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A 5–month feeding trail was carried out for red Tilapia (*Oreochromis* sp.) with an initial average weight of 30 g for size 5 × 5 × 1 m. in earthen ponds. Feeds containing varying percentages of raw *Spirulina* (RS) 0, 20, 40 and 60% were tested with three replications for each treatment. All the feeds were formulated to contain dietary requirement for the Tilapia 30% protein. The results indicated that the fish cultured with 60%RS and 40%RS had significantly ($p < 0.05$) higher protein efficiency ratio, immunity and gonadosomatic index (GSI) than those from 20%RS and 0% RS. Additionally, total-carotenoids and gamma-linoleic acid, as well as protein content in flesh of the fish fed with 60%RS were significantly higher than those from 40%RS, 20%RS and 0%RS ($p < 0.05$). It can be concluded that the raw *Spirulina*, used as feed of red tilapia, enhanced protein efficiency ratio, lysozyme activity, increased red blood cell and white blood cell and GSI of red tilapia. It also increased the amount of total-carotenoids and gamma-linoleic acid and protein in flesh of red tilapia.

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## DISTRIBUTION OF PHYTOPLANKTON COMMUNITY IN THE ARCTIC OCEAN; BERING SEA, CHUKCHI SEA AND CANADIAN BASIN

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In order to investigate the structure of phytoplankton community in the western Arctic Ocean, this study was carried out at 37 stations from July 19 to September 5, 2008 in the Bering Sea, Chukchi Sea and Canadian Basin. Phytoplankton communities were composed of 71 taxa representing Dinophyceae, Cryptophyceae, Bacillariophyceae, Chrysophyceae, Dictyochophyceae, Prasinophyceae and Prymneosiophyceae as well as unidentified nano-pico size phytoplankton. Phytoplankton standing crops ranged from minimum $2.19 \times 10^5$cells $\ell^{-1}$ at the station D84 in the Canadian Basin to maximum $8.29 \times 10^6$cells $\ell^{-1}$ at the station R09 in the Chukchi Sea within the study area. The most abundant species were nano-pico size phytoplankton at most of the stations, but the second abundant species were variable. During the cruise period, dominant species were *Thalassiosira* sp., *Chaetoceros* sp. and unidentified nano-pico phytoplankton such as *Dinobryon belgica* and *Cryptomonas* sp.. From the western Bering Sea to the Bering Strait, the biomass and diversity of phytoplankton were getting higher, but after the Bering Strait they were lower as latitude increased up to the central arctic regions. The statistical analysis showed that there were positive correlations between phytoplankton abundance and physical factors such as temperature and salinity($r = 0.46$, $p < 0.01$, $n = 37$; $r = 0.58$, $p < 0.001$, $n = 37$, respectively).

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## A PRELIMINARY MULTIGENE PHYLOGENY FOR THE CHRYSOPHYTE ALGAE

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Unlike other heterokant algae, the monophylly of the synurophytes and chrysophytes has not been obvious to phycologists studying this collection of taxa. A collaborative effort to resolve the evolutionary relationships of heterkant algae is currently ongoing. A byproduct of this project is a focus on the systematic relationships of synurophyte and chrysophyte taxa. Ultimately, seven genes for 50+ taxa will be used to produce this phylogeny. This study represents a hallmark interval towards this goal. The results for three genes for this taxic collection are presented. Results from the investigation support Anderson's separation of the synurophytes from the chrysophytes, but corroborate very few other aspects the existing taxonomic scheme. At best historical taxonomic categories represent paraphyletic transitions on the larger evolutionary tree. Where possible, morphological features have been entered into cladistic data matrices to evaluate the legitimacy of diagnostic features in distinguishing Family level and below taxonomic categories. Overall, these results suggest the need for additional development for a detailed morphological data set useful in reflecting homologous states within the chrysophyte lineages.

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## IDENTIFICATION OF ARGININE RESIDUES IN THE SUGAR BINDING SITE OF BRYOHEALIN A LECTIN, FROM THE MARINE GREEN ALGA *BRYOPSIS PLUMOSA*

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Bryohealin is lectin isolated from the marine green alga *Bryopsis plumosa*. It was reported to be involved in the wound-healing process of *B. plumosa*. The lectin molecule is composed of two identical subunits of 27 kDa each, cross-linked by disulfide bond and showed binding specificity to

*N*-acetyl-D-glucosamine and *N*-acetyl-D-galactosamine. We demonstrated characterization of a carbohydrate binding site of Bryohealin by chromatography and chemical modification methods. Bryohealin had identical two or more binding sites and shared same binding site for two different carbohydrates (GalNAc and GlcNAc). During chemical modification studies, hemagglutinating activities of Bryohealin were not affected by modification of histidine, tryptophan, aspartic acid, and glutamic acid. When 50% of arginine residues were modified with 1, 2-cyclohexanedione, activity of Bryohealin rapidly decreased. Protection was observed when the arginine modification was performed in the presence of inhibitory sugar (0.15 M GalNAc). The results suggest that the modified arginine is included in the carbohydrate binding site of Bryohealin. Tryptic digested peptides containing modified arginine residues were separated by HPLC. We will indentify which arginine residues are involved in the sugar binding site using mass spectrometry.

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## LAND-USE PATTERN AND DIVERSITY OF PHYTOPLANKTON ON KWAN PHAYAO, PHAYAO PROVINCE

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The study of impact of land-use pattern and diversity of phytoplankton on Kwan Phayao, Phayao (Kwan in Thai means lake) province from May, 2007 to April, 2008. This study to monitor the water quality of Kwan Phayao in different season, study source of pollution from different land-use pattern and human activities by remote sensing and geographical information systems (GIS) techniques, find the relationship among land-use pattern, human activities and water quality in Kwan Phayao. The goal of this study was to establish a spatial database and monitor land use change, as well as water quality by using Remote Sensing and Geographic Information System (GIS). The study found that all land use pattern tens basin of Kwan Phayao. This study were developed from LANSAT 7 ETM+ data from May, 2007 to April, 2008 to measure relatinve Chlorophyll-a and turbidity in Kwan Phayao, Phayao province. Assessments of water quality form 4 sites; inlet, the middle of Kwan Phayao, domestic area and out let. The water quality based on measurements of physic-chemical and biological parameters from all sampling sites were investigated water temperature 25.0–32.0°C, transparency 0.1–0.8 m, and DO 0.56–9.10 mg/l. The total number of phytoplankton species form all sites consisted of 3 Division, 30 Family 65 Genus. The Genus were 9 Cyanophyta, 29 Chlorophyta, 27 Chromophyta. The dominant species were *Microcystis* sp. and *Anabaena* sp. A model for Chloropyll-a was then applied to LANSAT 7 ETM+ frames, were detected in the basin of Kwan Phayao. Cholophyll-a in this study will improve our understanding of the temporal and spatial dynamics of algae bloom formation in Kwan Phayao and orther systems.

Key word: Kwan Phayao, Water quality and Diversity

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## EFFECTS OF NITRATE AVAILABILITY ON CARBON AND NITROGEN ASSIMILATION IN THE MARINE COCCOLITHOPHORE *EMILIANIA HUXLEYI*

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Coccolithophores are essential primary producers and the most important calcifiers in the ocean. Since primary production and calcification are affected by the concentration and form of nitrogen in the sea, we investigated the effects of low (5–15 μM) and high (300 μM) $NO_3^-$ on carbon and nitrogen assimilation in the marine coccolithophore *Emiliania huxleyi* under saturating irradiance and present $pCO_2$. Particulate organic carbon (POC) and inorganic carbon (PIC), as well as particulate organic nitrogen (PON), was determined by mass spectrometry. Kinetics of nitrate reductase (NR) for $NO_3^-$ and nitrite reductase (NiR) for $NO_2^-$ were estimated by means of colorimetric methods. *In vivo* activities of photosynthetic $O_2$ evolution, $CO_2$ and $HCO_3^-$ uptake rates were derived by membrane inlet mass spectrometry. Although growth rates remained equal between low and high $NO_3^-$ cells, coccoliths were mostly incomplete and malformed in low nitrate cells. Cellular POC and PIC, as well as cellular PON decreased under low $NO_3^-$. In agreement to this, lower cellular NR and NiR enzyme activities were found under low $NO_3^-$. Lower Km values of NR for $NO_3^-$ and NiR for $NO_2^-$ were observed in low $NO_3^-$ cells. Whereas $HCO_3^-$ uptake and photosynthesis decreased in low $NO_3^-$ cells, net $CO_2$ uptake rates were similar between high and low $NO_3^-$ cells. Our data suggests that low $NO_3^-$ decreases $HCO_3^-$ uptake and photosynthesis in *E. huxleyi*, but cells compensate for the lower $NO_3^-$ supply, by increasing the affinities of NR for $NO_3^-$ and NiR for $NO_2^-$.