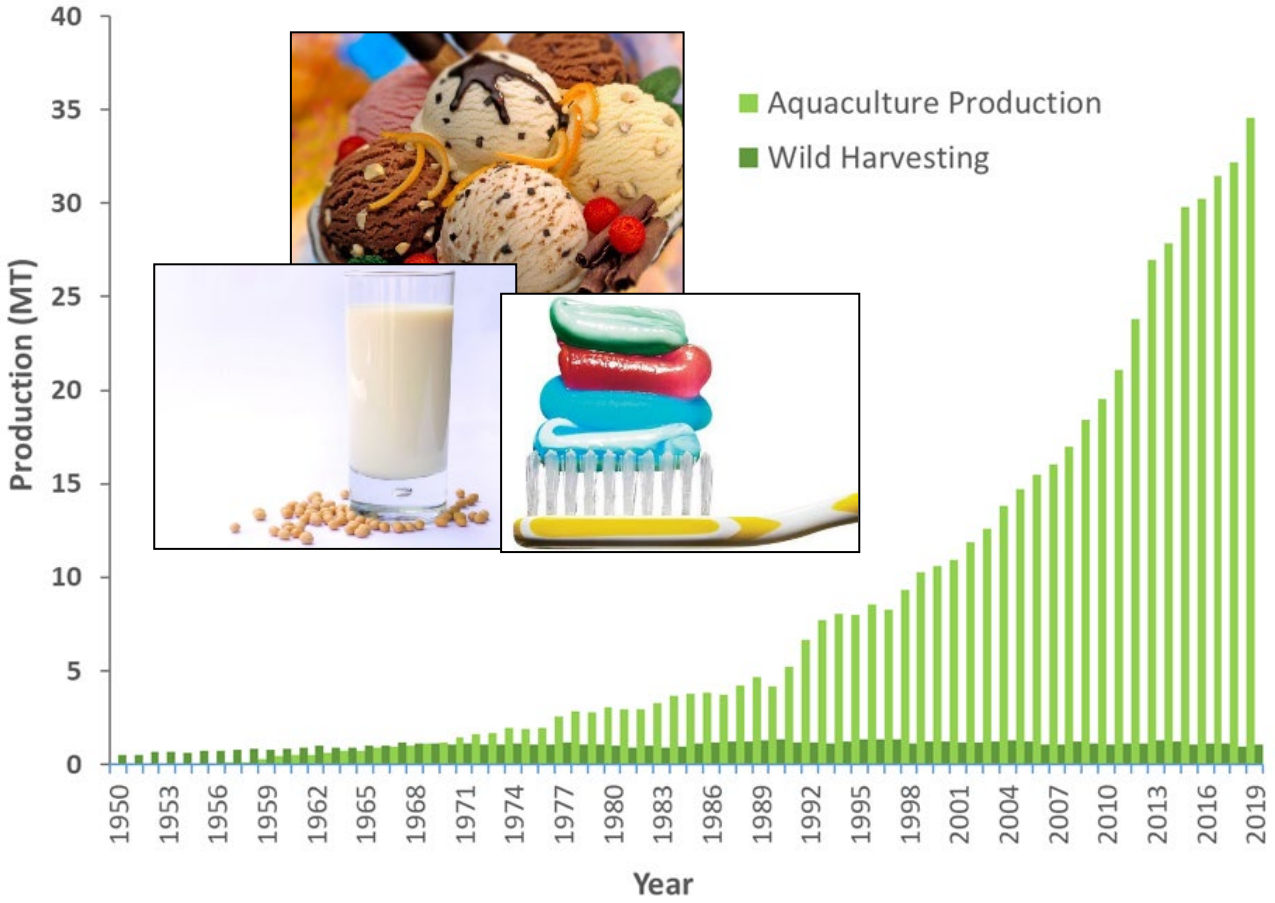
ISA news takes shine off SalMar harvest numbers

By Vince McDonagh - 10th October 2023

SalMar has today reported a bumper 24,000 tonne-plus increase in its 2023 third quarter harvest. But the company has also reported the discovery of infectious salmon anaemia (ISA) at one of its sites.

Fish Farmer Magazine (10 Oct 2023)

The importance of seaweed...



FAO FishStatJ 2021

US$14.7bn

95% in low to middle income countries

6M+ farmers globally

Major biosecurity-related challenges facing the seaweed industry

Occurrence of ice-ice syndrome and pests – led to significant losses of production globally

having **major socio-economic impacts** on the communities reliant on seaweed production

Ward *et al*. (2019) JWAS; Brakel *et al*. (2021) Plants, People, Planet

Managing Pests and Disease

Table 1 Biosecurity measures applied in two treatment farms

Biosecurity measure	BTF	NBTF
1. Propagules treatment	○ Visually health checked for thallus bleached, wounds, epiphytes/epi-endophytes, biofilm, fouling organisms, waste material attached at the preparation, grow-out and harvest ○ Only used the propagules with healthy sign, many shoot tips and visually cleaned from pests attached ○ Source of propagules known	○ Visually health checked for the propagules was randomly carried out in the preparation process only. ○ Initial propagule used as BTF ○ Source of propagules known
2. Farm equipment treatment	○ Newly purchased ropes (anchor ropes, planting ropes and tying ropes) ○ The boat was cleaned and sun-dried before use.	○ As BTF
3. Cleaning treatment	○ Epiphytes/epi-endophytes, biofilm, fouling and all waste attached were carefully removed manually from the crop and the ropes (using tissue paper or soft fabrics). ○ Bleached/discoloured thallus removed from the farm by cutting the bleached thallus apart	○ Seaweed crops and ropes were left uncleaned. ○ Bleached/discoloured thallus was fragmented naturally without maintenance.
4. Farm waste treatment	○ All bleached/discoloured thallus, epiphytes/epi-endophytes, biofilm and all waste materials were gathered and disposed landfill, and avoided to throw within farm area.	○ No measure in maintaining the farm wastes included the bleached/discoloured thallus and the pests attached
5. Environment monitor	○ Physical environmental parameters were measured at the beginning of the experiment and regularly throughout the grow-out phase within 3–4 days.	○ As BTF
6. Monitoring and evaluation	○ Every 2 days for cleaning and removing pests, bleached, and checking the health status of crops ○ Every 10 days for measuring the growth, pests coverage and ice-ice incidence	○ Measuring the growth, pests coverage and ice-ice incidence as BTF ○ No cleaning, removing and checking health of crops

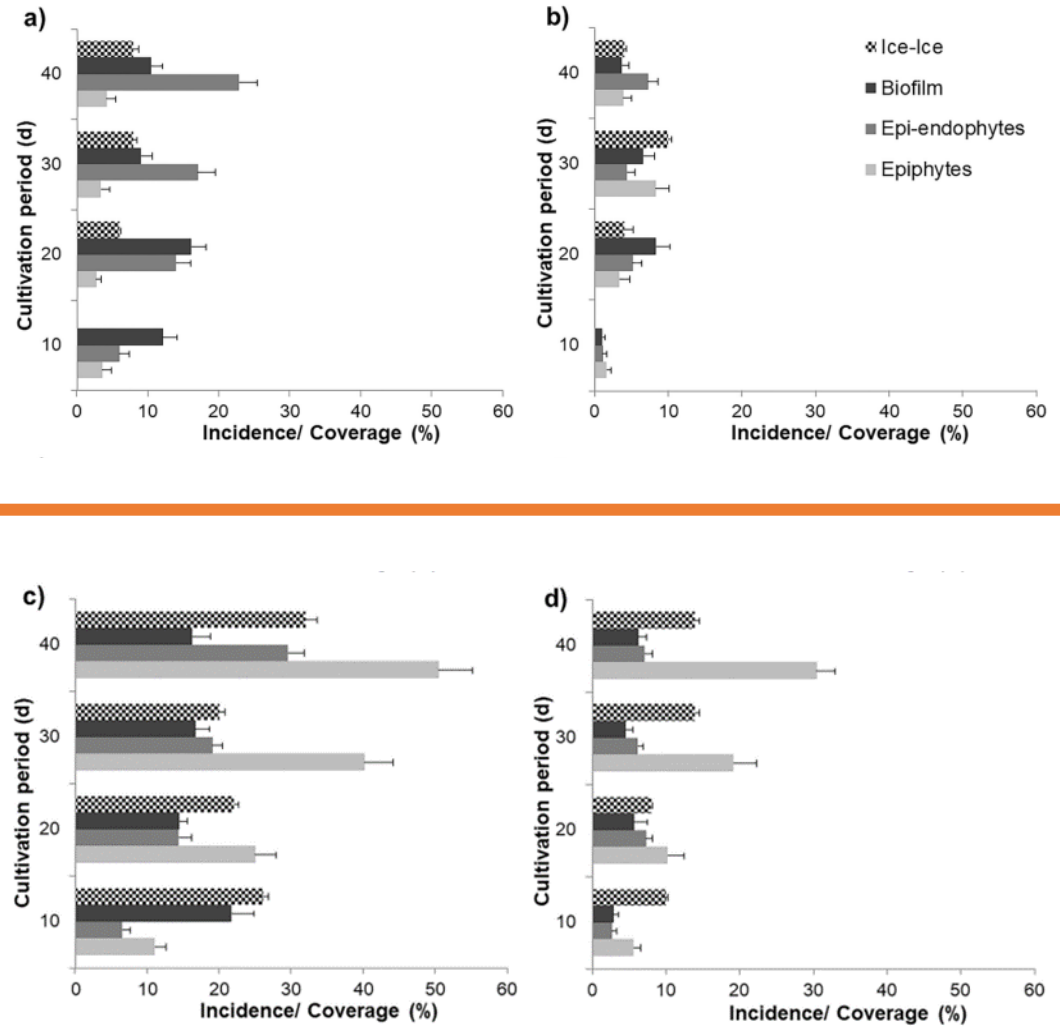
Kambey et al. (2021) J Appl Phycol

Managing Pests and Disease

BIOSECURITY TREATED FARM

NO TREATMENT

Kappaphycus malesianus *K. alvarezii*



K. malesianus - Bleaching

Kambey et al. (2021) J Appl Phycol

Managing Pests and Disease – Risk Components

Components	Risk
Crop/seedling	➢ Pathogen infected crop (indicated visually by a bleached /discoloured thallus) ➢ EFA infestation ➢ Low disease-resistant strains being propagated ➢ Traceability
Farm equipment	➢ Unclean, non-disinfected equipment (ropes, boat hulls, buoys) ➢ Weak rope ties
Work platform	➢ Crop condition (e.g., dehydrated before planting, wounded and contaminated with pathogens)
Environment	➢ High temperature, low salinity, high turbidity, low water movement/ current, high irradiance, pollution ➢ Inappropriate site location

Kambey et al. (2021) J Appl Phycol

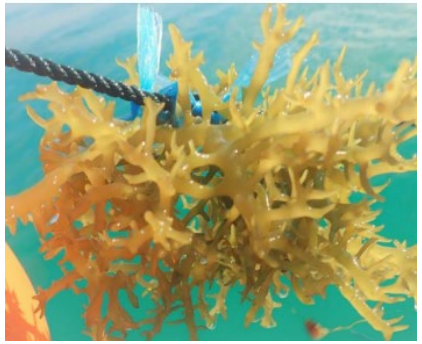
Managing Pests and Disease – SOP at a glance

Preparation process:

- ✓ Know your seedling source
- ✓ Check initial condition of the seedling
- ✓ Environmental factors are optimal for growing seaweed
- ✓ All farm equipment is cleaned and disinfected
- ✓ No reuse of infected crop

Grow-out process:

- ✓ Detect signs of diseases by regular crop checking
- ✓ Prevent diseases by removing the any infected crop
- ✓ Manage the farm risks via appropriate measures (crop separation, crop density, farm waste disposal)
- ✓ Monitor the farm system closely with regularly visits to the farm



Harvest & Post-harvest processes:

- ✓ Careful handling of the seaweeds during harvest and use of suitable drying techniques
- ✓ Do not dry the infected crop together with the healthy crop
- ✓ Dispose of the infected crop and farm wastes in landfill
- ✓ Clean and disinfect the farm equipment after use

Government control and monitoring:

- ✓ Regular monitoring of farms through random farm site visits
- ✓ Proactive mitigation of farm outbreaks
- ✓ Record the farm outbreaks for evaluation
- ✓ Build an effective monitoring and reporting system

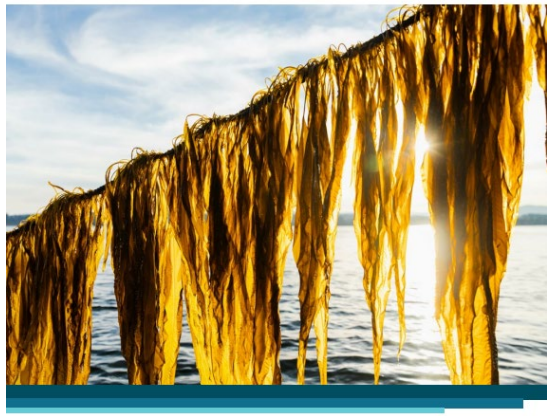
SAMS Scottish Association for Marine Science

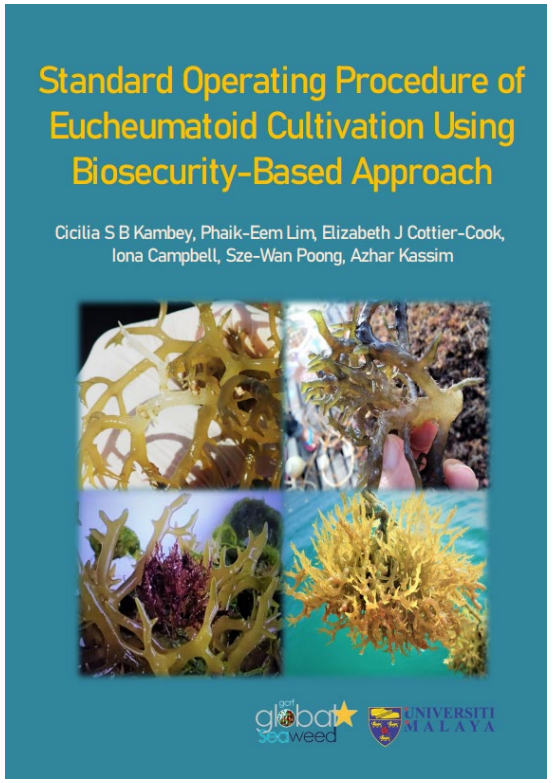
Kambey et al. (2021) IOES, Uni of Malaya

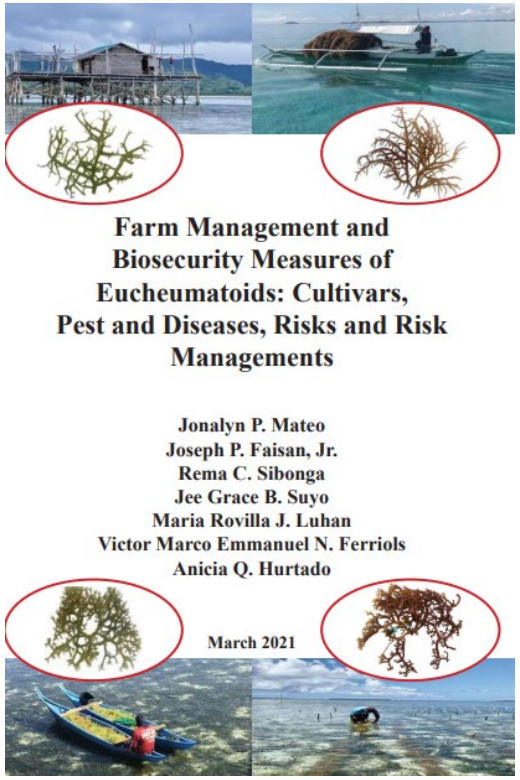
SEAWEED BIOSECURITY RESOURCES

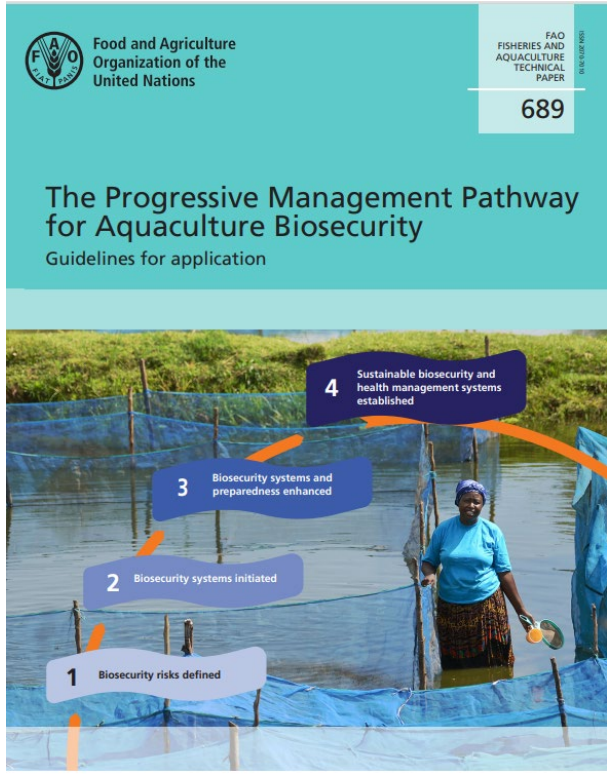
OPEN ACCESS

gcrf global Seaweed









nature comms

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A new Progressive Management Pathway for improving seaweed biosecurity

Elizabeth J. Cottier-Cook, Jennefe P. Cabarubias, Janina Brakel, Juliet Brodie, Alejandro H. Buschmann, Iona Campbell, Alan T. Critchley, Chad L. Hewitt, Jie Huang, Anicia Q. Hurtado, Cicilia S. B. Kambey, Phaik Eem Lim, Tao Liu, Jonalyn P. Mateo, Flower E. Msuya, Zizhong Qi, Louise Shaxson, Grant D. Stentiford & Melba G. Bondad-Reantaso

www.globalseaweed.org

Thank You | Terima kasih | Asante | Salamat

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