# 運用硝酸運輸基因指數來評估東海浮游矽藻之氮利用情形

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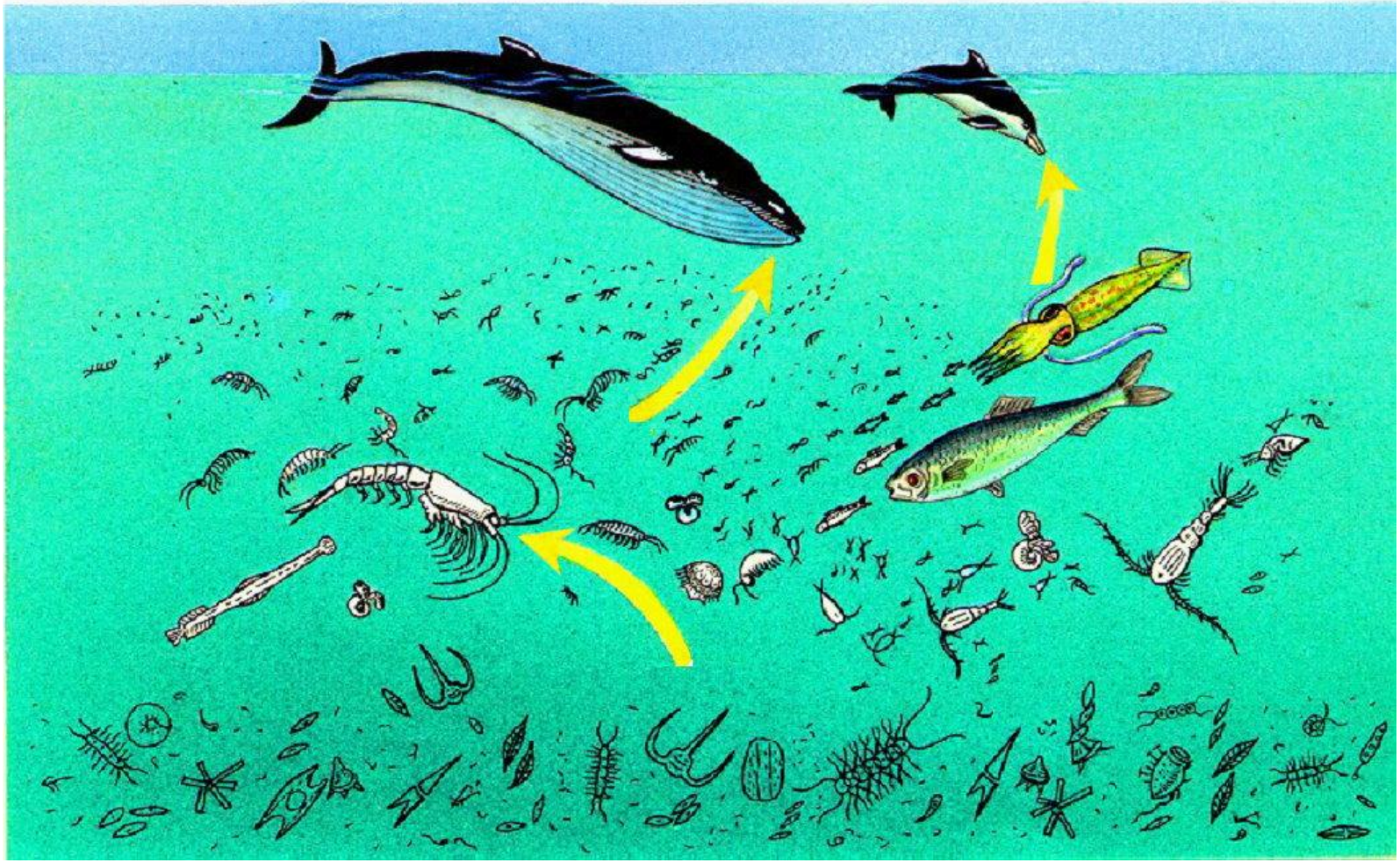
102/09/09

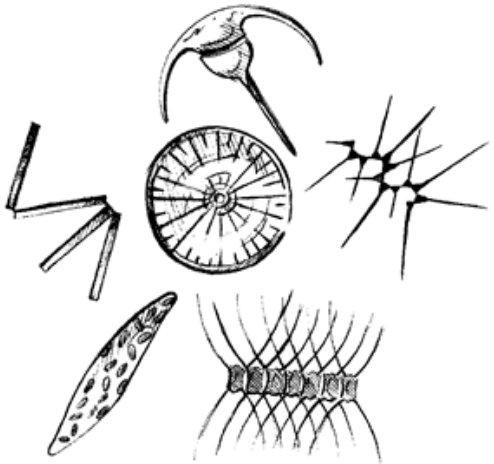
# 浮游植物在海洋生態中的角色



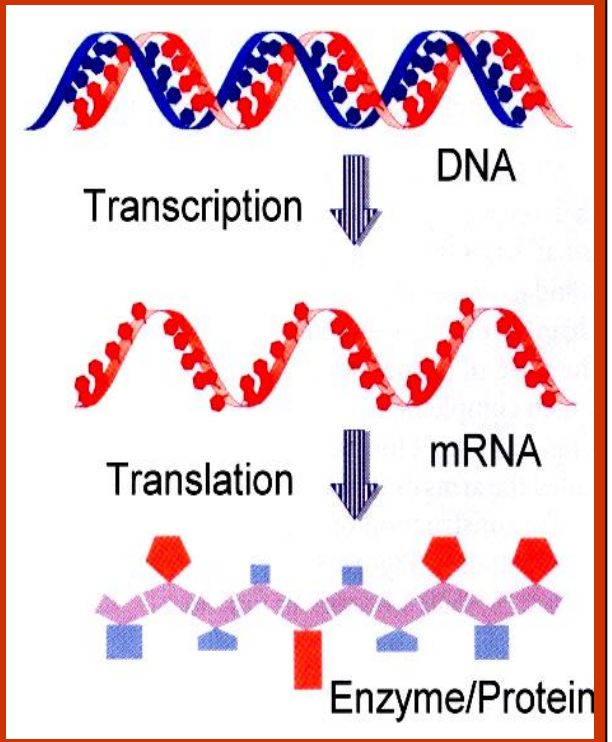
# 限制浮游植物生長的因子

Nutrients :N, P, Fe...

Temperature

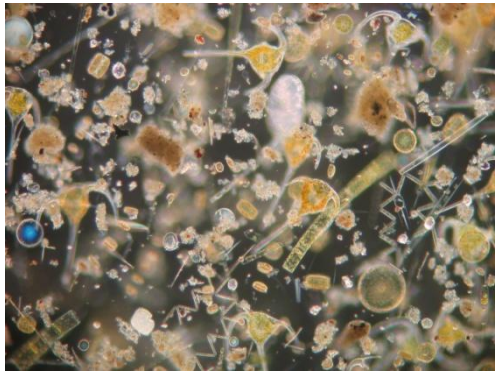


Under stress



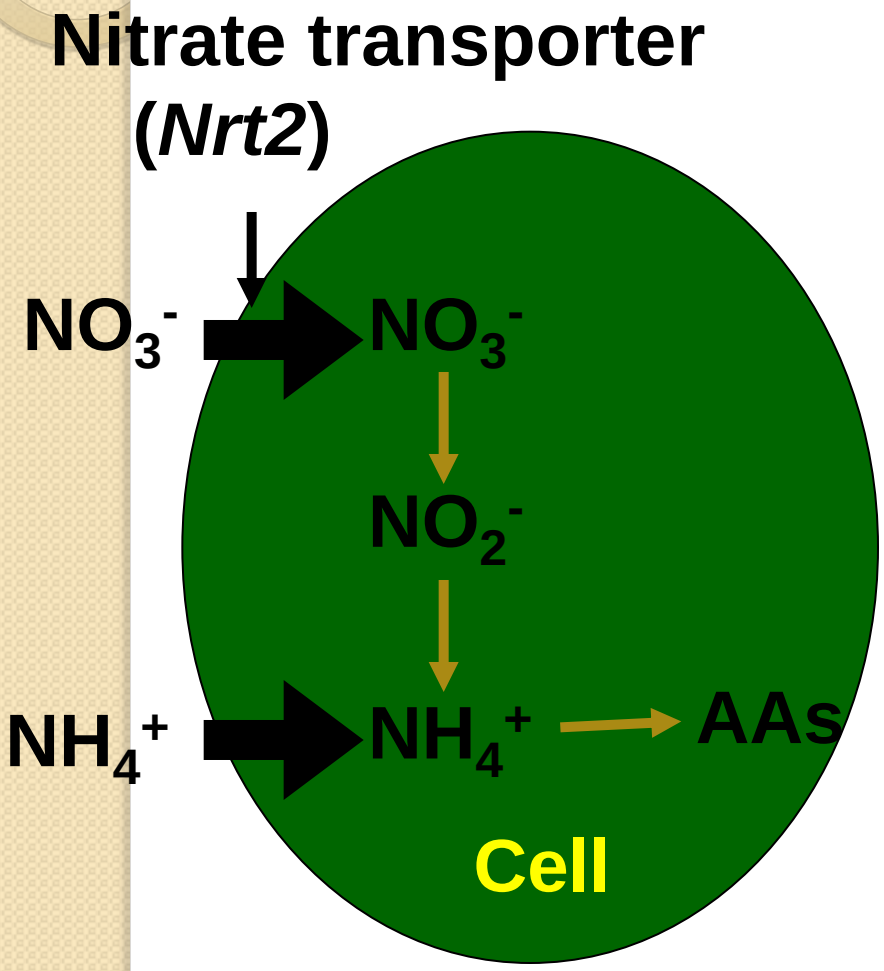

Molecular probe

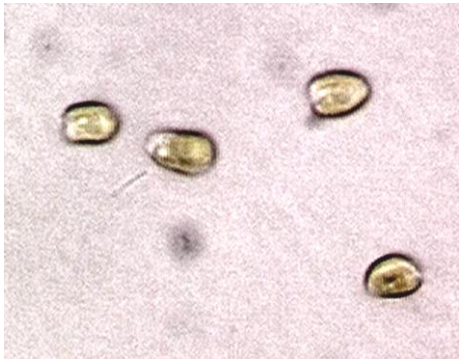
# 目標：發展指標基因來評估浮游植物之生理狀態



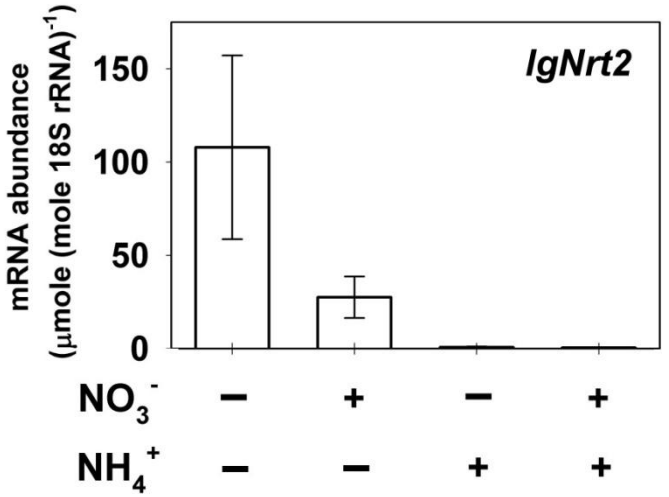
- 指標基因：氮指標 (硝酸運輸基因 ,*Nrt2*)

# 硝酸運輸基因（*Nrt2*）表現因應其氮環境變化之情形



***Isochrysis galbana***
**(Haptophyceae)**




Kang et al., 2007

# 在其他矽藻種類中也有相似的 *Nrt2* 表現情形

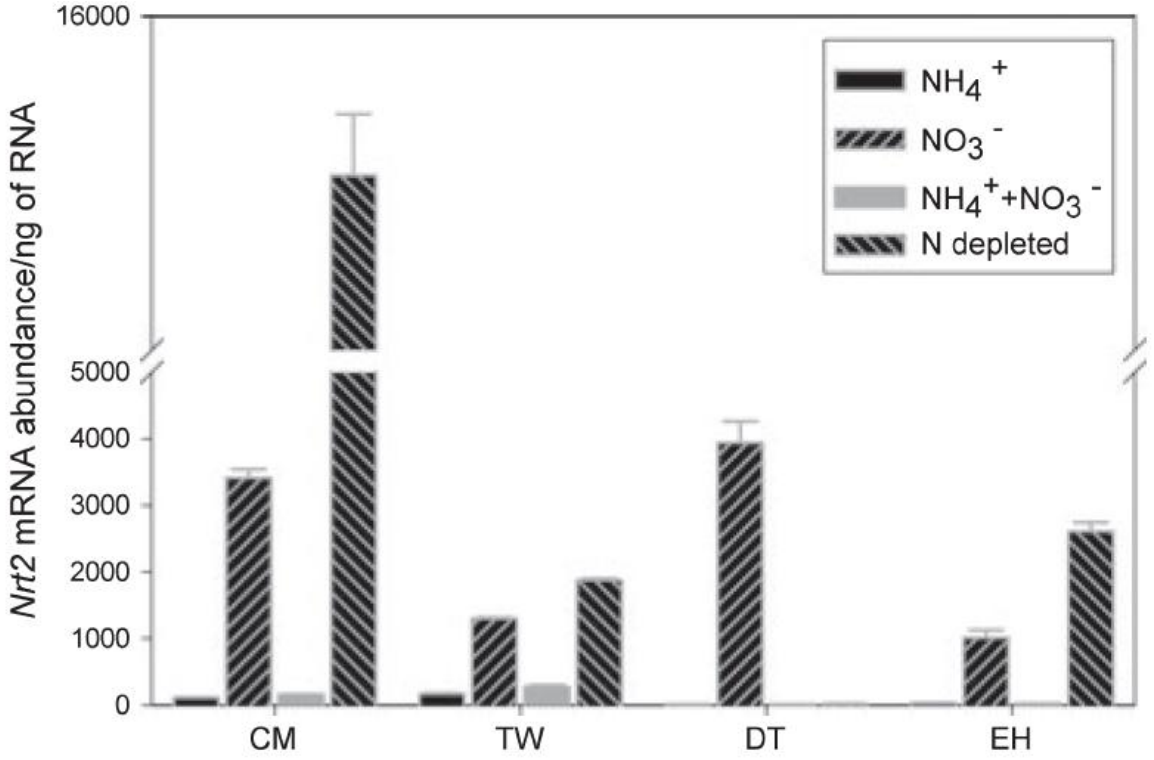
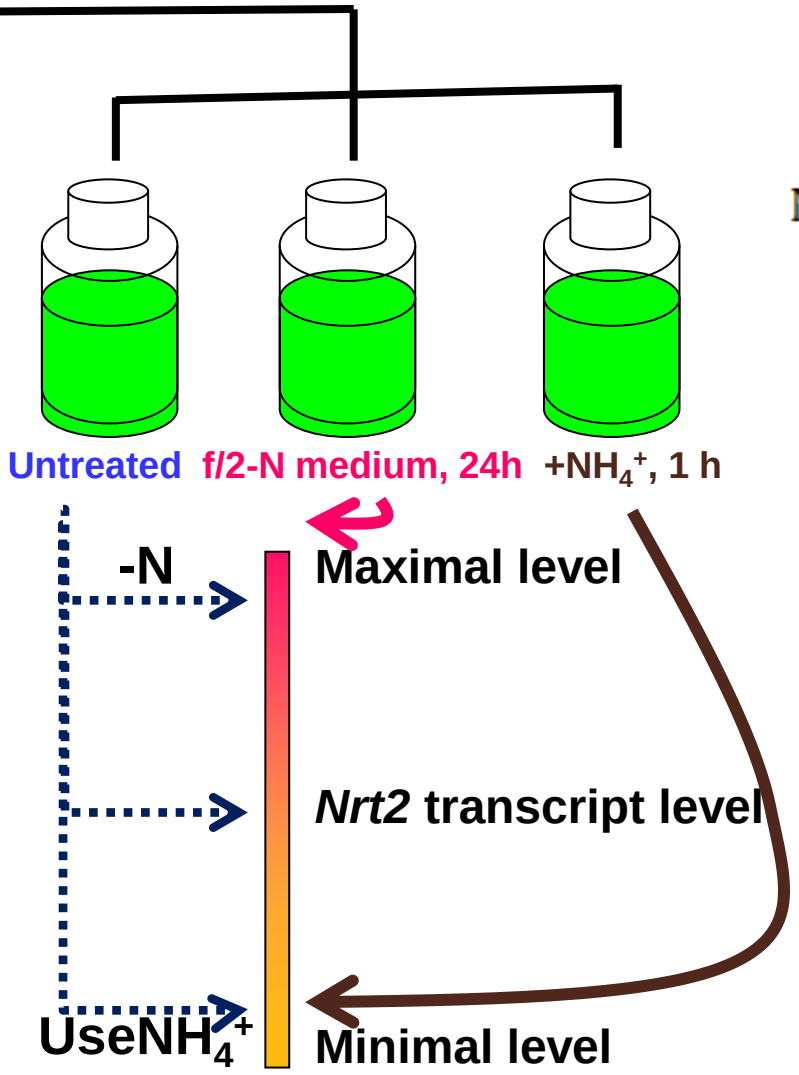



FIG. 4. Transcriptional abundance of high-affinity nitrate transporter (*Nrt2*) genes in phytoplankton species after overnight incubation under different nitrogen conditions. CM, *Chaetoceros muelleri*; TW, *Thalassiosira weissflogii*; DT, *Dunaliella tertiolecta*; EH, *Emiliania huxleyi*.

**Song & Ward, 2007**

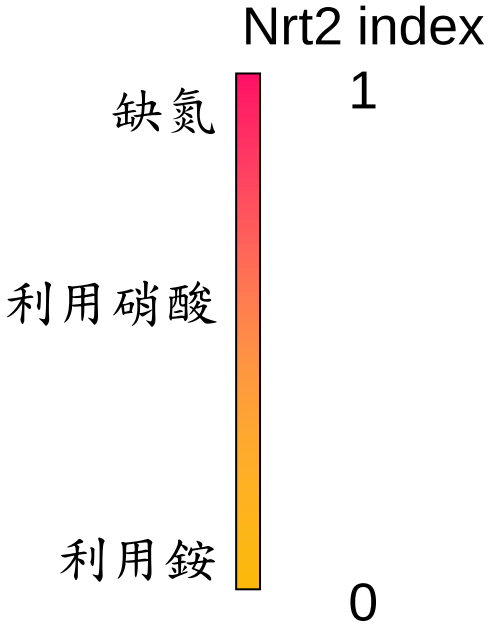
# 海上培養試驗及 Nrt2 指數




$$\text{Nrt2 index} = \frac{\log \text{Nrt2}_{\text{Org}} - \log \text{Nrt2}_{\text{Min}}}{\log \text{Nrt2}_{\text{Max}} - \log \text{Nrt2}_{\text{Min}}}$$

（現場值－最小值）

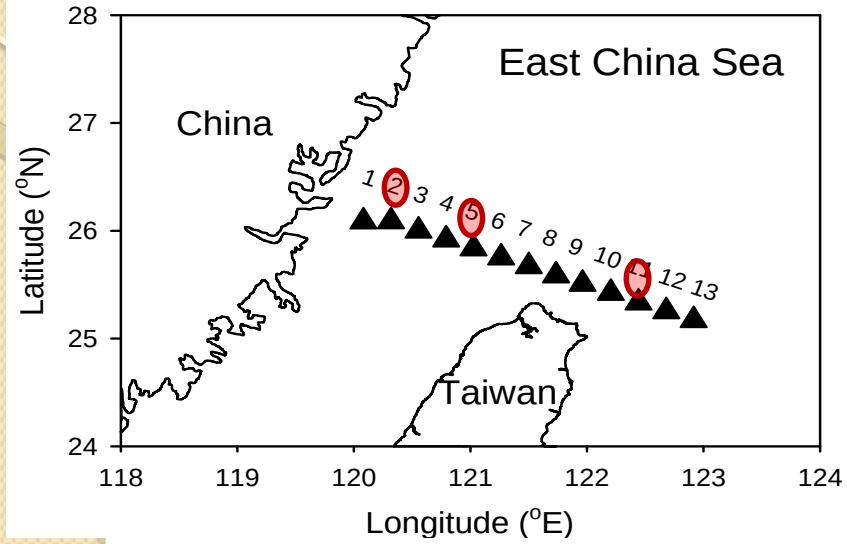
（最大值－最小值）



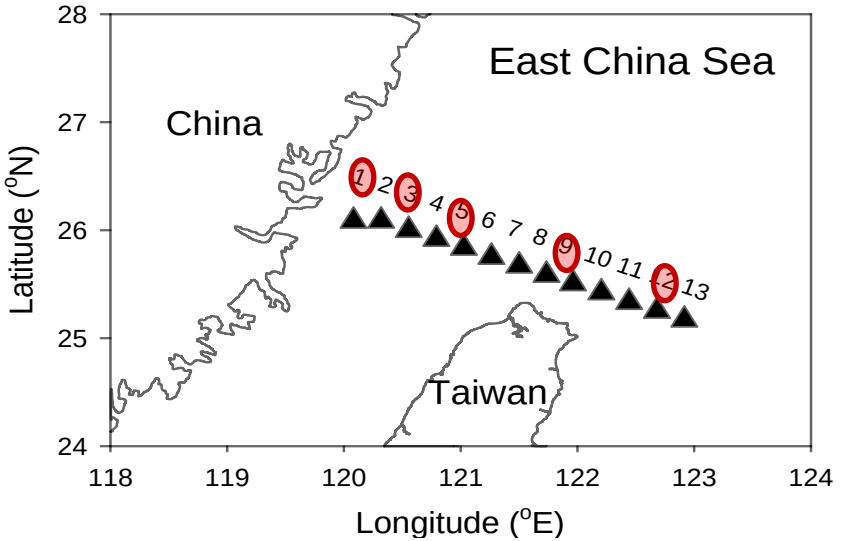

Kang, et al. 2009. J. Phycol. 45:864

# 海研二號小東海航次

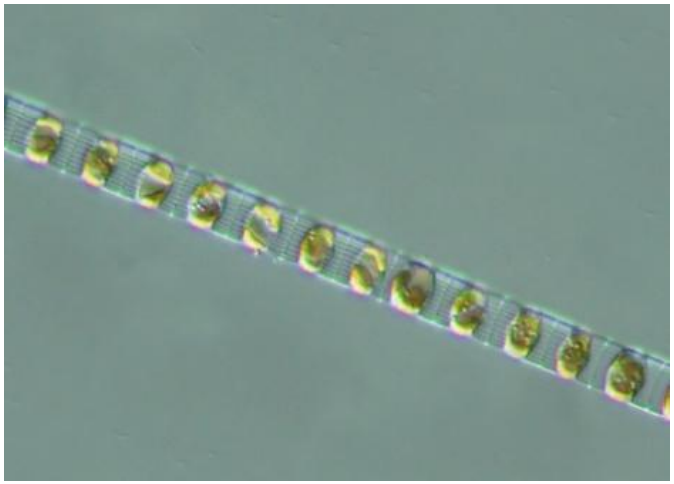
**2010. 8. 2-4.**



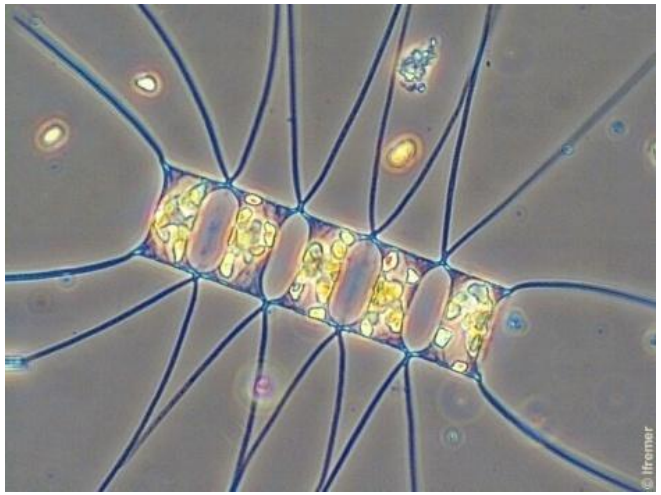

**2011. 6. 8-10.**



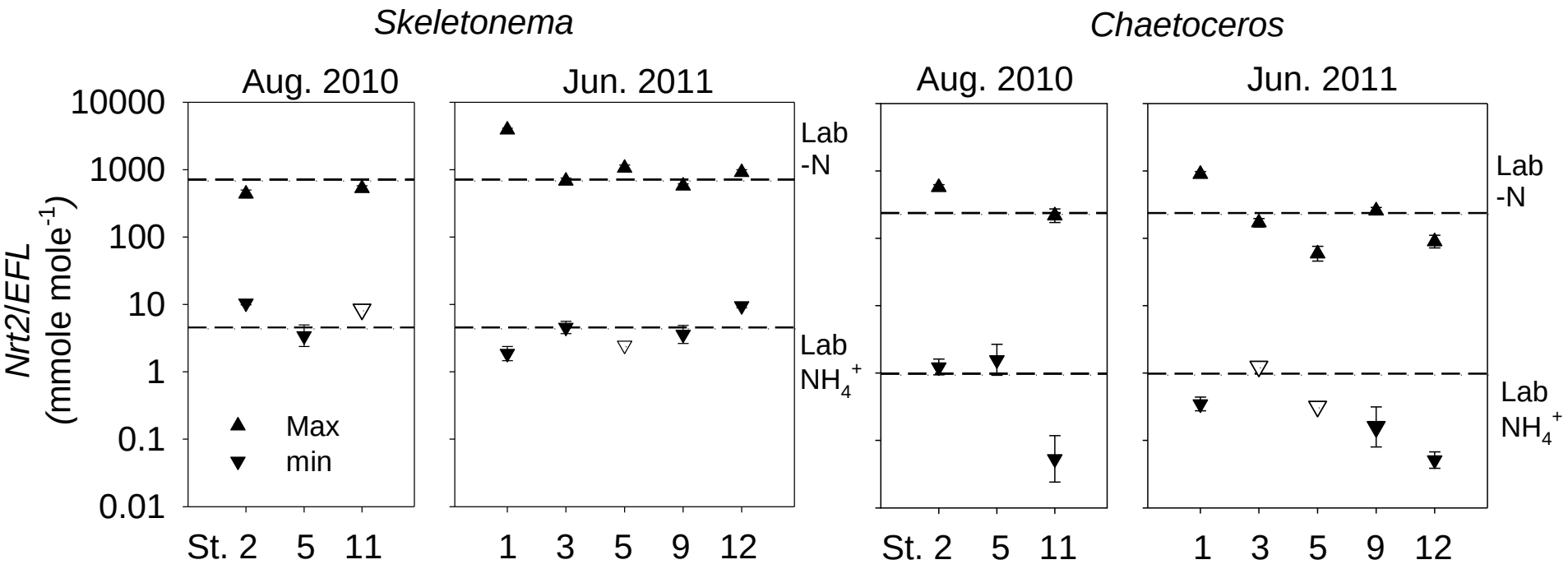

骨藻 *Skeletonema*



角刺藻 *Chaetoceros*

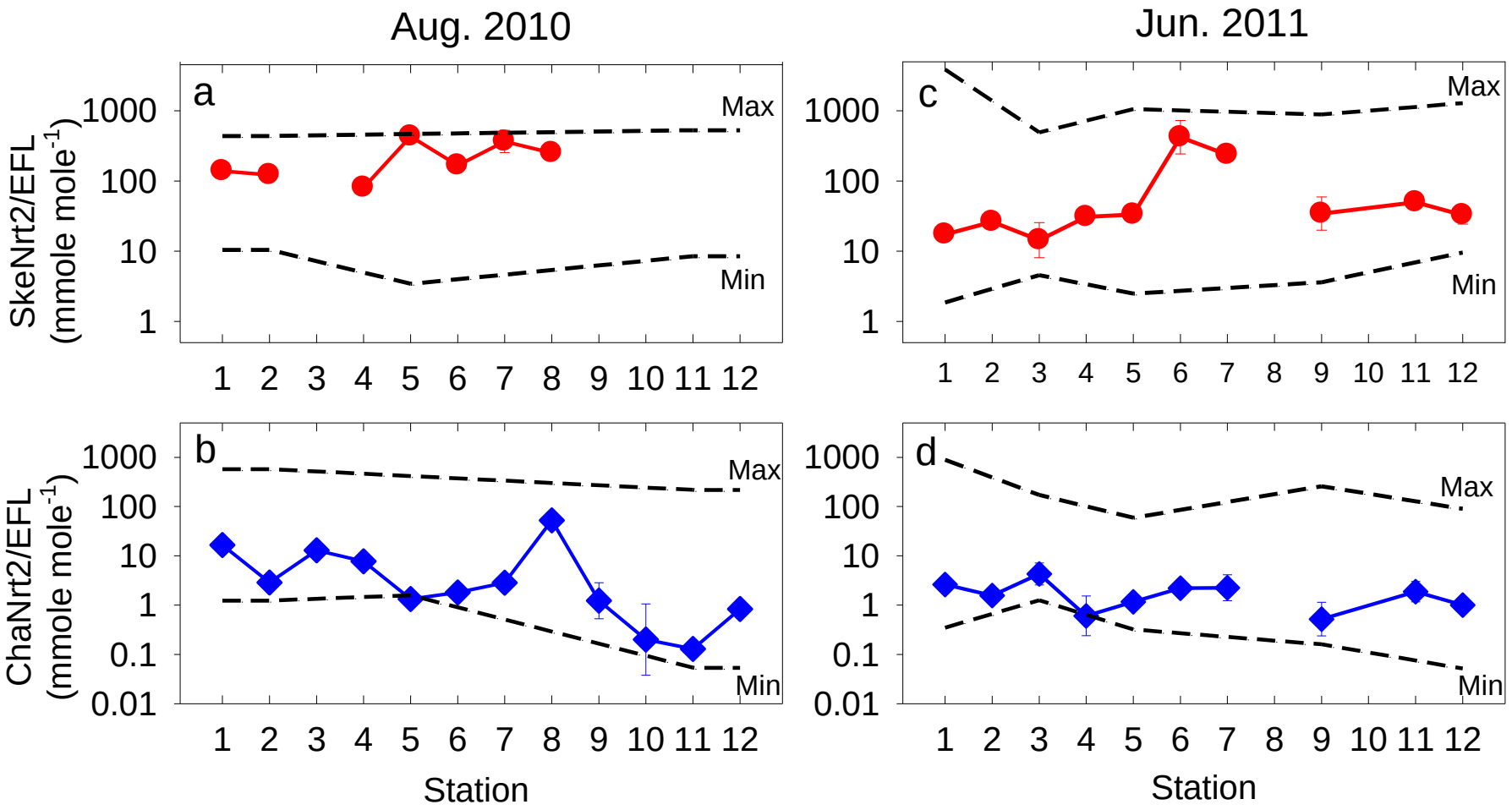


# 東海添加培養試驗結果

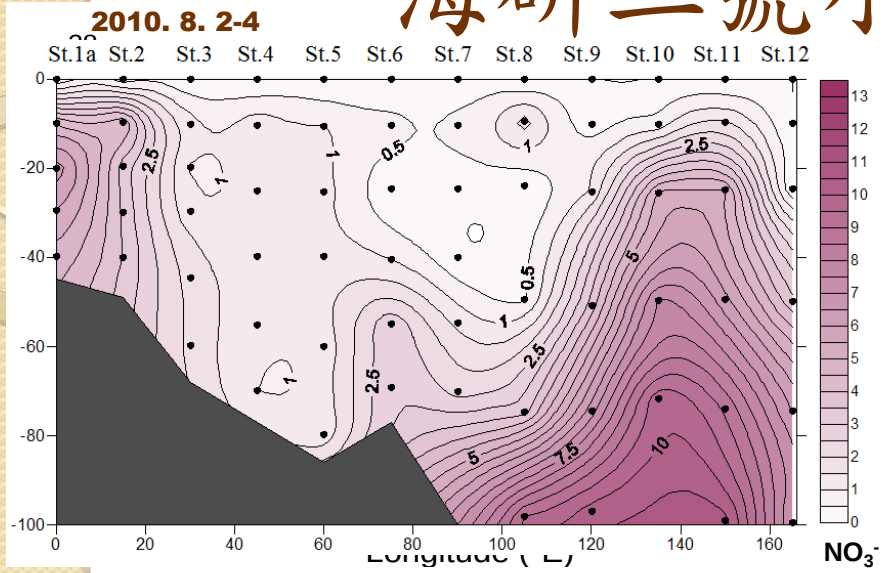



Lab: *Skeletonema costatum* (Kao)  Lab: *Chaetoceros affinis* CCMP 160

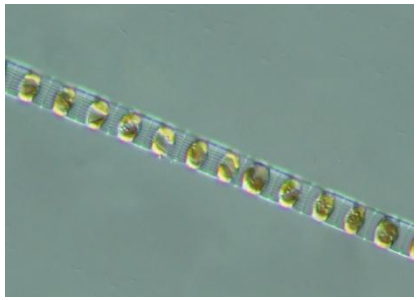
$$\text{Nrt2 index} = \frac{\log \text{Nrt2}_{\text{Org}} - \log \text{Nrt2}_{\text{Min}}}{\log \text{Nrt2}_{\text{Max}} - \log \text{Nrt2}_{\text{Min}}}$$



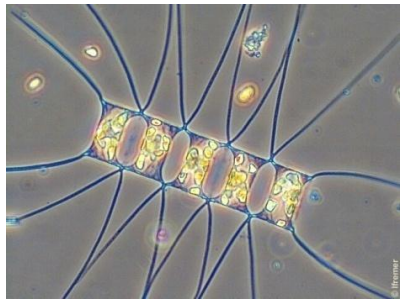
# 海研二號小東海航次



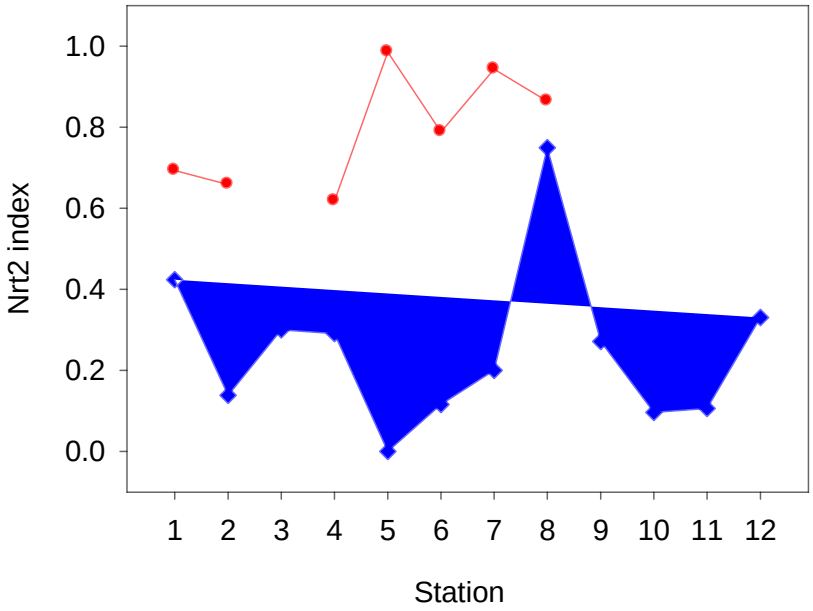

骨藻
***Skeletonema***



角刺藻
***Chaetoceros***



**2010. 8. 2-4.**

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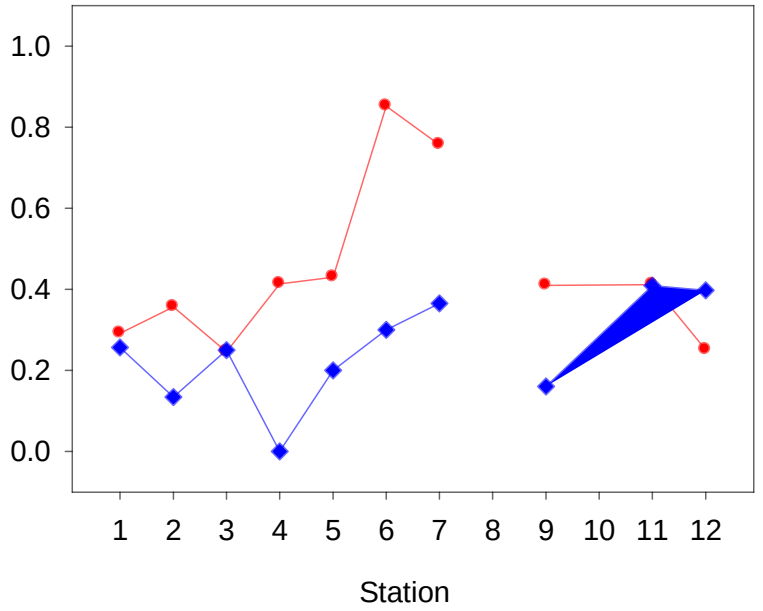

# Summary

1. 研究目標：發展指標基因來評估浮游植物之生理狀態

2. 在氮限制方面，硝酸運輸基因 *Nrt2* 表現量可運用來作為矽藻氮利用之指標基因。

3. 首度利用海上培養試驗比較實驗室藻種與野外藻種之 *Nrt2* 基因表現範圍，所獲得之最大、最小值可用來做為野外 *Nrt2* 基因表現之判讀標準。

4. 運用硝酸運輸基因指數可比較不同矽藻種類之氮利用情形。

# Thanks for your attention!

# References


- Kang, L. K., S. P. L. Hwang, G. C. Gong, H. J. Lin, P. C. Chen, and J. Chang (2007) Influences of nitrogen deficiency on the transcript levels of ammonium transporter, nitrate transporter and glutamine synthetase genes in *Isochrysis galbana* (Isochrysidales, Haptophyta). *Phycologia* 46:521-533.
- Kang, L. K., S. P. L. Hwang, H. J. Lin, P. C. Chen, and J. Chang (2009) Establishment of minimal and maximal transcript levels for nitrate transporter genes for detecting nitrogen deficiency in marine phytoplankton *Isochrysis galbana* (Prymnesiophyceae) and *Thalassiosira pseudonana* (Bacillariophyceae). *J. Phycol.* 45:864-872.
- Kang, L. K., H. F. Wang, and J. Chang (2011) Diversity of phytoplankton nitrate transporter sequences from isolated single cells and mixed samples from the East China Sea and mRNA quantification. *Appl. Environ. Microbiol.* 77:122-130.