UNIVERSITETET I BERGEN
Institutt for biologi

Innhold (klikk på sidetallet, så kommer du dit direkte ...)

Viktige tidsfrister

Mer info om følgende utlysninger og mange flere finner du på **Intranett >Forskning >BIO**
Husk BIOs interne frister 1 uke i forveien (gjelder ikke mindre bevilgninger som legater og fonds)

30. nov: - OECD mobilitet og workshops
- EØS-Polen
- EURY

1. des: - Forskningsrådet: FUGE; SFI; Samarbeid med Vest-Balkan; BILAT (mest US og Canada)
- Meltzerfondet
- Bergen universitetsfond

1. des: - mindre legater og fonds, f.eks. Olav Grolle Olsens legat til botanisk forsknig
- Nordisk støtte til arktisk forskning

15. des: - Fellowships for taxonomy of deep-sea life

6. jan: - Systems Biology of Microorganisms

Medio januar: diverse Marie Curie

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Internett: http://www.bio.uib.no
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Siste nytt fra BIO

9 BIO-artikler i neste Deep Sea Research

Tidsskriftet Deep Sea Research utkommer med en "Part 2" kalt Topical Studies in Oceanography". Novembernummeret er viet det tidligere omtalte eksperimentet med fostfat-tilsetting i havet ved Kypros, og heter *On the Nature of Phosphorus Cycling and Limitation in the Eastern Mediterranean*. I dette nummeret har 9 av 12 artikler medforfattere fra BIO. **Frede Thingstad** og **Tsuneo Tanaka** går igjen i det meste. Etter dette har Frede 12 artikler hittil i år, mens Tsuneo bare har 9. Men de har ikke 21 til sammen..

Siste nytt fra verden rundt oss

Dekanus-skiftet: avdukingsrituale samlet troppene

Tradisjonen tro ble det foretatt en høytidlig avdukning av portrettet til den avtroppede dekanen på mat.nat-fakultetet. Seansen samlet åtte tidligere dekaner.

Av Silje Gripsrud

– Dette er en veldig fin tradisjon og det er ekstra kjekt at så mange av de tidligere dekanene ville være med, sier Hans Petter Sejrup, som tok over som dekan etter BIO-professor **Dag L. Aksnes** nå i høst.

Lyset var dempet og blomster og sprudlevann var tatt frem i lokalene til fakultetssekretariatet i Harald Hårfagres gate. På den ene veggen som er prydet av fotografier av mat.nats tidligere dekaner, skjulte et grønt teppe så vidt den nyeste ervervelsen. Dag L. Aksnes var for en stund siden på besøk i Magnus Vabøs studio i Formidlingsavdelingen, og nå var festdeltakerne spente på resultatet. Les mer i På Høyden.

f.v Dag L. Aksnes, Harald Høiland, Arne Grammeltvedt, Eirik Sundvor, Ulf Lie, Hans Petter Sejrup, Kåre Utaaker, Arfinn Graue og Gunnar Aksnes (foto: Magnus Vabø)

TEKNA-Fiskehelseforeningen har fått ny nettside

Etter lengre tid med svært liten aktivitet på Fiskehelseforeningens nettsted har vi nå frisket opp utseendet slik at det stemmer mer overens med Teknas profil, samt oppdatert innholdet og supplert med en del nytt. http://www.tekna.no/fhf

Av spesiell interesse kan vi nevne at det nå er mulighet for annonsering på fiskehelseforeningens startside, samt at utgaver av fagtidsskriftet Fiskehelse som er eldre enn et år, blir tilgjengelig til nedlasting fra vårt arkiv. I tillegg har vi lagt inn mer informasjon om foreningen, som vi håper kan være til nytte både for våre medlemmer og andre. Vi fortsetter vår nyhetstjeneste med nytt fra forskningsfronten innen vårt fagfelt, og vi oppfordrer alle som ønsker en enkel måte å holde seg faglig oppdatert på til å gå inn på sidene jevnlig!! Har du noe nytt du mener vi bør omtale på nettsidene, eller ønsker du å skrive en artikkel til fagtidsskriftet Fiskehelse, så gi oss et vink på mailto:Fiskehelse@tekna.no!

Fiskehelseforeningen (FHF) er en landsomfattende forening for fiskehelsebiologer, som har arbeidsfelt innen akvakultur og fiskehelse. Fiskehelsebiologer er utdannet ved Universitetet i Bergen eller Tromsø, og har et 5-årig profesjonsstudie bak seg. Medlemmene arbeider i fiskehelsetjenester, forskning, legemiddelfirmaer, undervisning, fôrfirma m.v.

Hilsen Vidar Aspehaug

Forskerkurs

Pelagisk biogeokjemi ved Göteborgs Universitet

Kursen beskriver vårblomningen i havet från ett tvärvetenskapligt perspektiv. Vi är 5 lärare från 5 institutioner som gemensamt undervisar på kursen. Moment:
Tillväxt av växtplankton typiska för vårblomningen. Ljuset och närsalternas betydelse, tillväxthastighet och agregering bestäms på 3 arter. Experimenten utförs på botaniska institutionen i Göteborg
Effekten av betare och ljus på vårblomningens initiering. I mesocosmförsök (150 l) varierar vi ljus och betartäthet för att undersöka begränsande faktorer i fält. Experimentet utförs på Kristinebergs marina forskningsstation under 10 dagar
Utvecklingen av blomningen i fält. Parallellt med mesocsomförsöket följer vi blomningens dynamik i Gullmarsfjorden
Feb-mars 2006
Lärare
Peter Tiselius (marin ekologi, kursledare) peter.tiselius@kmf.gu.se +46 523 18511
Sten-Åke Wängberg (botanik)
Fred Sörensson (cell- och molekylärbiologi)
Göran Björk (oceanografi)
David Turner (marin kemi)
Ansökan och mer information

Design and Operation of Recirculation Technologies,

the sixth in the AquaTT-led, Marie Curie funded series known as AQUALABS. The course will take place 27th February 2006 – 3rd March 2006 inclusive at Wageningen University, the Netherlands. Targeted at PhD level students and early-stage researchers, 30 funded places are available on the course. Funded places cover the €700 course participation fee as well as travel (partial) and subsistence costs.
The application deadline is 13th January 2006 and complete applications (CV, application form, motivation letter, recommendation letter and Proof of Identity) must be sent via e-mail to lorraine@aquatt.ie
More info: www.aquatt.ie

Symposia, seminarer og info-møter

FSBI Symposium on Fish Population Structure: Implications to Conservation

University of Aberdeen, 10-14 July, 2006. Remember to submitting abstracts before the 1st December.
http://www.fsbi2006.org.uk/index.htm

Husk info-møte om polarforskning

30. november. Se under Utlysninger

Loïc Baulier: modelling salmon stock-recruitment

Fredag 2. desember klokka 1215 i seminarrommet i HIB 3. etg.
Loïc Baulier er kandidat til FishACE-stilling ved HI og kommer til jobintervju i Bergen 2/12. Samtidig holder han et foredrag her på BIO: *Modelling environmental stochasticity in Atlantic salmon stock-recruitment relationships: a Bayesian statistical approach of outliers and non-stationarity*.
Abstract: Stock-recruitment relationships (SR) models based on a log-Normally distributed multiplicative error term are broadly used in fisheries sciences. Though, these models very often do not represent the wide variability affecting time series well. This study is a statistical Bayesian analysis of SR relationships in Atlantic salmon stocks from five watercourses : Oir River (France), Nivelle River (France), Bush River (Northern Ireland), Saint-Jean River (Quebec), and Trinité River (Quebec). Several models are adjusted to each data series, and their relative credibility is assessed using the Bayes Factor:
i) classical models with a multiplicative log-Normal error term, with or without autocorrelated residuals.

ii) models with a log-Student error distribution. These models either use a single error form or are mixture models with a classical (log-Normal) and a robust (log-Student) error term.
iii) non-stationary models describing alternation between two mean recruitment modes. As far as the Bush and Nivelle stocks are considered, a model specifying a shift between the two recruitment modes is tested. For four of the five stocks, mixture models with two mean recruitment modes are the most credible. The classical model is always rejected. Although there are strong differences between the stocks considered here (in population dynamics, climate, anthropic pressures), models combining two recruitment regimes appears as the most credible, provided data series are long and contrasting enough.
These results underline the importance of non-stationarity in SR relationships due to environmental fluctuations. They also show the need to take environmental variables into account in SR relationships.

SKOK: invitasjon til faglunsj

Senter for kvinne- og kjønnsforskning (SKOK) inviterer med dette til en faglunsj der vi håper å kunne diskutere på hvilken måte senteret kan være en samarbeidspartner i arbeidet med å styrke kvinne- og kjønnsforskningen ved universitetet. Vi er åpne for å legge til rette for faglig samarbeid i form av lesesirkler, workshops, seminarer og konferanser.

Faglig ansatte på alle nivåer med interesse for fagfeltet er hjertelig velkommen til en dialog med oss på senteret. Fredag 2. desember 2005 kl. 12.00 på Seminarrommet, 3. etasje i Allégaten 34.

Det vil bli servert kaffe/te og snitter. Vi ber om **påmelding innen onsdag 30. november** til post@skok.uib.no

Velkommen!
Med vennlig hilsen Professor Ellen Mortensen, Faglig leder SKOK

Invitasjon til FAGDAG I ERNÆRING 2006

Programstyret for ernæring ønsker å gjenta suksessen med årets fagdag i ernæring, som fant sted 25. januar i år. Neste fagdag er derfor fastsatt til tirsdag 24. januar 2006 og vil finne sted i topp moderne konferanselokaler i Magnus Barfot Kinosenter.
Tema for neste års fagdag er "Fra hav til helse". Av programmet nevner vi

* Helseeffekter og helsebringende egenskaper av marin kost
* Fordøyelse, stoffskifte og symptomatiske effekter av mat
* Testing av marint råstoff, risikovurdering av matsikkerhet
* Mat- og ernæringssituasjonen i grupper av befolkningen
* Kostrådgivning som forebyggende helsearbeid
* Ernæring og mental helse

Endelig program vil bli sendt ut i uke 49 og med **påmeldingsfrist 20. desember**, men vi ber om at interesserte allerede nå merker seg tid og sted. Konferansen vil også denne gang være gratis, men deltakere må selv dekke eventuelle reisekostnader. Som sist vil det være muligheter for poster-presentasjoner eller annen form for utstilling av ernæringsrelatert virksomhet. Nytt denne gang blir muligheten for presentasjon på flatskjermer i lobby, med rullerende tekst.

Vennlig hilsen
Alfred Halstensen
Leder av programstyret

Forskning og kompetanseutvikling i samfunns- og næringsliv

Invitasjon til halvdagsseminar om grenseflaten mellom forskningvirksomhet og kompetanseutviklingstiltak i næringslivet.

Nettverk videreutdanning Bergen (NHH,UiB,HiB) inviterer faglig ansatte ved institusjonene til halvdagseminar på Hotel Terminus fredag 9. desember. Hensikten er å synliggjøre noen eksempler på koblingen mellom forsknings- og undervisningsrettet virksomhet overfor næringslivet. Seminaret avsluttes med lunch.
Program og påmelding

Utlysninger og prosjekter

Polarforskning

Husk info-møtet om IPY og søknadsprosedyren 30. november 10.15-13.00 på Realfagbygget.
Påmelding til sib@rcn.no
Mer info :
http://www.forskningsradet.no/forport/application;JSESSIONID_forport=DDdAhr3sb4IvRYFHWUZdC2ldYWAT8CcL24YiU0TbOll33PatADbu!115557107?origin=forside.jsp&event=bea.portal.framework.internal.refresh&pageid=Miljo&lang=no_NO&childId=1132069164652&childName=Pro/IPY/AapneMoter1&childAssetType=GenerellArtikkel

Fortsatt mulig å påvirke det tematiske innholdet i EUs 7. rammeprogram

UFD/Kunnskapsdepartementet har bedt Froskningsårdet å kommentere Kommisjonens forslag til rammeprogram, og Forskningsrådet vil trolig sende forslag på høring til institusjonene. Disse saker pleier å komme med temmelig kort frist, så hvis du er interessert, kan du se nærmere på Kommisjonens forslag og se hva du savner.

En annen måte å påvirke, anbefalt av Forskningsrådet, er å bruke egne nettverk og offisielle kontakter med Kommisjonen. De som deltar på EU-prosjekter kan kontakte prosjektkoordinatoren, som kan formidle innspillet videre til prosjektoffiseren ved Kommisjonen.

EUs Cordis-portal med eget websted for Norge

CORDIS, the EU's official information service on research, technological development and innovation, has launched its first national service for a non-EU Member State.
http://cordis.europa.eu.int/norway/home_en.html

Nye artikler

Frede Thingstad: fosfat i det østlige middelhav

Law CS, ER Abraham, EMS Woodward, MI Liddicoat, TW Fileman, TF Thingstad, V Kitidis & T Zohary 2005. The fate of phosphate in an in situ Lagrangian addition experiment in the Eastern Mediterranean. Deep Sea Research Part II: Topical Studies in Oceanography 52: 2911-2927

Abstract: The Eastern Mediterranean is the largest oceanic ecosystem that is phosphate-limited. To determine the impact of a transient input we executed a phosphate addition experiment in the surface waters of the Cyprus Eddy (33.3°N 32.3°E), and compared the ecosystem response with surrounding unperturbed water. A tracer, sulphur hexafluoride (SF6), added with the phosphate, enabled tracking of the patch when phosphate concentration declined to detection limits, and provided quantitative estimates of mixing, dilution and patch volume. The patch expanded to >400 km2 over 9 days with a lateral diffusion rate of 23±2 m2/s that was consistent with previous tracer releases in eddies. Mixed layer phosphate concentration was ~110 nmol/l immediately post-release, and declined to <5 nmol/l after 6 days. A phosphate budget was developed using SF6 as a proxy to discriminate between dilution and biological pathways, with dilution resulting in loss of ~75% of added phosphate from the patch centre by day 3. Non-conservative phosphate loss was largely due to biological incorporation into particulate-P, of which 50% accumulated at the patch centre whilst the remainder was removed by lateral dilution by day 3. Non-conservative phosphate loss at the patch centre was 15–15.5 nmol/l by day 4, which was equal to the cumulative biological P uptake of 15.6 (±5.6) nmol/l P and concurred with two other independent estimates of P uptake. This closure of the phosphate budget infers that the transfer of added P to mesozooplankton and higher consumers was not significant within the timescale of the experiment, despite the observed biomass increase that followed phosphate addition. Although

patch dilution significantly reduced phosphate concentration and particulate accumulation, and so the apparent biological response to the added phosphate, analysis suggests that lateral mixing would not prevent bacterial biomass accumulation at the growth rates observed, suggesting that another factor such as grazing was responsible.

Gro Anita Flaten, Evy Skjoldal, Tsuneo Tanaka og Frede Thingstad: mikrobiell P-syklus

Flaten GAF, EF Skjoldal, MD Krom, CS Law, RFC Mantoura, P Pitta, S Psarra, T Tanaka, A Tselepides, EMS Woodward, T Zohary and TF Thingstad 2005. Studies of the microbial P-cycle during a Lagrangian phosphate-addition experiment in the Eastern Mediterranean. Deep Sea Research Part II: Topical Studies in Oceanography 52: 2928-2943

Abstract: Microbial uptake of orthophosphate was studied before and during a Lagrangian experiment where orthophosphate was added to the surface mixed layer in the Cyprus Gyre, Eastern Mediterranean, a region previously hypothesized to be characterized by P-limited growth of both phytoplankton and heterotrophic bacteria. The addition of ca. 110 nM orthophosphate to a ca. 16 km2 patch in situ led, within 1 day, to an increase in particulate-P from 8 to ca. 15 nM, a result in good agreement with a previous microcosm bioassay indicating this system to have a maximum capacity for orthophosphate consumption of between 10 and 25 nM phosphate. In samples of unperturbed water taken before the addition, outside, or below the experimental patch, orthophosphate turnover time (Tt) was <4 h, argued to be consistent with the assumption of diffusion-limited phytoplankton growth. Upon addition, Tt increased to 94 h. Estimates of maximum potential uptake rate (Vmax) for orthophosphate in unperturbed water exceeded by more than one order of magnitude the biological P-requirement (v) as obtained from stoichiometric conversion of C-based primary and bacterial production values to estimated P-requirement. Upon addition of orthophosphate, Vmax decreased to a level comparable to v. The observations are consistent with the assumption of P-starved cells before and P-replete cells with excess external orthophosphate after the addition. Orthophosphate uptake in unperturbed water was dominated by<1 μm organisms (mean ±SD between samples 0.56±0.03 μm). In samples with higher turnover time, orthophosphate uptake was shifted towards larger organisms, culminating after 5 days with a near doubling in mean size (1.08 μm). The size distribution of particulate-P standing stock had a mean size of 10 μm, indicating the presence of a substantial biomass of micro-organisms larger than those involved in P-uptake. Comparison of the measured particulate-P with microscope-based biomass estimates indicated a microbial food web dominated by heterotrophic organisms (70% of particulate-P), distributed with ca. 25% of total particulate-P in heterotrophic bacteria, ca. 40% in heterotrophic flagellates, and ca. 5% in ciliates. Concentration of bioavailable phosphate (Sn) estimated from the relationship Sn=vTi indicated Sn values<1 nM PO4 before the addition, increasing afterwards. Estimates of the sum Kt+Sn for the 0.6–0.2 μm size fraction were in the range 1–7 nM PO4 before and outside patch, suggesting this sum to be dominated by the half-saturation constant Kt. Kt+Sn increased to 69 nM after addition, then dropped over the following week back to background levels. As reported elsewhere in this volume, there was a decline in the observed chlorophyll concentrations, but a positive response in copepods. Less clear than the effects at the level of osmotroph physiology were the subsequent responses expected in the food web. Two possible mechanisms are discussed: (1) a positive response in bacterial production and the subsequent food chain of bacterial predators, and (2) a positive response in phytoplankton predators due to a shift in food quality rather than in food quantity.

Tsuneo Tanaka og Frede Thingstad: planteplankton-respons på P-tilsetting

Psarra S, T Zohary, MD Krom, RFC Mantoura, T Polychronaki, N Stambler, T Tanaka, A Tselepides & TF Thingstad 2005. Phytoplankton response to a Lagrangian phosphate addition in the Levantine Sea (Eastern Mediterranean). Deep Sea Research Part II: Topical Studies in Oceanography 52: 2944-2960

Abstract: In order to test the hypothesis of P-limitation on primary production and microbial biomass, a mesoscale Lagrangian phosphate-enrichment experiment was performed in the warm core of the Cyprus Eddy (Eastern Mediterranean Sea) in May 2002. This study reports the effects of the

phosphate addition on the phytoplankton community, by measuring induced changes in biomass, primary production, and community structure. Prior to the addition, primary production and chlorophyll a were very low ($0.107\,\mu gC\,l^{-1}\,h^{-1}$ and $18\,ng\,l^{-1}$, respectively), typical of the ultra-oligotrophic conditions prevailing in the area. The autotrophic community was dominated in terms of both abundance and biomass (60% of total chl-a) by picoplankton (mostly Synechococcus). More than 90% of the autotrophic biomass was confined to particles $<10\,\mu m$, while larger phytoplankton (diatoms, dinoflagellates, coccolithophores) were very scarce. Unexpectedly, the addition of P resulted in a decrease in phytoplankton biomass. Total HPLC-chlorophyll slightly declined to $11\,ng\,l^{-1}$ in the P-enriched patch, five days after the P-addition. As the patch was diluted away (7–9 days), chlorophyll concentrations returned to background levels. Similar trends were observed in chlorophyll determined fluorometrically and in primary production. Picophytoplankton and smaller nanophytoplankton abundance declined (by 49 and 65%, respectively) within the first four days of the experiment. At the same time, there was a small increase of larger nanophytoplankton (10–$20\,\mu m$) and microphytoplankton ($>20\,\mu m$) species. Small nanophytoplankton (2–$10\,\mu m$) were the group most affected by the addition. These results together with an onboard microcosm experiment (reported elsewhere in this issue), in which ammonia was added to the P-enriched water, indicate that the system was N and P co-limited for phytoplankton. The decrease in pico and smaller nanophytoplankton was probably caused by increased predation by micrograzers that became more active because of the increased heterotrophic bacterial activity and/or the increased P content of their prey. The immediate decrease in Synechococcus numbers, as the system became temporarily N-limited implies that N-fixation caused by this particular cyanobacteria was unlikely to occur.

Tsuneo Tanaka: mikrobiologisk respons på P-tilsetting

Pitta P, N Stambler, T Tanaka, T Zohary, A Tselepides & F Rassoulzadegan 2005. Biological response to P addition in the Eastern Mediterranean Sea. The microbial race against time. Deep Sea Research Part II: Topical Studies in Oceanography 52: 2961-2974

Abstract: The response of the microbial food web to P-addition was studied during a 10-day Lagrangian experiment in the Eastern Mediterranean during which orthophosphate was added to the surface water of the Cyprus anticyclonic eddy. Very low levels of all microbial populations (heterotrophic bacteria, *Synechococcus*, *Prochlorococcus*, autotrophic and heterotrophic nanoflagellates, ciliates) and bacterial production were detected, verifying the extreme oligotrophic character of this area. The microbial biomass was dominated by heterotrophs and the heterotroph/autotroph ratio increased from 1.05 before to 2.8 after the P-addition, on day 4. Bacteria took advantage of the supply of the putative limiting factor (P) increasing their production but not their abundance. The heterotrophic nanoflagellates remained stable in numbers. By contrast, *Synechococcus* and autotrophic nanoflagellates decreased after the P addition. This is an indication of consumption by ciliates which were the only organisms that showed a significant increase in abundance during the first 4 days after the P addition, relative to the period before the addition as well as to the second phase of the experiment (days 5–9). In particular, the mixotrophic ciliate biomass increased by 50% after the P release. In environmental conditions of general resource scarcity as is the case of the Eastern Mediterranean, the addition of the putative limiting factor (P) was reflected in the increased abundance of microzooplankton shortly after the enrichment as a result of a quick transfer of energy ("heterotrophic by-pass") through bacteria and heterotrophic nanoflagellates. A "mixotrophic by-pass" of phytoplankton primary producers also occurred, transferring the P-addition driven primary production to higher trophic levels through mixotrophic ciliates

Tsuneo Tanaka og Frede Thingstad: mikrokosme-eksperiment med N- og P-tilsetting til planteplankton

Zohary T, B Herut, MD Krom, RFC Mantoura, P Pitta, S Psarra, F Rassoulzadegan, N Stambler, T Tanaka, TF Thingstad & EMS Woodward 2005. P-limited bacteria but N and P co-limited phytoplankton in the Eastern Mediterranean—a microcosm experiment. Deep Sea Research Part II: Topical Studies in Oceanography 52: 3011-3023

Abstract: An on-board microcosm experiment was set up to test the hypothesis that the observed lack of phytoplankton biomass increase response to a mesoscale in situ P-enrichment experiment in the P-limited Eastern Mediterranean (Krom et al., 2005a) was a consequence of co-limitation by P and N

availability in this ultraoligotrophic environment. Six microcosms were filled with subsurface seawater (ambient DIN: 90–100 nM) taken from inside a P-enriched patch (IN), which in the absence of biological activity would have had ca. 22 nM of PO_4^{-3}. Another six microcosms were filled with unfertilized (<2 nM PO_4^{-3}) subsurface seawater from outside the patch (OUT). The bottles were either supplemented with 1600 nM NH_4^+ or not, incubated on-deck and subsampled daily, or at the first and last (fourth) day of the experiment, for a suite of biological parameters. The addition of N to OUT water did not induce cell abundance increases in either the phototrophic or heterotrophic sides of the food chain, in line with previous assessments that the Eastern Mediterranean is not purely N-limited. The IN and OUT treatments, to which no NH_4^+ was added, mimicked the behavior of the in situ experiment, with an order of magnitude higher bacterial production of IN vs. OUT water, but no noticeable phytoplankton response. The addition of N to IN water, previously exposed to P, led to substantial responses of the entire microbial community, including 4 to 80-fold increases in chlorophyll, other pigments, bacterial activity, and the abundance of ciliates—relative to IN water to which N was not added. The ca. 10-fold increase in chlorophyll within 4 days was mostly due to a major increase in both abundance (×4) and fluorescence per cell (×17) of *Synechococcus*, whereas *Prochlorococcus* disappeared. These changes were accompanied by removal from the water of 570 nM of the added NH_4^+, equivalent to 570/22 or N : P ratio of 26 : 1, similar to the ratio measured for POM in the area. Possibly, non-Redfield ratios were maintained, still leaving by day 4 some 1100 nM of N that could not be used due to the lack of P. These results support our hypothesis that the lack of response of phytoplankton to the mesoscale P-enrichment was due to their concurrent N-starvation, i.e. N and P co-limitation. In contrast, bacteria could grow when only P was added, implying pure P-limitation. Thus, the heterotrophic and autotrophic components of the same aquatic community experienced different limitations.

Tsuneo Tanaka og Frede Thingstad: betydningen av støv fra Sahara i østre middelhav

Herut B, T Zohary, MD Krom, RFC Mantoura, P Pitta, S Psarra, F Rassoulzadegan, T Tanaka & TF Thingstad 2005. Response of East Mediterranean surface water to Saharan dust: On-board microcosm experiment and field observations. Deep Sea Research Part II: Topical Studies in Oceanography 52: 3024-3040

Abstract: An on-board microcosm experiment was performed during the CYCLOPS May 2002 cruise to track the biogeochemical response of Eastern Mediterranean surface seawater to a gradient addition of fresh and pre-leached Saharan dust, mimicking the potential fertilization effect as opposed to the impact of adding particles alone. Response parameters examined were P-turnover time, bacterial production and abundance, chlorophyll *a*, other phytopigments, abundance of different pico and nanophytoplankton groups, primary production rates, abundance of heterotrophic nanoflagellates and ciliates. The addition of fresh Saharan dust (range: 0.2–$4.9\,mg\,l^{-1}$) and the subsequent nutrient release triggered an increase in phytopigments and primary production, while no response was detected for pre-leached dust particles. Most responses were linearly related to the amount of fresh dust added. *Synechococcus* and prymnesiophytes increased in abundance along with cellular pigment content while *Prochlorococcus* disappeared, heterotrophic bacteria increased production rates, and ciliates showed a small increase in cell density. A less clear response was recorded by in situ measurements following a Saharan dust storm during a cruise in the Levantine Basin in May 2001. The calculated amount of nutrients and dust particles delivered by such an event to a 15-m thick mixed surface layer is low ($\sim 0.3\,nmol\,P\,l^{-1}$, $\sim 9\,nmol\,N\,l^{-1}$ and $0.06\,mg\,dust\,l^{-1}$), falling close to the lowest dust addition in our microcosm experiment. Even so, an enhancement of phosphate turnover time, a sharp decline of *Prochlorococcus* abundance, and slight increases in chlorophyll *a* and bacterial activity were observed in response to the dust storm. Considering the linear effect of fresh dust concentrations on the bacterial activity, primary production and pigment concentration (total and per cell), and the likely stimulation of grazing, it is not surprising that changes due to moderate strength dust storms are mostly close to detection limit of either field or remote sensing measurements.

Frede Thingstad: betydningen av P og N-tilsetting i vann påvirket av kystvann

Kress N, TF Thingstad, P Pitta, S Psarra, T Tanaka, T Zohary, S Groom, B Herut, RFC Mantoura, T Polychronaki, F Rassoulzadegan & G Spyres 2005. Effect of P and N addition to oligotrophic Eastern

Mediterranean waters influenced by near-shore waters: A microcosm experiment. Deep Sea Research Part II: Topical Studies in Oceanography 52: 3054-3073
Abstract: Phosphate (P), nitrate (N) or P+N added in a microcosm experiment to oligotrophic waters of the Eastern Mediterranean influenced by near-shore waters triggered a range of responses in the autotrophic and heterotrophic compartments of the system. Chlorophyll *a* increased in all treatments, including the no-addition control, implying that nutrients became available also from internal sources (recycling). Larger and faster biomass increase as well as a larger P utilization took place in the P+N treatments. Diatoms bloomed in the P+N treatments whereas coccolithophores bloomed following the addition of P ultimately reaching N-limitation. Bacterial activity responded with a transient peak to both low P-alone and N-alone additions (0.01 and 1 μM, respectively). For reasons not well understood, no such response was observed at higher P-alone additions (0.05 and 0.5 μM), whereas at the two highest P+N additions the positive response was delayed. We therefore were unable to conclude conclusively on bacterial limitation. In most cases, the increase in bacterial activity was not matched by an increase in abundance, suggesting a tight top-down control of the biomass. Instead, heterotrophic nanoflagellate and ciliate abundances increased in all treatments. A slightly elevated orthophosphate turnover-time (T_t) (32 h) in the initial waters did not give a clear indication of P-limitation, although the system could absorb the lowest P-addition (0.01 μM) without increase in T_t. N alone lead to a reduction in T_t as would be expected in an N-limited system consuming existing surplus P after N-addition.
The response of the near-shore influenced system used in this study was in accord with the 'classical' response to nutrient introduction—increase in chlorophyll *a* and in large size phytoplankton. In contrast, in the ultraoligotrophic Cyprus Eddy [Krom, Thingstad, Carbo, Drakopoulos, Fileman, Flaten, Groom, Herut, Kitides, Kress, Law, Liddicoact, Mantoura, Pasternak, Pitta, Polychronaki, Psarra, Rassoulzadegan, Skjoldal, Spyres, Tanaka, Tselepides, Wassmann, Wexels-Riser, Woodward, Zodiatis, Zohary, 2005. Overview of the CYCLOPS P addition lagrangian experiment in the Eastern Mediterranean. Deep-Sea Research II, this volume.], the short T_t (<4 h) indicated P-limitation, the combined addition of P and N (as ammonium) induced a bloom of picocyanobacteria [Zohary, Herut, Krom, Mantoura, Pitta, Psarra, Rasssoulzadegan, Stambler, Tanaka, Thingstad, Woodward, 2005. P-limited bacteria but N&P co-limited phytoplankton in the Eastern Mediterranean—a microcosm experiment. Deep-Sea Research II, this volume.] and the in situ P alone addition led to a decrease in chlorophyll.

Frede Thingstad: næringskjedemodellering av P-tilsetting

Thingstad T. 2005. Simulating the response to phosphate additions in the oligotrophic eastern Mediterranean using an idealized four-member microbial food web model. Deep Sea Research Part II: Topical Studies in Oceanography 52: 3074-3089
Abstract: Elsewhere in this volume, observations of the natural microbial food web in the Cyprus Gyre, eastern Mediterranean, and its transient responses both to phosphate additions in situ and to phosphate and ammonium additions when enclosed in microcosm bottles, are reported. We here explore an idealized four-population model of the microbial part of the food web, containing features suggested in these reports to be essential for the observed responses. Such features include a steady state with P-limited growth heterotrophic bacteria and P-limited or N/P co-limited growth of phytoplankton a mechanism for luxury consumption and nutrient storage in the osmotrophs (phytoplankton and bacteria), a supply of labile organic carbon substrates in excess of bacterial carbon demand, a relatively small excess of bio-available nitrogen, and an assumption that heterotrophic bacteria are superior to phytoplankton in competing for dissolved organic nitrogen. From a P-limited steady-state dominated by heterotrophic organisms, the model responds to the in situ phosphate addition of the Lagrangian experiment with a decrease in chlorophyll, an increase in bacterial production and in bacterial biomass, and a decrease in uptake potential for phosphate. These modeled responses at the osmotroph level are qualitatively and quantitatively comparable to those observed, while detailed comparison of model and observations at the predator level appears more difficult. The model is also able to explain main traits of the dynamic patterns observed in microcosm experiments, both when different concentrations of phosphate were added to previously unperturbed water, and when water collected inside the patch of the Lagrangian experiment was enclosed and supplied with ammonia. We conclude that the idealized model contains sufficient elements to capture a useful first-order approximation to a presumably quite complex microbial food web. In this model, predator

growth responds not only to food quantity, but also to food quality (stoichiometry). From steady states where also zooplankton are P-limited, the model thus has a potential for much more rapid zooplankton response to a phosphate-pulse than possible in models with fixed organism stoichiometry. The potential of transmitting a signal to the copepod level via food composition, rather than only via food abundance, is discussed. Implicit in both model and observations is a requirement of a large, unmeasured, production of degradable organic substrates for bacterial growth.

Gro Anita Flaten, Evy Skjoldal, Tsuneo Tanaka og Frede Thingstad: oppsummering av CYCLOPS-eksperimentet

Krom MD, TF Thingstad, S Brenner, P Carbo, P Drakopoulos, TW Fileman, GAF Flaten, S Groom, B Herut, V Kitidis, N Kress, CS Law, MI Liddicoat, RFC Mantoura, A Pasternak, P Pitta, T Polychronaki, S Psarra, F Rassoulzadegan, EF Skjoldal, G Spyres, T Tanaka, A Tselepides, P Wassmann, CW Riser, EMS Woodward, G Zodiatis &T Zohary 2005. Summary and overview of the CYCLOPS P addition Lagrangian experiment in the Eastern Mediterranean. Deep Sea Research Part II: Topical Studies in Oceanography 52: 3090-3108

Abstract: CYCLOPS was a European Framework 5 program to further our understanding of phosphorus cycling in the Eastern Mediterranean. The core of CYCLOPS was a Lagrangian experiment in which buffered phosphoric acid was added to a <4×4 km patch of water together with SF_6 as the inert tracer. The patch was followed for nine days in total. Results obtained prior to the experiment showed that the system was typically ultra-oligotrophic and P-starved with DON:DOP, PON:POP and DIN:DIP all having ratios greatly in excess of 16:1 in surface waters. To our surprise, we found that although the added phosphate was rapidly taken up by the microbial biota, there was a small but significant decrease in chlorophyll *a* and no increase in primary production, together with an increase in heterotrophic bacterial activity, ciliate numbers and in the gut fullness and egg numbers in the zooplankton community. A microcosm experiment carried out using within-patch and out-of-patch water showed that the phytoplankton community were N and P co-limited while the bacteria and micrograzers were P-limited. Thus this system tends to N and P co-limitation of phytoplankton productivity in summer possibly caused by bioavailable DIN being converted into non-bioavailable forms of DON.

On the basis of the data collected within the programme it was concluded that this behavior could be explained by three non-mutually exclusive processes described as (1) trophic by-pass in which the added phosphate gets directly to the grazing part of the predatory food chain from the heterotrophic bacteria bypassing the phytoplankton compartment phosphate, (2) trophic tunnelling in which phosphate is rapidly taken up by both phytoplankton and bacteria via rapid luxury consumption. This causes an immediate change in the phosphorus content but not the abundance of the prey organisms. The added P then "reappears" as responses at the predator level much more rapidly than expected, and (3) mixotrophic by-pass in which inorganic nutrients, including the added P, are taken up by mixotrophic ciliates directly, bypassing the phytoplankton. For details of the results of this study and the processes described, the readers are referred to the relevant papers within this volume.

The implications of these results for nutrient cycling in the Eastern Mediterranean are discussed. In particular it is noted that the efficient and rapid grazing observed in this study might explain why the system although impacted by anthropogenic nutrient input has shown little or no measurable change in microbial productivity since added nutrients are rapidly transferred out of the photic zone via the by-pass and tunnelling processes and are exported from the basin. It is also suggested that fish productivity is higher than has been suggested by conventional food chain models due to this grazing. Two possible reasons for the unusual P-starved nature of the basin are presented.