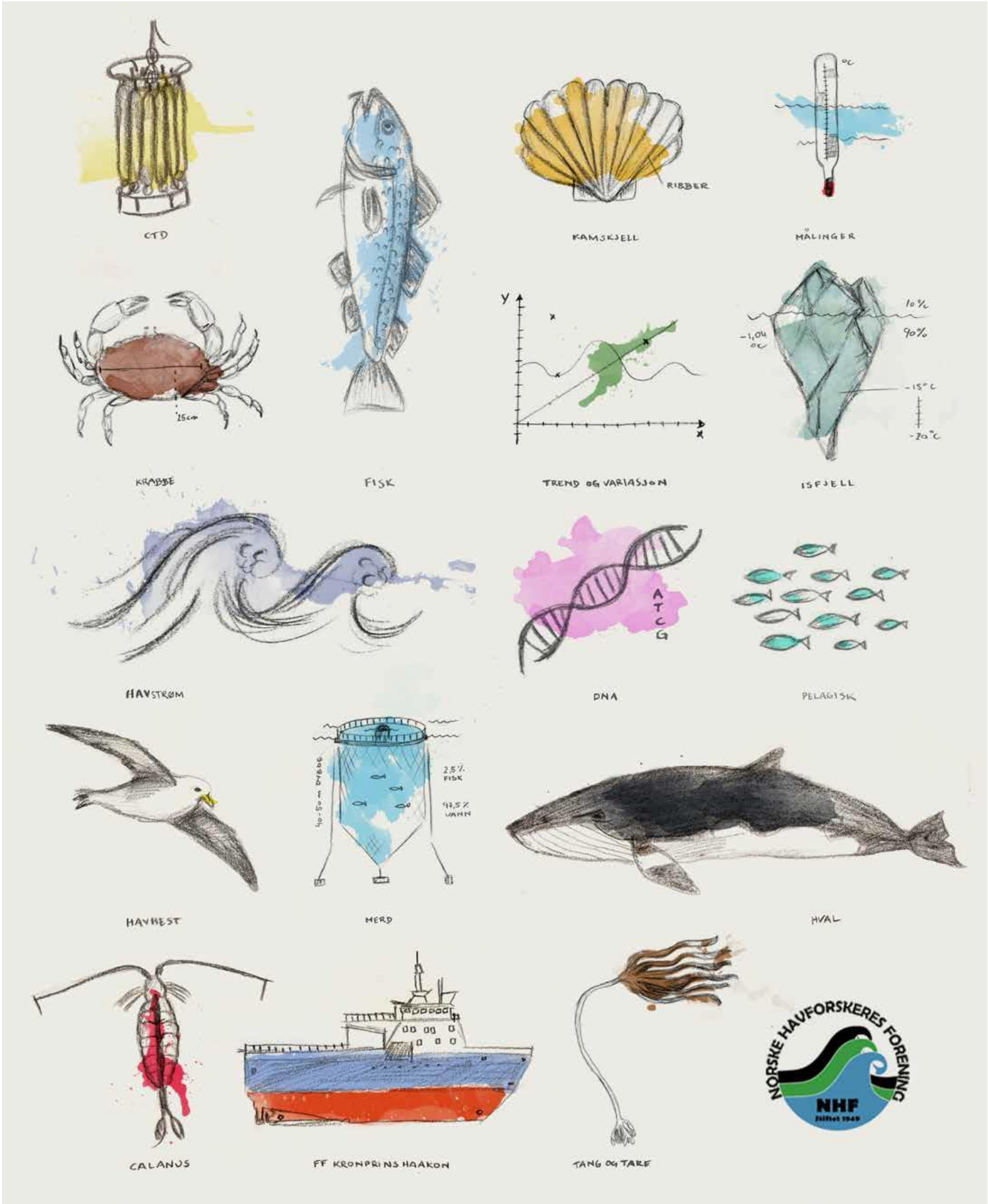
HAVFORSKERMØTE 2014
TROMSØ 3.–5. NOV 2014
PROGRAM OG SAMMENDRAG



BEDRIFTMEDLEMMER:

Havforskermøtet 2014 i Tromsø på Quality Hotel Saga

Sunt hav helt klart! Hvem leverer grunnlaget?

MANDAG 03.11.14

11:00 -12:30	Registrering
12:30 -13:30	**Lunsj**
13:30-40	Velkomsttale
13:40 - 14:25	*Invitert foredragsholder:* ***Robert Barrett (Tromsø Museum)*** **"SJØFUGL I HARDT VÆR – FØR OG NÅ"**
14:30-14:50	**TRANSCRIPTOME PROFILING AND METABOLIC RESPONSE OF THE NORTHERN DIATOM** *ATTHEYA LONGICORNIS* **TO IRON LIMITATION:** Tien-sheng Huang, Hans C. Eilertsen and Trond Ø. Jørgensen
14:50-15:10	**SUSTAINABLE ENERGY PRODUCTION BY MASS CULTURE OF DIATOMS:** Artamonova Elena Yuryevna
15:10-15:30	Poster foredrag
15:30-16:20	**Kaffe og Poster**
16:20-16:50	**ARVEN ETTER NANSEN:** M. Reigstad
16:50-17:10	**LITTORAL AND SHALLOW SUBLITTORAL ALGAL VEGETATION FROM 8 SITES AROUND SVALBARD:** Siri Røang Moy, Stein Fredriksen, Tove Gabrielsen, Wenche Eikrem
17:10-17:30	**CONSERVATION OF DEEP-WATER HABITATS IN THE NORTH EAST ATLANTIC: USING MAREANO SPECIES DATA TO IMPROVE THE OSPAR HABITAT DEFINITIONS:** Genoveva Gonzalez-Mirelis, Pål Buhl-Mortensen
17:30-17:50	**MICROALGAL DIVERSITY IN A RED SEA SEAGRASS MEADOW COMMUNITY:** Anders Wold, Wenche Eikrem, Bente Edvardsen
17:50-18:10	**GENETISK STREKKODING AV MARINE VIRVELLØSE DYR:** *Katrine Kongshavn, Jon Anders Kongsrud, Endre Willassen*
19:00	**Mottagelse på Framsenteret med tapas/sjømat**

TIRSDAG 04.11.14

09:00 – 09:45 **Foredrag av æresmedlem: Hartvig Christie (NIVA):**
"HVORFOR BLIR IKKE TARESKOGEN NORMALT SPIST OPP (HABITATUTNYTTELSE, PRODUKSJON OG ENERGITRANSPORT HOS DYRELIV I MARINE PLANTESAMFUNN)"

09:50-10:10 **IS GLOBAL WARMING CHANGING THE GREEN SEA URCHIN (*STRONGYLOCENTROTUS DROEBACHIENSIS*)'S ABUNDANCE, RECRUITMENT AND DEPTH DISTRIBUTION IN THE INNER OSLOFJORD?:** Fredrik Oulie Nyhagen

10:10-10:30 Poster foredrag

10:30-11:10 Kaffe og Poster

11:10-11:30 **NEDBEITING OG GJENVEKST AV TARESKOGEN LANGS NORSKEKYSTEN:** Knut Sivertsen

11:30-11:50 **STORSKALA SKIFTNINGER I TARE-KRÅKEBOLLE BALANSEN. ENDRINGER I KLIMA OG PREDASJON GIR SPENNENDE ØKOLOGISKE OG FORVALTNINGSMESSIGE PERSPEKTIVER.:** Hartvig Christie m fl.,

11:50-12:10 **MILJØTILSTAND I BØRGIN.:** Longva, O., Mork, J., Lepland, A., McClimans, T.

12:10-12:30 **LAKSEOPPDRETT, LUSEMIDLER OG PÅVIRKNING PÅ LOKALE REKEBESTANDER:** Knut Eirik Jørstad, Ole B. Samuelsen og Guldborg Søvik

12:30-13:30 Lunsj

13:30-14:15 *Invitert foredragsholder:* ***Bjørn Serigstad (Havforskningsinstituttet):*** **MARIN MILJØOVERVÅKING PÅ DYPT VANN – NY TEKNOLOGI - ERFARINGER FRA FORSKNINGSFARTØYET DR. FRIDTJOF NANSEN I AFRIKA**

14:20-14:40 **SELECTED PHYSICAL, BIOLOGICAL AND BIOGEOCHEMICAL IMPLICATIONS OF A RAPIDLY CHANGING ARCTIC MARGINAL ICE ZONE:** David G. Barber, Haakon Hop, Christopher J. Mundy, Brent Else, Igor A. Dmitrenko, Jean-Eric Tremblay, Jens K. Ehn, Philipp Assmy, Malin Daase, Lauren M. Candlish, Søren Rysgaard

14:40-15:00 **EVALUATION OF A 33 YEAR-LONG HINDCAST OF WATER LEVEL, SEA ICE, CURRENTS, AND HYDROGRAPHY IN THE NORTHERN NORTH ATLANTIC INCLUDING THE ARCTIC SEA AND THE ADJACENT BARENTS AND NORTH SEAS:** Lars Petter Røed, Vidar Lien, Arne Melsom, Nils Melsom Kristensen, Yvonne Gusdal and Bjørn Ådlandsvik

15:00-15:20 **EFFECTS FROM CLIMATE AND EUTROPHICATION ON THE DIVERSITY OF HARD BOTTOM COMMUNITIES ON THE SKAGERRAK COAST 1990-2010:** Norderhaug KM, Gundersen H, Pedersen A, Moy F, Green N, Walday MG, Gitmark JK, Ledang AB, Bjerkeng B, Hjermann DØ, Trannum HC**.**

15:20-16:20 Kaffe og Poster

16:30-17:30 ÅRSMØTE

19:00 FESTMIDDAG

ONSDAG 05.11.14

Debattema"Ressursrådgivning på anbud"

09:00-11:45 **Paneldebatt:** Starter med 15 min. innlegg fra: Lars Horn (NFR), Sidsel Grønvik (NINA), Edel Elvevoll (UiTø) og Knut Sunnanå (HI)

11:45-12:00: Oppsummering og prisutdeling

12:00-13:00 Lunsj

AVREISE

INVITERTE FOREDRAG

HVORFOR BLIR IKKE TARESKOGEN NORMALT SPIST OPP (HABITATUTNYTTELSE, PRODUKSJON OG ENERGITRANSPORT HOS DYRELIV I MARINE PLANTESAMFUNN)

Æresmedlem 2013: **Hartvig Christie (NIVA)**

Flerårige marine makrofytter (tang, tare, ålegras) er kjent for å ha et rikt dyreliv med høy sekundærproduksjon. For at slike økosystemer skal opprettholdes er det viktige at dyrelivet og forekomstene er balansert og organisert slik at de ikke opptrer destruktivt overfor plantene som både fungerer som primærprodusenter (næring) og leveområde. Et eksempel på ubalanse mellom trofiske nivåer er fullstendig nedbeiting (jfr kråkeboller), men de fleste sekundærprodusenter som lever i slike samfunn utnytter planteproduksjonen ved å beite på epifytter, eller ved å utnytte partikulært materiale, mikroorganismer o.a. Selv om sekundærproduksjonen er høy, klarer ikke dyrene å utnytte alt produsert plantemateriale, og predatorkontroll, plassmangel og transport/spredning av plantemateriale og dyr er viktige faktorer i denne sammenheng. Foredraget vil belyse ulike mekanismer som bidrar til å organisere disse systemene slik at de vedvarer.

SJØFUGL I HARDT VÆR – FØR OG NÅ

Invitert foredragsholder: **Robert Barrett (Tromsø Museum)** "Sjøfugl i hardt vær – før og nå"

Sjøfugl i Norge er truet på alle kanter, og mange bestander går ned, noen kraftig ned. I foredraget vil Rob belyse hvordan sjøfugl er blitt påvirket av mennesker gjennom årene, fra steinalderen og fram til i dag, både direkte og indirekte. De viktigste truslene har vært jakt, fangst, forstyrrelser og fiskeriene. I dag truer klimaendring. Plast i havet er også et problem for noen arter, spesielt havhest. Rob vil ta utgangspunkt i norske fugl, men vil også vise hvordan de samme påvirkninger truer sjøfugl globalt.

MARIN MILJØOVERVÅKING PÅ DYPT VANN – NY TEKNOLOGI - ERFARINGER FRA FORSKNINGSFARTØYET DR. FRIDTJOF NANSEN I AFRIKA

Bjørn Serigstad, Havforskningsinstituttet

(se eget ark)

ARVEN ETTER NANSEN

Marit Reigstad, UiT Arktiske Universitet
(se eget ark)

FOREDRAG

TRANSCRIPTOME PROFILING AND METABOLIC RESPONSE OF THE NORTHERN DIATOM *ATTHEYA LONGICORNIS* TO IRON LIMITATION

Tien-sheng Huang[1], Hans C. Eilertsen[2] and Trond Ø. Jørgensen[1,3]
[1]Norwegian College of Fishery Science, [2]Institute of Arctic and Marine Biology, University of Tromsø, N-9037 Tromsø, [3]MabCent-SFI, University of Tromsø, N-9037 Tromsø, Norway

Global challenges in biofuels, chemicals and nutrients stress the need for biomass from marine sources in the near future. Microalgae-derived compounds and their biomass have potential applications from aquaculture and animal feed to human health. **Northern diatoms have been shown to** serve as important sources of bioactive compounds in our recent achievements, screening for pharmaceutical / drug bioactives. This makes the diatoms excellent models for elucidating biomass production / chemical composition under changing environments, e. g. inorganic micronutrients.

Iron has a critical impact on diatom distribution, abundance and bloom success, but cellular mechanisms responding to iron availability remain unclear in northern diatoms. We have examined the northern diatom ***Attheya longicornis*** growth and nutrient utilization by their tolerance to iron chelation induced by iron chelator deferroxamine (DFO)**. Iron limitation was evident by lower levels of chlorophyll *a* and a reduction in photosynthesis efficiency, compared to a slight increase of growth rate by iron overloading.** The altered metabolic responses were verified by flow cytometry analysis with fluorescent probes to assess membrane integrity, cellular esterase and reactive oxygen species (ROS) production, respectively. In order to identify genes that are significant for the iron-acquisition systems, we have conducted transcriptomic studies in culturing experiments with manipulation of iron. Comparative transcriptomic analysis of ***A. longicornis*** grown under iron limitation relative to the control has showed strong up regulation of genes that encode known phytoplankton markers for iron stress such as flavodoxin and plastocyanin genes and genes involved in iron affinity and iron uptake systems. Our data suggest major shifts in bioengetic metabolisms responses to iron limitation. In addition, up-regulated and down regulated **genes will be compared with database from** *Phaeodactylum tricornutum* and ***Thalassiosira pseudonana*.** This study provides transcriptome responses of ***A. longicornis*** to iron stress and together with physiological measurement reveals mechanisms that enable the complex and flexible responses of this northern organism to environmental changes.

SUSTAINABLE ENERGY PRODUCTION BY MASS CULTURE OF DIATOMS.

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The project is aimed at biomass production of Northern lipid rich diatom algae. Oil and other components of the produced biomass may be used for fish food in aquaculture that allows reducing fishing pressure on the wild stock. Besides, algae may be used for biofuel production as well as for omega-3 fatty acids for the human health industry. The biological material will be also analyzed for bioactive components for medical purposes.

Diatoms. Background.

Second to bacteria algae are the oldest life-forms on earth. Physiologically and chemically they are diverse and complicated. As flowering plants they need light, water, CO_2, N and P to grow, and due to efficient utilization of light and inorganic nutrients they produce lipids, proteins and carbohydrates in large amounts in a short time. Algae also contain bioactive components that differ in type and concentration from terrestrial plants. The nutritional quality of algae as judged from both a marine animal side as well as from the mammal (including humans) side is excellent due to a favorable fatty acid profile and high quality proteins. Cold-adapted algae can contain exceptional proteins, which may be developed through hydrolysis into bioactive peptides.

Microalgae are also efficient in removing CO_2 from their environment by bio-fixation. The physiology and growth conditions of Northern and arctic microalgae have been extensively studied at UiT and are well known, so the present project has a firm basis in established knowledge in addition to closely related ongoing experimental activities.

Our concept: The conventional mass production of microalgae mostly uses small species (5-10 µm) for cultivation. Our purpose is to use large diatoms (>200 µm) that have a much smaller surface to volume ratio. Large diatoms have the advantage of better light use and minimize self-shadowing effect in dense cultures. The other advantage of large diatom cultivation is that less amount of shell needs to be removed that significantly simplifies oil extraction.

The chemical composition of algae differs greatly depending on such cultivation conditions as light, temperature, pH, salt concentration, redox potential, etc. The project is aimed at finding the optimum conditions for reproducible culture and its further use for industrial purposes.

LITTORAL AND SHALLOW SUBLITTORAL ALGAL VEGETATION FROM 8 SITES AROUND SVALBARD

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Corresponding author: Siri R. Moy (sirirmo@student.ibv.uio.no)

The benthic vegetation is an essential part of the marine community by creating a habitat and supporting many species of both other algae and animals. The earliest investigations from Svalbard dates back to the 1840's, and several species lists have been drawn up since then. However, macroalgal investigations from large parts of Svalbard are still missing.

In this study we preformed a qualitative analysis of the algal vegetation at eight different sites located around the coast of Svalbard during 1st – 10th of July 2013. The material was collected from the littoral and the shallow sublittoral zone and identified to species or genus by use of morphological characters in particular. The use of entirely morphological characters to identify some species of macroalgae can be difficult due to their variability in appearance and similarity to other related species. We have therefore included DNA-barcoding of two brown algae and one red alga in this study.

The results from this study yield species lists from all eight stations. A total of 53 different taxa were registered from the survey. The site Norskeøyane had the highest number of different taxa (32). One new species, *Halothrix lumbricalis*, for Svalbard was recorded. DNA – barcoding identified *Saccharina groenlandica* from six out of seven sites, a species morphologically very similar to *Laminaria digitata*. *L. digitata* was only identified from one station. Barcoding revealed all fucoid algae to be *Fucus evanescens* and *Ceramium virgatum* was the only species of *Ceramium* registered.

This work will serve as a baseline for future studies with respect to climate changes and distribution of macroalgae from sites around Svalbard.

CONSERVATION OF DEEP-WATER HABITATS IN THE NORTH EAST ATLANTIC: USING MAREANO SPECIES DATA TO IMPROVE THE OSPAR HABITAT DEFINITIONS

Genoveva Gonzalez-Mirelis, Pål Buhl-Mortensen
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The OSPAR Convention has put forward definitions of threatened and/or declining deep-water habitats to help countries in the North East Atlantic region better direct their conservation efforts. These definitions, however, are based solely on species composition and they are not always easy to apply at the local level. For example, it is not clear what should be the minimum abundance of each indicator species before an area can be considered to have a given habitat present?

We examined distribution data of various indicator species and developed criteria to determine whether a given locality should be classified as OSPAR habitat. We use the definition of "deep-sea sponge aggregations" as a case in point. To test the applicability of the definition, we have used species occurrence data from underwater video transects from over 200 localities, which were collected under the MAREANO ("MARine Areal database for NOrwegian waters") programme. During video analysis, every occurrence of any of the indicator sponge species is noted and its density estimated. We carried out multivariate analyses to document the internal coherence of the community, analyzed spatial pattern to determine patch size and map clusters, and examined the variation in observed density within patches to determine appropriate abundance thresholds.

We detected a clear subdivision of "deep-sea sponge aggregations" into at least two different sponge aggregation types, including one soft-bottom and one hard-bottom type. Preliminary analyses show that the average size of a soft-bottom, sponge aggregation patch (typically featuring a carpet of shedded spicules) is 35 m across. Observed densities can be up to 10 sponges/m^2 and the mean density inside the patches was 2 sponges/m^2. We propose refined definitions of some of the OSPAR deep-water megafaunal habitats based on observed patterns of species composition and abundance, as well as clear criteria on how to apply them to achieve more effective conservation.

MICROALGAL DIVERSITY IN A RED SEA SEAGRASS MEADOW COMMUNITY

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Corresponding author: *Anders Wold* (anderwol@student.matnat.uio.no)

Seagrass meadows are known for their high diversity of marine species and important ecological role in shallow marine and estuarine waters around the world. These habitats are experiencing a decline globally partly due to anthropogenic activity. Little is known about the microalgal diversity associated with this habitat in the Red Sea in general, and in Saudi Arabia specifically.

We are examining the species composition in a bay north of Jedda in Saudi Arabia. Samples were collected from the water column above the meadow, scrapings of seagrass leaves, and the sediment. Species representing all major microalgal phyla (Bigyra, Chlorarachniophyta, Chlorophyta, Cryptophyta, Cyanophyta, Dinophyta, Euglenophyta, Haptophyta and Ochrophyta) have been isolated, cultured, DNA-extracted, and DNA marker regions (SSU, LSU and ITS ribosomal DNA) have been amplified and sequenced, i.e. barcoded. The choice of markers was based both on the amount of reference sequences available, and the amount of variation found in the DNA regions in question. The sequences have been compared with reference sequences from the GenBank database, and phylogenetic trees reconstructed to infer the taxonomic placement of the strains. We are also using light- and electron microscopy along with the molecular analyses to determine which species are present, and characterize understudied or novel species. Based on said methods, we see indications of two novel species being present in the culture collection – one being a representative of family Pavlovaceae (Haptophyta), the other of family Rhizochromulinaceae (Ochrophyta).

This study will provide further understanding of the microbial species composition in tropical seagrass meadows. It will show whether the meadow in question holds a unique microalgal community or is similar to that in other tropical regions, and possibly if there are any novel species present.

GENETISK STREKKODING AV MARINE VIRVELLØSE DYR

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Ved Universitetsmuseet i Bergen (UM) pågår det nå omfattende genetisk strekkoding (barcoding) av marine evertebrater fra nordlige og østlige områder av Atlanterhavet. Arbeidet i norske farvann er en del NorBOL, Norwegian Barcode of Life, som støttes av Artsprosjektet og Norges Forskningsråd. NorBOL har som målsetning å opparbeide strekkoder på 20 000 norske arter innen 2018.

Vi bidrar til å bygge opp et kvalitetssikret bibliotek i databasen BOLD (www.boldsystems.org) over korte, artsspesifikke DNA-sekvenser fra COI-regionen, med tilhørende voucherindivider som blir permanent inkludert i museets samlinger.

Gjennom å supplere tradisjonell, morfologibasert taksonomi med genetiske metoder kan vi avdekke uoverensstemmelser i navnsettingen på arter mellom ulike forskningsmiljø i inn- og utland. Ved å oppdage behov for taksonomiske revisjoner og å bidra til harmonisering av taksonomier vil vi oppnå en bedre forståelse av regionalt artsmangfold og biodiversitet, samt populasjoners geografiske utbredelse. Store genetiske forskjeller vil også kunne indikere nye arter. Etter hvert som databasen befolkes av sikkert identifiserte sekvenser, vil man også kunne bruke nettbaserte identifiseringsmaskiner til å artsbestemme prøver basert på små vevsprøver fra alle livsstadier.

Vi presenterer her foreløpige resultater etter innsending av nær 2500 prøver og 700 arter børstemark, krepsdyr, pigghuder og bløtdyr. Vi vil også informere om hvordan man kan bidra i prosjektet. Vi vil gjerne ha flere samarbeidspartnere!

Nøkkelord: DNA, barcoding, genetisk strekkoding, MAREANO, NorBOL, taksonomi, Universitetsmuseet i Bergen, evertebrater

IS GLOBAL WARMING CHANGING THE GREEN SEA URCHIN *(STRONGYLOCENTROTUS DROEBACHIENSIS)*'S ABUNDANCE, RECRUITMENT AND DEPTH DISTRIBUTION IN THE INNER OSLOFJORD?

Fredrik Oulie Nyhagen NIVA

Global warming predictions suggest an increase in temperature and decrease in salinity in fjords and coastal water, which may impact cold water species and particularly echinoderms vulnerable to low salinity. Environmental data from the Oslofjord shows temperature is increasing while salinity is decreasing. This study aims to see if *Strongylocentrotus droebachiensis*, a species well-known for transforming kelp-beds to barren grounds, is affected by these changes. The Oslofjord's urchin population may be isolated from the coastal populations further north, rendering it vulnerable to changes in these parameters. If extinct, the grazing rates in the fjord may be strongly reduced, shifting it from barren grounds to an algae and kelp-dominated system. The urchin population in the fjord was investigated and compared to earlier investigations and monitoring data. The study concludes that depth and abundance were correlated and will be discussed in relation to salinity and temperature data from the same period. Recruitment will be compared to data from earlier investigations.

NEDBEITING OG GJENVEKST AV TARESKOGEN LANGS NORSKEKYSTEN

Knut Sivertsen, UiT Norges Arktiske Universitet, Tromsø

Nedbeiting av tareskogen av kråkeboller (*Strongylocentrotus droebachiensis)* langs norskekysten ble observert fra 1974. Nedbeitede områder ble observert om lag samtidig fra Nordmøre til grensa mot Russland. Omfanget økte etter hvert utover til mer bølgeeksponerte områder. Undersøkelser i Troms i 1990 og Vest-Finnmark i 2004 viste at om lag halvparten av arealet av tareskogen var nedbeitet. Store deler av kysten ble undersøkt for nedbeiting i 1980- og 1990-årene. Disse undersøkelsene danner grunnlag for å registrere gjenvekst etter nedbeitingen.

Områder i Hitra, Sør-Trøndelag, som ble undersøkt ca hvert tredje år siden 1980, viser at gjenvekst av tareskog startet ca år 1990, og omfanget har avtatt fram til 2002 da all tareskogen var vokst til igjen. Undersøkelser av syv lokaliteter i Bliksvær i Bodø, som var helt nedbeitet i 1980-årene, var taren i mai 2013 helt vokst til igjen, mens i områder ved moloen i Bodø havn dominerte kråkeboller. Lokale beboere utenfor Bodø hevdet at tareskogen var vokst til igjen ca i 2006-2007. Undersøkelser i skjærgården av Troms, Vest-Finnmark, Hammerfest og Laksefjorden, siden 2000 viser ingen tegn på gjenvekst.

Varangerfjorden, der kongekrabbe har de høyeste forekomstene og oppholdt seg lengst, ble undersøkt i 2011 og 2012. Området vest for Bugøynes viste at omfanget av nedbeiting hadde økt kraftig siden 1985. Kongekrabben har trolig hatt liten påvirkning på kråkebollebestandene. Områdene Skogerøy (øst for Bugøynes) og Kongsfjorden var omfanget av nedbeitet tareskog om lag det samme som i 1985. På noen lokaliteter i ytre del av Bøkfjorden (utenfor Kirkenes) var tareskogen helt nedbeitet. På andre hadde taren lavere tetthet og høyt innslag av andre alger enn de vanlige tareartene. Det er usikkert om dette var tareskog som hadde vokst til etter å ha vært nedbeitet, eller om det er typisk tareskog som vokser nær den nordøstlige utbredelsesgrensen for stortare. Undersøkelser i Porsangerfjorden i august i år viser at kråkebolletettheten har avtatt og størrelsen har økt de siste 2-3 årene.

Gjenvekst av tare i Trøndelag, Helgeland og Salten som var det sørlige området hvor taren var nedbeitet kan skyldes økt temperatur og forandringer i populasjonsdynamikken til kråkebollene.

STORSKALA SKIFTNINGER I TARE-KRÅKEBOLLE BALANSEN. ENDRINGER I KLIMA OG PREDASJON GIR SPENNENDE ØKOLOGISKE OG FORVALTNINGSMESSIGE PERSPEKTIVER.

Hartvig Christie m fl., NIVA i samarbeid med UiT og APN

Den langvarige tilstanden med tareskog nedbeitet av kråkeboller er i endring. Nylig viser over tusen registreringer i Nordland, Troms og Finnmark at tareskog kommer tilbake stedvis langs kysten av Helgeland, Salten og i Øst-Finnmark. Gjennom feltobservasjoner, eksperimenter og bruk av tilgjengelige data har vi funnet en sammenheng mellom temperaturøkning og økende predasjon fra taskekrabbe på tilbakegang av kråkeboller i Nordland, mens økende predasjon av kongekrabbe synes å være ansvarlig for lokal reduksjon av kråkebolletetthet i Øst-Finnmark. Vi har også involvert data for forekomst av topp-predatorer som kysttorsk, og vil presentere modeller for hvordan fysiske og biologiske (både bottom up og top down) interaksjoner påvirker forholdet mellom kråkebolle eller tare-dominans. Vi vil belyse styrken til de ulike interaksjonene og diskutere fremtidige utfordringer i den sammenheng.

MILJØTILSTAND I BØRGIN.

Longva, O. [1], Mork, J. [3], Lepland, A. [1],McClimans, T. [2]
[1]NGU [2]Sintef, [3]NTNU
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Børgin (tidligere omtalt som Borgenfjorden) er ett av de 17 områdene som det i september 2009 ble meldt oppstart for i første pulje av Nasjonal marin verneplan. Området ligger vest i Nord-Trøndelag fylke og tilhører kategorien *Poller*. NGU, NTNU og SINTEF har gjennomført en analyse av miljøstatus i fjorden for Fylkesmannen i Nord-Trøndelag for å møte Vanndirektivets krav. Som støtte for analysen ble det gjennomført dybdekartlegging av 11,4 km^2 av pollens arealer, og kartlegging av sedimentforhold og strømforhold. Dataene ble samlet inn med NGUs fartøy F/F Seisma i 2012.

Bunnsedimentene er generelt slamholdige unntatt ved innløpet ved Straumen, hvor man finner partier med grovere sedimenter delvis ført inn i fjorden med strømmen og delvis vasket ut av leira av bunnstrømmer. Det er indikasjoner på at strømsystemet er endret fra 1970-tallet, og det spekuleres i om det kan ha sammenheng med utfylling av sundet sør for Sundsøya og/eller naturlig erosjon i innløpet.

Kjemisk sett er miljøstatusen for Børgin god. Både tungmetallanalyser og analyser av organiske miljøgifter viser at bunnsedimentene ikke er forurenset i henhold til Miljødirektoratets (Klifs) krav, og at innholdet av miljøgifter generelt har blitt lavere de siste tiårene. Økologisk sett virker fjorden også "frisk", bortsett fra områdene dypere enn ca. 20 m i indre basseng som har oksygensvikt i bunnvannet deler av året. Oksygensvikten er en naturgitt prosess og forholdene har trolig endret seg lite de siste 100 år.

LAKSEOPPDRETT, LUSEMIDLER OG PÅVIRKNING PÅ LOKALE REKEBESTANDER

Knut Eirik Jørstad(1), Ole B. Samuelsen (2) og Guldborg Søvik (2)
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Et bærekraftig fiskeoppdrett innebærer få eller ingen negative miljøvirkninger, noe som er en prioritert målsetting for både næringen selv og for samfunnet. Luseproblemet og rømming (inkludert genetiske problemer) har vært vurdert som de viktigste risikomomentene. Fra fiskerisiden fokuseres det nå også på bruk av kjemiske midler til avlusing, der dette settes i sammenheng med en kraftig nedgang i rekebestanden langs kysten og i fjordene. Så langt er dette ikke undersøkt, men det er kjent at flubenzuroner virker hemmende på skallskifte prosessen hos krepsdyr, inkludert lakselus. Reker finnes på egnet bunnhsubstrat langs hele norskekysten og i fjordene, og rekefiske er økonomisk viktig. Om natten vandrer reken oppover i vannmassene for å beite på dyreplankton. De utgjør derfor en nøkkel-art med hensyn til energiflyt i næringsnettet. Et pilotprosjekt ved Solheim i Masfjorden undersøkte flubenzuroner i både reker og sjøkreps like etter en lusebehandling og 8 måneder senere. Ved hjelp av detaljert kartlegging av bunnforholdene ble det funnet aktuelle fiskesteder tett opp til anlegget, der både reker og sjøkreps ble fanget med bruk av teiner. Dette materialet ble videre brukt i kjemisk analyser for flubenzuroner. Det bør nå gjennomføres både kontrollerte laboratorieforsøk på reker og lusemidler, samt settes i gang detaljerte feltundersøkelser på reker i fjorder med høg tetthet av lakseoppdrett og sammenligne med områder uten oppdrettsanlegg.

SELECTED PHYSICAL, BIOLOGICAL AND BIOGEOCHEMICAL IMPLICATIONS OF A RAPIDLY CHANGING ARCTIC MARGINAL ICE ZONE

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The Marginal Ice Zone (MIZ) of the Arctic Ocean is changing rapidly due to a warming Arctic climate with commensurate reductions in sea ice extent and thickness. This Pan-Arctic review summarizes the main changes in the Arctic ocean-sea ice-atmosphere (OSA) interface, with implications for primary-and secondary producers in the ice and the underlying water column. Changes in the Arctic Marginal Ice Zone (MIZ) were interpreted for the period 1979-2010, based on best-fit regressions for each month. Trends of increasingly open water were significant for each month, with quadratic fit for August-November, illustrating particularly strong seasonal feedbacks in sea ice formation and decay. Geographic interpretations of physical and biological changes were based comparison of regions with significant changes in sea ice: 1) The Pacific Sector of the Arctic Ocean including the Canada Basin and the Beaufort, Chukchi and East Siberian Seas; 2) The Canadian Arctic Archipelago; 3) Baffin Bay and Hudson Bay; and 4) the Barents and Kara Seas. Changes in ice conditions in the BSKS region appear to be primarily forced by ocean heat fluxes during winter, whereas changes in the other sectors appear to be more summer-autumn related and primarily atmospherically forced. Effects of seasonal and regional changes in OSA-system with regard to increased open water were summarized for photosynthetically available radiation, nutrient delivery to euphotic zone, primary production of ice algae and phytoplankton, ice-associated fauna and zooplankton, and gas exchange of CO_2. Changes in the physical factors varied largely among regions, and showed direct effects on organisms linked to sea ice. Zooplankton species appear to be more flexible and likely able to adapt to variability in the onset of primary production.

EVALUATION OF A 33 YEAR-LONG HINDCAST OF WATER LEVEL, SEA ICE, CURRENTS, AND HYDROGRAPHY IN THE NORTHERN NORTH ATLANTIC INCLUDING THE ARCTIC SEA AND THE ADJACENT BARENTS AND NORTH SEAS

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We consider results from a 33 year-long hindcast (1980-2012) of water level, sea ice, currents, and hydrography for an area covering the northern North Atlantic, the Arctic Sea and the adjacent Barents and North Seas. The hindcast is based on a non-eddy resolving (20 km mesh size), coupled ice-ocean circulation model. No data-assimilation is used, except for a slow relaxation towards a climatological monthly mean sea surface salinity. The system is forced using atmospheric input from ECMWF (ERA40, ERA Interim and operational analyses). On the open ocean lateral boundaries we use the UK Met Office 1993-2012 FOAM reanalysis extended backwards from 1993 to 1980 by constructing a monthly mean climatology. To assess the quality of the model results we compare them to available observations using various analyses tools. Given the model's coarse resolution, we find them to reproduce the observations surprisingly well. However, we note that the model's hydrography consistently deviates in coastal areas. This is hardly surprising in light of the model's coarse resolution.

EFFECTS FROM CLIMATE AND EUTROPHICATION ON THE DIVERSITY OF HARD BOTTOM COMMUNITIES ON THE SKAGERRAK COAST 1990-2010

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Eutrophication is one of the most serious environmental problems in the Skagerrak and climate change may increase eutrophication in the future. This study focused on the effects from eutrophication, climate and interactions between the two on biodiversity on rocky bottom communities on the outer Skagerrak coast. Monitoring data from the period 1990 to 2010 including macroalgae, sessile fauna and physical and hydrochemical data were analysed. The most important factors regulating species richness, diversity and community structure were physical factors including wave exposure level and other factors varying with depth and biogeographical region. Climate variation and eutrophication variables had also important impacts on diversity and community structure. Periods with high nutrient and particle concentrations and periods with extreme temperatures negatively impacted benthic diversity. These impacts could be traced at least back to the previous summer. The study highlights the importance of regarding effects from multiple stressors in combination, and we predict that climate change will decrease benthic diversity in the Skagerrak in the future.

PLAKATER

(alle får tilbud om å presentere plakaten i plenum med max 3 slides)

THE AQUA-USERS PROJECT: TRANSFORMING EARTH OBSERVATION DATA INTO USER RELEVANT AND TIMELY SERVICES FOR THE AQUACULTURE INDUSTRY

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With global population expansion, the demand for high-quality protein is rising. Increased aquaculture production is clearly needed, and over the past three decades, aquaculture has developed to become the fastest growing food production sector in the world; it has expanded, diversified, intensified and technologically advanced. A large part of aquaculture production is taking place in an open sea environment with which it interacts complexely.. Therefore, monitoring is needed on several levels.

The EU-funded project AQUA-USERS will provide the aquaculture industry with user-relevant and timely information based on the most up-to-date satellite data and innovative optical in-situ measurements. The key purpose is to develop an application that brings together satellite information on water quality and temperature with in-situ observations as well as relevant weather prediction and met-ocean data. The application and underlying database will be linked to a decision support system that includes a set of (user-determined) management options. Specific focus will be put on the development of indicators based on Earth observation data for aquaculture management including indicators for harmful algae bloom events. The methods and services developed within AQUA-USERS will be tested by the members of the user board, 8 aquaculture companies and organisations, which represent different geographic areas and aquacultural production systems.

SEASCAPE DESCRIPTION OF AN UNUSUAL CORAL REEF AREA OFF VESTERÅLEN, NORTHERN NORWAY

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Several studies have indicated that the distribution of cold-water coral reefs is correlated with rough topography and slopes exceeding a certain critical angle. In this study, based on results from multibeam and videos (obtained by the Norwegian seabed mapping program MAREANO), we show that this is not always the case. The study area is situated in the Hola glacial trench off Vesterålen. Here, *Lophelia*-reefs occur in the deep parts of the trench at the northern side where the currents flow from the coast towards the shelfbreak. The seabed is relatively level with small gravelly patches within a mainly sandy environment. One active gas seep was discovered in the outer part of the reef area, but no signs of seepage or carbonate crusts were found within the central and denser reef area. In total, there were 330 reefs in the area. These were 31 - 334 m long, 27 - 114 m wide, and 4 – 17 m high. Most (132) of the reefs were smaller than 100 m in longest direction, whereas only 81 reefs were longer than 200 m. The shape of the reefs changes from circular to elongate with increasing size. They normally consist of a relatively small (20x20 m) living up-current front and a longer "tail" of coral debris. Signs of erosion were common around the reef front. Seabed topography has no direct influence on the coral distribution, but influences the environment by modifying the hydrodynamic setting. Local topographic features such as peaks and ridges induce accelerated currents and are favorable locations for reef growth. The Hola trench is a landscape feature which also seems to induce strong currents, bringing nutrient rich water from local production at the shelf. Within the range of the coral's temperature and salinity tolerance the combination of hard bottom substrate for coral larvae settlement and relevant food transport rates are probably more important than the local topography of the seabed.

«BIOLOGI OG ØKO-FYSIOLOGI HOS TASKEKRABBE *(CANCER PAGURUS)* I NOREG. FORSKJELLAR MELLOM «NORDLENDINGAR» OG «SØRINGAR»?» PRESENTASJON AV EIN DOKTORGRAD

Snorre Bakke, Møreforsking, Ph.D. kandidat Universitetet i Tromsø

Fisket etter taskekrabbe i Noreg strekk seg frå svenskegrensa til Vesterålen i nord. Det blir landa mellom fem og seks tusen tonn årleg, noko som utgjer om lag 10 % av dei europeiske landingane. For mange av dei mindre båtane er arten difor ein av dei viktigaste kystnære ressursane. Nyare undersøkingar tydar på at taskekrabben den seinare tida har bevegd seg nordover. Med registreringar så langt nord som Finnmark dekker Noreg i dag nesten halvparten av artens geografiske utbreiing som strekk seg sør til Marokko. Tross krabbens vide utbreiing i Noreg, og at den er ein så viktig kommersiell ressurs, finst det lite kunnskap om artens biologi i våre farvatn, kor mykje av den tilgjengelege informasjon er overført frå studiar i andre land. Gjennom eit doktorgradsløp er målsettinga å tileigne seg meir «stadeigen» kunnskap om biologi og økofysiologi hos taskekrabbe, samt geografiske forskjellar. I doktorgradsløpet vil ein undersøke størrelse, og om ein lykkast metodisk, alder ved kjønnsmodning for taskekrabbe i Rogaland, Trøndelag og Vesterålen. Ein vil vidare forsøke å identifisere om der er forskjellar i reproduksjonssyklus mellom krabber frå nord og sør. Dette skal undersøkast gjennom å analysere 14 år med data samla inn frå ein referanseflåte av fiskarar samt ta nytte av NIR-teknologi til å overvake rognutvikling i krabber frå ulike regionar. Den sparsame kunnskapen ein har om krabbens øko-fysiologiske tilpassingar viser at miljømessige forhold skulle vore ein større flaskehals for krabbens nordlege utbreiing. Til sist er difor også ei av målsetningane i doktorgraden å gjere nokre innleiande studiar av preferansetemperaturar hos krabbe, og om der er forskjellar mellom krabbe med opphav sør og i nord av Noreg. Innhaldet i den startande doktorgraden vil presenterast i form av ein plakat ved Havforskarmøtet.

RuBisCO IN ARCTIC DIATOMS

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Diatoms are unicellular microalgae that often dominate marine ecosystems. As photosynthetic organisms they use CO_2 and light energy to produce organic matter. A fundamental enzyme in CO_2 sequestration and cell growth is Ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO). This enzyme catalyzes the first step in CO_2 fixation and has been called the most abundant protein on Earth. RuBisCO enzymes from diatoms have been described as having high specificity and high turnover rates compared to RuBisCO from other photosynthetic organisms. Enzymes from cold-water species tend to have high catalytic efficiency as species adapted to low temperatures have had to modify enzyme structure and function. This in turn would require low concentrations of these enzymes in the cells. Little is know about the RuBisCO of Arctic species, but recent studies suggest that RuBisCO accounts for a minor percentage of total protein in phytoplankton cells.

This study is therefore aimed at measuring RuBisCO concentrations in Arctic diatom species using immunological techniques and enzyme specific antibodies. Monoclonal species are grown in large (100 L) tanks under changing environmental parameters to monitor changes in physiology and examine variability in RuBisCO content among species. Diatoms are a renewable resource that can be employed e.g. as feed in aquaculture, as lipid producers for biofuel, and as a source for essential fatty acids and other high value molecules. Knowledge about RuBisCO content and efficiency of different species can help selective productive strains for mass cultivation.

MULTIPLE TOOLS USED TO MONITOR EFFECTS OF KELP TRAWLING IN NORTHERN NORWAY

Frithjof E Moy, Henning Steen, Torjan Bodvin, Institute of Marine Research (IMR)

Harvesting seaweed and kelp has long tradition and great potential in Norway. The kelp forests (*Laminaria hyperborea*) are highly productive systems that create habitats for a highly diverse community. Many of these organisms are vital elements in the food web up to commercially harvest fish and crustaceans. Commercial kelp trawling takes place along the Norwegian coast from Rogaland to Sør-Trøndelag, and today 150-170.000 tons of kelp are harvested to alginate production, of a total estimated kelp biomass of 50 mill tons. Even if the harvest is minor to the total estimated biomass, it creates local resistance and protest from interest groups, pointing at negative effects on the local abundance of fish.

Regrowth of kelp in previously barren ground areas grazed by sea urchins, questions the possibility of kelp harvest in new regions. Today, test trawling is performed in Nord-Trøndelag and Nordland. This, and new demands for ecosystem based management, sets focus on the need for new knowledge on the effects of kelp trawling on kelp ecosystem services.

As a consequence of the test trawling in new regions, IMR has initiated studies with multiple fishing gears including video transect, photo rigs, fish pot, and fishing nets, set up in a BACI-design. The test fishery is conducted in close co-operation with professional fishermen.

BIOPROSPECTING MARINE DIATOMS

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UiT – Institute of Arctic and Marine Biology/MabCent

While the marine biota at large have proven to be an important source of new molecules and potential drugs, the immensely species rich diatom group are underrepresented in terms of reported bioactive marine compounds compared to e.g. marine bacteria, porifera, molluscs and seaweeds (Bull and Stach 2007, Blunt, Copp et al. 2010, Blunt, Copp et al. 2011, Murphy, Hotchkiss et al. 2014). Therefore we aimed at investigating the potential of marine diatoms as a source of bioactive compounds with potential pharmaceutical or nutraceutical applications.

Diatom isolates were obtained from water samples in the Barents Sea and mass production of marine diatom biomass was performed at the Phytoplankton lab at UiT. The biomass was then freeze dried, extracted and prefractioned using HPLC and FLASH chromatography and all fractions were subsequently tested in the Marbio (UIT) assay line consisting of 23 different assays covering therapeutic areas such as anti - cancer, diabetes, immunoregulatory, anti-bacterial. In addition the anti-oxidant potential was tested.