Limalevä
Gonyostomum semen

Ekologia, elintavat ja esiintyminen

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Suomen ympäristökeskus SYKE
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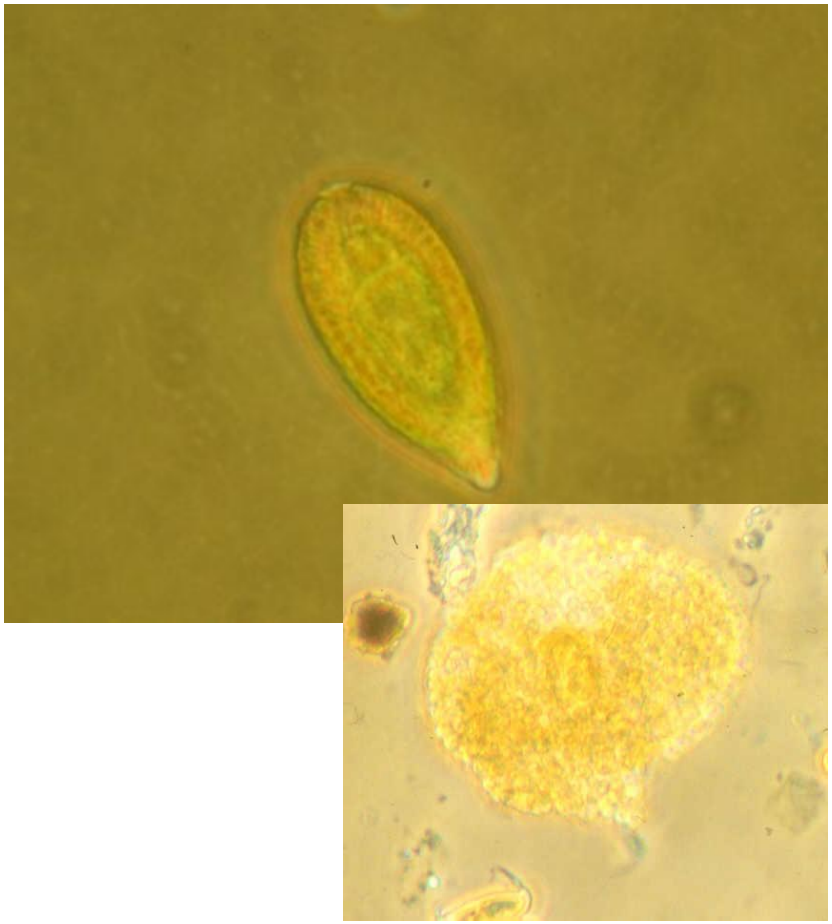
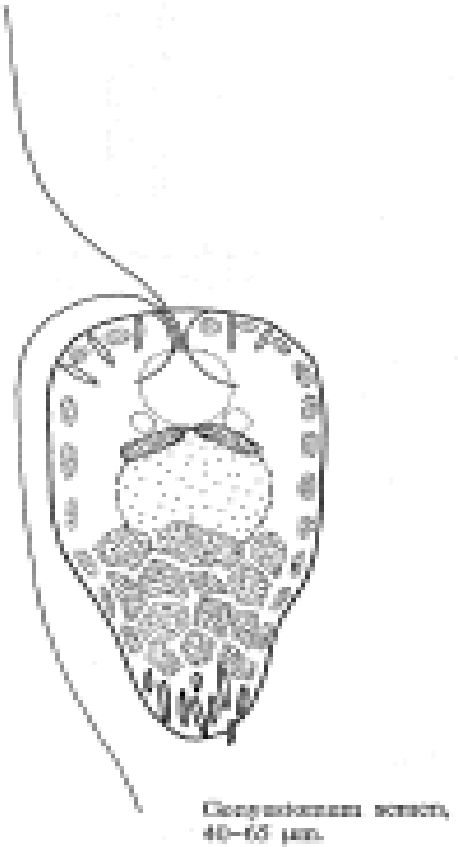
SYKE

Gonyostomum semen, Raphidophyceae

- 2-siimainen kookas (30-100 µm), yksisoluinen levä
- suurikokoisena merkittävä kasviplanktonbiomassan (klorofyllin) muodostaja





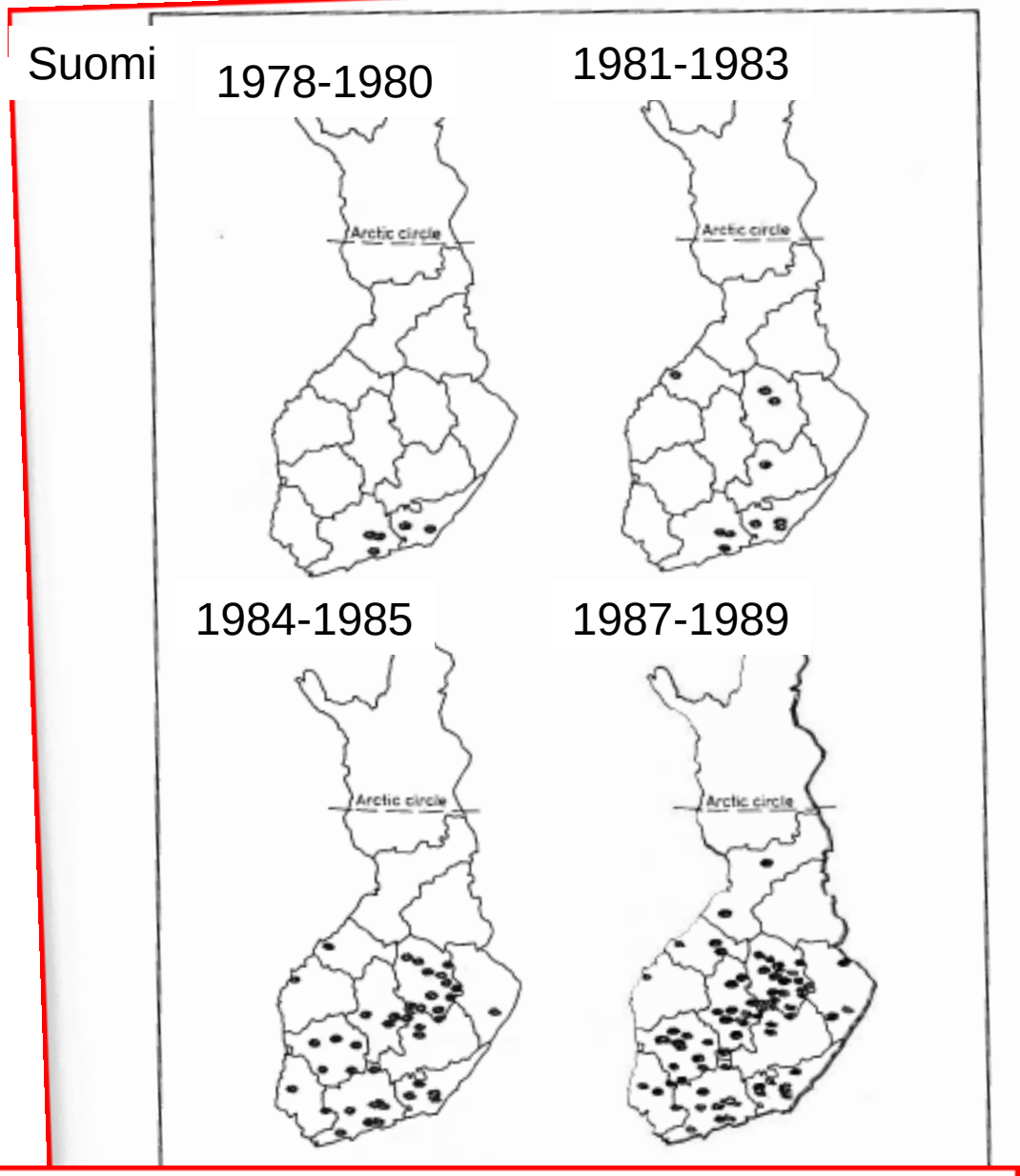
G. semen

- nk. 'invasive species'
- laaja levinneisyys
- levinnyt uusiin järviin Pohjois-Euroopassa

Maileht K. Hydrobiologia 2012 (painossa)

FI	+
NO	+
SE	+
EE	+
LV	+
LT	
DK	+
UK	+
NL	
IE	
PL	
DE	
BE	
HU	
FR	
RO	
IT	
ES	+
GR	
CY	

suurin biomassa humusjärvet (väri 112 mg/l Pt)



Lepistö L, Antikainen S, Kivinen J (1994) The occurrence of *Gonyostomum semen* (Ehr.) Diesing in Finnish lakes. Hydrobiologia 273:1–8

Global Change Impacts on Phytoplankton Communities in nutrient-poor Lakes

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Ruotsi

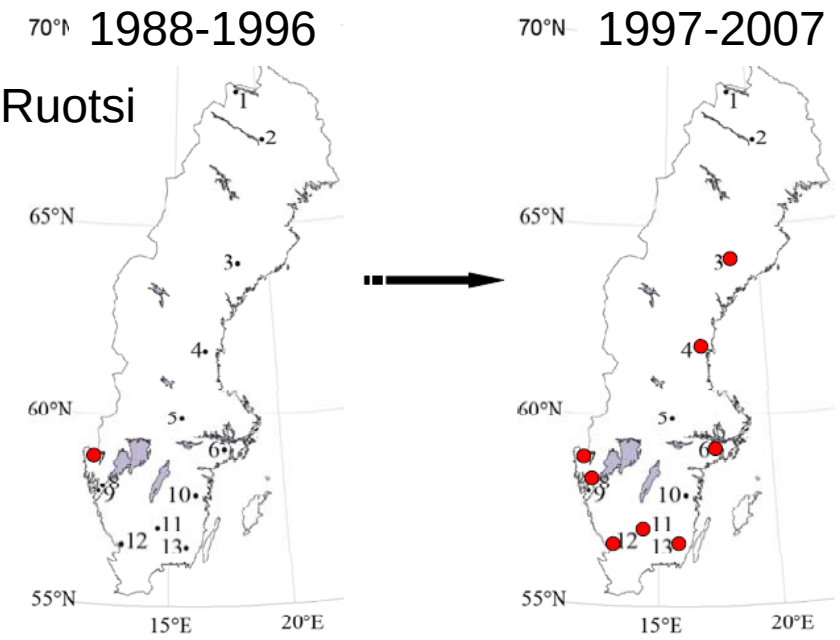


Figure 4. Occurrence of *Gonyostomum semen* in 13 lakes between 1988 – 2007. Red circles symbolize lakes where *Gonyostomum semen* was found.

SESSION-13

PAPER-2: Nuisance alga *Gonyostomum semen*: Implications for Its Gglobal Expansion

Reet Laugaste & Peeter Nõges

Viro

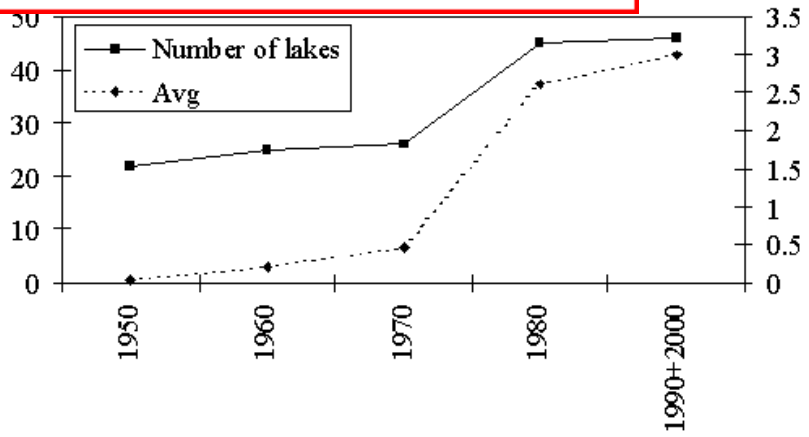
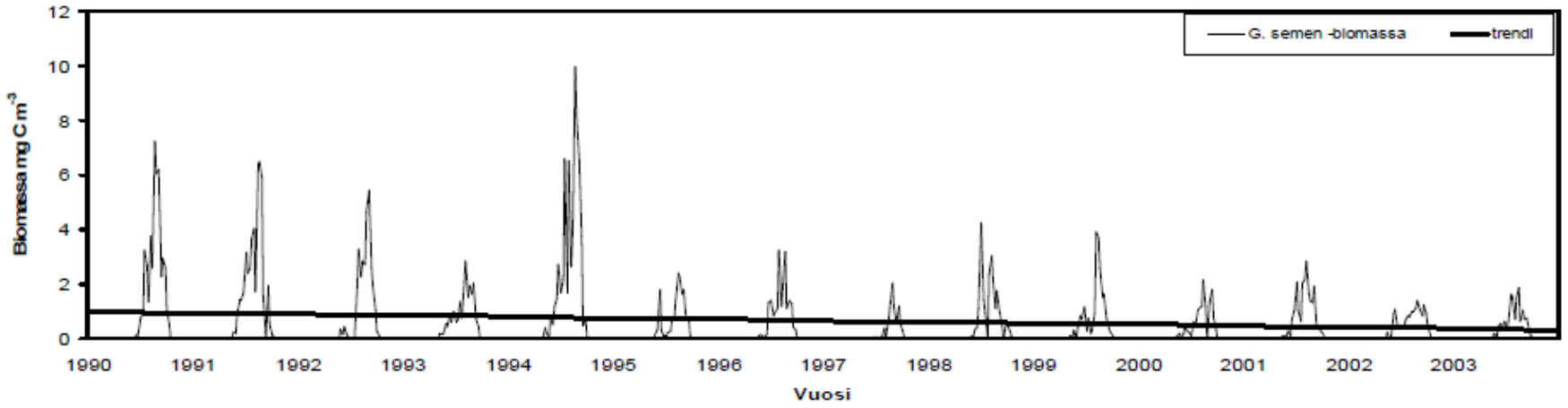


Fig. 2. Number of lakes with *G. semen* and the average abundance of the species on a 5-step scale by decades.

SYKE

Limalevä - elintavat

- massaesiintymiä tunnettu kauan (1935 Cedar Pond Massachusetts)
- laji osittain heterotrofi (nk. miksotrofi)
- uiminen: vaeltaa aamulla pintaan ja illalla alaspäin
  - ravinteiden haku pohjasedimentistä /ravinnerikkaasta alusvedestä
  - eläinplanktonin laidunnuksen välttäminen
- **sedimentti liittyy olennaisesti elinkiertoon (lepovaiheet)**
- talvehtii leposoluina sedimentissä, leposoluja kun lämpötila <10 °C

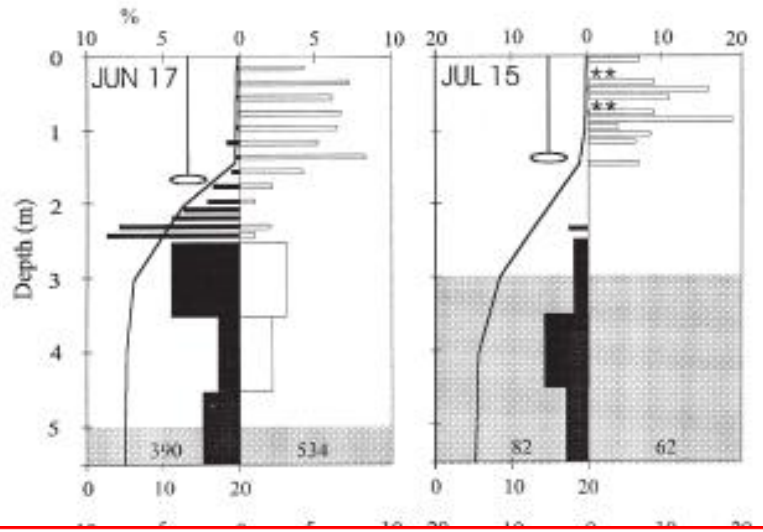


Kuva 3. *Gonyostomum semen* -biomassa avovesikausilla 1990–2003 (näytteenottoväli 7 vuorokautta) sekä kausivaihteluista puhdistettu viikkokohtainen trendi (vuositasolla k = -2,4 x 10^{-2} g m^{-3} v^{-1}).

Valkea-Kotinen, Evo: Peltomaa E. 2007 HY pro gradu

Limalevän pystyvaellus vesipatsaassa

Salonen & Rosenberg 2000 J Plankton Res.



Järvinen 2002

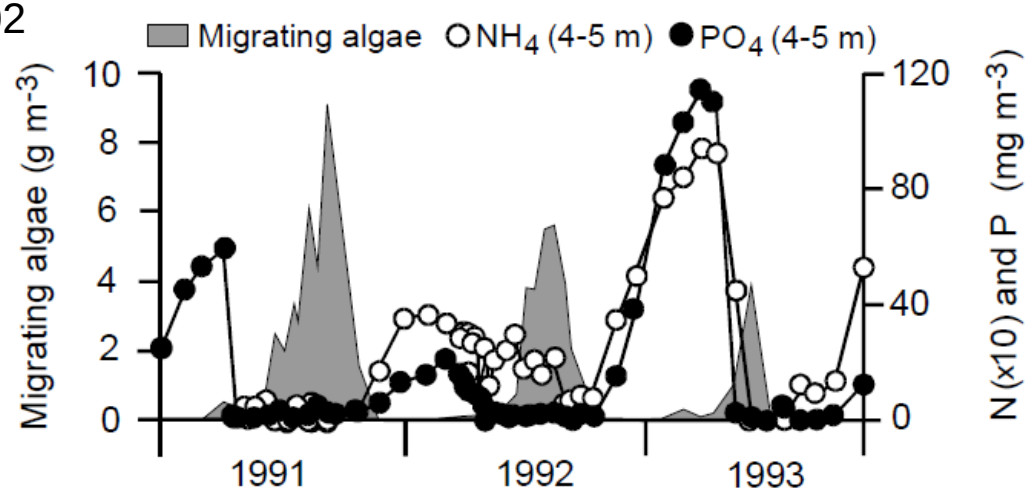


Figure 7. *Concentrations of inorganic phosphorus and ammoniun-nitrogen in the hypolimnion of the control side of L. Iso Valkjärvi in 1991–1993, and the total biomass of migrating algae (Gonyostomum semen+cryptomonads). The high nutrient concentrations during the winter of 1992–1993 resulted from the fish-kill in autumn 1992 and a consequent decomposition of fish carcasses (cf. IV, chapter 7.4).*

G. Semen elinkierto

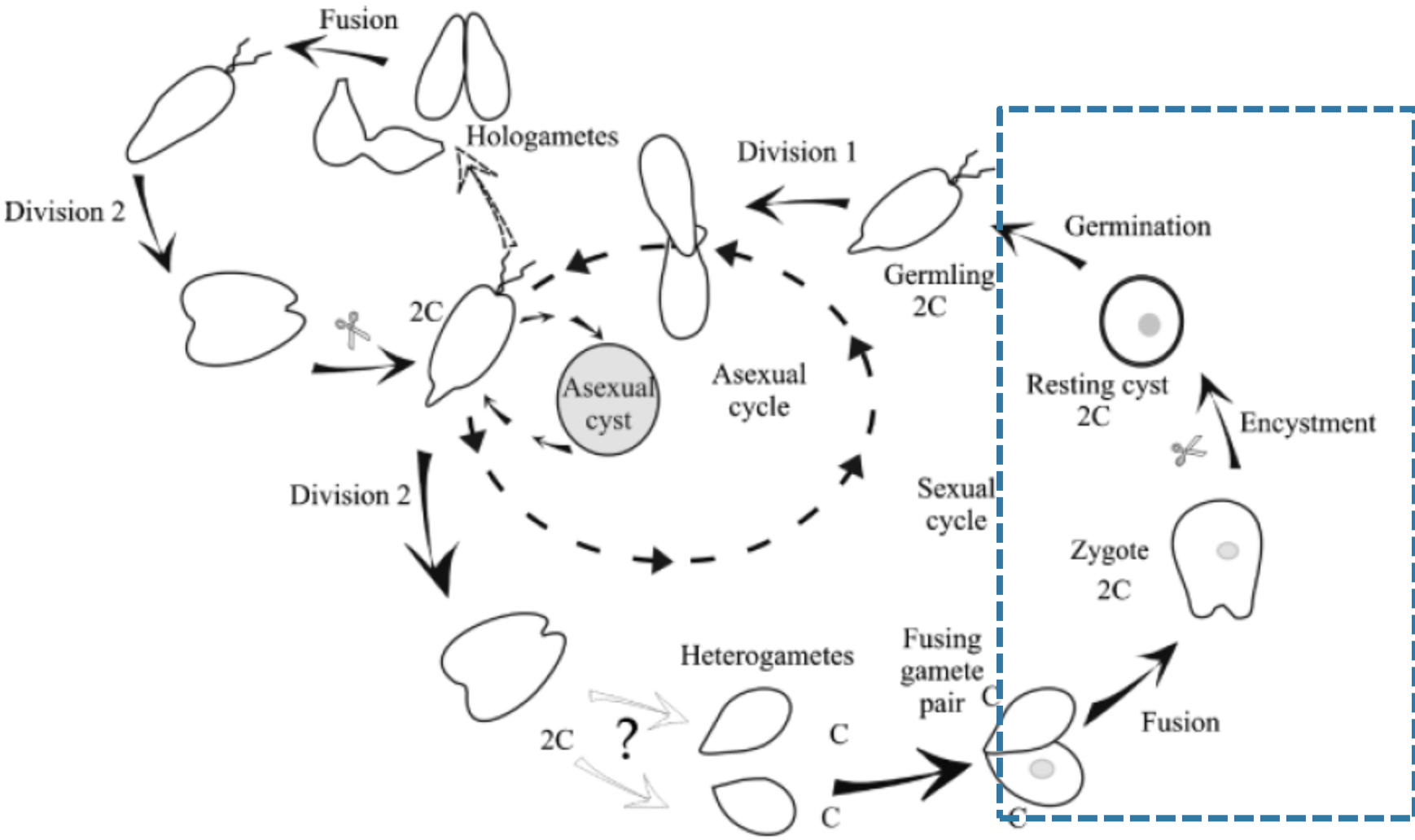


FIG. 1. Life cycle of *Gonyostomum semen* in culture and DNA contents assuming that vegetative cells are 2C in the G1 phase (s for explanation). The scissors indicate the steps not allowed in the clonal culture G3.

Limalevän vaikutus

- aiheuttaa epämiellyttävän limapinnan iholle uimisen jälkeen
- tukkii vedenpuhdistuslaitteet
- vaikutus muihin eliöihin -> ei ilmeisesti vähennä järven tuottavuutta

Freshwater Biology

Freshwater Biology (2011) doi:10.1111/j.1365-2427.2011.02615.x

Changes in phytoplankton, benthic invertebrate and fish assemblages of boreal lakes following invasion by *Gonyostomum semen*

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4. This study shows that high *G. semen* lakes are characterised by less edible phytoplankton, dominance by a few species and enhanced benthic secondary and fish production. Hence, the conjecture that high biomasses of *G. semen* create a bottleneck in the energy transfer to higher trophic levels seems less likely in boreal lakes.

Limalevän elinympäristö

Kasvua suosivat (kirjallisuuden perusteella:

- fosforia y(kok-P) >20 µg/l
- liuennut orgaaninen aines (DOC), humus väriarvo 100 – 200 mg/l Pt
- veden pH välillä 4,7 – 7,7 (humus)happamuus(?)
- järven voimakas lämpötilakerrostuneisuus

Kasvua haittaa:

- liiallinen valo, yli 75 – 95 µmol m^{-2} s^{-1}

Limnol. Oceanogr., 57(3), 2012, 727–734

doi:10.4319/lo.2012.57.3.0727

Grazing resistance allows bloom formation and may explain invasion success of *Gonyostomum semen*

Karen Lebret,[a,*] María Fernández Fernández,[a] Camilla H. C. Hagman,[b] Karin Rengefors,[a] and Lars-Anders Hansson [a]

Vol. 51: 87–96, 2008
doi: 10.3354/ame01176

AQUATIC MICROBIAL ECOLOGY
Aquat Microb Ecol

Published April 24

OPEN ACCESS

Cell lysis of competitors and osmotrophy enhance growth of the bloom-forming alga *Gonyostomum semen*

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SYKE

Hydrobiologia (2005) 533: 243–252

Factors influencing *Gonyostomum semen* blooms in a small boreal reservoir lake

D.L. Findlay[1,*], M.J. Paterson[1], L.L. Hendzel[1] & H.J. Kling[2]

- Kanadalainen Lake 979
- Limalevä runsastui, kun ”valoa” <100 µmol/m2/s ja TP>30 µg/l
- G. semen korreloi merkittävästi TP ja DOC (pH)
- runsastui, kun vesikirppu *Daphnia rosea* <10 yks/l

results observed in Lake 979 were supported by a laboratory experiment where the appearance of *G. semen* from Lake 979 sediment was stimulated by altering chemical and biological variables. The stimulation of *G. semen* blooms appears to be dependant on multiple variables rather than a single variable.

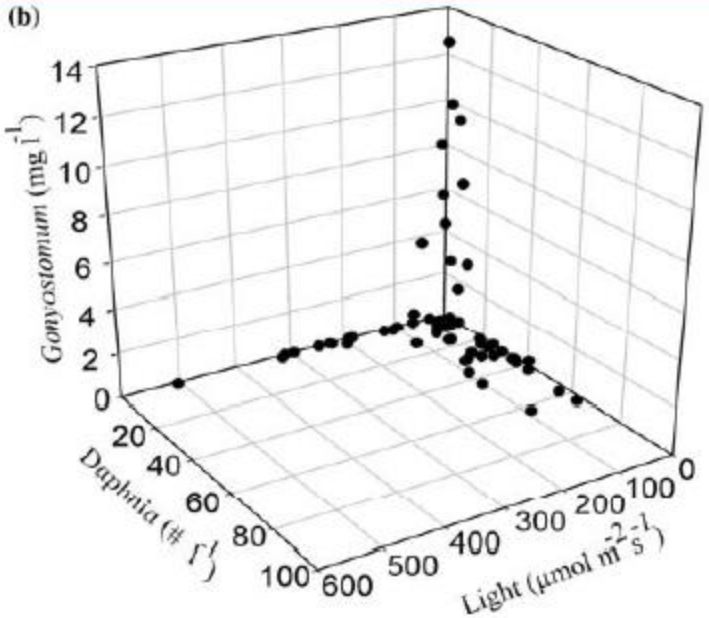


Figure 5 (a) Time series of *G. semen* and *Daphnia* sp. biomasses for Lake 979 from 1993 to 1997 and (b) relationship between *G.*

Runsastuminen/massaesiintymät

- lisääntynevät ilmastonmuutoksen myötä
- hyötyvät vesipatsaan kerrostuneisuudesta
- ilmaston lämpenemisen myötä levittäytyminen pohjoisemmaksi

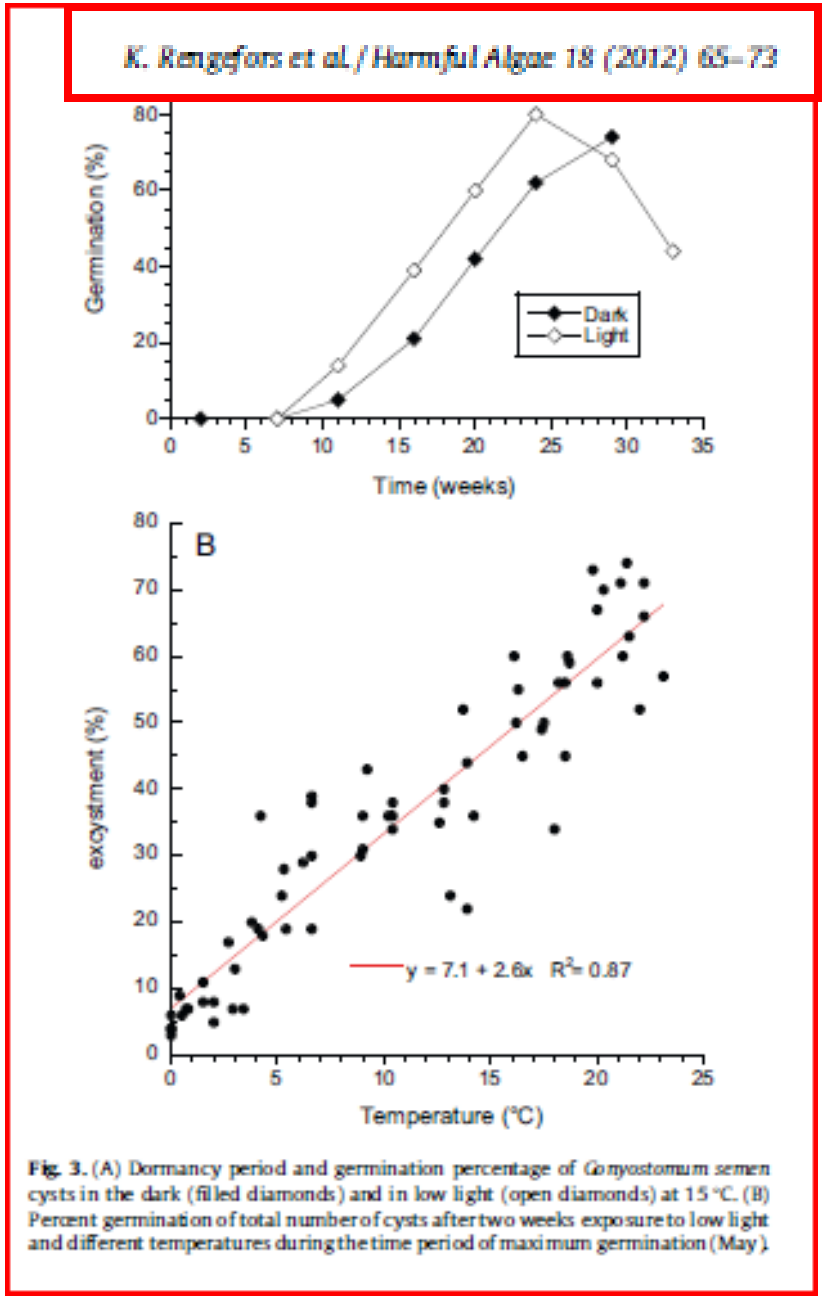


Fig. 3. (A) Dormancy period and germination percentage of *Gonyostomum semen* cysts in the dark (filled diamonds) and in low light (open diamonds) at 15 °C. (B) Percent germination of total number of cysts after two weeks exposure to low light and different temperatures during the time period of maximum germination (May).

Limalevää suosii Jäälissä (?)

- Valon heikko tunkeutuminen veteen
  - rautasakka/humusrautakolloidit
  - veden väri
- sedimentin ravinnevarastot lähellä
- veden korkeahko PO_4-P pitoisuus (resuspensio)
- eläinplanktonyhteisön koostumus
  - lajisto pienikokoista -> limalevä liian suurikokoista ruokaa; hankajalkaisten osalta laidunnusta häiritsee mahdollisesti limalevän trikokystit (Lebret et al. 2012)

<u>Mahdollinen keino (edellyttää testausta/labrakokeita yms.):</u>

- sedimentinfosforin sitominen
- tosin Phoslock ei näyttänyt toimivan
- $AlCl_3$?

MUTTA….

Angeler, D. G., C. R. Allen, and R. K. Johnson. 2012. Insight on invasions and resilience derived from spatiotemporal discontinuities of biomass at local and regional scales. *Ecology and Society* **17**(2): 32.
http://dx.doi.org/10.5751/ES-04928-170232

Insight

Insight on Invasions and Resilience Derived from Spatiotemporal Discontinuities of Biomass at Local and Regional Scales

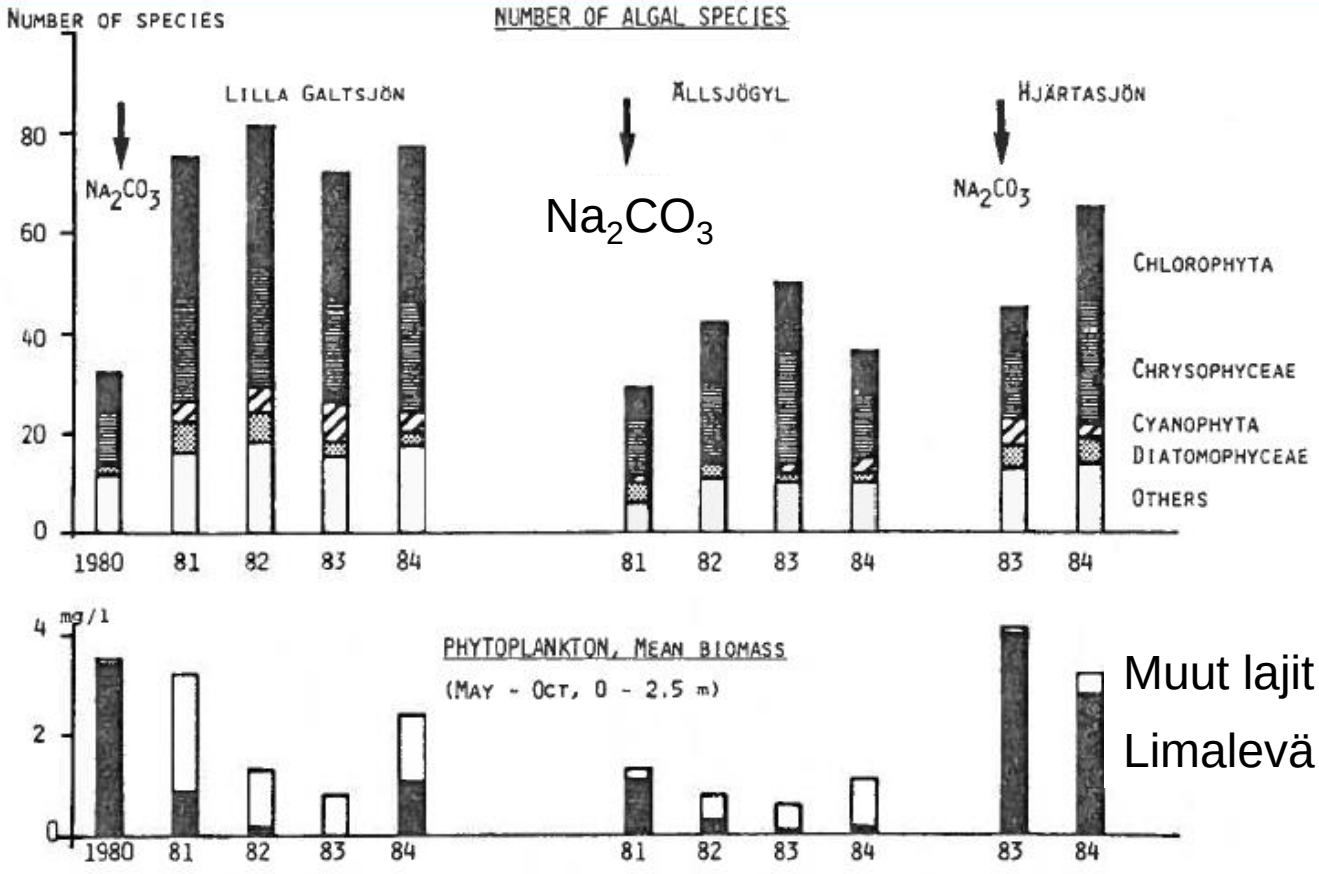
David G. Angeler [1], *Craig R. Allen* [2,3], *and Richard K. Johnson* [1]

75 ruotsalaista järveä, vuodet 1997-2007

and correlations with environmental variables were lake specific. The increased complexity of regional biomass patterns suggests that processes that act within or between scales reinforce the presence of *G. semen* and its potential to develop high-biomass blooms in boreal lakes. Emergent regional patterns combined with locally stochastic dynamics suggest a bleak future for managing *G. semen*, and more generally why invasive species can be ecologically successful.

Hydrobiologia 161: 217–236 (1988)
R. I. Jones and V. Ilmavirta (eds.). Flagellates in Freshwater Ecosystems

Mass development of the flagellate *Gonyostomum semen* (Raphidophyta) in Swedish forest lakes – an effect of acidification?



Na_2CO_3

Muut lajit

Limalevä

Fig. 5. Number of algal species and mean algal biomass (0–2.5 m) in Lakes Lilla Galtsjön, Ällsjögyl and Hjärtasjön before and after sediment treatment (arrow).

Lähitulevaisuuden menetelmiä haitallisten levien torjunnassa? -> kehitteillä

Harmful Algae 8 (2009) 857–863

Contents lists available at ScienceDirect

Harmful Algae

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

On the control of HAB species using low biosurfactant concentrations

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[a] Department of Ecology/Limnology, Lund University, Ecology Building, SE-223 62 Lund, Sweden
[b] Department of Horticulture, Microbial Horticultural Laboratory, Swedish University of Agricultural Sciences, SE-230 53 Alnarp, Sweden
[c] Institut de Ciències del Mar (ICM-CMIMA-CSIC), Pg. Marítim de la Barceloneta, 37-49, 08003 Barcelona, Spain

Daphnia was tested. Our conclusions were that very low biosurfactant concentrations (5 μg mL^{-1}) decreased both the photosynthesis efficiency and the cell viability and that higher concentrations (50 μg mL^{-1}) had lethal effects in four of the five HAB species tested. The low concentrations employed in this study and the diversity of HAB genera tested suggest that biosurfactants may be used to either control initial algal blooms without causing negative side effect to the ecosystem, or to provoke lethal effects when necessary.

Kiitos!