

# Integrated pest management to control sea lice

- Are we there yet?

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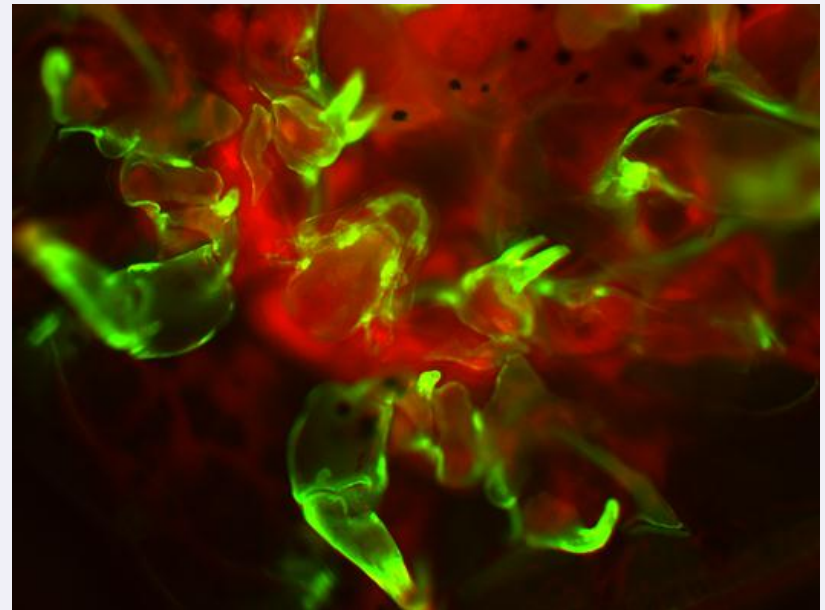


Photo: Sussie Dalvin, Institute of Marine Research



**Veterinærinstituttet**  
Norwegian Veterinary Institute

Pests globally consume food  
estimated to feed an additional  
one billion people (Birch et al 2011)



**Veterinærinstituttet**  
— *Norwegian Veterinary Institute*

# Main areas of concern

- Crop protection
- Sustainable growth
- Pesticides use



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# IPM and definitions (agriculture)

- A consensus on IPM definition is yet to be reached
  - Survey in 1996 recorded 64 definitions of integrated control, pest management or integrated pest management.  
(Bajwa and Kogan 1996)

*IPM is a decision support system for the selection and use of pest control tactics, singly or harmoniously coordinated into a management strategy, based on cost/benefit analyses that take into account the interests of and impacts on producers, society, and the environment.*

*(Kogan 1998)*

# Field-to-field management approaches

- Addresses only small fractions of a pest population at any give time
- Allows producers to control pests independently
- Do not take into account migrating pest individuals into the treated area from infestations in untreated areas
- Relies on remedial interventions triggered by a certain pest threshold
- An insufficient approach against mobile pests

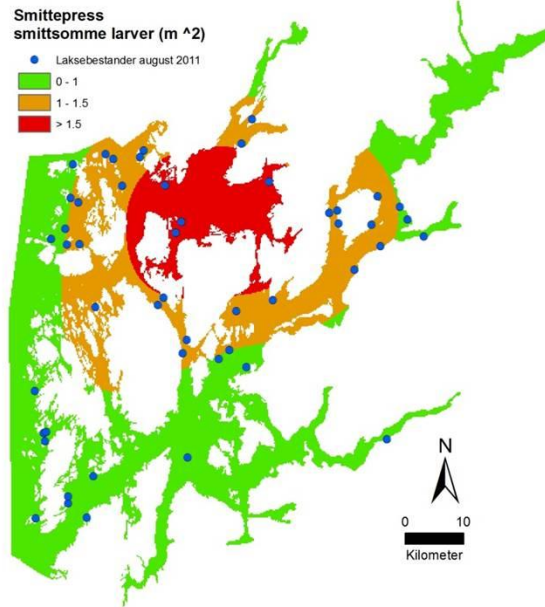


# Area wide management approaches

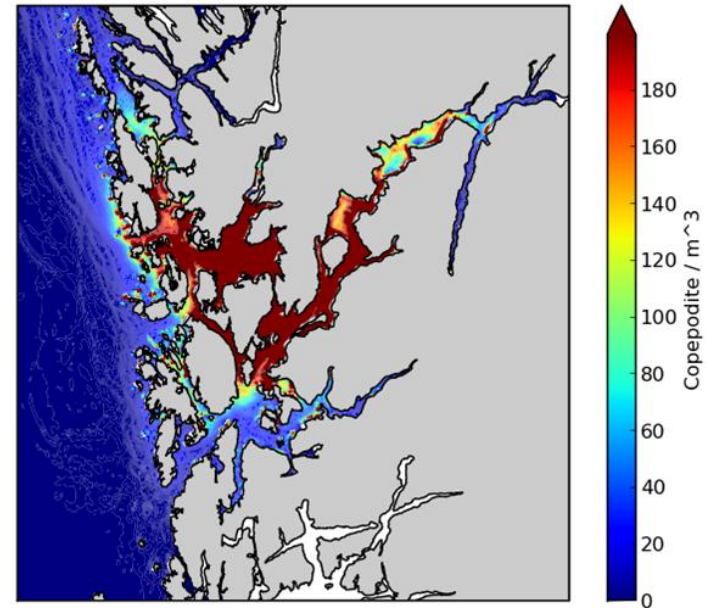
- IPM applied against an entire pest population within a delimited geographic area
  
- Requires:
  - Planning
  - Ecological understanding
    - Spatial distribution of the pest population
  - Longer-term commitment
  - Coordinated implementation by farmers and all other stakeholders
  
- Success or failure of AW-IPM programs?
  - Effective management an critical issue



# Dispersion of sea lice larva, a key element in the definition of an area



Peder A Jansen, Norwegian Veterinary Institute

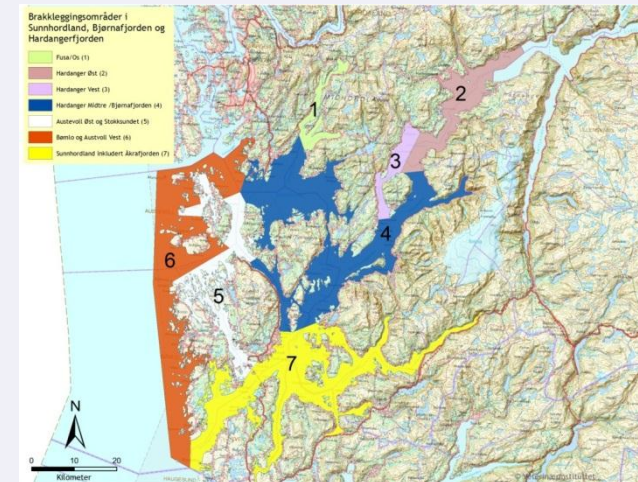
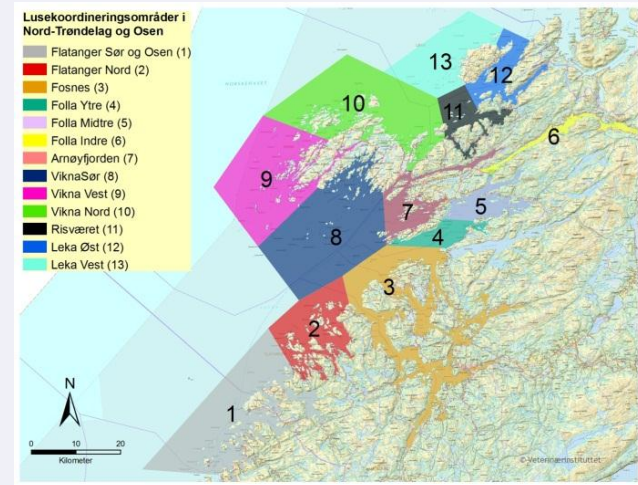


Lars Asplin, Institute of Marine Research





# Sea lice and management areas in Norway

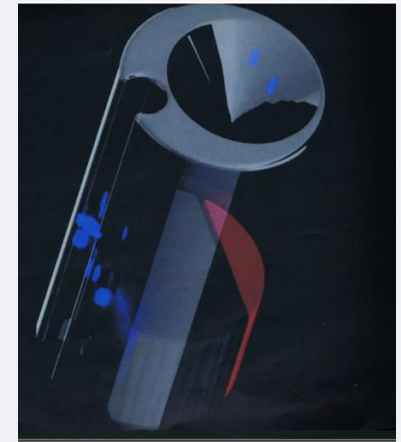


# The toolbox against sea lice

- Medicines
- Year class stocking/fallowing
- Other non-medical measures:
  - Cleaner fish
  - Health feed/supplements
  - Breeding
  - Tarpaulin/plankton net for shielding
  
- In development:
  - Copepods traps
  - Electric current field
  - Laser
  - Mechanic delousing
  - Thermal delousing
  - Vaccine



Photo: A. Ingvarsdottir



L. Salmonis trap  
(Bowman and Skiftesvik)



Seafarm Pulse Guard

# Medicines available in Norway

- For use in topical treatments:
  - Pyrethroids (ALPHAMAX<sup>®</sup> and BETAMAX VET.)
  - Organophosphorus compound (Salmosan<sup>®</sup> )
  
- For use as oral treatments:
  - Avermectin (SLICE<sup>®</sup>)
  - Chitin inhibitors (Ektobann vet. and Releeze)
  
- In addition:
  - Hydrogen peroxide



# Cleaner fishes

- Sales registered (2010 Norway):
  - 535 tonnes
  - 11 mills of cleaner fishes
- Used in about 50% of Norwegian salmon and trout farming (2010)
- Dependent on wild catch
- Commercial production ongoing:
  - 3 production sites of wrasses
  - 3-4 production sites of lump sucker



# Plankton net for protection against sea lice larvae

- Net mesh (100 $\mu$ m)
- Significant difference in sea lice numbers (shielded vs non shielded cages)

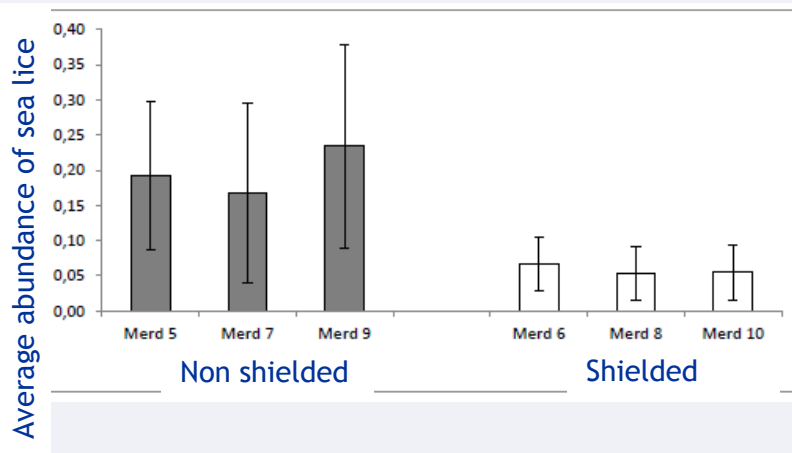
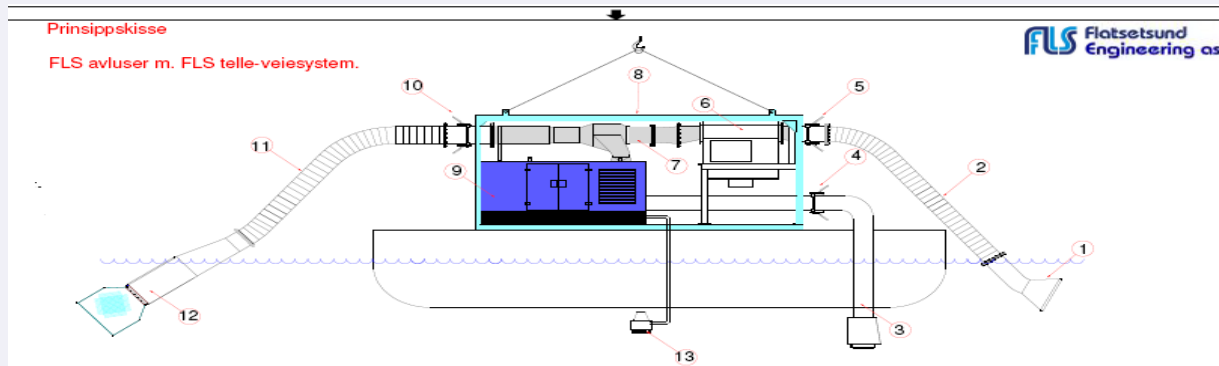


Photo: T.Larsen, Calanus AS

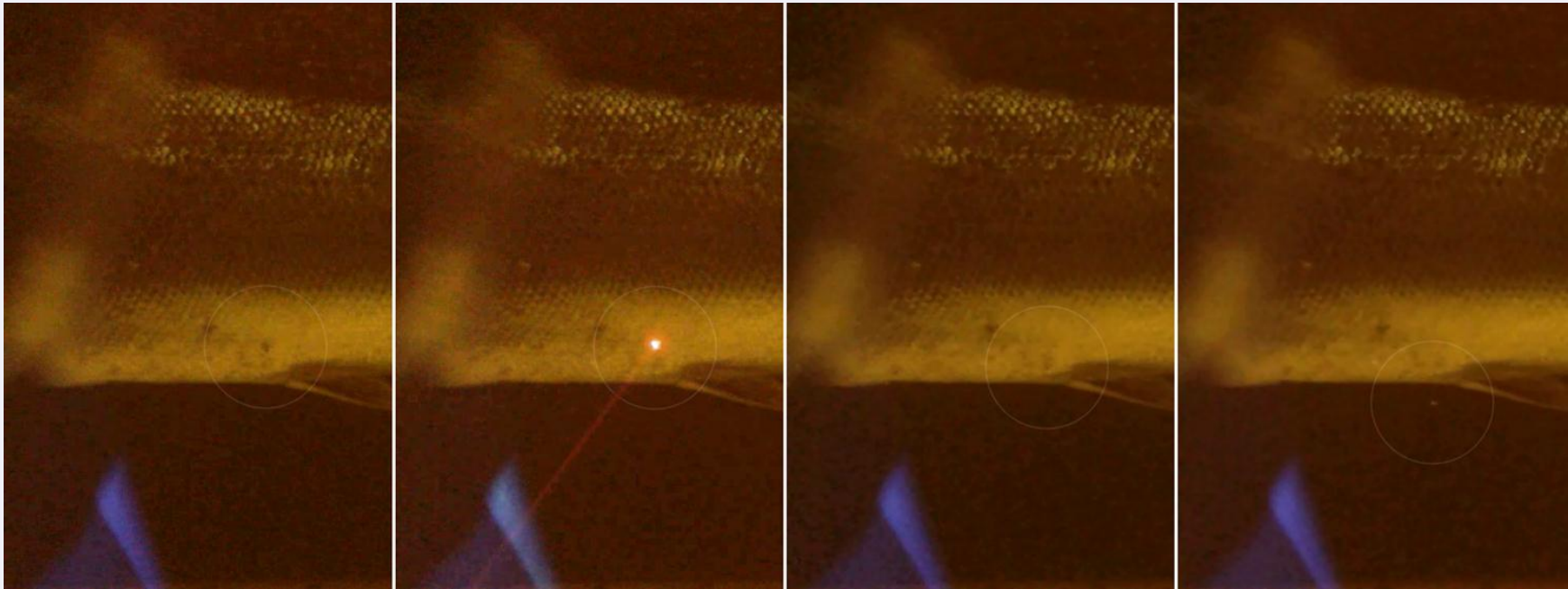
# Mechanical removal of sea lice

- Removes mobiles by water flush
- Need for further development and higher capacity



# Star wars against sea lice

- Promising method for continuous control of settled sea lice



- Laser - to control sea lice infections
- Development project, Beck engineering in cooperation with Marine Harvest, Lerøy Seafood Group and SalMar.

# Goal - development of a true aquatic IPM

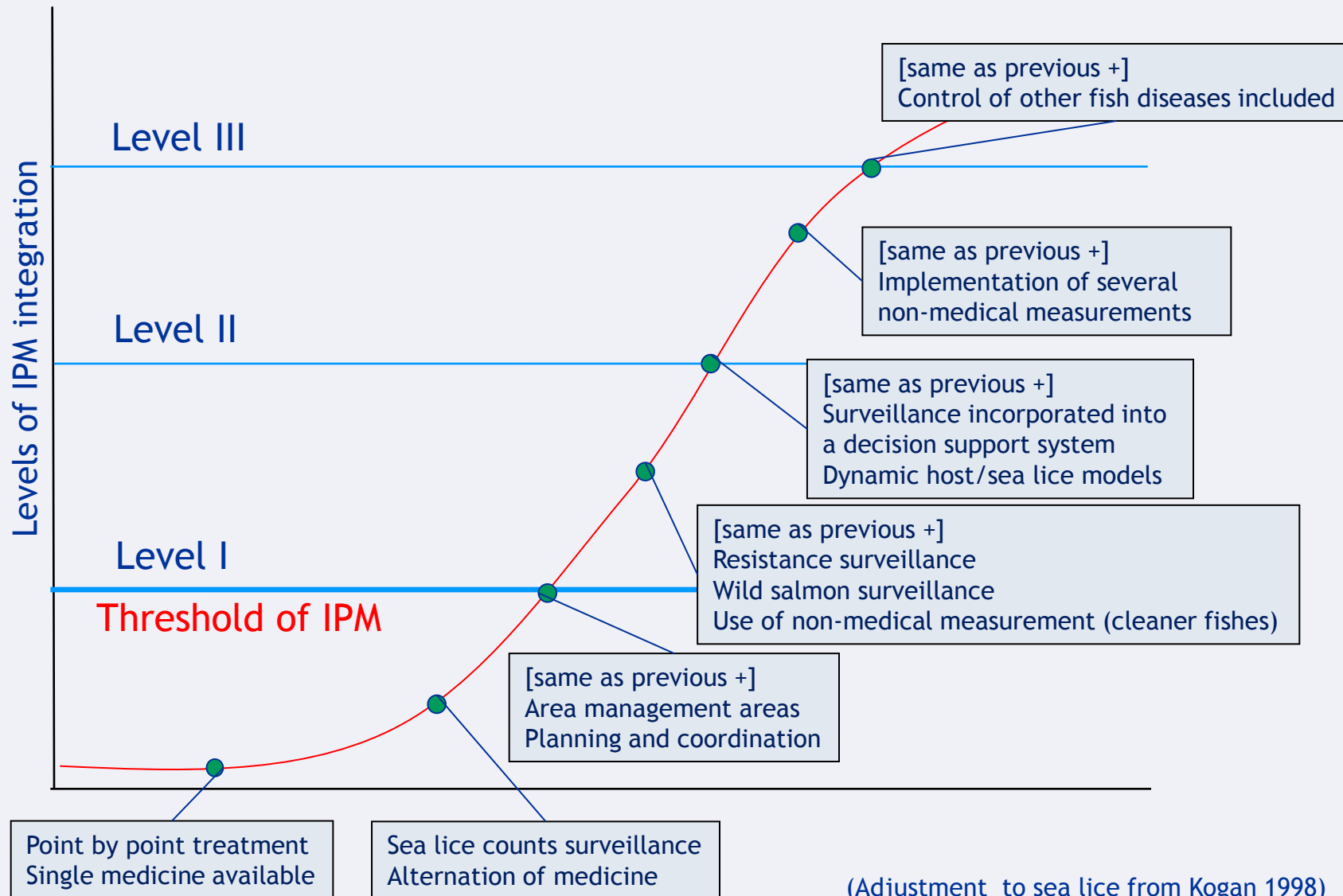
*From the definition:*

- *decision support system*
- *pest control tactics*
- *coordination into a management strategy,*
  - *based on cost/benefit analyses that take into account the interests of and impacts on producers, society, and the environment.*





# Continuum from conventional sea lice control to level III IPM



(Adjustment to sea lice from Kogan 1998)



# Are we there yet?

- Bottlenecks:
  - Surveillance and epidemiological understanding
  - Development and implementation of non-chemical measurements
  - Coordination and agreement of IPM strategy
- Need for a coordinated research program to enhance implementation of integrated sea lice control



Thanks to all who has contributed with information

## See you for the 4th Sea lice multination workshop in 2013

Recommended for more information on IPM:

Marcos Kogan: Annu. Rev. Entomol. 1998.43:243-70

Brewer and Goodell: Annu. Rev. Entomol. 2012.57:41-59

Birch et al: Journal of Experimental Botany. 2011. 62:3251-3261

<http://www.namdalakvasenter.no/?side=97&nyhet=269>

