Fishy Business:
Harmful algae bloom (HAB) exposure in aquaculture pens

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Image credit: *Fish Said Fred*

Harmful algal blooms (HAB) are sudden increases in a species of cyanobacteria or microalgae (a bloom) that cause harmful effects. The combination of exposure to the toxins produced by algae and asphyxiation (which is due to hypoxia that is a result of the algal bloom) causes high levels of fish mortality in aquaculture pens. This poster focusses on the effect of toxins on fish produced by algae in aquaculture pens. (3)

Harmful Algae Species

Pseudochattonella spp.(1)

- Two species, difficult to tell apart
- Covered in mucocysts
- Cause gill irritation
- Little information on bloom/toxin formation

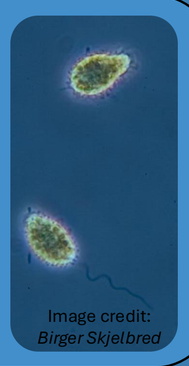


Image credit: *Birger Skjelbred*

Chrysochromulina leadbeateri(2)

- Growth: correlated with temp
- Toxicity may be linked to polyamines
- Toxic mechanism still unknown

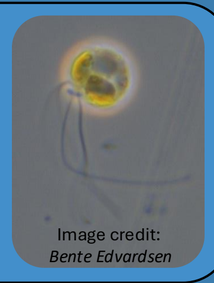


Image credit: *Bente Edvardsen*

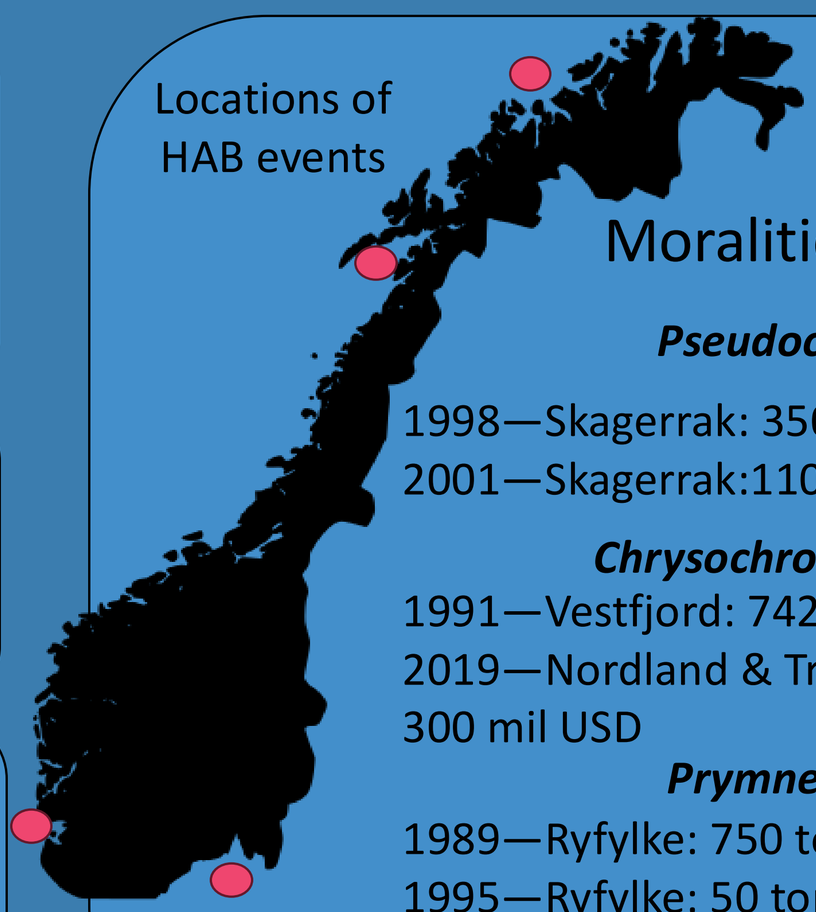
Prymnesium parvum(3,4)

- Produces ichthyotoxins
- Prymnesin-1 & Prymnesin-2
  - Isolated in 1995
- Exact mechanism still debated
- May be linked to unbalanced N:P

Image credit: *J. Kownacka*

HAB Events in Norway(3)

Locations of HAB events



Moralities of Past HABs

***Pseudochattonella* spp.**

1998—Skagerrak: 350 tons killed, 1.4 mil USD
2001—Skagerrak:1100 tons killed, 3.5 mil USD

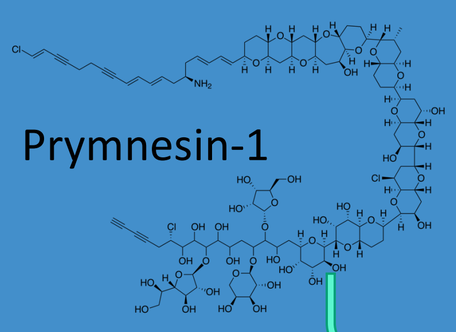
Chrysochromulina leadbeateri

1991—Vestfjord: 742 tons killed, 5 mil USD
2019—Nordland & Troms: 14.500 tons killed, 300 mil USD

Prymnesium parvum

1989—Ryfylke: 750 tons killed, 9 mil USD
1995—Ryfylke: 50 tons killed, 0.3 mil USD
1998—Skagerrak: 900 tons killed, 9 mil USD
2007—Erfjord: 350 tons killed, 3.5 mil USD

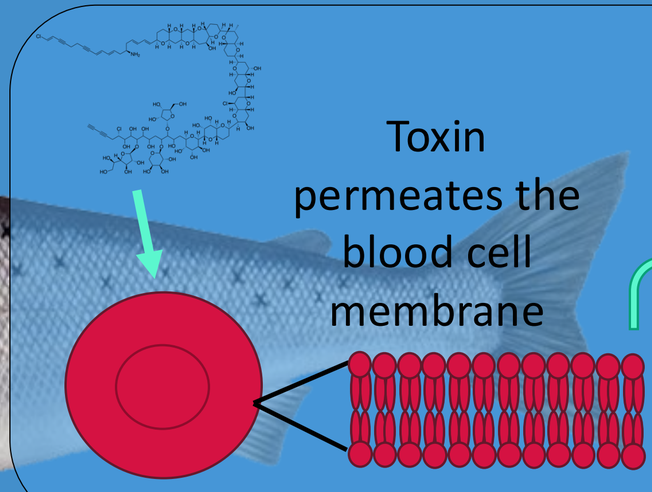
Prymnesium parvum Toxin in Fish(4,5)



Prymnesin-1

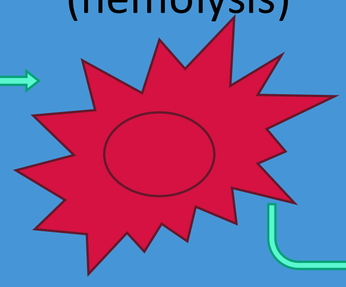
Toxin taken up by the gills

Picture credit: *R.E. Parkhomenko*



Toxin permeates the blood cell membrane

Blood cell is ruptured (hemolysis)



Loss of red blood cells causes hypoxia in the blood

Solutions(6)

- Phosphatic clay minerals to mitigate HAB → They have an ability to flocculate algal cells and remove nutrients.
- Chemical control: spraying electrolytes → increases the water's pH and promote cell lysis due to increased persistence of ammonia species.
- Sonication → To agitate the microalgae in the pens and remove them.
- Improve environmental conditions around aquaculture pens → Nutrient manipulation, change the ratio of nitrogen and phosphorus.

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2) Johnsen, G., Dalløkken, R., Eikrem, W., Legrand, C., Aure, J., & Skjoldal, H. R. (1999). Eco-physiology, bio-optics and toxicity of the ichthyotoxic Chrysochromulina leadbeateri (Prymnesiophyceae). Journal of Phycology, 35(6), 1465-1476.
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