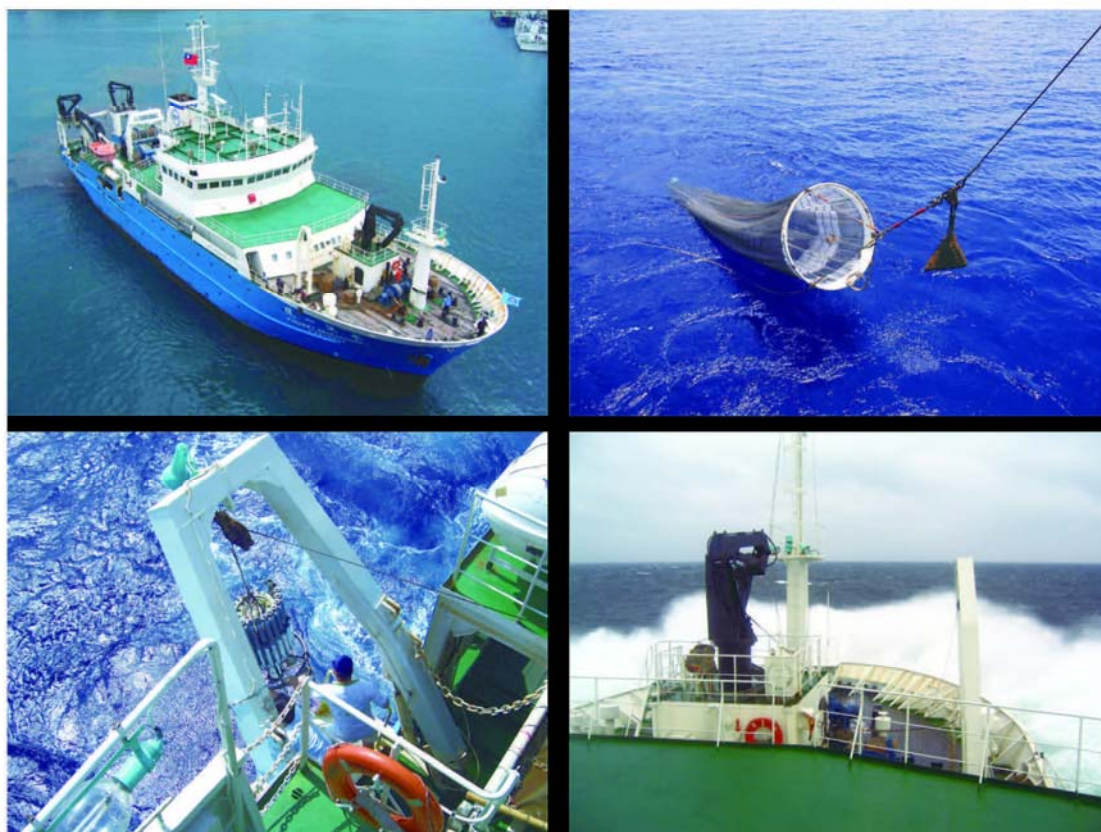




Cruise Report of TaiCOFI Surveys in 2009

2009年台灣周邊海域漁場環境監測航次報告



農委會科技計畫編號 98農科-10.2.1-水-A3

Fisheries Research Institute

Council of Agriculture, Executive Yuan

Keelung, Taiwan

December 2011

行政院農業委員會水產試驗所

中華民國 100 年 12 月

序

台灣以海洋立國，承賦海洋賜給我們豐富的資源，對於漁業資源的利用更是倚重，各式新鮮美味的魚類更是國人最優質的蛋白質來源。但隨著全球暖化造成的海洋環境變遷，台灣過去「一午、二鯧、三鮠、四嘉魷」的家常食魚文化正逐漸改變，「有錢吃鮠、無錢免吃」等魚類俗語也悄悄的消失。幸運的是，水產資源本身具有可再生的回復能力，只要我們好好的管理，一切都還不嫌晚。

漁業是一個古老的行業，但管理漁業資源卻需要最先進的科學。氣候變遷已被證實為影響許多漁業資源變動的主要原因，而溫度、鹽度、基礎生產力等水團特性則是影響漁場、漁期變動的關鍵因子。為有效監測海洋物理與化學環境，以便及時發現問題並提供解決對策，本所自 2003 年起著手實施「台灣周邊海域漁場環境監測」計畫，有系統地針對台灣周邊海洋環境進行大規模調查，以期掌握海洋環境變遷與生物棲息環境間的動態關係，作為漁業資源評估及管理策略擬定的重要依據，盡可能減輕氣候變遷造成的衝擊。

大規模海洋環境調查是相當具有挑戰性的工作，水試一號每年 1 萬哩的航程需時近 60 天，期間必須不分晝夜 24 小時作業，海象惡劣時進行觀測更有相當之困難度，而本專刊正是本所研究人員辛苦工作的結晶，衷心期望藉由本專刊之發行，提供豐碩調查成果予國內相關研究單位卓參，讓本所執行之「台灣周邊海域漁場環境監測計畫」發揮更大的服務功能，為開創我國漁業的光明前景盡一份棉薄之力。

所長

蘇坤成

謹誌

中華民國一百年十二月

Preface

Taiwan is an island and the ocean is our priceless property. All kinds of fisheries resources provide our compatriots the best high quality animal protein. However, with the changing of climate, the custom of our daily meal for fish is also gradually changing. Some common fish species become rare. Luckily, the fisheries resources are resilient itself if proper management measures were taken.

Fishery is an old business, but to manage it properly requires state of the art science. Climate change was proven to be the main cause of the fluctuation of some aquatic resources, and water temperature, salinity and primary production of the water masses are the key factors that effect the variation of fishing grounds and fishing season. How to monitoring our ocean to detect anomalies effectively and to find a way to deal with the situation is the priority for fishery researchers. Therefore, Fisheries Research Institute implemented the Taiwan Cooperative Oceanic Fisheries Investigations (TaiCOFI) program based on the hydrography of the surrounding waters off Taiwan to investigate in the dynamics between fishery resources and environmental factors. Through this thorough investigation, we try to understand the coupling of physical, chemical and biological dynamics in the surrounding waters of Taiwan to figure out the factors associated with the fluctuation of fishery resources and mitigate the impact of climate change.

To collect samples at sea around waters of Taiwan is a challenging task. The mileage for RV *Fishery Research I* is about 10000 nautical miles per year, and our researchers overcome all difficulties to maintain the time series. Through publishing 「Cruise Report of TaiCOFI Surveys in 2009」, we hope our investigation results will be helpful to fishery researchers in Taiwan and contribute more to the society, leading fisheries in Taiwan towards sustainability.

Director



Fisheries Research Institute

前言

近年來由於全球氣候變遷及海洋環境污染問題日益嚴重，許多國家已致力於海洋環境及生物資源之基礎探測與資料庫之建置。然以往我國有關海洋方面之研究計畫多侷限於局部海域之短期研究，觀測線或觀測點常隨計畫主題改變而改變，缺乏長期而有系統性的調查資料，再者，多數計畫係以海洋物理化學為研究重點，漁業研究學者欲將這些資料應用在水產資源研究上，著實不易。

有鑑於此，水產試驗所於 2003 年起著手實施「台灣周邊海域漁場環境監測」計畫，於周邊海域設置 62 個測站按季蒐集水溫、鹽度、營養鹽、葉綠素、浮游動物等漁場環境資訊，嘗試透過此全面性之調查來瞭解台灣周邊海域長期水文、海況及漁業生物時空分佈資訊，進而掌握影響台灣周邊海域漁業資源變動的機制。六年來，承蒙各方提供寶貴之經驗與建議，不斷改進海洋探測科儀操作及採樣相關流程，在本所同仁與國內相關學術單位的共同努力下，無論在各項科儀操作效率、漁場環境調查技術或漁業生物研究上均已小有成果。

本專刊彙集本所於 2009 年執行「台灣周邊海域漁場環境監測」計畫（農委會科技計畫編號：98 農科-10.2.1-水-A3）之調查成果，計畫執行之海上採樣作業流程、各調查項目實驗室檢測流程、各航次出海採樣及樣本分析人員均有詳述於後，此外，利用 Surfer 軟體以圖示方式刊出台灣周邊海域之水溫、鹽度、營養鹽、葉綠素、浮游動物及基礎生產力等漁場環境因子之調查成果以供各界參考。本計畫內容涉及廣泛專業領域，也由於人力及經驗的關係，雖戮力以赴亦難免有疏漏不周之處，希冀各界先進不吝賜教斧正。

Introduction

With the changing of climate and the growing of marine environmental pollutions in recent years, many countries have devoted to establishing their database for marine environment and aquatic living resources. However, in the past, marine research programs in Taiwan were mostly confined to a short time scale and of a limited region. Besides, transects or stations of surveys were usually changing with the changing of projects, resulted in a scarcity of long term and systematic observations of waters around Taiwan. Furthermore, most programs were aimed at marine chemistry and physics studies. It is hard for fishery scientists to incorporate that information into fishery stock assessment.

As a result, Fisheries Research Institute implemented 「Taiwan Cooperative Oceanic Fisheries Investigations, TaiCOFI」 program in 2003 to conduct quarterly cruises to collect water temperature, salinity, nutrients, chlorophyll-*a* and zooplankton measurements at 62 stations in the surrounding waters of Taiwan. Through this thorough investigation, we try to understand the coupling of physical, chemical and biological dynamics in the surrounding waters of Taiwan to figure out the factors associated with the fluctuation of fishery resources. For the past 6 years, we really appreciated for the valuable advices from academic communities to improve our field sampling techniques and operation procedures of marine observation instrument. With the hardworking of our staff members and associated academic organizations, now we have preliminary achievements in the operating efficiency of marine observation instruments, fishing ground investigation techniques and fisheries biology research.

The data presented in this report were collected during four cruises in 2009 of the TaiCOFI program. Data from the cruises were collected and processed by personnel of FRI and Professor Cheng Shiue-Yuan of National Taiwan Ocean University participated in the analysis of primary productivity. Standard procedures of field program and sample analysis are described in detail and the distribution of water temperature, salinity, nutrients, chlorophyll-*a*, zooplankton and primary production are illustrated in figures for each cruise. Finally, we will extent our special thanks for your advices to improve this cruise report.

目錄

前言	II
目錄	IV
海上採樣作業流程	VI
樣本實驗檢測流程	X
計畫主持人	XIV
計畫執行人員	XIV
各航次出海採樣人員	XV
各航次參數分析人員	XVI
略語表	XVII
參考文獻	XVIII
圖 01. 2009-01 航次航跡圖	- 1 -
圖 02. 2009-05 航次航跡圖	- 2 -
圖 03. 2009-08 航次航跡圖	- 3 -
圖 04. 2009-10 航次航跡圖	- 4 -
圖 05. 2009-01 航次水溫分布	- 5 -
圖 06. 2009-05 航次水溫分布	- 6 -
圖 07. 2009-08 航次水溫分布	- 7 -
圖 08. 2009-10 航次水溫分布	- 8 -
圖 09. 2009-01 航次鹽度分布	- 9 -
圖 10. 2009-05 航次鹽度分布	- 10 -
圖 11. 2009-08 航次鹽度分布	- 11 -
圖 12. 2009-10 航次鹽度分布	- 12 -
圖 13. 2009-01 航次硝酸鹽(NO_3^-)濃度分布	- 13 -
圖 14. 2009-05 航次硝酸鹽(NO_3^-)濃度分布	- 14 -
圖 15. 2009-08 航次硝酸鹽(NO_3^-)濃度分布	- 15 -
圖 16. 2009-10 航次硝酸鹽(NO_3^-)濃度分布	- 16 -
圖 17. 2009-01 航次磷酸鹽(PO_4^{3-})濃度分布	- 17 -
圖 18. 2009-05 航次磷酸鹽(PO_4^{3-})濃度分布	- 18 -
圖 19. 2009-08 航次磷酸鹽(PO_4^{3-})濃度分布	- 19 -
圖 20. 2009-10 航次磷酸鹽(PO_4^{3-})濃度分布	- 20 -
圖 21. 2009-01 航次矽酸鹽(SiO_2^{2-})濃度分布	- 21 -
圖 22. 2009-05 航次矽酸鹽(SiO_2^{2-})濃度分布	- 22 -
圖 23. 2009-08 航次矽酸鹽(SiO_2^{2-})濃度分布	- 23 -
圖 24. 2009-10 航次矽酸鹽(SiO_2^{2-})濃度分布	- 24 -
圖 25. 2009 年 1 月及 5 月葉綠素甲(chl- <i>a</i>)分布	- 25 -
圖 26. 2009 年 8 月及 10 月葉綠素甲(chl- <i>a</i>)分布	- 26 -

圖 27. 2009 年 5 月基礎生產力分布	- 27 -
圖 28. 2009 年 8 月及 10 月基礎生產力分布	- 28 -
圖 29. 2009 年 1 月、5 月、8 月及 10 月浮游動物生物量分布	- 29 -
圖 30. 2009-01 航次浮游動物優勢大類出現百分率	- 30 -
圖 31. 2009-01 航次浮游動物優勢大類出現百分率(續)	- 31 -
圖 32. 2009-05 航次浮游動物優勢大類出現百分率	- 32 -
圖 33. 2009-05 航次浮游動物優勢大類出現百分率(續)	- 33 -
圖 34. 2009-08 航次浮游動物優勢大類出現百分率	- 34 -
圖 35. 2009-08 航次浮游動物優勢大類出現百分率(續)	- 35 -
圖 36. 2009-10 航次浮游動物優勢大類出現百分率	- 36 -
圖 37. 2009-10 航次浮游動物優勢大類出現百分率(續)	- 37 -
表 01. 2009-01-05 航次基礎觀測資料	- 38 -
表 02. 2009-05-06 航次基礎觀測資料	- 39 -
表 03. 2009-08-25 航次基礎觀測資料	- 40 -
表 04. 2009-10-13 航次基礎觀測資料	- 41 -

Contents

Introduction.....	III
Contents	VI
Field Observations	IX
Laboratory procedures	XII
Program leader	XIV
Participating researchers	XIV
Cruise personnel	XV
Personnel participating in the data analysis	XVI
Abbreviations.....	XVII
Reference	XVIII
Fig. 01. Stations and Cruise tracks for TaiCOFI Survey in Jan. 2009	- 1 -
Fig. 02. Stations and Cruise tracks for TaiCOFI Survey in May 2009	- 2 -
Fig. 03. Stations and Cruise tracks for TaiCOFI Survey in Aug. 2009.....	- 3 -
Fig. 04. Stations and Cruise tracks for TaiCOFI Survey in Oct. 2009.....	- 4 -
Fig. 05. Temperature distribution in Jan. 2009	- 5 -
Fig. 06. Temperature distribution in May 2009	- 6 -
Fig. 07. Temperature distribution in Aug. 2009	- 7 -
Fig. 08. Temperature distribution in Oct. 2009.....	- 8 -
Fig. 09. Salinity distribution in Jan. 2009.....	- 9 -
Fig. 10. Salinity distribution in May 2009.....	- 10 -
Fig. 11. Salinity distribution in Aug. 2009.....	- 11 -
Fig. 12. Salinity distribution in Oct. 2009	- 12 -
Fig. 13. Nitrate (NO_3^-) distribution in Jan. 2009	- 13 -
Fig. 14. Nitrate (NO_3^-) distribution in May 2009	- 14 -
Fig. 15. Nitrate (NO_3^-) distribution in Aug. 2009	- 15 -
Fig. 16. Nitrate (NO_3^-) distribution in Oct. 2009.....	- 16 -
Fig. 17. Phosphate (PO_4^{3-}) distribution in Jan. 2009	- 17 -
Fig. 18. Phosphate (PO_4^{3-}) distribution in May 2009	- 18 -
Fig. 19. Phosphate (PO_4^{3-}) distribution in Aug. 2009	- 19 -
Fig. 20. Phosphate (PO_4^{3-}) distribution in Oct. 2009.....	- 20 -
Fig. 21. Silicate (SiO_2^{2-}) distribution in Jan. 2009.....	- 21 -
Fig. 22. Silicate (SiO_2^{2-}) distribution in May 2009.....	- 22 -
Fig. 23. Silicate (SiO_2^{2-}) distribution in Aug. 2009	- 23 -
Fig. 24. Silicate (SiO_2^{2-}) distribution in Oct. 2009	- 24 -
Fig. 25. Chlorophyll- <i>a</i> (chl- <i>a</i>) distribution in Jan.and May 2009.....	- 25 -
Fig. 26. Chlorophyll- <i>a</i> (chl- <i>a</i>) distribution in Aug.and Oct. 2009.....	- 26 -

Fig. 27. Primary production distribution in May 2009	- 27 -
Fig. 28. Primary production distribution in Aug.and Oct. 2009	- 28 -
Fig. 29. Biomass of zooplankton sample in 2009	- 29 -
Fig. 30. Percentage of the composition of zooplankton in Jan. 2009	- 30 -
Fig. 31. Percentage of the composition of zooplankton in Jan. 2009	- 31 -
Fig. 32. Percentage of the composition of zooplankton in May 2009	- 32 -
Fig. 33. Percentage of the composition of zooplankton in May 2009	- 33 -
Fig. 34. Percentage of the composition of zooplankton in Aug. 2009	- 34 -
Fig. 35. Percentage of the composition of zooplankton in Aug. 2009	- 35 -
Fig. 36. Percentage of the composition of zooplankton in Oct. 2009	- 36 -
Fig. 37. Percentage of the composition of zooplankton in Oct. 2009	- 37 -
Chart 01. Basic observation data in Jan. 2009	- 38 -
Chart 02. Basic observation data in May 2009	- 39 -
Chart 03. Basic observation data in Aug. 2009	- 40 -
Chart 04. Basic observation data in Oct. 2009	- 41 -

海上採樣作業流程

在台灣周邊海域選定 62 個測站，利用水試一號試驗船及其裝備，按季節別於 2009 年 1 月、5 月、8 月及 10 月，進行下列之工作項目：

1. CTD 溫鹽調查：

採用 Seabird SBE-911PLUS 溫鹽深儀 (CTD)，每測站均投放至 1000 m (水深不足之測站則以實際水深少 10 m 為原則)，取得溫深鹽之連續資料。

2. 分層採水：

利用 General Oceanics 之自動採水瓶，採取 5、25、50、75、100、150 m 等水層之海水各 2000 ml。

3. 葉綠素甲測定：

取各層海水 1000 ml，利用 Millipore 濾紙過濾後，以 -20°C 急速冷凍保存，再攜回實驗室檢測。

4. 營養鹽類測定：

分別收集各層海水 100 ml，以液態氮(-196°C)急速冷凍保存後，再攜回實驗室檢測。

5. 浮游動物採集：

以 ORI 網下放至 200 m 深(水深不足之測站則以實際水深少 5 m 為原則)，以 1 m/s 速度上揚，取得之樣本以 5% 福馬林海水溶液保存，再攜回實驗室測定生物量及分類。

Field Observations

The survey was carried out in the waters surrounding Taiwan by *Fishery Researcher I* during quarterly cruise in January, May, August and October in 2009. The following procedures were conducted at each station.

1. Temperature and salinity:

CTD, Seabird SBE-911PLUS, was lowered from the surface to 1000 m (or 10 m above the bottom for shallow areas).

2. Water sampling for chlorophyll-*a* and nutrients:

The Rosette (GO-1015), mounted on the frame of CTD, were sequentially closed and collected 2 liter water sample at specific target depths (5, 25, 50, 75, 100, 150 m) as the CTD was raised.

3. Chlorophyll-*a* concentration measurement:

One liter of sea water samples were immediately filtered through Whatman GF/F filter papers and then put in -20°C refrigerator for chlorophyll-*a* concentration measurement in the laboratory.

4. Nutrients concentration measurement:

100 ml of sea water samples for each depth were collected and then put in liquid nitrogen (-196°C) for nutrients concentration measurement in the laboratory.

5. Sampling gear and methods for zooplankton:

The ORI net, with a 1.6 m diameter mouth opening, 6 m in length and 0.333 mm meshes, was towed obliquely to 200 m (for shallow areas, 10 m above the bottom) at each station. The net opening is fastened with a short 3-lead bridle connected to several meters of line which attached to the towing cable by a clamp. A General Oceanic flowmeter is suspended across the center of the net mouth to measure the amount of water filtered during each tow. The net was towed at a ship speed of 1.0 knots for about 10 minutes. After the net was on board, samples were pouring into the PVC bottle and preserved immediately in 5 % formalin buffered with sodium borate.

樣本實驗檢測流程

壹、營養鹽、葉綠素及基礎生產力之測定流程

取各水層水樣急速凍結保存後，分析各水層之硝酸（nitrate）、磷酸（phosphate）、矽酸（silicate）等營養鹽，另外將濾畢各層海水之濾紙以丙酮溶解萃取出葉綠素分析其葉綠素甲濃度；利用光暗瓶溶解氧法，分析台灣周邊海域之基礎生產力（primary productivity）。

1. 硝酸測定：

硝酸以 Wood-Armstrong-Ricgard 法測定，將過濾之試水通過銅-鎘還原管，使硝酸還原成亞硝酸，然後加入 Sulfanilamide 及 NED 溶液，於分光光度計上以 542 nm 測定吸光值並計算其濃度，另取同樣試水不經銅-鎘還原管，直接測定水中之亞硝酸濃度，將經過銅-鎘還原管之數值扣除水中亞硝酸之濃度後，依銅-鎘還原管之還原率計算水中硝酸之濃度。

2. 磷酸測定：

磷酸以 Molybdenum blue-Ascorbic acid 法測定，將過濾後之試水加入以 Ammonium molybdate、Sulfuric acid、Ascorbic acid 及 Potassium antimonyl-tartrate 所配製的還原溶液，待其成色後在分光光度計以波長 885 nm 測定吸光值並計算待測物之濃度。

3. 矽酸測定：

矽酸以 Molybdosilicate 法測定，將過濾之試水先後添加 50 % HCl、10 % Ammonium molybdate 及 10 % Oxalic acid 後，加入以 1-amino-2-naphthol-4-sulfonic acid、Na₂SO₃ 及 NaHSO₃ 所配製的還原試劑，混合完成後於分光光度計上以波長 815 nm 測定其吸光值，由各波長之吸光值並計算待測物之濃度。

4. 葉綠素甲測定：

葉綠素甲以 Trichromatic 法測定，將各水層過濾後的濾紙，分別加入丙酮研磨後，放入恆溫培養箱（4 °C）24 小時之後，將樣品置於冷凍離心機 4 °C、轉速 3000 rpm 離心 15 秒後，分別取出上清液，使用分光光度計測其各波長之吸光值後由公式(Jeffrey and Humphrey, 1975)計算葉綠素甲濃度。

5. 基礎生產力測定：

將試水分別裝入錫箔紙包覆之暗色溶氧及透明瓶中，分別進行光度恆溫培養，經 24 小時後，測定溶氧瓶中水樣始末之溶氧差，換算成碳生產力即得。

貳、浮游動物鑑種及計數流程

返航後先將樣品靜置，以便後續分量。

分樣：

取一瓶樣品，將其上部的澄清液先用小塊 100 目網布過濾直至網布上有浮游動物出現為止，然後先將樣品瓶中的動浮液倒入小燒杯中，再利用洗滌瓶將樣品瓶中及網布上的浮游動物完全沖洗至小燒杯內，再將採樣回來的樣品瓶上標籤撕下，貼在一個 150 ml 的標本瓶上。接著，將小燒杯中的動浮液倒入分樣器中，將分樣器左右擺動約十次，然後站在分樣器前方目測左右數量是否一致，若一致再將其倒出，倒出後會分為兩部分，將其中一部分裝入剛才貼有標籤的 150 ml 的標本瓶（該瓶分量為 1/2），將剩下的那一部分再倒入分樣器內進行分樣，重複上述步驟。直到目測該分量的樣品中約有 1000 隻左右浮游動物為止。

鑑種及計數：

將該測站的最小分量樣本瓶中的動浮液倒入培養皿，將裝有動浮液的培養皿擺上顯微鏡的載物台計數及鑑種，計數時以 Z 字的方法依序計數，一個方格內的動浮算完再算下一個方格，鑑一隻就按一下該種的計數器，緩慢移動培養皿，該培養皿算完後，將其倒入 250 ml 的燒杯中，再算第二盤直到將該最小分量樣本瓶中的動浮液全數算完，此時確認計數器的值全部加起來是否有超過 2000 隻，若超過 2000 隻，該測站即計算完畢；若尚未超過 2000 隻，則將另一瓶還未計算的最小分量樣本瓶的動浮液全數算完，若仍然小於 2000 隻，就再將上一分量的樣本瓶的動浮液全數算完，直到計數器全部加起來有超過 2000 隻，該測站樣本才算計數完畢。

生物沉澱量、排水容積、濕重：

1. 生物沉澱量：取 100 ml 沉澱管，將管中的水位都標定到 100，靜置一個晚上後，目視生物沉澱量刻度，在記錄沉澱管上的數值時需要往下數一格，以減少誤差。
2. 濕重：將一測站之樣本倒入沉澱管中，並注意沉澱管中樣本之容積之刻度，在將沉澱管中之樣品倒入吸引器中，將其樣本浮游動物與樣本液分開，吸至浮游動物沒有多餘之樣本液後，將其浮游動物放入秤中量其重量，即為其濕重。
3. 排水容積：濕重測量完畢時，剩下的澄清液倒入沉澱管中觀察其刻度，

Laboratory procedures

Seawater samples were collected at discrete depths (from 5 to 150 m) for inorganic nutrients (NO_3^- 、 PO_4^{3-} 、 SiO_2^{2-})、chlorophyll-*a* (chl-*a*) and primary productivity (PP) and then were analyzed with standard methods depending on variable chemical properties in the laboratory.

1. Nitrate

Nitrate (NO_3^-) was measured by reducing nitrate to nitrite (NO_2^-) and then determining the nitrite by employing the pink azo dye method. Sulfanilamide and NED solutions were added to seawater samples and then measured by using a spectrophotometer analyzer at 542 nm for final determination of concentrations.

2. Phosphate

Phosphate (PO_4^{3-}) was determined by the molybdenum blue method. Ammonium molybdate、Sulfuric acid、Ascorbic acid and Potassium antimonyl-tartrate mixed solutions at room temperature were added to seawater samples and then measured by using a spectrophotometer analyzer at 885 nm for final determination of concentrations.

3. Silicate

Silicate (SiO_2^{2-}) was measured by the Molybdenum blue method. Seawater samples were immediately acidified with 50 % Hydrochloric acid、10 % Ammonium molybdate and 10 % Oxalic acid and then 1-amino-2-naphthol-4-sulfonic acid、 Na_2SO_3 and NaHSO_3 mixed solutions were added to the samples. For final determination of concentrations, samples were measured by using a spectrophotometer analyzer at 815 nm.

4. Chlorophyll-*a*

Chlorophyll-*a* (chl-*a*) was measured by the Trichromatic method. Pigments were extracted in cold acetone (90%) for 24 hours. The samples were centrifuged at 3000 rpm under 4°C for 5 minutes and then transfer the samples extracts from the centrifuge tube to the cuvette by careful pipeting. The final determination of chlorophyll-*a* samples were measured by using a spectrophotometer.

5. Primary productivity

Primary productivity (PP) were measured by the Dissolved Oxygen method. Seawater samples were cultured in the light and dark tanks for 24 h and then

measured by using a DO meter analyzer on board.

6. Zooplankton

Each plankton sample was repeatedly divided with a Folsom splitter until its subsample contained 2000 specimens of zooplankton. Zooplanktons were then sorted and classified into 30 categories. The number of each category was recorded and the abundance of each category was expressed as the number of individuals per cubic meter (inds/m³).

計畫主持人 Program leader

農業委員會水產試驗所研究員兼主任秘書 劉燈城 Liu Don-Chung

計畫執行人員 Participating researchers

單 位 名 稱	研 究 人 員	職 稱
農業委員會水產試驗所海洋漁業組	吳繼倫 Wu Chi-Lun	研究員兼組長
農業委員會水產試驗所海洋漁業組	陳郁凱 Chen Yu-Kai	助理研究員
農業委員會水產試驗所海洋漁業組	藍揚麒 Lan Yang-Chi	助理研究員
農業委員會水產試驗所海洋漁業組	王友慈 Wang Yu-Tzu	聘用助理研究員
農業委員會水產試驗所海洋漁業組	潘佳怡 Pan Chia-I	聘用助理研究員
農業委員會水產試驗所海洋漁業組	陳人平 Chen Zen-Pin	聘用助理研究員
農業委員會水產試驗所海洋漁業組	簡煌彬 Jen Hung-Bun	專業技工
農業委員會水產試驗所海洋漁業組	張玉真 Chan Yu-Cheng	專業技工
農業委員會水產試驗所海洋漁業組	楊珮芬 Yang Pay-Fen	專業技工
農業委員會水產試驗所沿近海資源研究中心	吳龍靜 Wu Long-Jing	研究員兼主任
農業委員會水產試驗所沿近海資源研究中心	翁進興 Weng Jinn-Shing	副研究員
農業委員會水產試驗所沿近海資源研究中心	陳秋月 Chen Chiu-Yueh	專業技工
國立台灣海洋大學環境生物與漁業科學系	鄭學淵 Cheng Sha-Yen	副教授

各航次出海採樣人員 Cruise personnel

2009- 01- 05 航次	所內人員		所外人員	
	陳郁凱	助理研究員		
	陳人平	聘用研究助理		
	潘佳怡	聘用研究助理		
	梁宏彥	國防儲備役		
2009- 05- 06 航次	所內人員		所外人員	
	陳郁凱	助理研究員	王河順	海大環漁系研究助理
	陳人平	聘用研究助理	鐘采玉	海大環漁系研究生
	潘佳怡	聘用研究助理	鐘偉銓	海大環漁系研究生
	楊佩芬	專業技工		
2009- 08- 25 航次	所內人員		所外人員	
	陳郁凱	助理研究員	鐘采玉	海大環漁系研究生
	賴竹蘭	助理研究員	鐘偉銓	海大環漁系研究生
	陳人平	聘用研究助理		
	張玉真	專業技工		
2009- 10-13 航次	所內人員		所外人員	
	陳郁凱	助理研究員	王河順	海大環漁系研究助理
	陳人平	聘用研究助理	江世章	海大環漁系研究生
	陳玉姬	專業技工		
	梁宏彥	國防儲備役		
水試一號試驗船人員	陳林耀	船長	高懷恩	大副
	林正雄	二副	朱振銘	三副
	張豐平	輪機長	程秀同	大管
	翁建順	二管	鄭清波	三管
	廖介生	輪機員	丁振傑	輪機員
	謝耀瑩	輪機員	陳建良	大廚
	蔡嘉進	二廚	林文賢	漁航員
	羅勝義	漁航員	李堂炯	漁航員
	葉日信	漁航員	蔡安傑	漁航員
	林冠宏	漁航員	陳明展	漁航員
	許俊為	漁航員	何國銘	漁航員
	陳柏青	漁航員	蔡宏義	漁航員

各航次參數分析人員

Personnel participating in the data analysis

分析項目	分析人員
海洋氣象觀測	陳郁凱
CTD 溫鹽探測	陳郁凱
營養鹽濃度分析	鄭學淵實驗室
葉綠素甲濃度分析	陳秋月
基礎生產力	鄭學淵實驗室
浮游動物分類	簡煌彬、張玉真、林芝仔

略語表

Abbreviations

Date	作業日期
SMT	作業開始時間
Lati.	緯度(°N)
Long.	經度(°E)
Depth	深度(m)
SST	表層水溫(°C)
Air T.	氣溫(°C)
Air P.	氣壓(mb)
Wind D.	風向
Wind F.	風速(節)
O.N.D.	作業水深(m)
Fl. Ct.	濾水器讀數
V.W.S.	濾水體積(m ³)
N.A.	Not Available

參考文獻

Ahlstrom, E. H., 1969. Distributional atlas of fish larvae in the California Current region: jack.

Alvarino, A., 1965. Distributional atlas of Chaetognatha in the California Current region.

Anonymous, Scripps Inst. of Oceanogr., 1962. Data Rept. Phys. and Chem. Data CCOFI Cruise 6107-08. SI0 Ref. No. 62-16.

Anonymous, 1963. CalCOFI atlas of IO-meter temperatures and salinities 1949 through 1959.

Berner, L.D., 1967. Distributional atlas of Thaliacea in the California Current region.

Bowman, T. E. and M. W. Johnson, 1973. Distributional atlas of calanoid copepods in the California Current region, 1949 and 1950.

Brinton, E., 1967. Distributional atlas of Euphausiacea (Crustacea) in the California Current region.

Chambers, L. A., 1965. An oceanographic and biological survey of the southern California mainland shelf. Calif. State Water Qual. Cont. Bd. Publ. No.27: 1-231.

E.E. Wood, F.A.J. Armstrong and F.A. Richards , 1967. Determination of nitrate in sea water by cadmium-copper reduction to nitrite. J. Mar. Biol. U.K.47,23-31.

Fleminger, A., 1964. Distributional atlas of calanoid copepods in the California Current region.

Fleminger, A., 1967. Distributional atlas of calanoid copepods in the California Current region.

Isaacs, J. D., A. Fleminger and J. K. Miller, 1971. Distributional atlas of zooplankton biomass in the California Current region: Winter 1955-1959.

Kramer, D., and E. H. Ahlstrom, 1968. Distributional atlas of fish larvae in the California Current.

Kramer, D., 1970, Distributional atlas of fish eggs and larvae in the California Current region: Pacific sardine, *Sardinops caerulea* (Girard, 1854). 1951 through 1966.

Lacalli, T. C., 2000. Larval budding, metamorphosis, and the evolution of life-history patterns in echinoderms. *Invertebr. Biol.* 119:234-241.

Levin, L. A., 2006. Recent progress in understanding larval dispersal: new directions and digressions. *Integr. Comp. Biol.* 46:282–297.

M.C. Rand, A.E. Greenberg and M.J. Taras , 1976. Standard methods for the examination of water and wastewater. American Public Health Association.

McGowan, J.A., 1967. Distributional atlas of pelagic molluscs in the California Current region.

Neubert, M. G., and H. Caswell., 2000. Demography and dispersal: calculation and sensitivity analysis of invasion speed for structured populations. *Ecology* 81:1613–1628.

Owen, R. W., Jr., 1974. Distribution of primary production, plant pigments and Secchi depth in the California Current region, 1969.

Rakestraw, N. W., P. L. Horner, and W. S. Wooster (Eds.), 1957. Oceanic observations of the Pacific: 1949. Univ. Calif. Press, Berkeley, 363 p.

Reid, J. L., Jr., R. S. Arthur, and E. B. Bennett (Eds.). 1963 a. Oceanic observations of the Pacific: 1951. Univ. Calif. Press, Berkeley, 598 p.

Smith, P. E., 1974. Distribution of zooplankton volumes in the California Current region, 1969.

Strickland, J. D. H., 1968. Research on the marine food chain; progress report, Jan. 1967-June 1968.

Strickland, J. D. H., and T. R. Parsons., 1968. A practical handbook of seawater analysis. Fish.

Thomas, W. H. and D. L. R. Seibert, 1974. Distribution of nitrate, nitrite, phosphate and silicate in the California Current region, 1969.

Wyllie, J.G., 1966. Geostrophic flow of the California Current at the surface and at 200 meters.

陳建初，1981。水質分析。九大圖書公司。

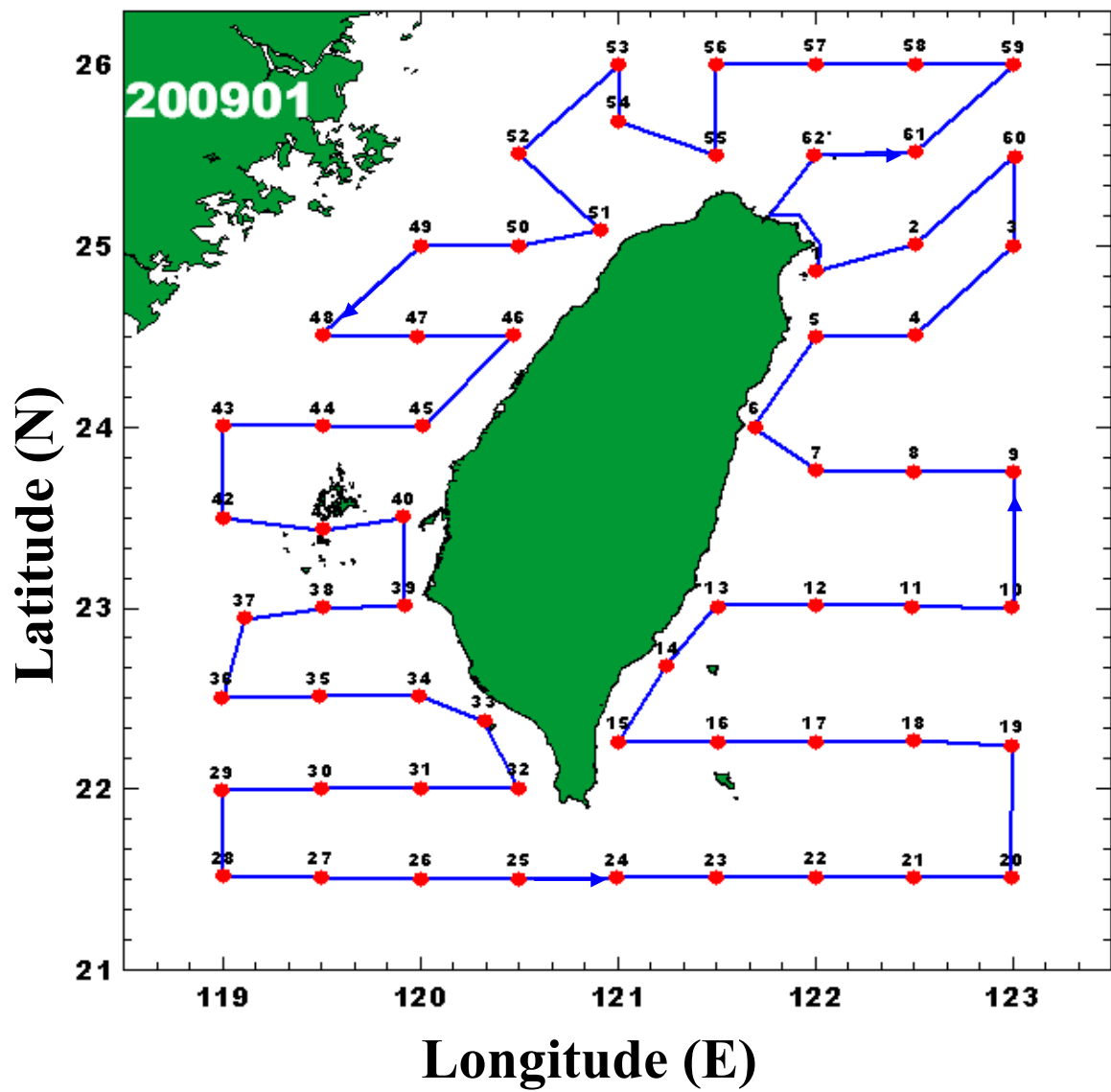


圖 01. 2009-01 航次航跡圖

Fig. 01. Stations and Cruise tracks for TaiCOFI Survey in Jan. 2009

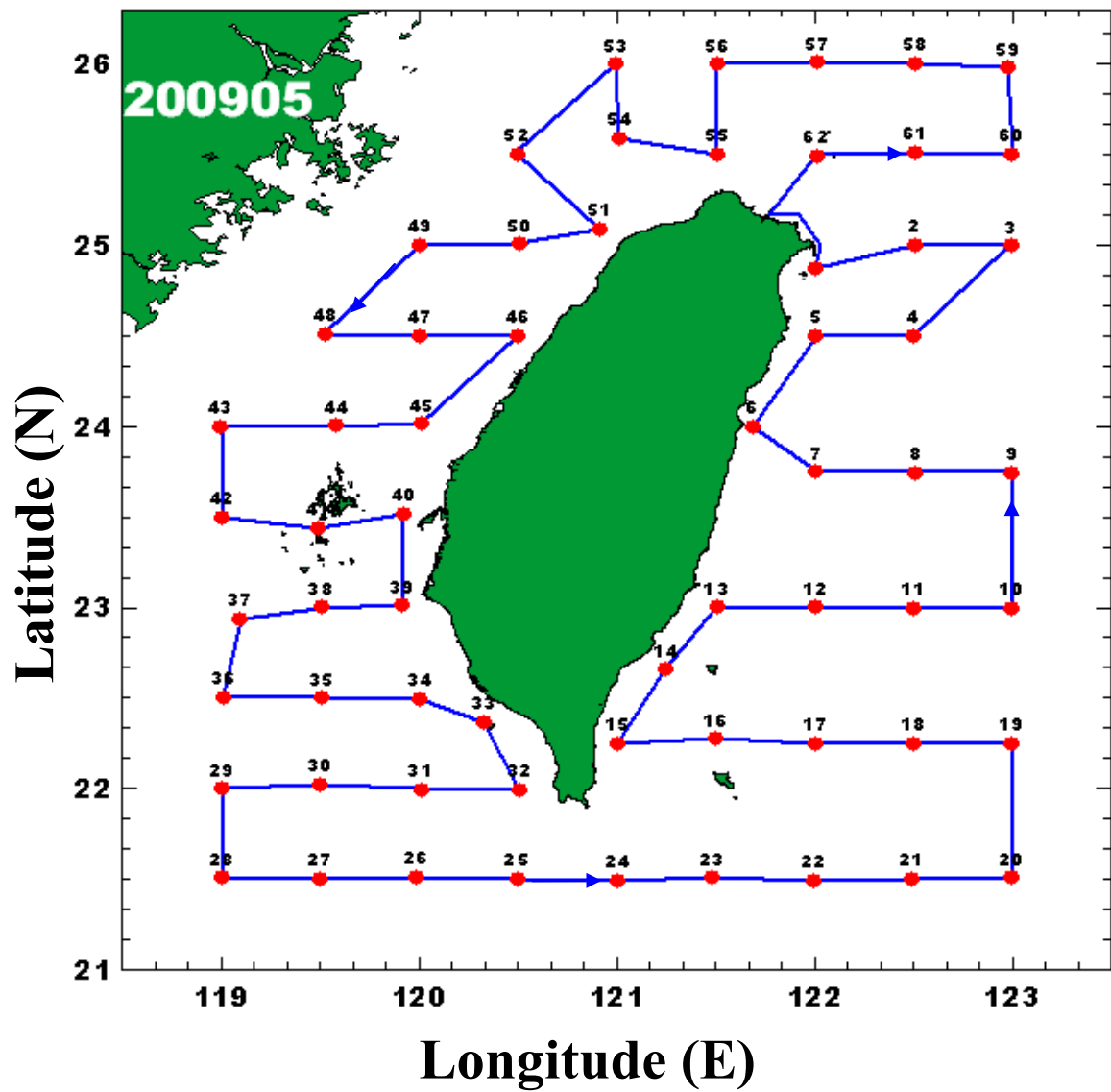


圖 02. 2009-05 航次航跡圖

Fig.02. Stations and Cruise tracks for TaiCOFI Survey in May 2009

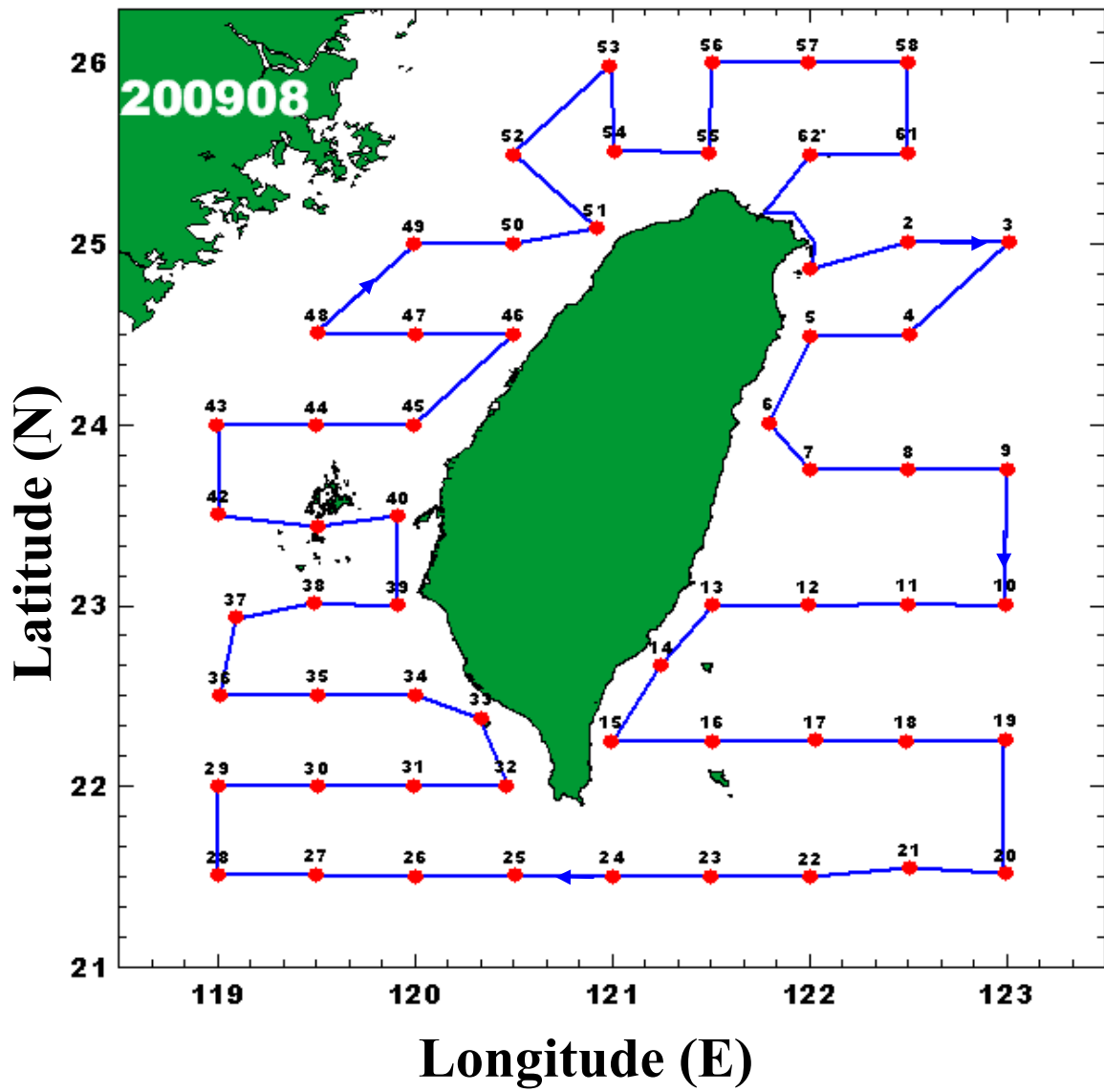


圖 03. 2009-08 航次航跡圖

Fig.03. Stations and Cruise tracks for TaiCOFI Survey in Aug. 2009

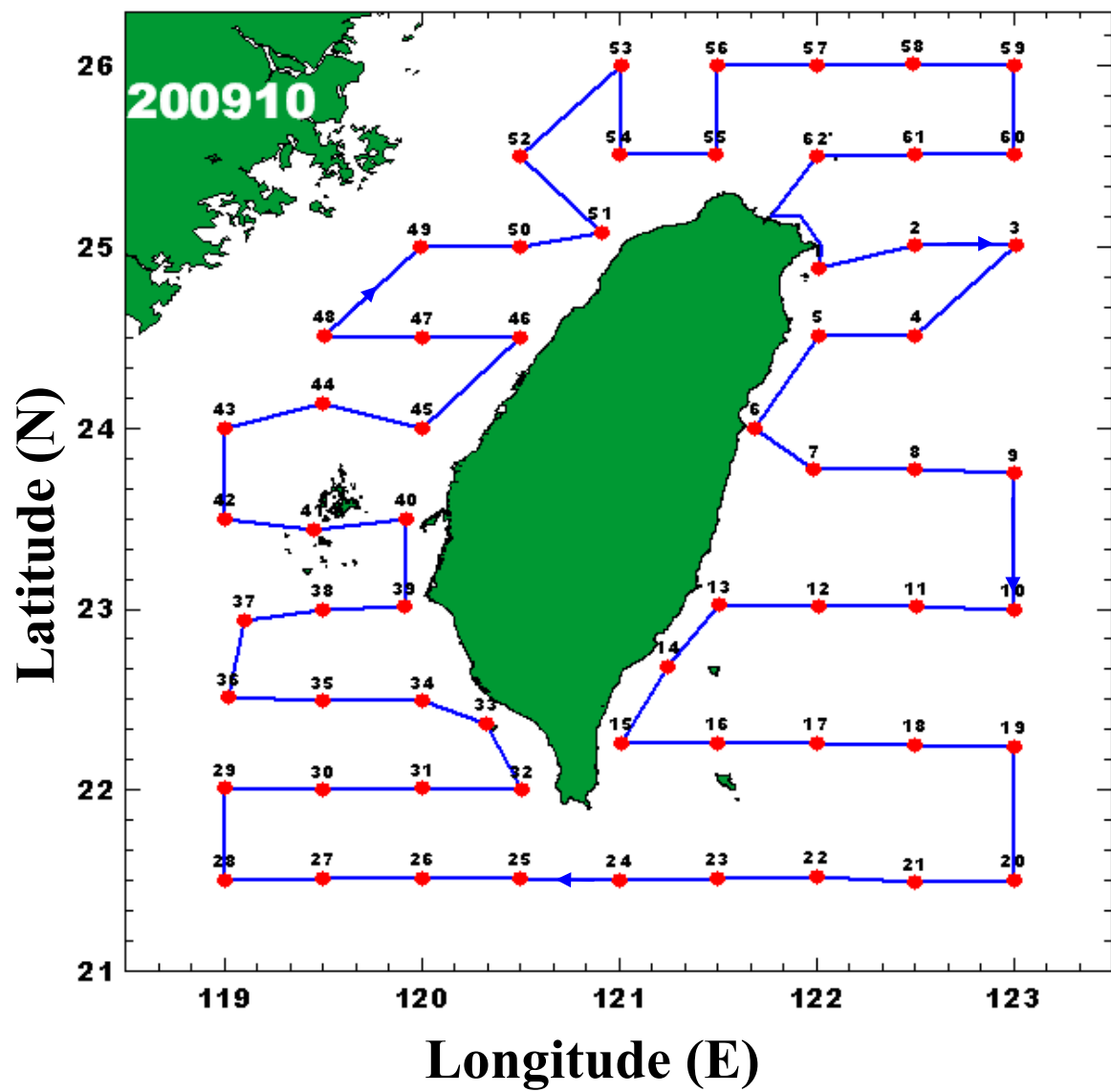


圖 04. 2009-10 航次航跡圖

Fig.04. Stations and Cruise tracks for TaiCOFI Survey in Oct. 2009

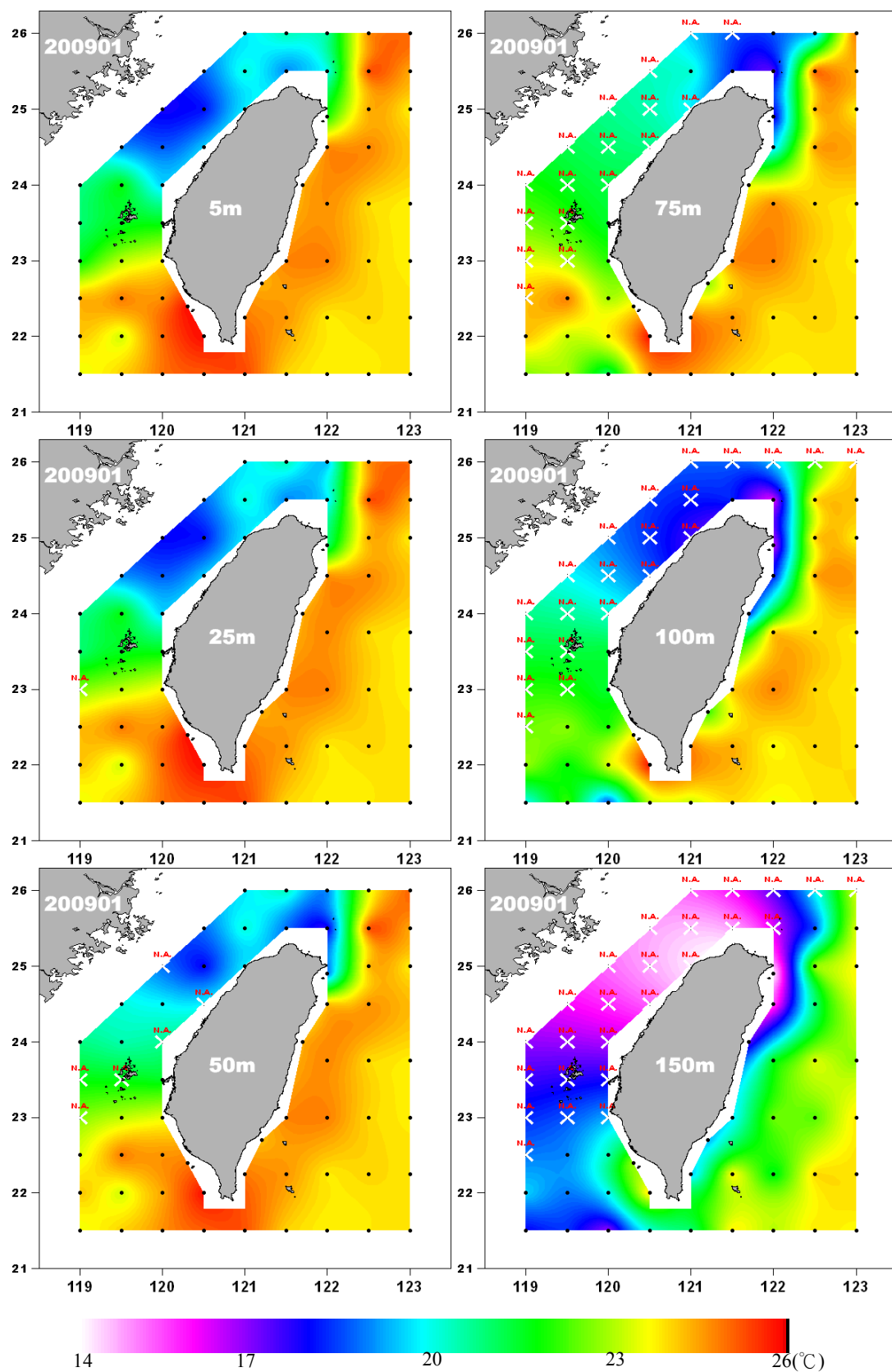


圖 05. 2009-01 航次水溫分布
Fig.05. Temperature distribution in Jan. 2009

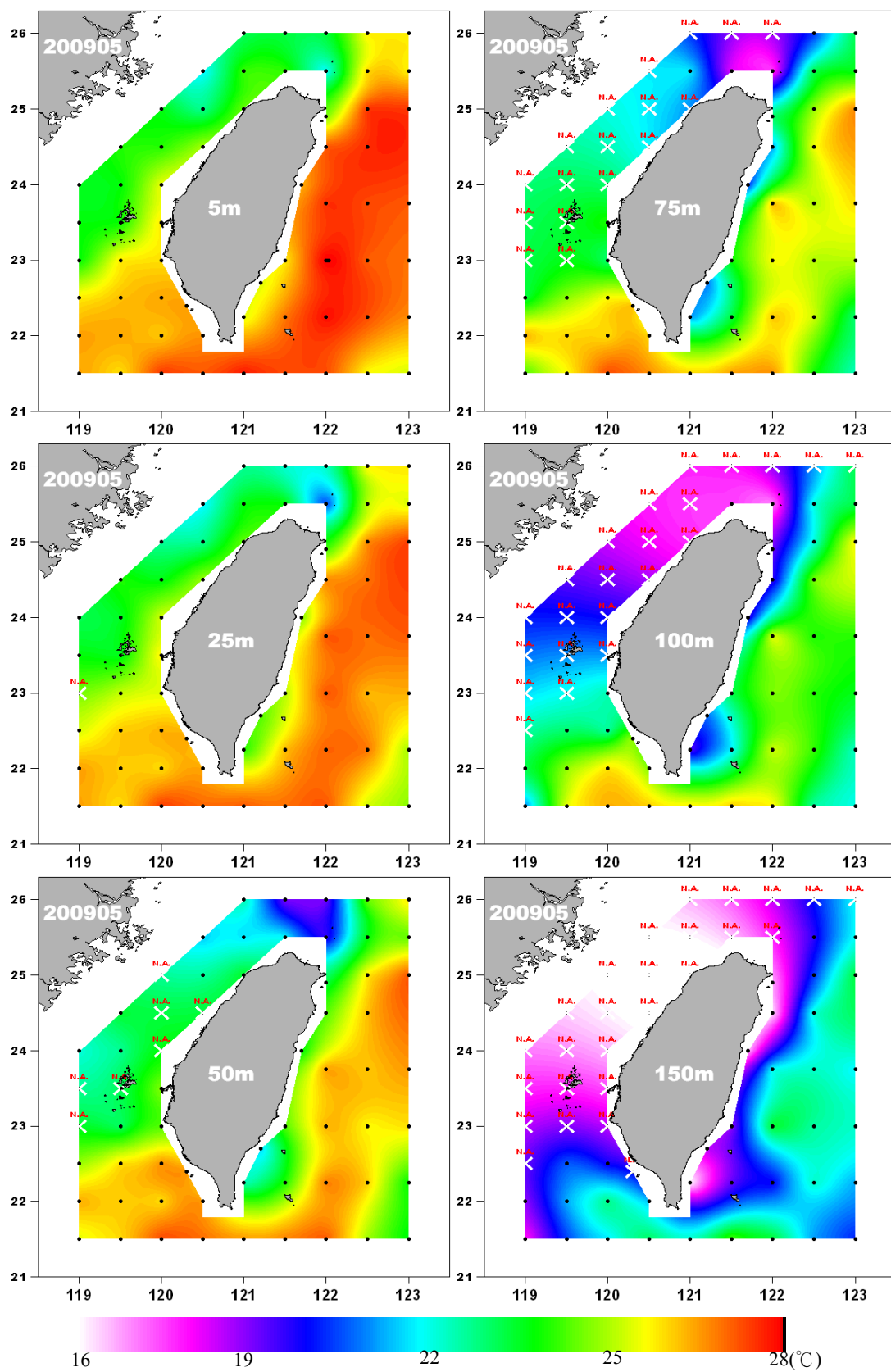


圖 06. 2009-05 航次水溫分布
Fig.06. Temperature distribution in May 2009

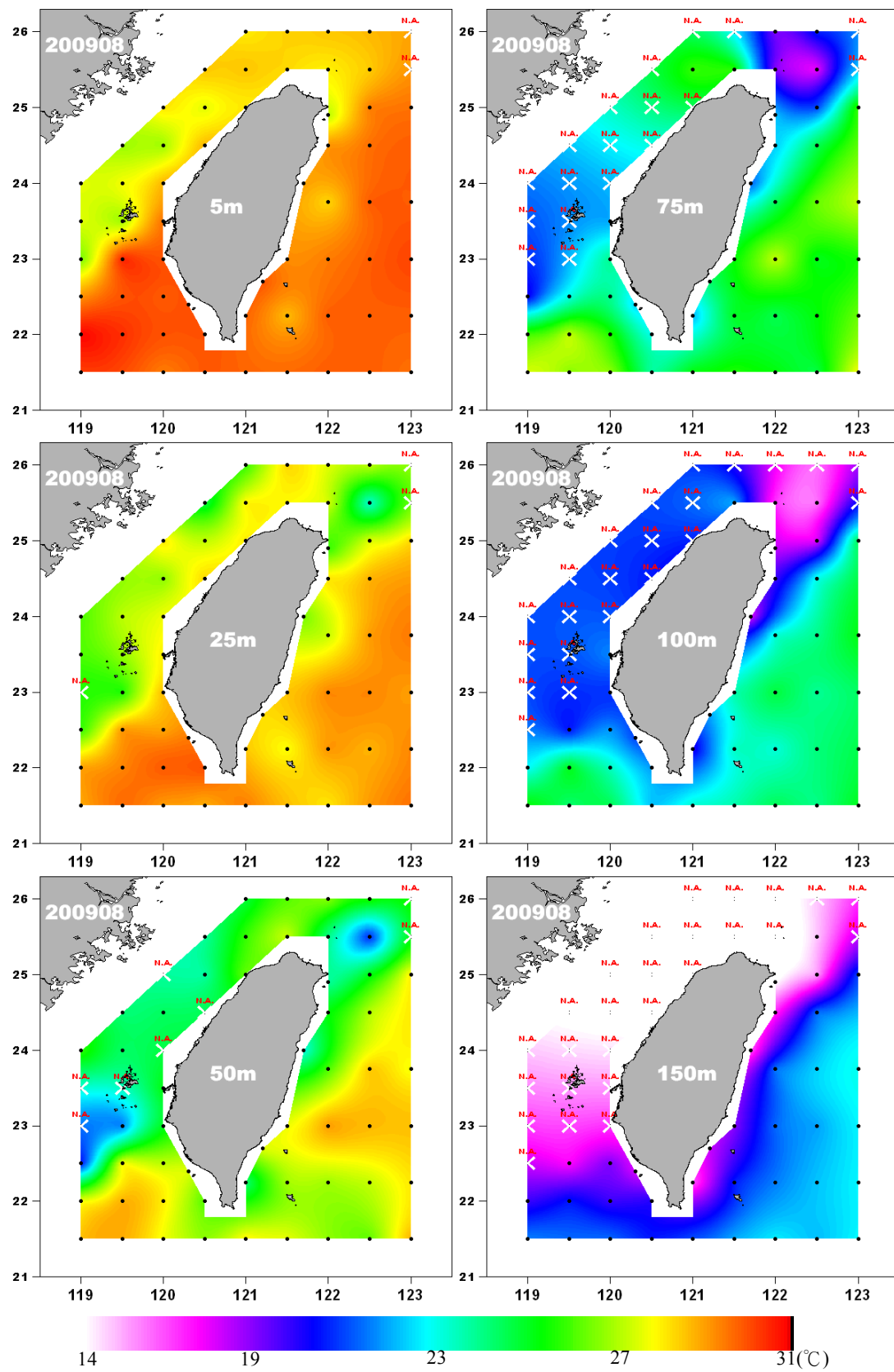


圖 07. 2009-08 航次水溫分布
Fig.07. Temperature distribution in Aug. 2009

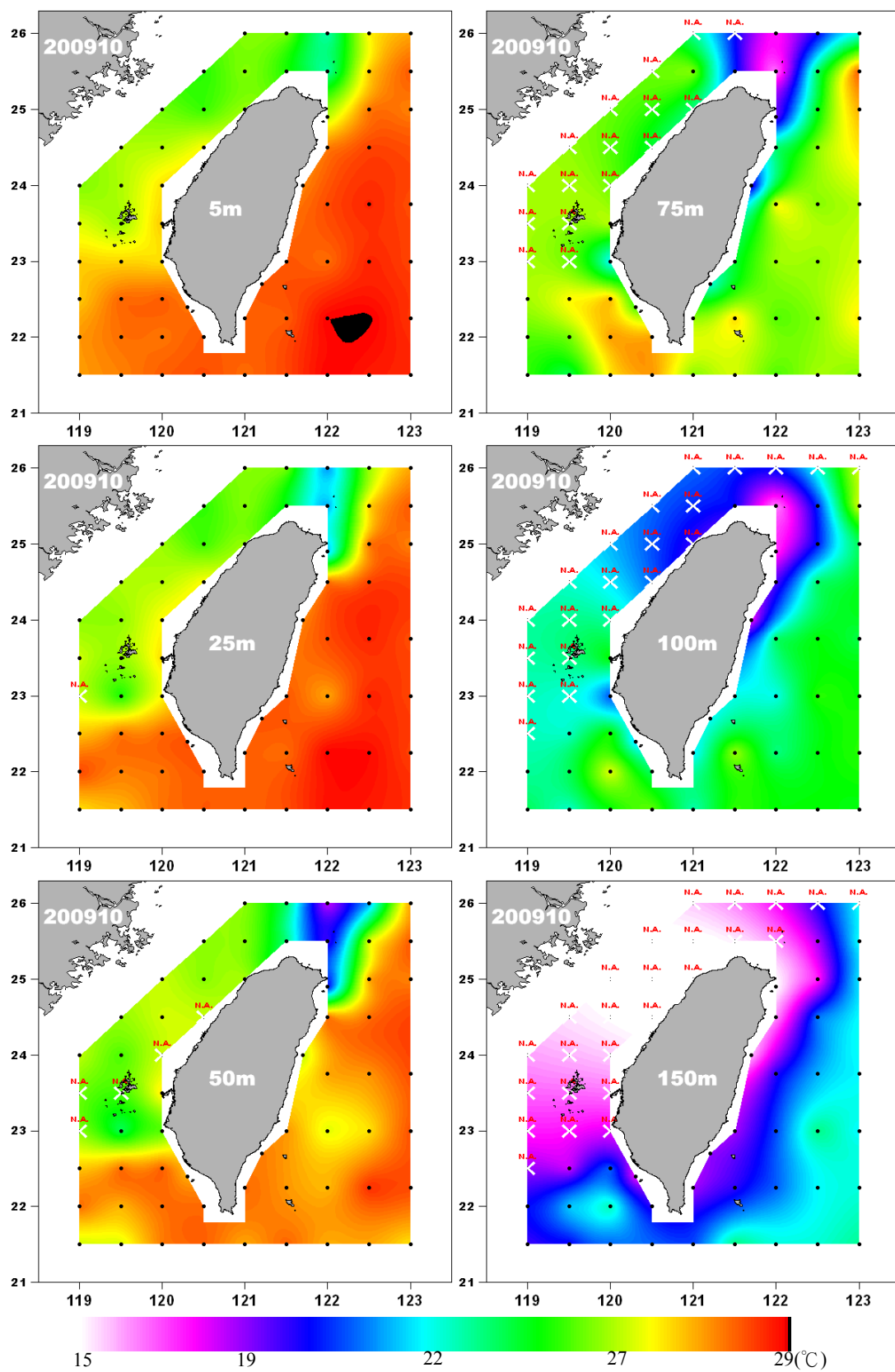


圖 08. 2009-10 航次水溫分布
Fig.08. Temperature distribution in Oct. 2009

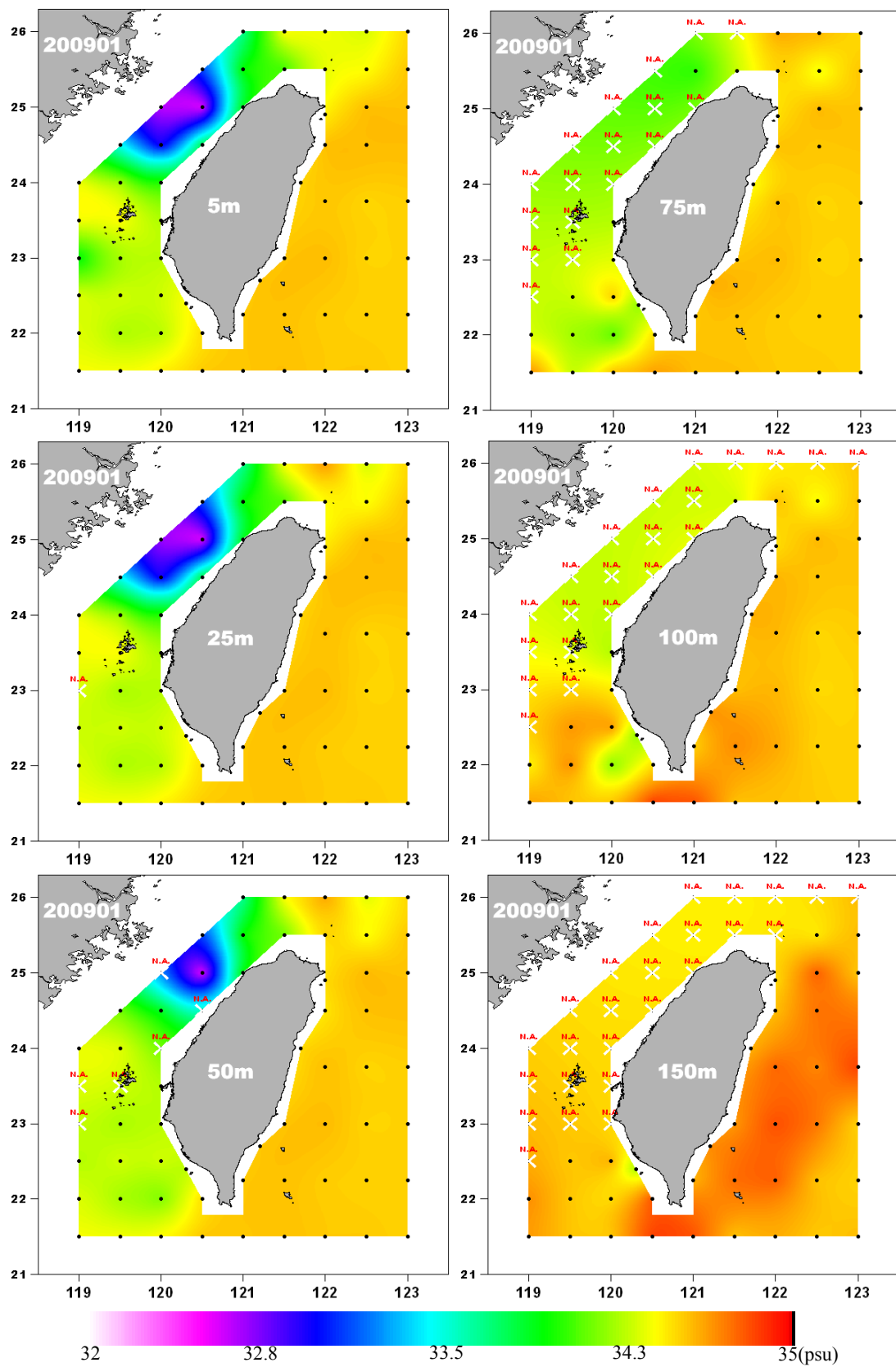


圖 09. 2009-01 航次鹽度分布
Fig. 09. Salinity distribution in Jan. 2009

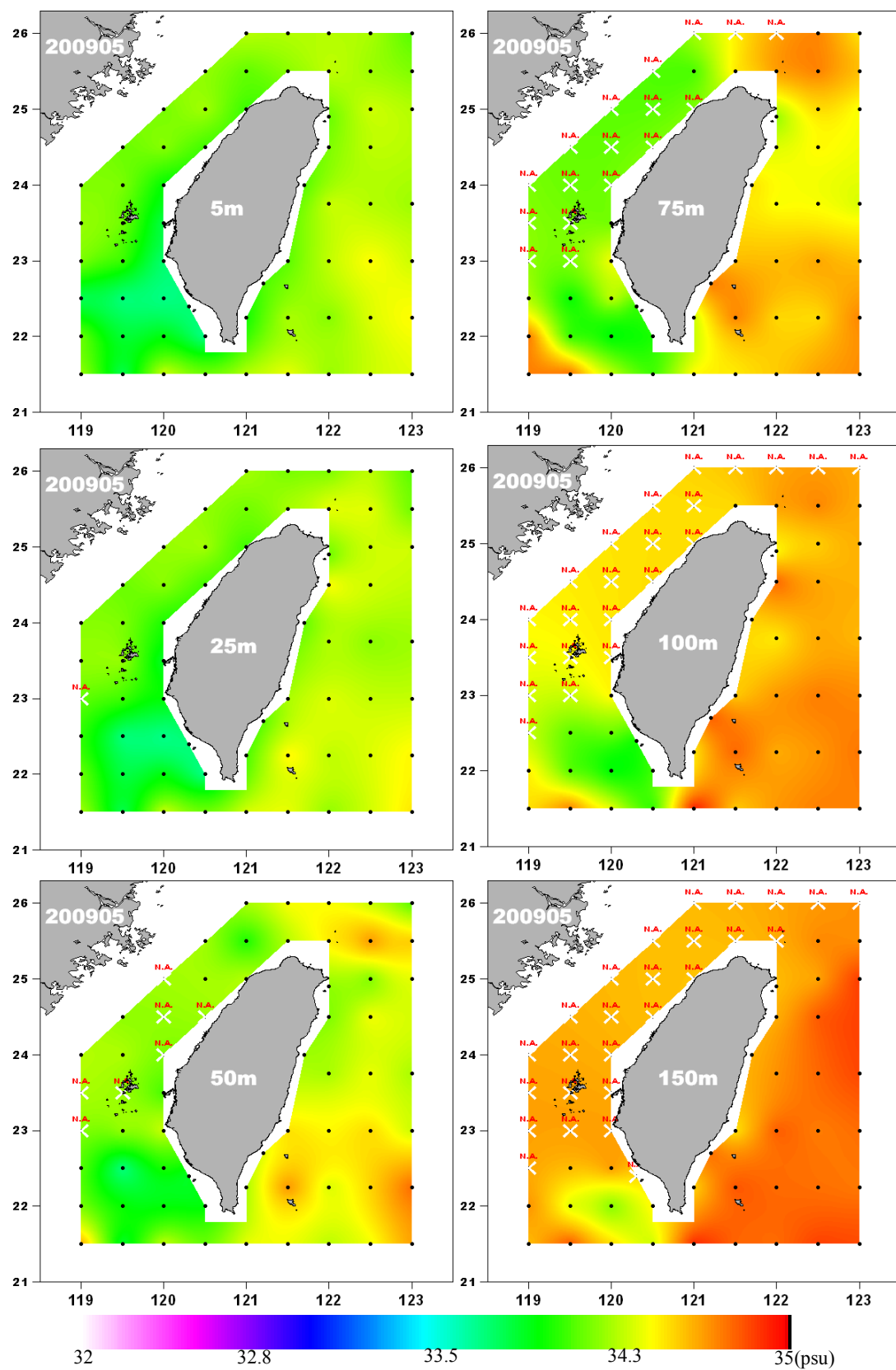


圖 10. 2009-05 航次鹽度分布
Fig. 10. Salinity distribution in May 2009

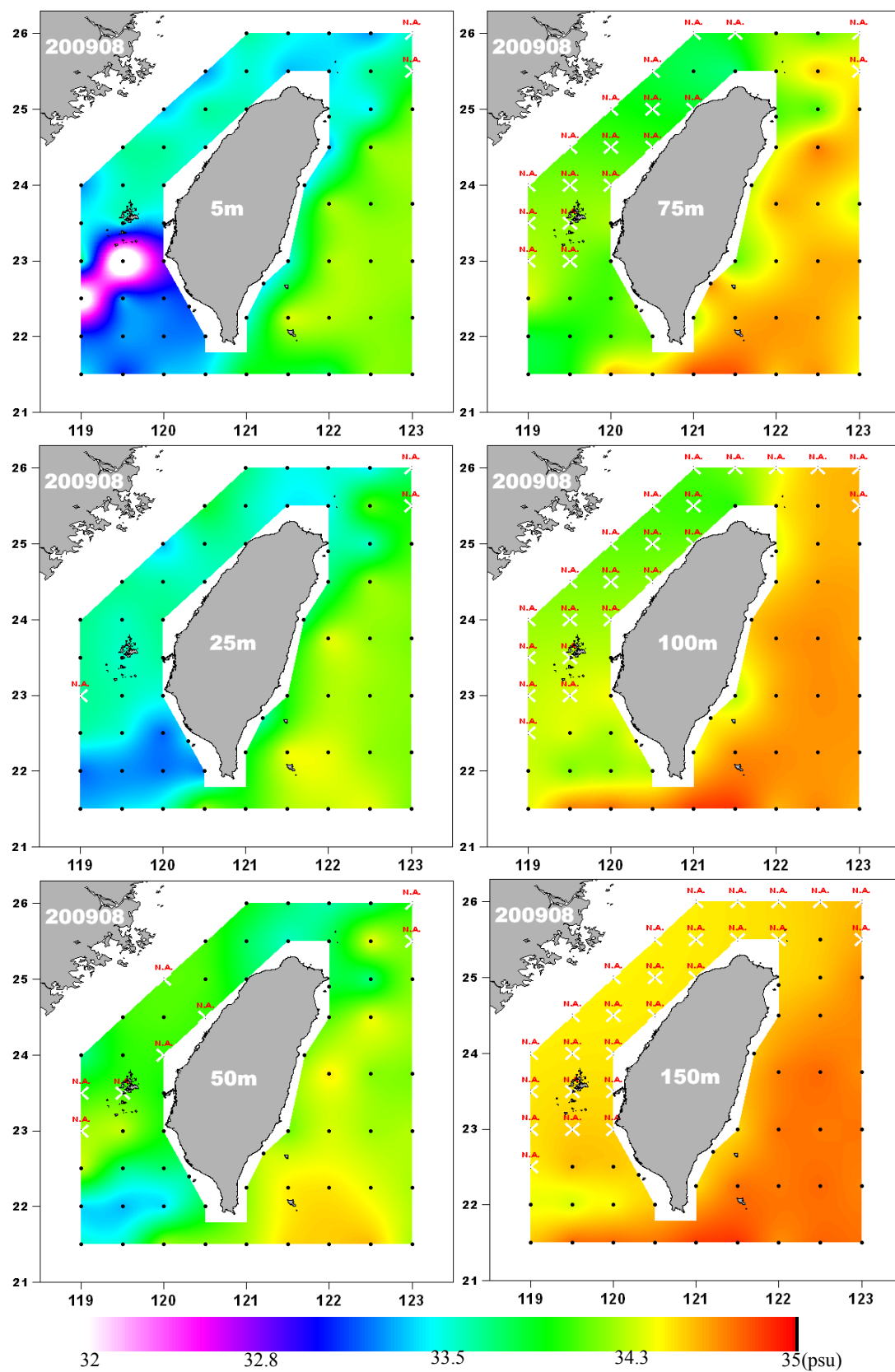


圖 11. 2009-08 航次鹽度分布
Fig. 11. Salinity distribution in Aug. 2009

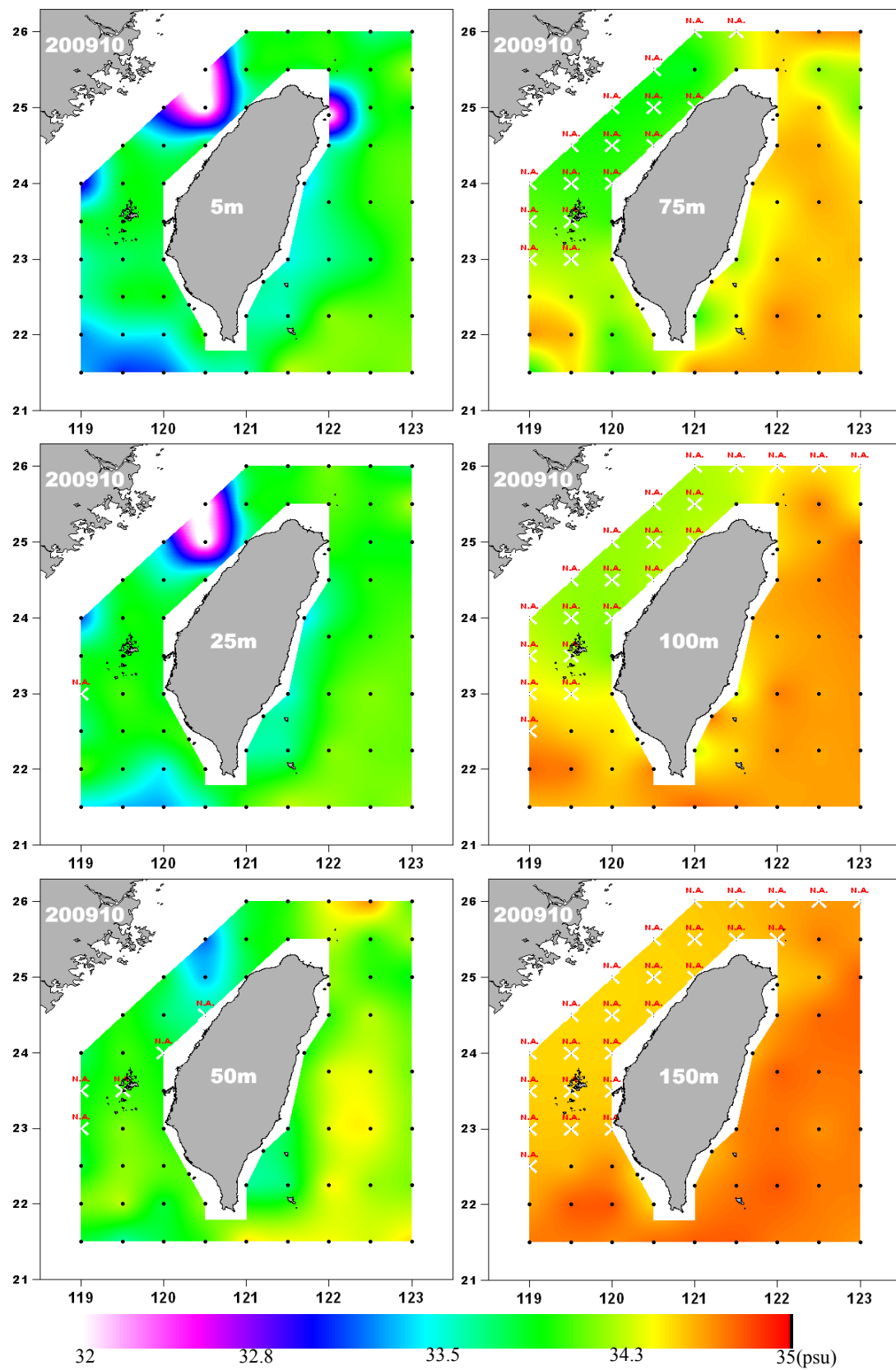


圖 12. 2009-10 航次鹽度分布
Fig. 12. Salinity distribution in Oct. 2009

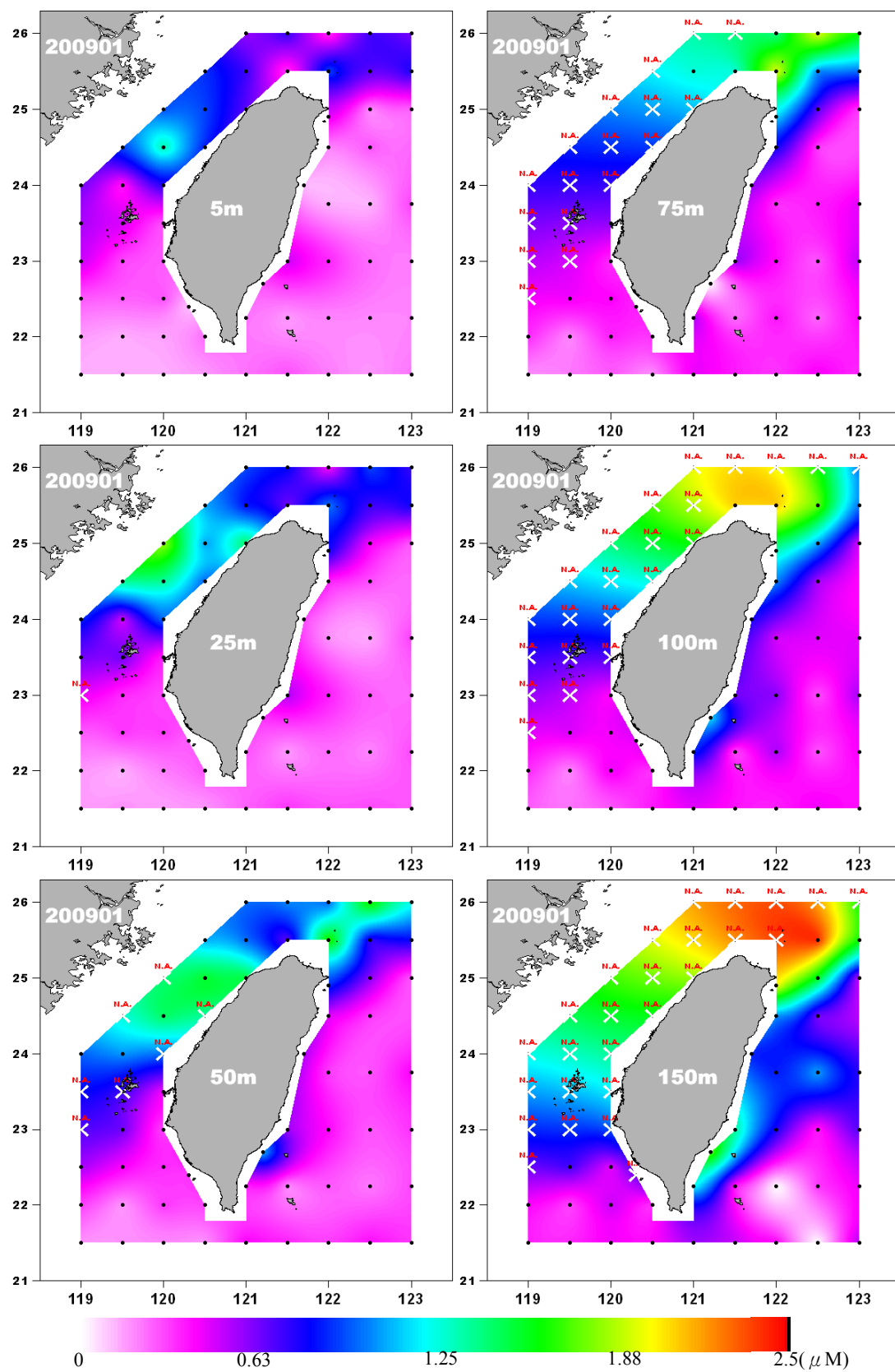


圖 13. 2009-01 航次硝酸鹽(NO_3^-)濃度分布
 Fig. 13. Nitrate (NO_3^-) distribution in Jan. 2009

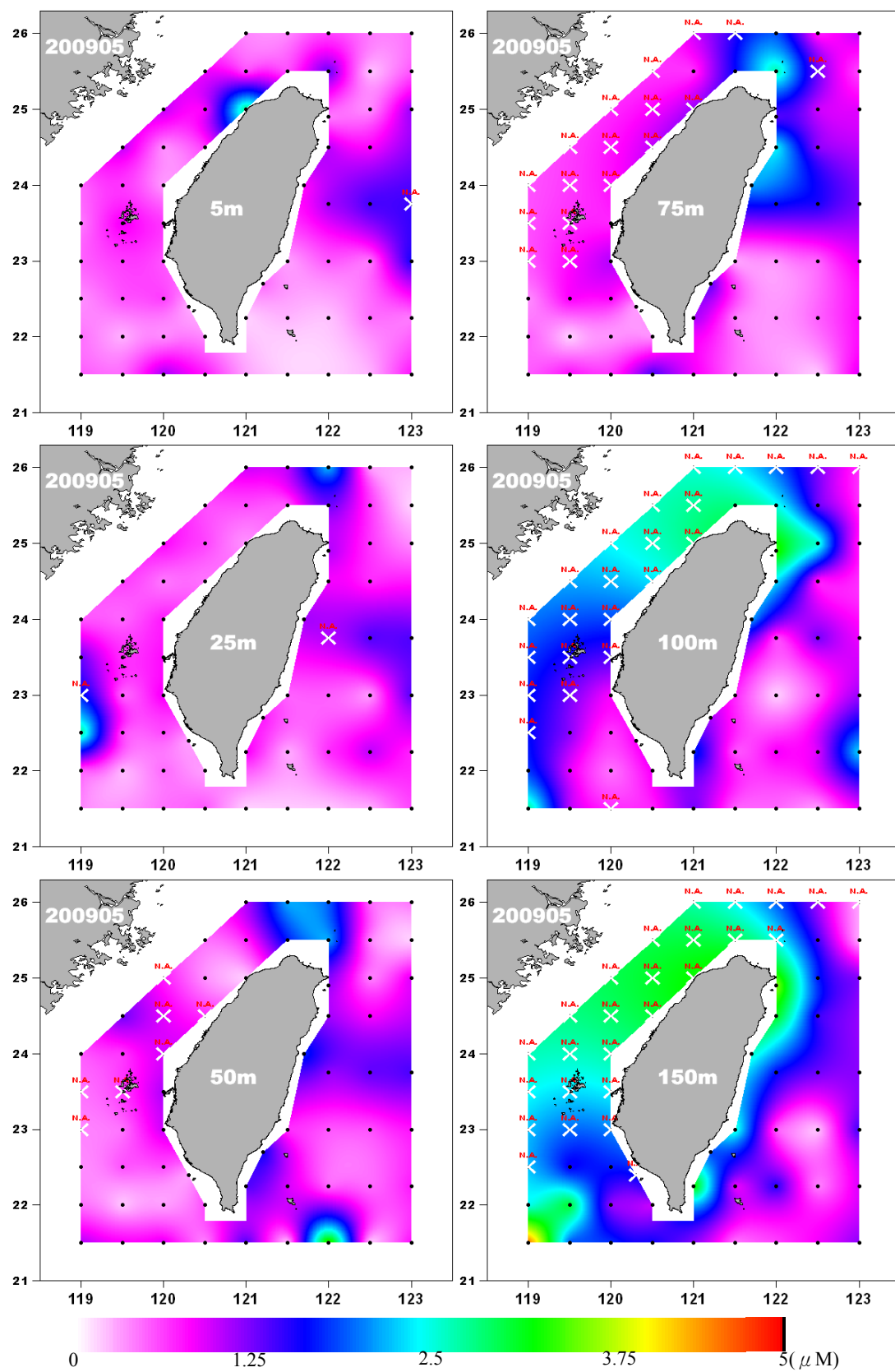


圖 14. 2009-05 航次硝酸鹽(NO_3^-)濃度分布
Fig. 14. Nitrate (NO_3^-) distribution in May 2009

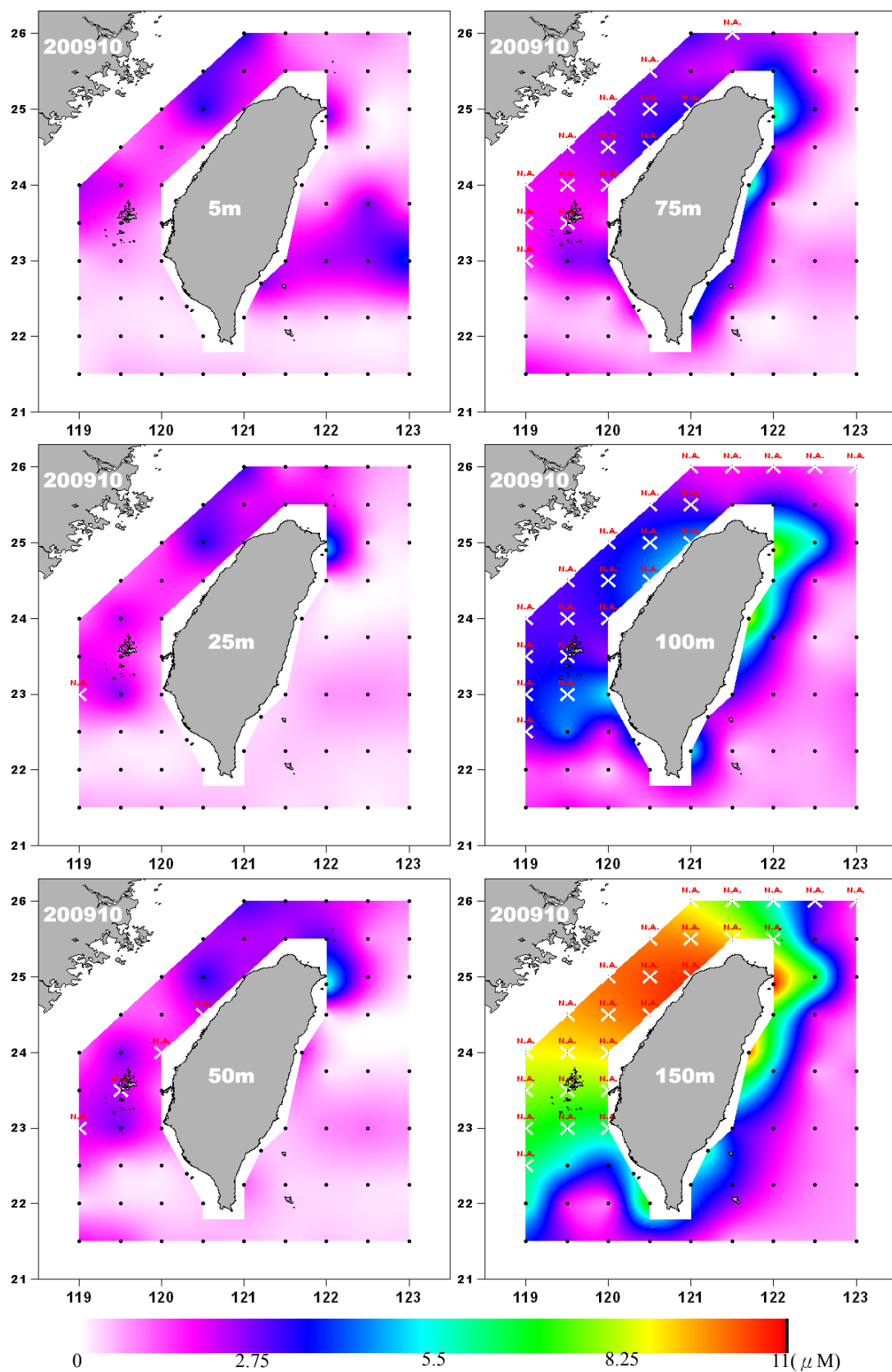


圖 16. 2009-10 航次硝酸鹽(NO_3^-)濃度分布
 Fig. 16. Nitrate (NO_3^-) distribution in Oct. 2009

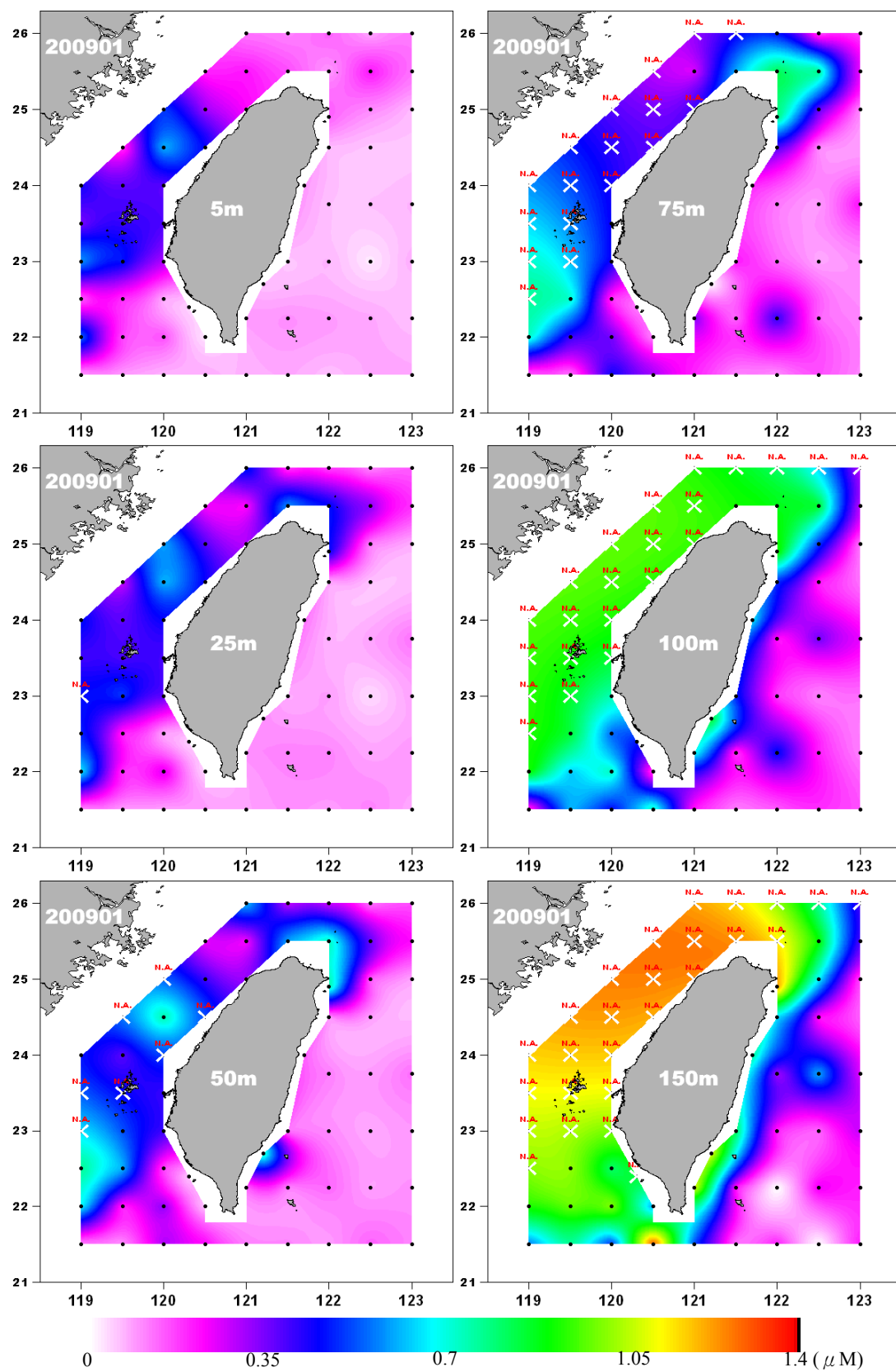


圖 17. 2009-01 航次磷酸鹽(PO_4^{3-})濃度分布
 Fig. 17. Phosphate (PO_4^{3-}) distribution in Jan. 2009

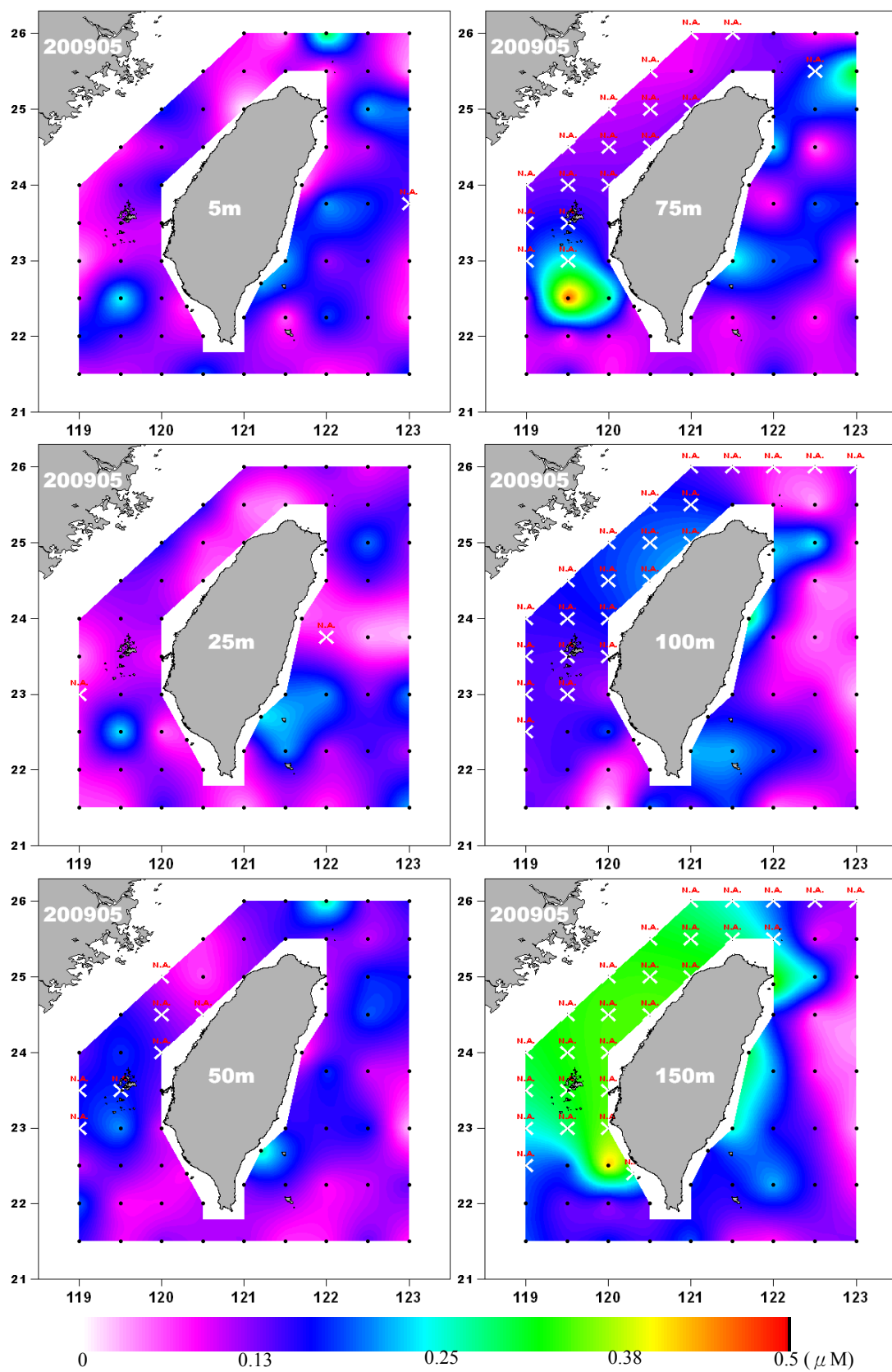


圖 18. 2009-05 航次磷酸鹽(PO_4^{3-})濃度分布
 Fig. 18. Phosphate (PO_4^{3-}) distribution in May 2009

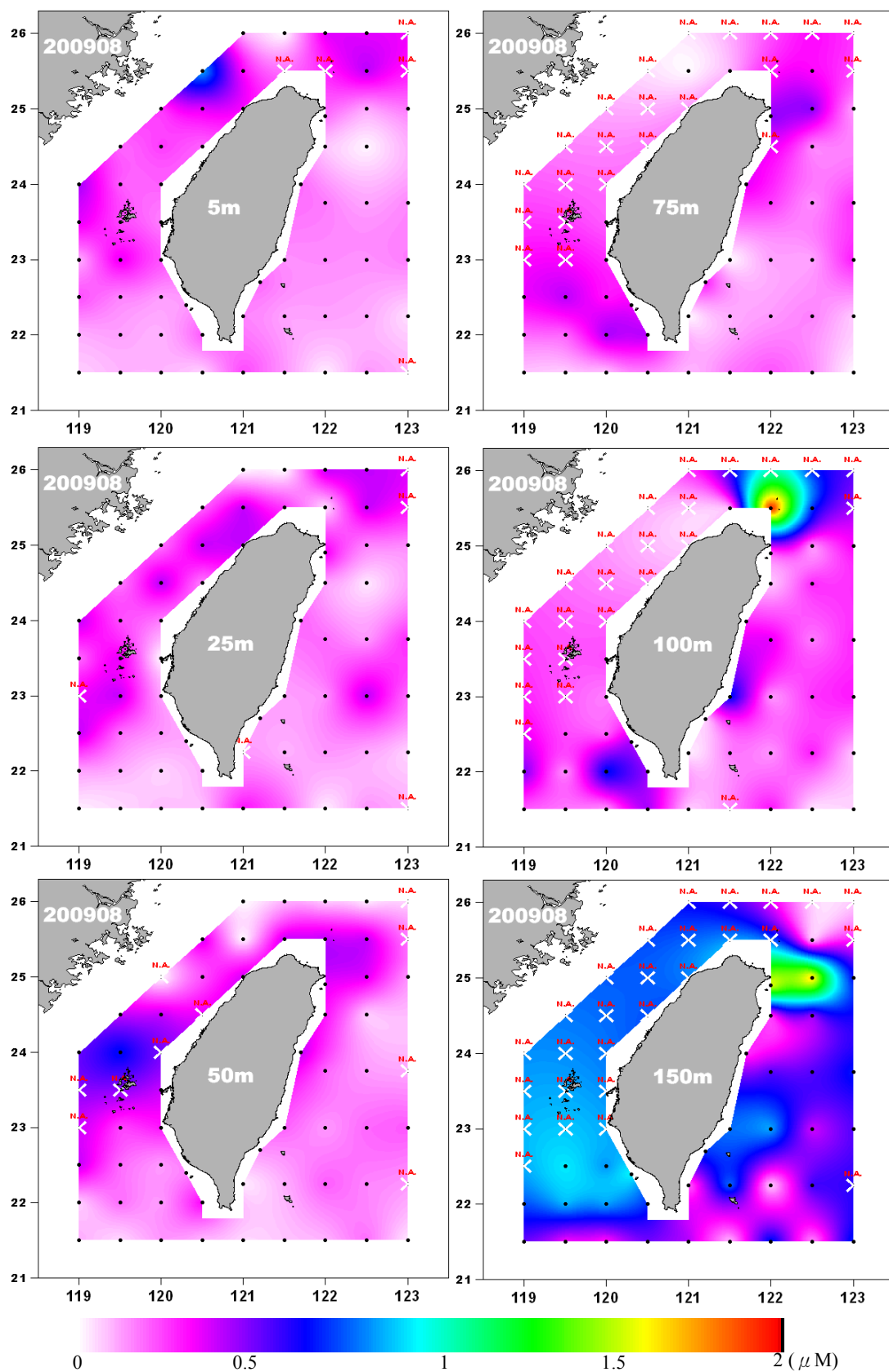


圖 19. 2009-08 航次磷酸鹽(PO_4^{3-})濃度分布
 Fig. 19. Phosphate (PO_4^{3-}) distribution in Aug. 2009

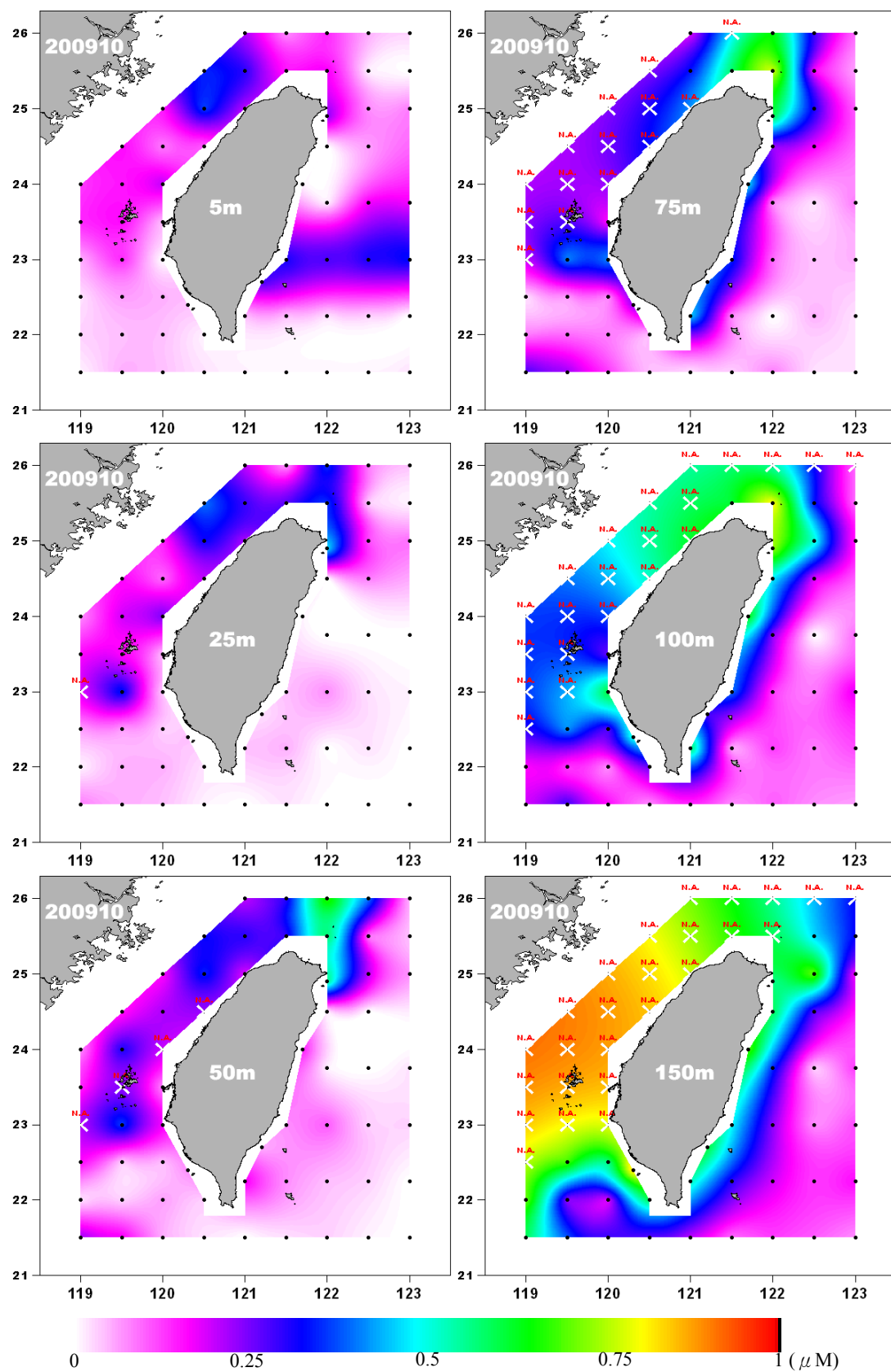


圖 20. 2009-10 航次磷酸鹽(PO_4^{3-})濃度分布
 Fig. 20. Phosphate (PO_4^{3-}) distribution in Oct. 2009

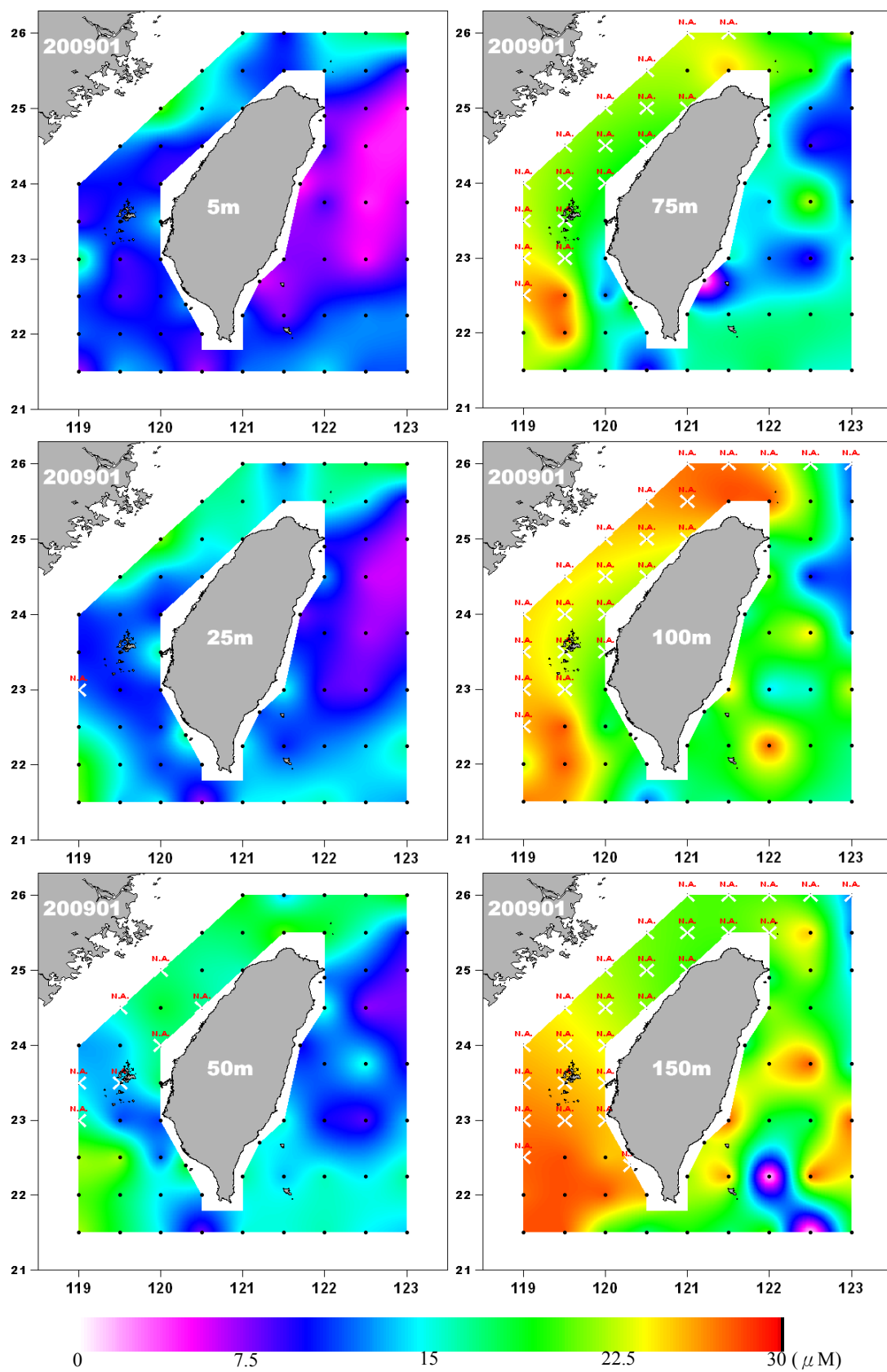


圖 21. 2009-01 航次矽酸鹽(SiO_2^{2-})濃度分布
 Fig. 21. Silicate (SiO_2^{2-}) distribution in Jan. 2009

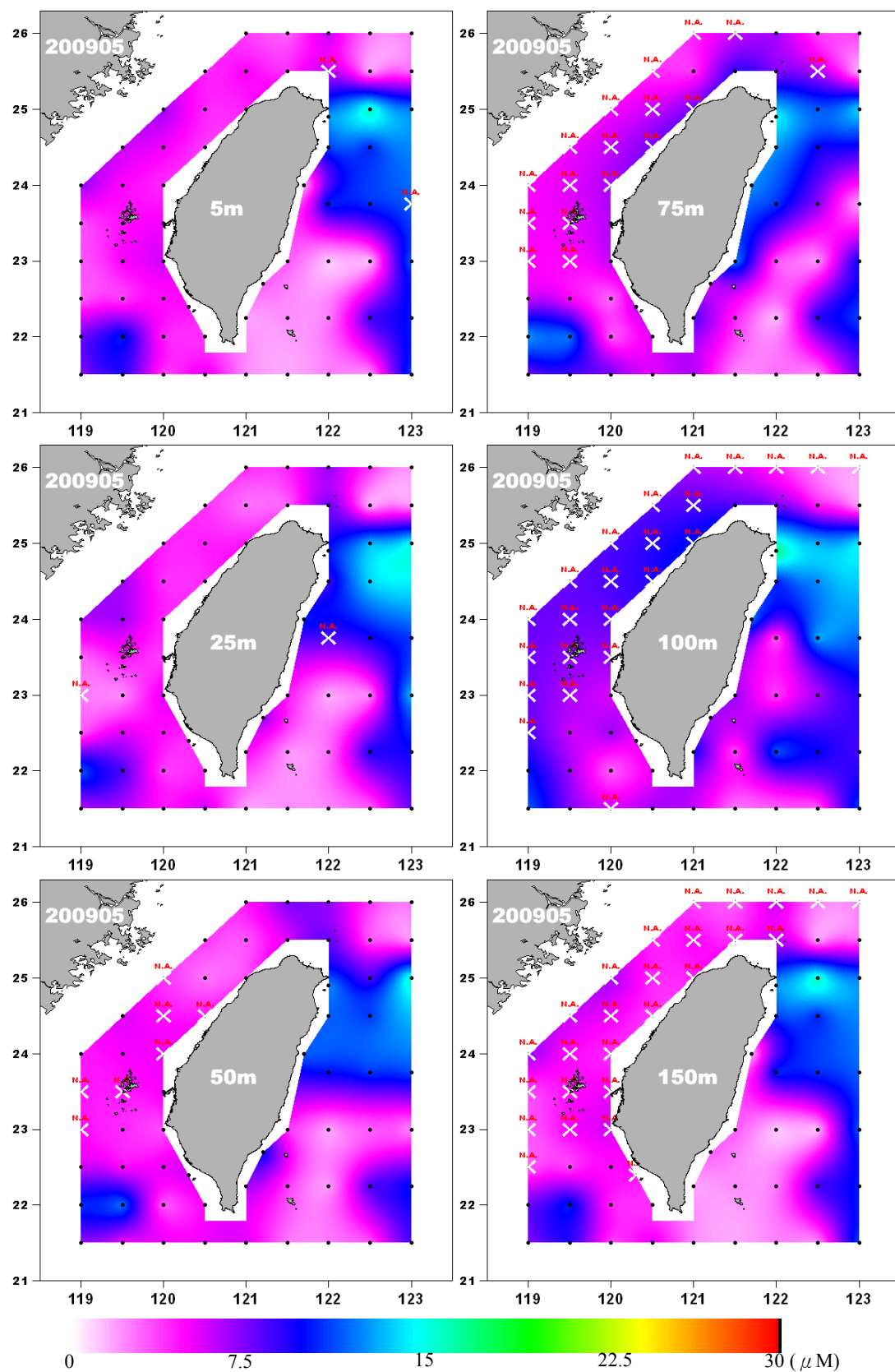


圖 22. 2009-05 航次矽酸鹽(SiO_2^{2-})濃度分布
 Fig. 22. Silicate (SiO_2^{2-}) distribution in May 2009

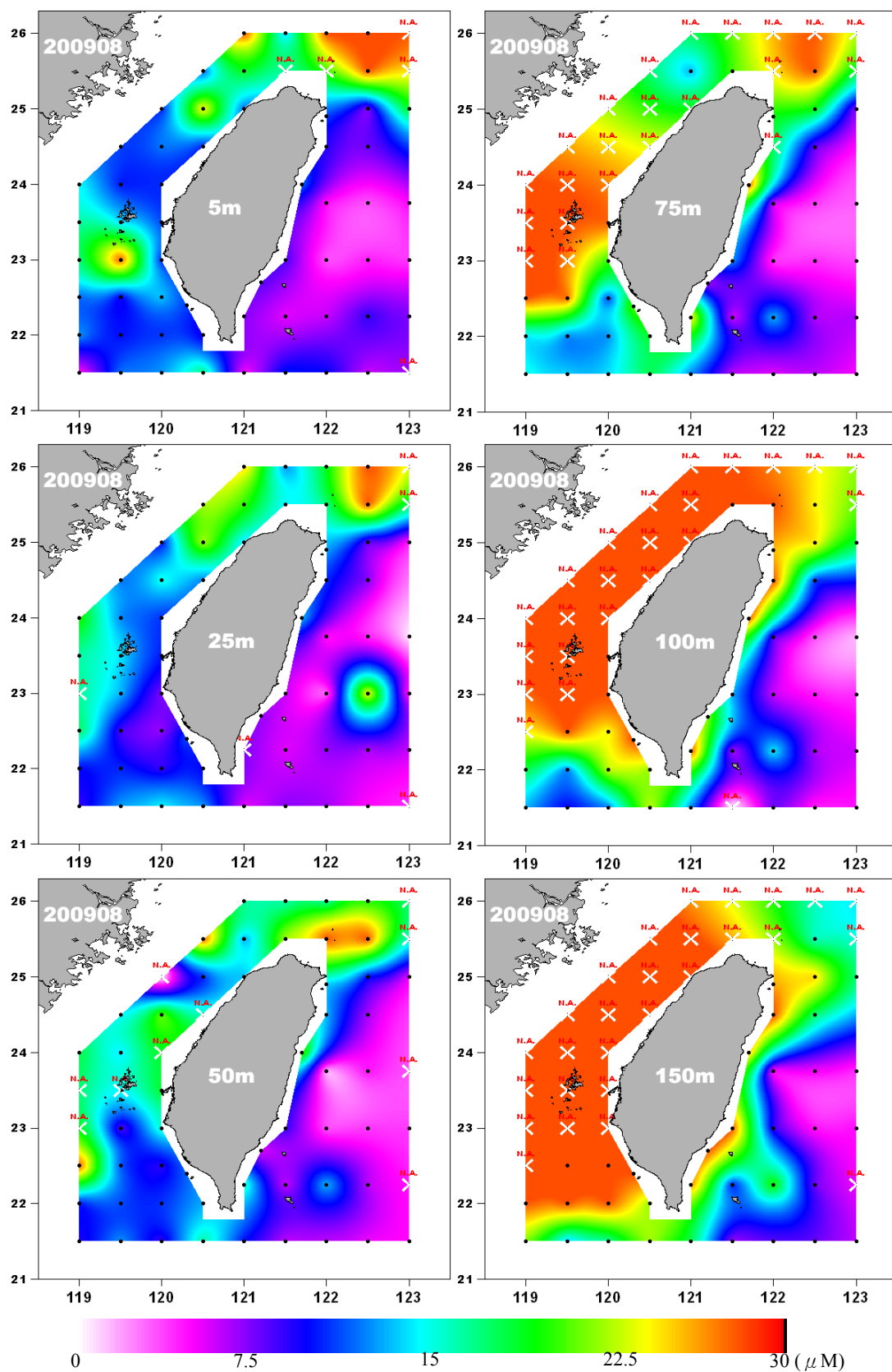


圖 23. 2009-08 航次矽酸鹽(SiO_2^{2-})濃度分布
Fig. 23. Silicate (SiO_2^{2-}) distribution in Aug. 2009

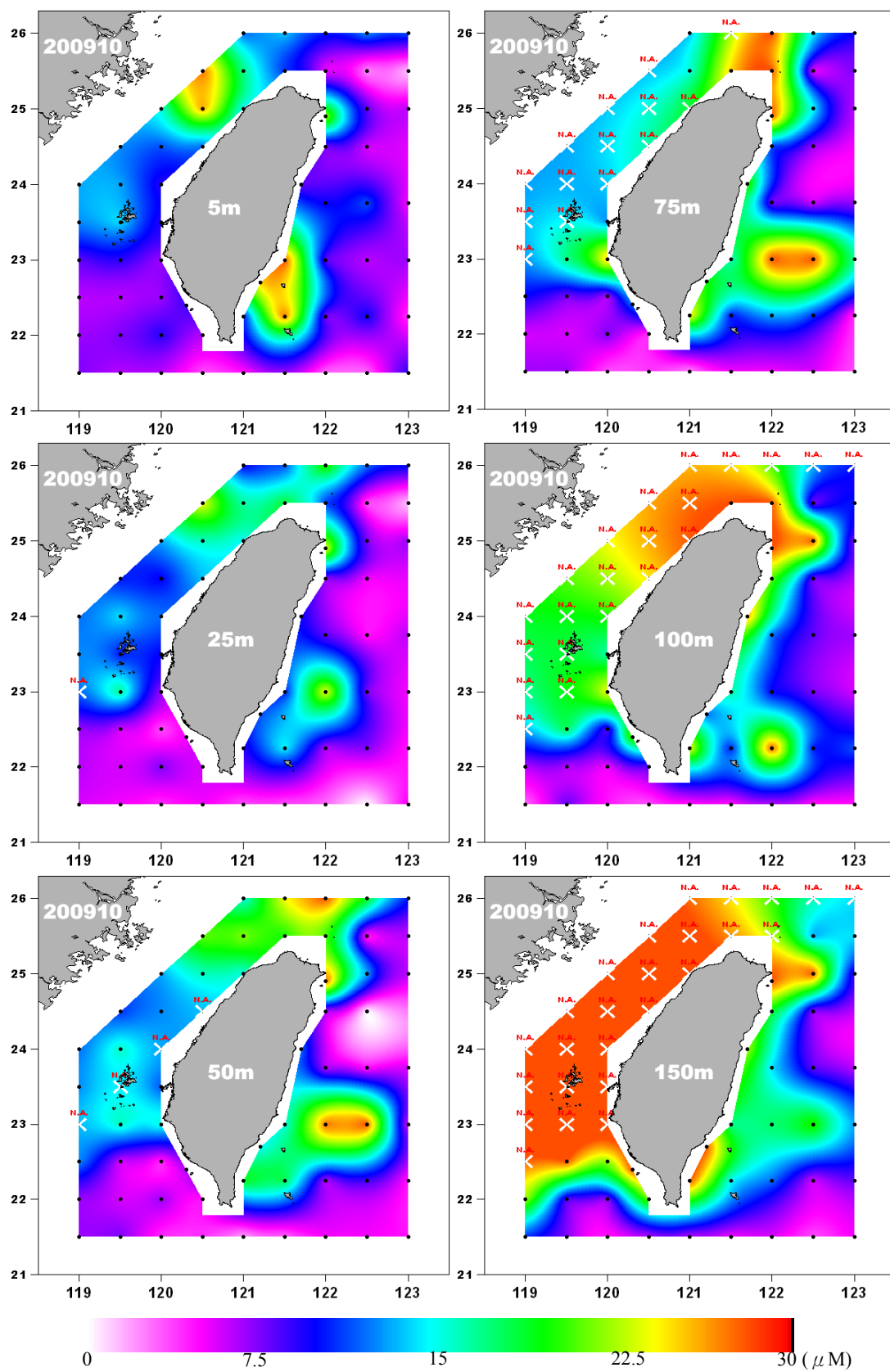


圖 24. 2009-10 航次矽酸鹽(SiO_2^{2-})濃度分布
 Fig.24.Silicate (SiO_2^{2-}) distribution in Oct. 2009

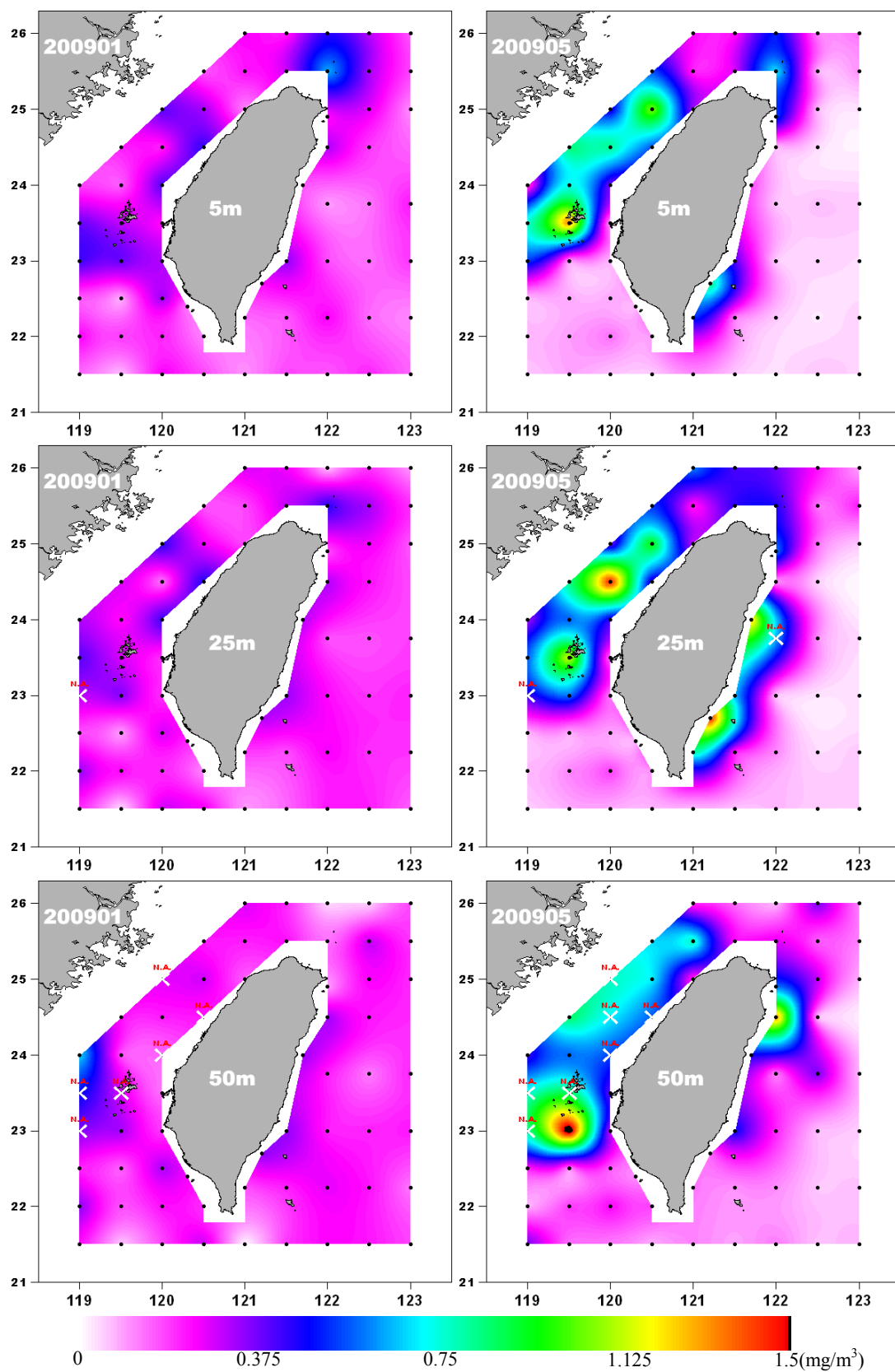


圖 25. 2009 年 1 月及 5 月葉綠素甲(chl-a)分布
 Fig. 25. Chlorophyll-*a* (chl-*a*) distribution in Jan. and May 2009

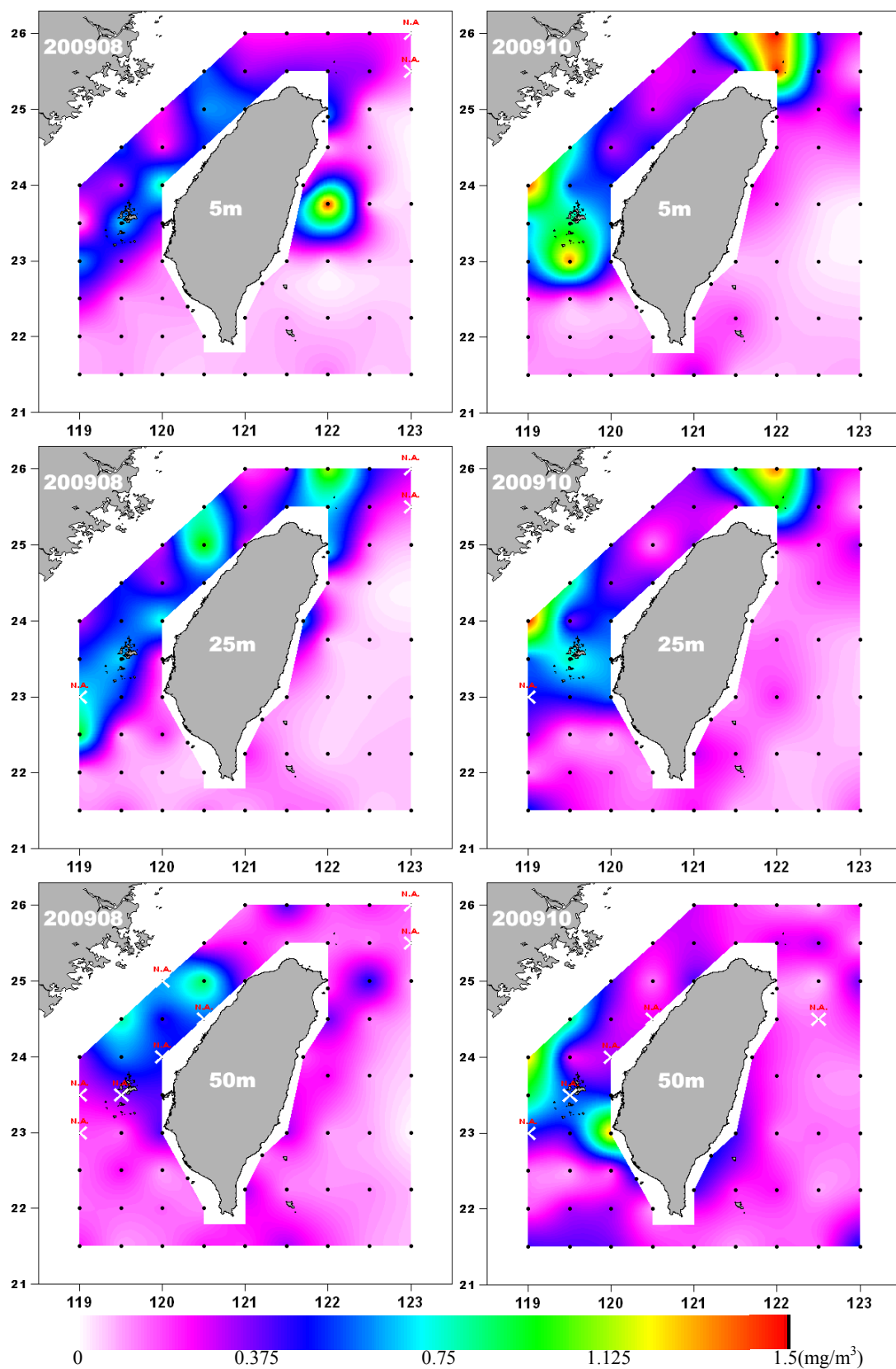


圖 26. 2009 年 8 月及 10 月葉綠素甲(chl-a)分布
 Fig. 26. Chlorophyll-a (chl-a) distribution in Aug. and Oct. 2009

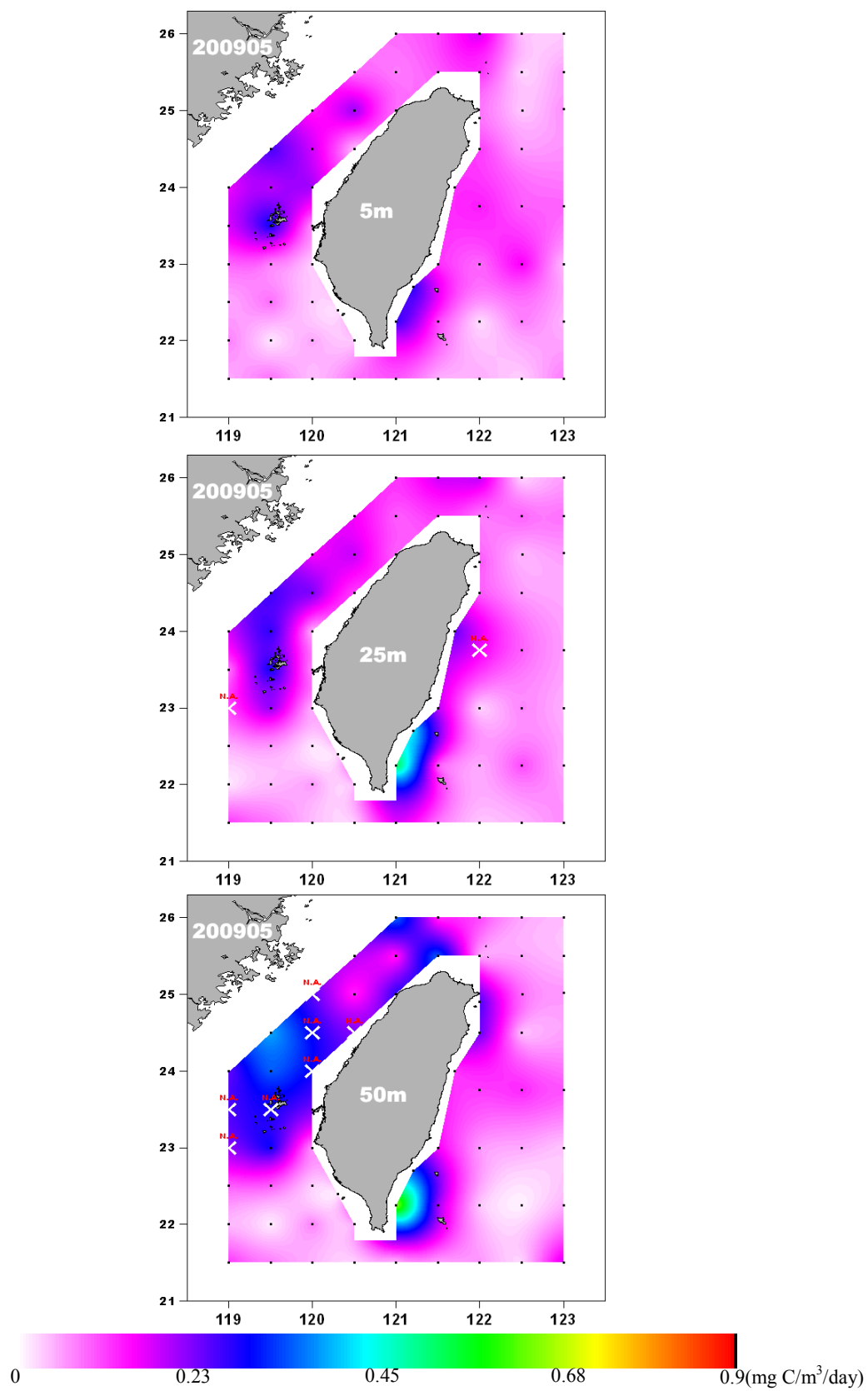


圖 27. 2009 年 5 月基礎生產力分布
Fig. 27. Primary production distribution in May 2009

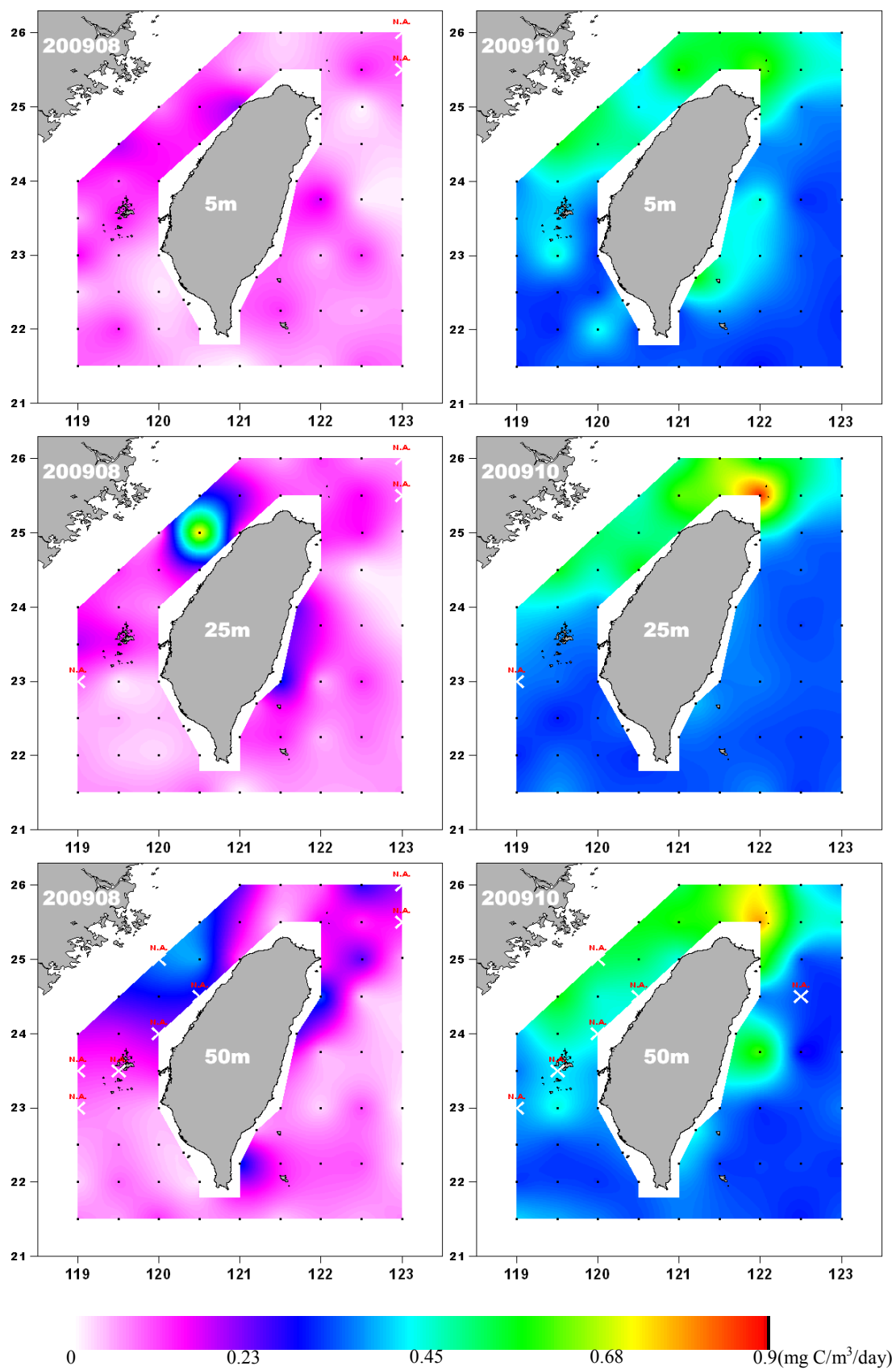


圖 28. 2009 年 8 月及 10 月基礎生產力分布
Fig. 28. Primary production distribution in Aug. and Oct. 2009

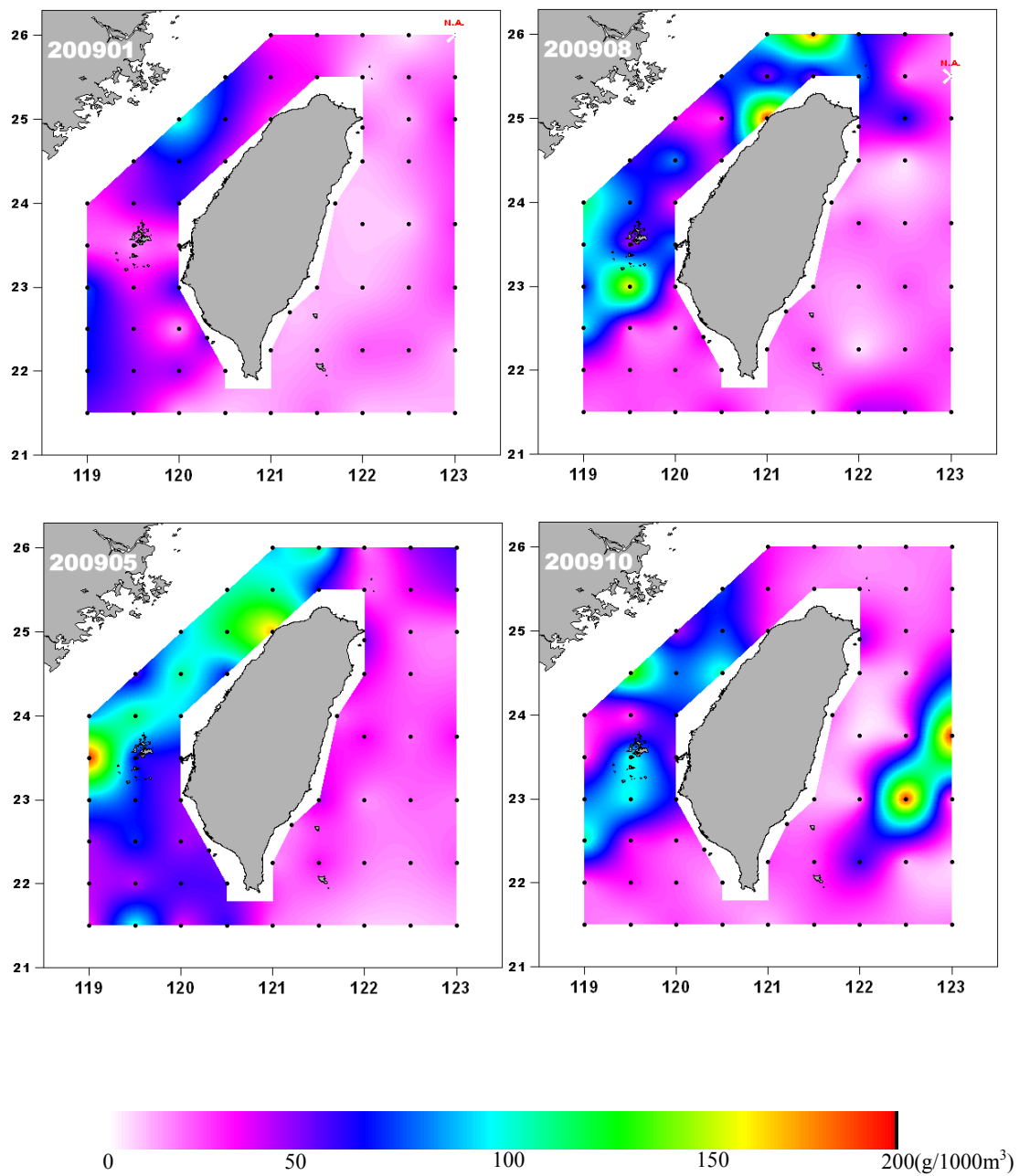


圖 29. 2009 年 1 月、5 月、8 月及 10 月浮游動物生物量分布
 Fig. 29. Biomass of zooplankton sample in 2009

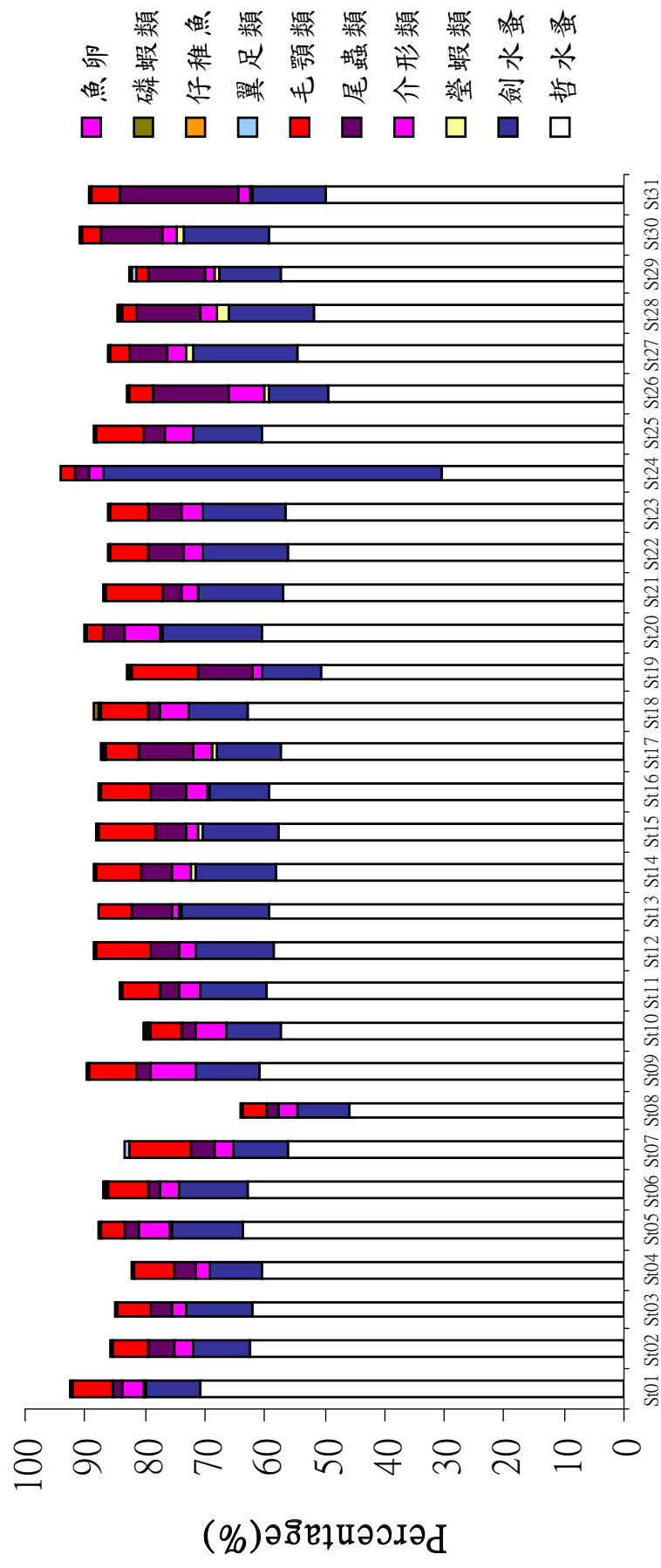


圖 30. 2009-01 航次浮游動物優勢大類出現百分率
Fig. 30. Percentage of the composition of zooplankton in Jan. 2009

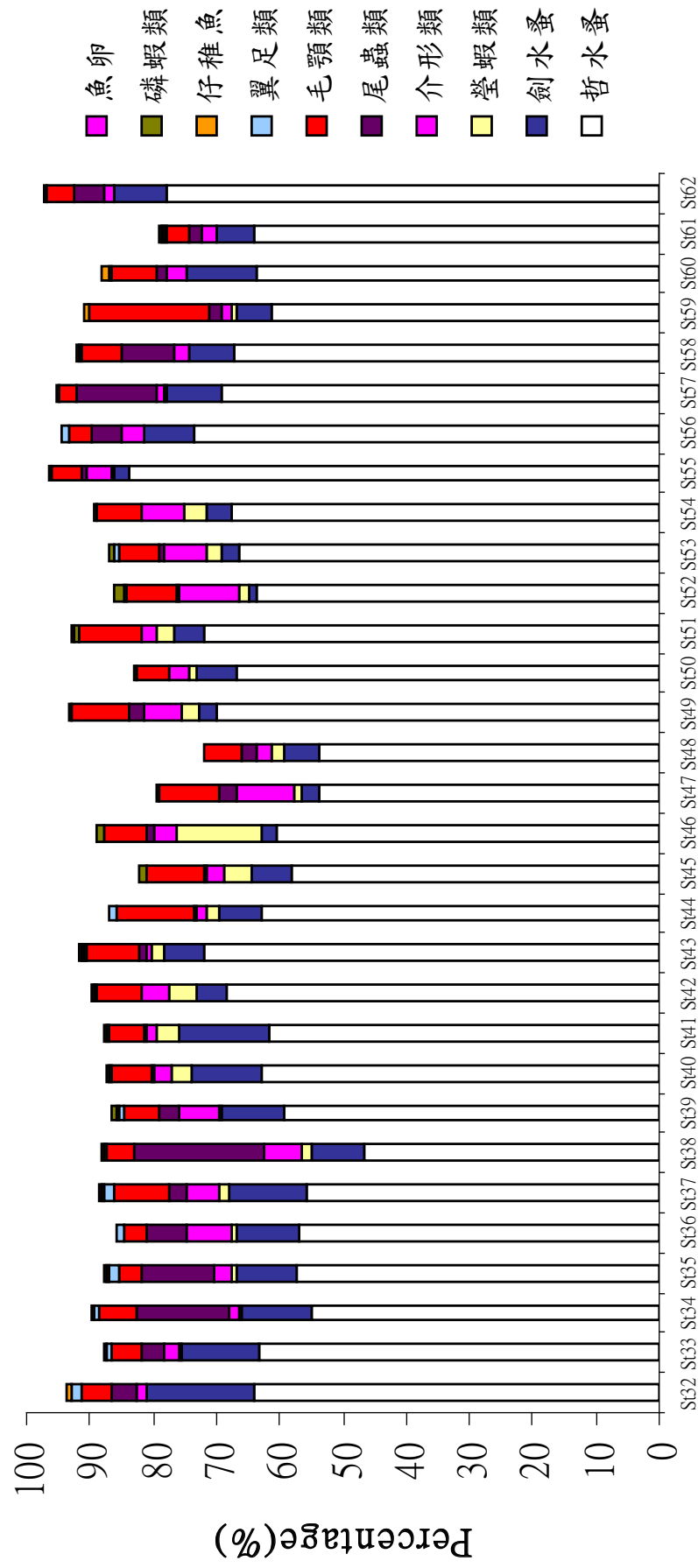


圖 31. 2009-01 航次浮游動物優勢大類出現百分率(續)

Fig. 31. Percentage of the composition of zooplankton in Jan. 2009

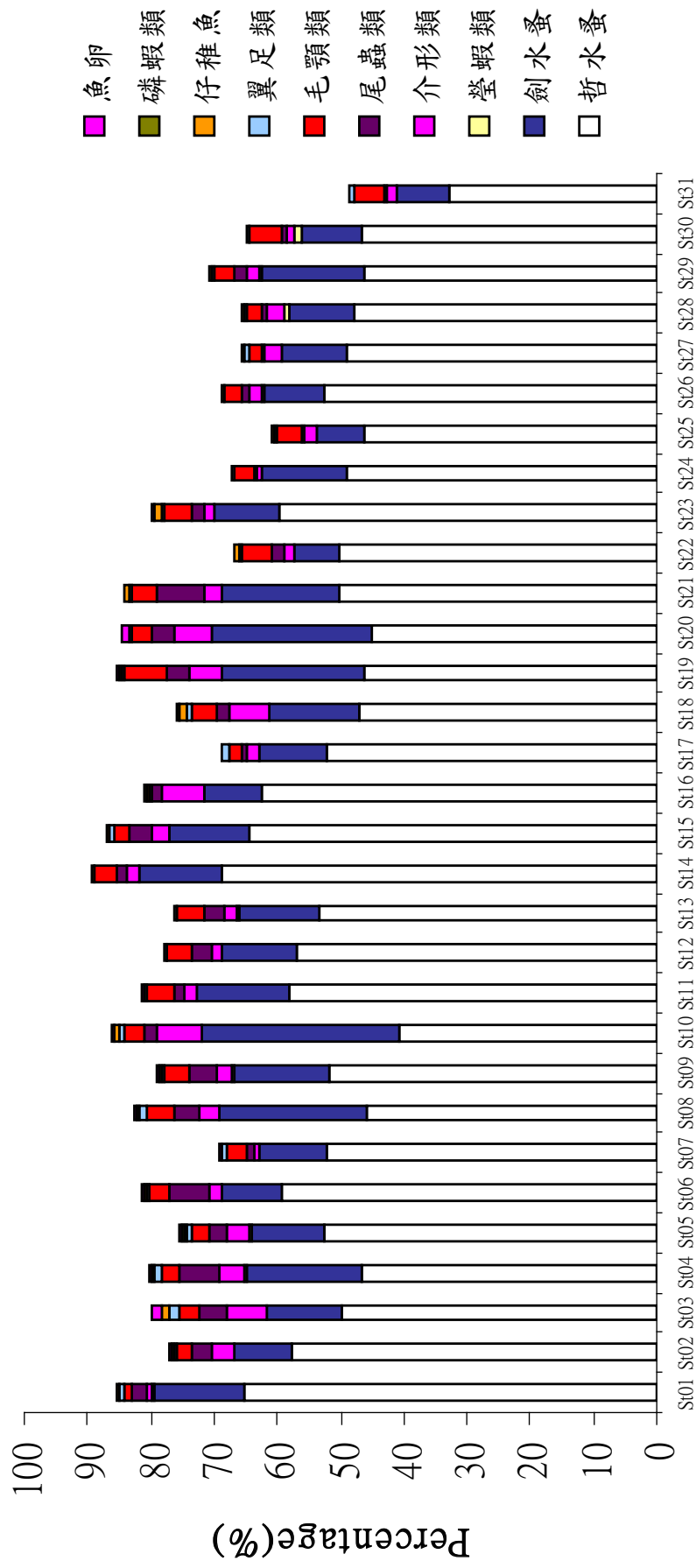


圖 32. 2009-05 航次浮游動物優勢大類出現百分率

Fig. 32. Percentage of the composition of zooplankton in May 2009

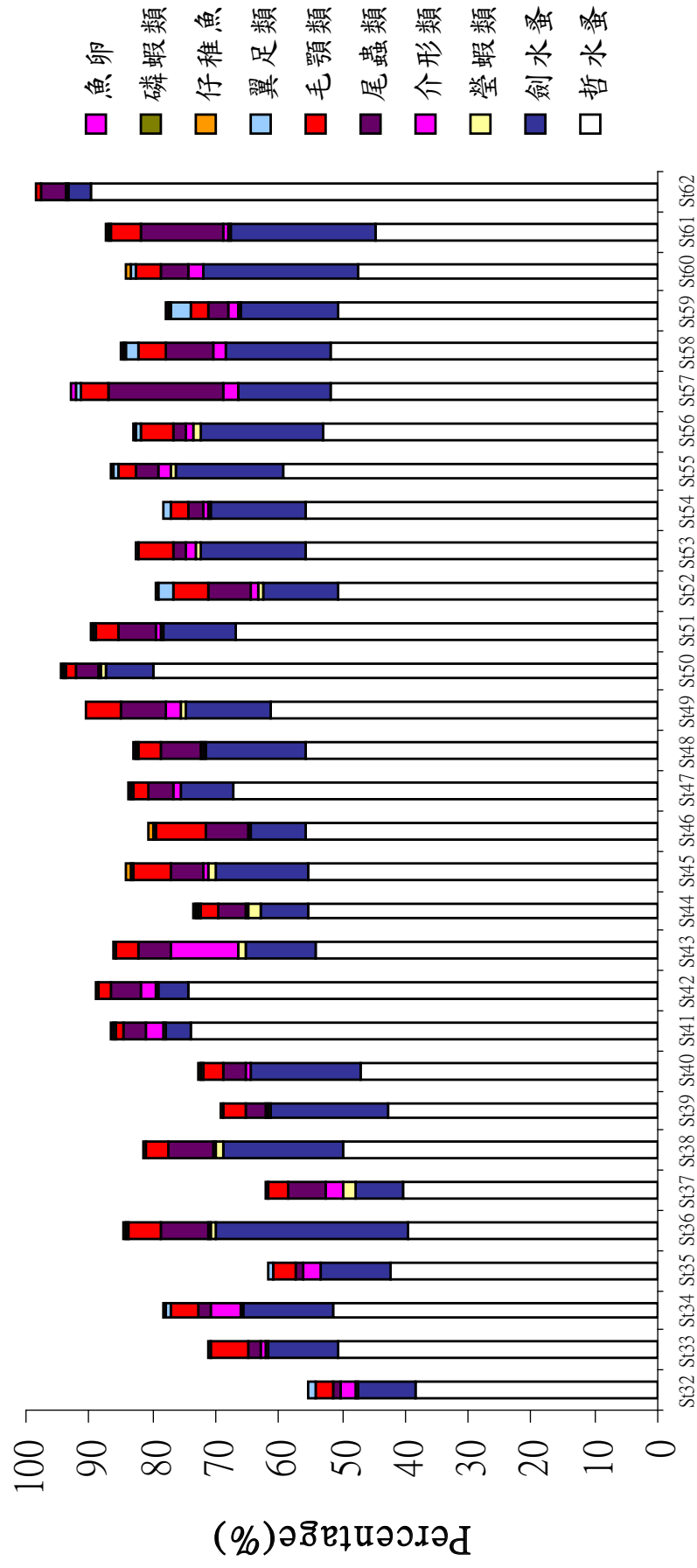


圖 33. 2009-05 航次浮游動物優勢大類出現百分率(續)
Fig. 33. Percentage of the composition of zooplankton in May 2009

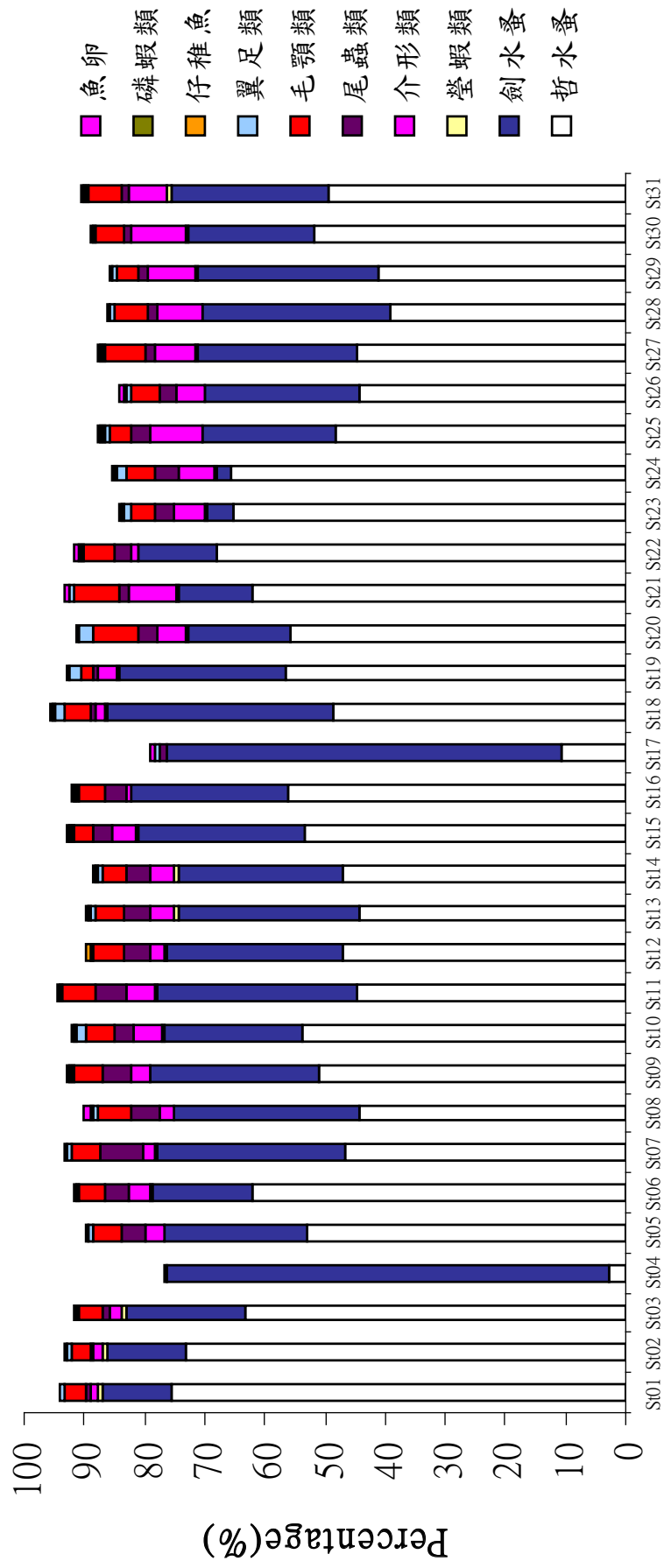


圖 34. 2009-08 航次浮游動物優勢大類出現百分率

Fig. 34. Percentage of the composition of zooplankton in Aug. 2009

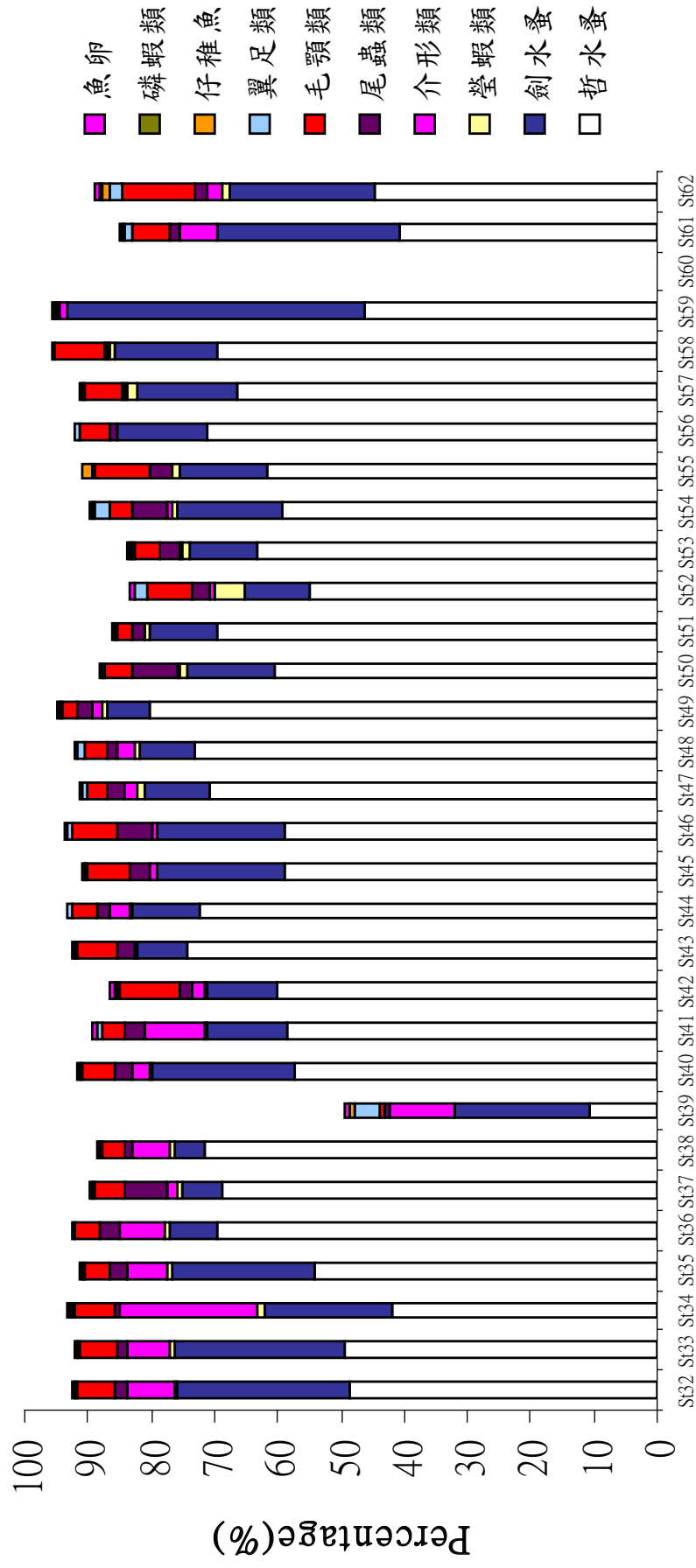


圖 35. 2009-08 航次浮游動物優勢大類出現百分率(續)

Fig. 35. Percentage of the composition of zooplankton in Aug. 2009

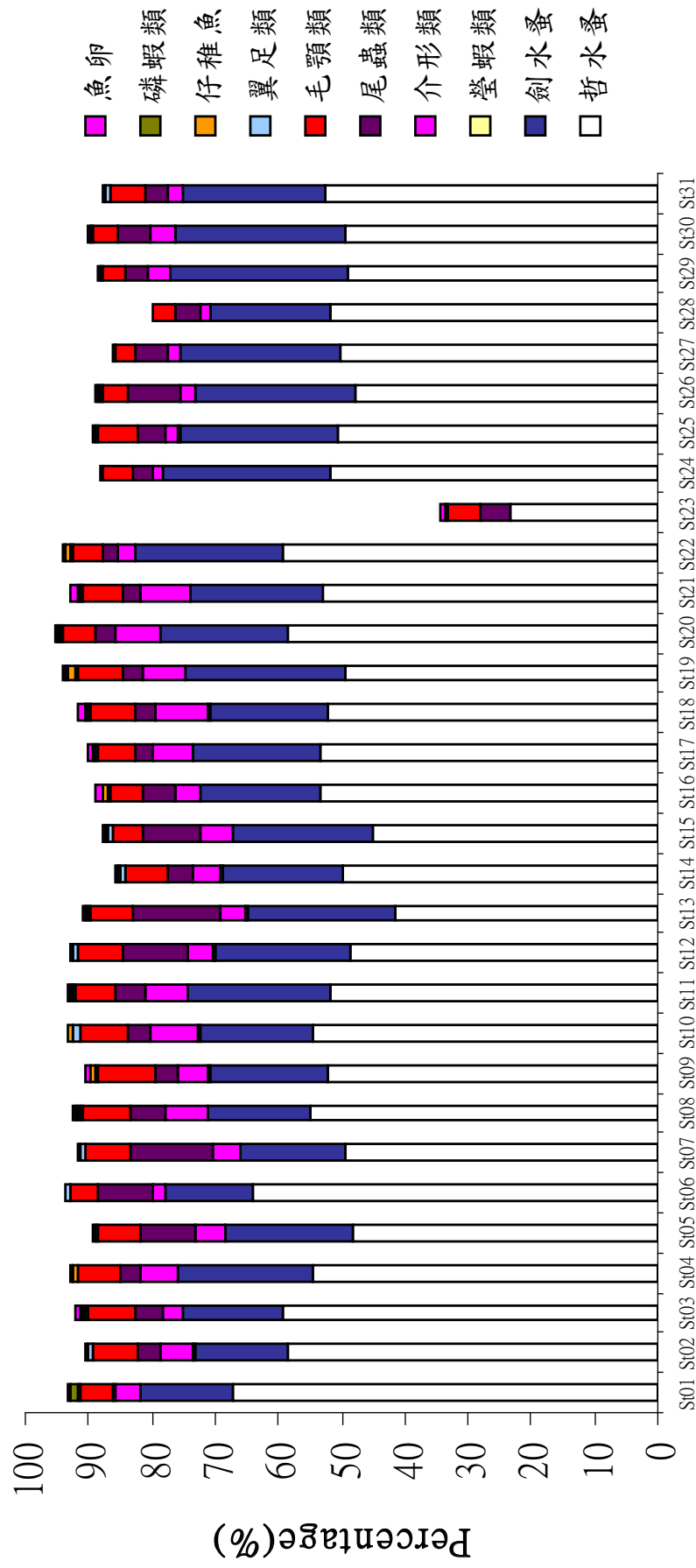


圖 36. 2009-10 航次浮游動物優勢大類出現百分率
Fig. 36. Percentage of the composition of zooplankton in Oct. 2009

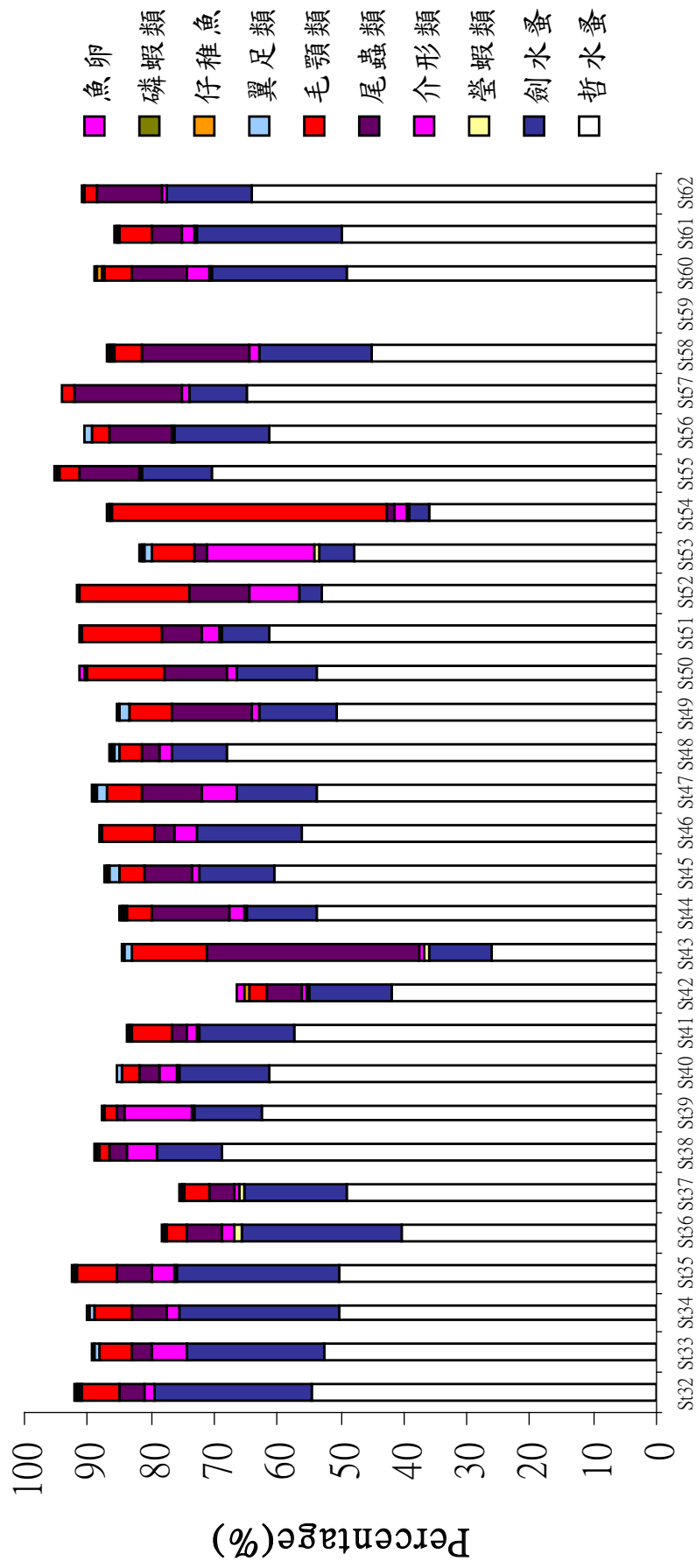


圖 37. 2009-10 航次浮游動物優勢大類出現百分率(續)
Fig. 37. Percentage of the composition of zooplankton in Oct. 2009

表 01. 2009-01-05 航次基礎觀測資料
Chart 01. Basic observation data in Jan. 2009

Station	Date	SMT	Lati.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D	Fl. Ct.	V.M.S.
St01	20090117	0640	24.86	122.01	365	22.7	13.3	1022.35	250	4.0	200	1312	787.2
St02	20090117	0256	25.01	122.51	1442	24.1	15.0	1021.46	168	6.7	200	1523	913.8
St03	20090116	1947	25.00	123.00	1622	23.8	14.1	1022.88	009	8.6	200	1253	751.8
St04	20090116	1608	24.51	122.51	585	24.3	12.7	1021.46	103	6.3	200	1179	707.4
St05	20090116	1320	24.50	122.00	805	24.3	18.9	1022.17	198	0.0	200	1115	669.0
St06	20090116	1008	24.00	121.69	666	23.4	18.2	1025.02	291	2.2	200	1197	718.2
St07	20090116	0730	23.76	122.01	3256	23.7	16.8	1024.49	283	5.5	200	1359	815.4
St08	20090116	0423	23.75	122.50	3104	23.7	18.2	1023.60	081	5.6	200	1592	955.2
St09	20090116	0110	23.75	123.01	3640	23.1	17.6	1024.31	078	9.7	200	1324	794.4
St10	20090115	2030	23.00	123.00	5274	23.2	18.1	1025.20	077	10.4	200	1209	725.4
St11	20090115	1714	23.01	122.49	5503	23.3	17.7	1024.49	040	9.2	200	1482	889.2
St12	20090115	1410	23.01	122.00	4866	23.4	17.0	1025.00	036	8.3	200	1482	889.2
St13	20090115	1105	23.01	121.50	2018	23.3	16.9	1026.62	038	14.3	200	1360	816.0
St14	20090115	0828	22.68	121.25	1083	23.1	26.3	1026.62	022	12.1	200	1157	694.2
St15	20090115	0517	22.26	121.00	1204	23.4	17.5	1024.13	016	14.1	200	1343	805.8
St16	20090115	0205	22.26	121.51	642	23.3	17.8	1024.13	046	16.9	200	1418	850.8
St17	20090114	2305	22.26	122.00	4770	22.8	16.4	1025.73	005	14.7	200	1591	954.6
St18	20090114	2000	22.27	122.50	4833	22.8	17.7	1025.38	052	13.3	200	1666	999.6
St19	20090114	1700	22.24	123.00	3764	22.5	17.0	1023.60	013	13.0	200	1461	876.6
St20	20090114	1158	21.51	122.99	4784	22.7	17.0	1023.77	026	10.1	200	1324	794.4
St21	20090114	0837	21.51	122.50	4786	22.7	17.2	1025.73	047	13.7	200	1548	928.8
St22	20090114	0509	21.51	122.00	3480	23.0	17.7	1023.06	049	17.0	200	1373	823.8
St23	20090114	0149	21.51	121.50	2130	23.4	18.6	1023.42	043	11.2	200	1203	721.8
St24	20090113	2156	21.51	120.99	1212	24.1	18.9	1023.77	052	14.2	200	1282	769.2
St25	20090113	1735	21.50	120.50	1670	24.5	19.0	1021.99	067	16.4	200	1314	788.4
St26	20090112	0742	21.50	120.00	2951	23.5	18.9	1021.10	033	11.5	200	1231	738.6
St27	20090112	0427	21.51	119.49	2952	23.2	18.8	1020.04	029	9.4	200	1232	739.2
St28	20090112	0105	21.52	119.00	2762	23.2	18.4	1020.57	011	7.5	200	1072	643.2
St29	20090111	2157	21.99	119.00	1450	22.8	17.3	1021.10	013	7.0	200	1294	776.4
St30	20090111	1902	22.00	119.49	2288	22.5	16.4	1020.21	036	7.0	200	1215	729.0
St31	20090111	1605	22.00	120.00	1146	23.5	16.9	1018.08	013	5.4	200	1159	695.4
St32	20090111	1327	22.00	120.50	300	23.9	17.6	1018.61	010	6.3	200	1481	888.6
St33	20090111	1048	22.38	120.32	530	22.4	14.2	1021.10	326	4.2	200	1258	754.8
St34	20090109	0906	22.51	120.00	725	22.5	14.1	1019.68	012	17.4	200	1673	1003.8
St35	20090109	0537	22.51	119.49	210	23.0	15.4	1019.15	016	16.6	200	1558	934.8
St36	20090109	0156	22.50	119.00	84	23.2	15.3	1020.21	028	13.6	78	479	287.4
St37	20090108	2337	22.94	119.11	25	21.5	14.8	1020.39	027	15.2	24	108	64.8
St38	20090108	2124	23.00	119.50	72	22.4	14.8	1019.86	003	12.1	69	571	342.6
St39	20090108	1905	23.01	119.92	125	23.0	16.0	1017.19	012	18.1	115	700	420.0
St40	20090108	1610	23.50	119.91	124	21.1	14.9	1016.83	018	19.4	110	719	431.4
St41	20090108	1326	23.43	119.51	55	20.4	12.8	1017.90	024	19.2	49	366	219.6
St42	20090108	0937	23.50	119.00	54	20.8	13.5	1021.46	030	13.3	45	321	192.6
St43	20090108	0647	24.01	119.00	62	19.7	12.7	1020.93	022	15.7	50	308	184.8
St44	20090108	0250	24.01	119.50	62	19.9	14.2	1019.68	024	14.1	55	289	173.4
St45	20090107	2245	24.00	120.01	38	20.2	15.7	1018.97	023	15.3	33	199	119.4
St46	20090107	1915	24.51	120.47	54	19.6	15.4	1017.90	015	18.1	49	481	288.6
St47	20090107	1600	24.50	119.99	58	18.8	15.0	1017.37	013	14.5	50	219	131.4
St48	20090107	1255	24.51	119.50	62	19.5	14.0	1018.43	017	13.9	50	271	162.6
St49	20090107	0908	25.00	120.00	55	18.4	13.3	1021.10	007	15.8	50	269	161.4
St50	20090107	0634	25.00	120.50	79	19.7	15.6	1018.79	023	12.0	74	358	214.8
St51	20090107	0426	25.09	120.91	76	20.2	16.6	1018.43	027	9.9	72	473	283.8
St52	20090107	0103	25.51	120.50	63	19.7	14.1	1019.04	012	14.0	50	262	157.2
St53	20090106	2107	26.00	121.01	78	20.3	13.9	1020.21	025	13.3	70	762	457.2
St54	20090106	1754	25.69	121.00	92	20.8	14.9	1018.08	035	10.5	87	502	301.2
St55	20090106	1525	25.50	121.50	115	25.6	14.7	1016.48	040	12.3	110	681	408.6
St56	20090106	1225	26.00	121.50	67	21.0	13.6	1018.43	054	9.6	60	317	190.2
St57	20090106	0950	26.00	122.01	99	21.8	12.9	1020.57	012	9.4	90	506	303.6
St58	20090106	0702	26.01	122.51	103	23.3	12.8	1018.79	053	16.0	100	942	565.2
St59	20090106	0400	26.00	123.01	94	23.0	13.0	1017.00	027	16.3	90	1044	626.4
St60	20090116	2243	25.50	123.01	771	23.9	14.4	1023.24	109	10.3	200	940	564.0
St61	20090105	2214	25.52	122.51	308	23.8	8.7	1018.79	040	17.8	200	1356	813.6
St62	20090105	1640	25.50	122.00	120	20.8	8.5	1017.90	038	15.8	115	5179	3107.4

表 02. 2009-05-06 航次基礎觀測資料
Chart 02. Basic observation data in May 2009

Station	Date	SMT	Lati.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D	Fl. Ct.	V.M.S.
St01	20090518	1028	24.87	122.00	310	26.2	23.8	1009.36	003	8.4	200	1400	840.0
St02	20090518	0644	25.00	122.51	1452	28.0	25.4	1009.18	022	5.2	200	1154	692.4
St03	20090518	0244	25.00	122.99	1634	27.8	23.9	1007.93	101	43.0	200	1574	944.4
St04	20090517	2217	24.50	122.50	601	28.0	25.0	1010.96	061	4.0	200	1387	832.2
St05	20090517	1845	24.50	122.01	782	28.3	25.3	1009.00	358	9.6	200	1620	972.0
St06	20090517	1515	24.00	121.69	511	28.5	26.4	1008.11	175	5.5	200	1327	796.2
St07	20090517	1150	23.75	122.01	3444	28.7	26.9	1009.33	190	5.8	200	1230	738.0
St08	20090517	0705	23.75	122.51	3054	28.2	26.3	1010.25	176	7.8	200	1243	745.8
St09	20090517	0303	23.29	123.00	5975	27.9	25.9	1010.78	188	8.6	200	1531	918.6
St10	20090516	2138	23.00	123.00	5182	27.9	25.9	1010.78	178	6.4	200	1146	687.6
St11	20090516	1749	23.00	122.50	5527	28.0	26.1	1009.53	168	4.7	200	1526	915.6
St12	20090516	1340	23.00	122.00	4902	28.8	26.8	1009.89	178	3.7	200	1454	872.4
St13	20090516	1000	23.00	121.50	1067	25.9	27.6	1011.00	186	4.0	200	1250	750.0
St14	20090516	0641	22.66	121.25	1065	24.1	27.1	1011.20	301	4.4	200	3854	2312.4
St15	20090515	0552	22.25	121.00	1210	27.1	24.6	1011.85	018	5.5	200	2345	1407.0
St16	20090515	0236	22.28	121.50	339	27.9	25.2	1010.60	190	4.3	200	1650	990.0
St17	20090514	2250	22.25	122.00	4577	28.4	25.4	1011.14	047	8.0	200	1633	979.8
St18	20090514	1928	22.25	122.50	4850	28.0	25.5	1010.96	032	6.3	200	1557	934.2
St19	20090514	1622	22.24	123.00	3540	28.4	26.6	1009.00	015	6.0	200	1688	1012.8
St20	20090514	0949	21.51	122.99	5010	27.5	25.1	1035.00	356	5.8	200	1061	636.6
St21	20090512	0445	21.50	122.49	4791	27.6	25.6	1011.21	012	2.6	200	1271	762.6
St22	20090512	0001	21.49	122.00	5350	28.0	25.6	1009.32	064	5.3	200	1119	671.4
St23	20090511	1950	21.51	121.49	2105	28.5	25.7	1009.53	096	2.4	200	1318	790.8
St24	20090511	1647	21.49	121.00	929	28.9	26.6	1008.82	285	0.0	200	1168	700.8
St25	20090511	1213	21.50	120.49	1606	28.2	25.7	1020.00	064	3.7	200	1330	798.0
St26	20090511	0810	21.51	119.99	2972	28.0	26.2	1010.25	076	7.0	200	1271	762.6
St27	20090511	0426	21.50	119.50	2990	27.4	24.6	1007.29	090	7.7	200	1278	766.8
St28	20090511	0102	21.51	119.01	2768	27.4	25.0	1008.47	100	7.4	200	1332	799.2
St29	20090510	2115	22.00	119.00	1444	27.4	24.7	1009.53	097	5.6	200	1326	795.6
St30	20090510	1742	22.02	119.50	2383	27.7	24.9	1008.29	061	31.0	200	1443	865.8
St31	20090510	1420	22.00	120.01	1168	28.3	27.7	1009.36	272	0.0	200	1008	604.8
St32	20090510	1112	21.99	120.51	332	27.8	26.3	1010.42	162	4.3	200	1241	744.6
St33	20090510	0855	22.37	120.33	143	27.3	26.3	1010.60	328	2.0	145	926	555.6
St34	20090510	0650	22.49	120.00	558	27.1	24.6	1010.25	041	33.0	200	1357	814.2
St35	20090510	0403	22.50	119.51	248	26.8	24.4	1009.36	067	6.5	200	1473	883.8
St36	20090510	0138	22.51	119.01	86	26.4	23.9	1009.53	109	4.1	75	656	393.6
St37	20090509	1750	22.94	119.10	28	25.3	22.8	1009.00	035	0.0	22	110	66.0
St38	20090509	1539	23.00	119.50	72	26.4	23.3	1008.90	312	6.6	72	470	282.0
St39	20090509	1312	23.01	119.91	123	26.7	23.7	1009.36	306	4.0	110	772	463.2
St40	20090509	0953	23.52	119.92	94	26.1	23.8	1010.78	343	3.3	109	697	418.2
St41	20090509	0725	23.44	119.49	56	24.9	22.4	1010.07	297	2.0	52	372	223.2
St42	20090509	0430	23.50	119.01	51	24.6	21.6	1009.00	040	7.2	45	238	142.8
St43	20090509	0135	24.00	119.35	60	25.1	21.9	1009.18	025	5.1	55	344	206.4
St44	20090508	2258	24.00	119.53	70	25.7	22.8	1009.71	014	4.0	60	388	232.8
St45	20090508	2011	24.02	120.01	38	26.6	24.0	1009.18	032	58.0	33	236	141.6
St46	20090508	1535	24.50	120.50	48	26.4	25.4	1007.93	016	3.7	43	288	172.8
St47	20090508	1256	24.50	120.00	60	25.4	24.1	1009.00	082	3.0	55	254	152.4
St48	20090508	1006	24.51	119.52	54	24.8	21.3	1008.82	033	15.0	50	221	132.6
St49	20090508	0600	25.00	120.00	51	24.4	22.3	1008.47	016	13.7	45	176	105.6
St50	20090508	0305	25.01	120.50	75	25.0	22.8	1007.04	066	6.7	70	325	195.0
St51	20090508	0030	25.09	120.91	78	25.3	23.4	1007.75	084	12.6	67	303	181.8
St52	20090507	2032	25.51	120.49	66	24.5	21.9	1009.36	066	11.0	55	1148	688.8
St53	20090507	1646	26.00	120.99	80	24.6	21.9	1010.07	059	67.0	72	407	244.2
St54	20090507	1356	25.59	121.01	88	26.4	23.0	1009.53	065	12.4	85	527	316.2
St55	20090507	1035	25.50	121.51	120	25.1	22.9	1090.00	095	8.0	110	713	427.8
St56	20090507	0735	26.00	121.51	72	24.3	21.6	1012.00	069	5.1	60	400	240.0
St57	20090507	0445	26.01	122.01	100	24.9	21.9	1010.25	064	59.0	75	518	310.8
St58	20090507	0143	26.00	122.51	105	25.4	21.8	1011.14	072	60.0	100	682	409.2
St59	20090506	2235	25.98	122.97	95	25.2	21.0	1012.56	120	3.3	89	670	402.0
St60	20090506	1900	25.50	123.00	774	25.2	21.7	1010.96	012	24.0	200	1105	663.0
St61	20090506	1550	25.51	122.51	346	25.4	24.8	1012.00	013	8.7	110	684	410.4
St62	20090506	1240	25.50	122.01	112	23.6	21.3	1012.56	029	44.0	200	1647	988.2

表 03. 2009-08-25 航次基礎觀測資料
Chart 03. Basic observation data in Aug. 2009

Station	Date	SMT	Lati.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D	Fl. Ct.	V.M.S.
St.01	20090825	1655	24.86	122.01	421	30.0	27.4	1007.22	064	2.2	200	1459	875.4
St.02	20090825	2020	25.01	122.50	1437	31.2	27.6	1008.11	062	8.7	200	1563	937.8
St.03	20090825	2331	25.01	123.01	1612	30.5	28.1	1008.11	078	3.3	200	1150	690.0
St.04	20090826	0516	24.50	122.50	590	30.7	27.9	1006.51	154	0.0	200	978	586.8
St.05	20090826	0851	24.49	122.01	1026	30.6	28.5	1007.93	264	2.0	200	1101	660.6
St.06	20090826	1408	24.01	121.80	741	31.7	30.1	1006.51	262	0.0	200	1692	1015.2
St.07	20090826	1717	23.75	122.00	3445	32.0	29.6	1006.15	090	0.0	200	1245	747.0
St.08	20090826	2035	23.75	122.50	3092	31.8	29.3	1006.69	204	0.0	200	846	507.6
St.09	20090826	2344	23.75	123.00	3648	31.6	28.6	1006.69	082	0.0	200	1161	696.6
St.10	20090827	0502	23.00	122.99	5422	31.4	28.6	1006.86	293	3.4	200	1440	864.0
St.11	20090827	0830	23.01	122.50	5507	31.5	29.3	1007.40	322	2.2	200	985	591.0
St.12	20090827	1155	23.00	122.00	4880	32.4	29.2	1006.15	230	2.2	200	1131	678.6
St.13	20090827	1535	23.00	121.51	2050	31.6	28.6	1004.91	185	4.8	200	1179	707.4
St.14	20090827	1920	22.67	121.25	1116	31.6	28.6	1005.80	059	5.0	200	1256	753.6
St.15	20090828	1640	22.25	121.00	1209	31.6	29.4	1004.73	054	2.2	200	1241	744.6
St.16	20090828	1322	22.25	121.51	713	31.2	29.2	1005.08	010	2.4	200	973	583.8
St.17	20090828	0948	22.26	122.03	4629	31.4	29.7	1006.33	359	2.0	200	930	558.0
St.18	20090828	0635	22.25	122.49	4847	31.3	28.7	1006.15	353	2.6	200	1146	687.6
St.19	20090829	1804	22.26	122.99	3278	31.3	28.4	1005.26	045	3.7	200	834	500.4
St.20	20090830	0629	21.52	122.99	4837	30.8	28.0	1005.97	012	4.6	200	740	444.0
St.21	20090830	0945	21.55	122.51	4767	31.5	28.5	1006.51	046	4.7	200	1074	644.4
St.22	20090830	1427	21.50	122.00	3462	31.3	28.8	1007.55	049	5.2	200	1416	849.6
St.23	20090830	1815	21.71	120.18	2101	31.3	28.4	1005.44	063	3.6	200	1001	600.6
St.24	20090830	2142	21.68	120.99	1196	31.1	28.5	1007.22	060	6.0	200	1147	688.2
St.25	20090831	0130	21.51	120.51	1800	31.0	28.2	1005.97	075	6.4	200	839	503.4
St.26	20090831	0445	21.50	120.01	2945	30.8	28.5	1005.62	070	4.0	200	1408	844.8
St.27	20090831	0750	21.35	122.37	2881	31.2	28.7	1007.21	081	4.3	200	1160	696.0
St.28	20090831	1100	21.51	119.00	2763	31.6	29.0	1006.86	039	2.2	200	1207	724.2
St.29	20090831	1427	22.00	119.00	1438	32.2	29.7	1005.97	301	2.0	200	996	597.6
St.30	20090831	1752	22.00	119.50	2380	32.0	29.4	1005.80	152	5.0	200	1240	744.0
St.31	20090831	2104	22.00	120.00	1065	31.9	29.6	1007.04	094	10.5	200	53609	32165.4
St.32	20090901	1235	22.01	120.47	921	31.5	29.3	1006.15	073	12.8	200	3182	1909.2
St.33	20090901	0328	22.38	120.33	280	31.1	27.5	1005.80	063	2.8	200	990	594.0
St.34	20090901	0555	22.50	120.01	619	31.0	28.6	1006.15	002	2.8	200	1237	742.2
St.35	20090901	0920	22.50	119.51	234	31.3	28.9	1007.40	027	1.0	200	1193	715.8
St.36	20090901	1250	22.50	119.01	86	31.2	27.8	1005.97	347	5.0	75	367	220.2
St.37	20090901	1605	22.93	119.09	26	30.5	27.4	1004.91	012	7.4	20	152	91.2
St.38	20090901	1839	23.01	119.50	74	31.1	28.3	1004.91	022	9.1	71	638	382.8
St.39	20090901	2111	23.00	119.91	126	31.3	28.6	1006.69	053	0.0	120	673	403.8
St.40	20090902	0032	23.50	119.91	117	30.8	28.3	1005.08	178	3.7	100	789	473.4
St.41	20090902	0320	23.44	119.50	50	29.9	26.7	1003.48	000	2.4	45	397	238.2
St.42	20090902	0607	23.50	119.01	5080	29.5	27.1	1003.84	027	12.5	45	257	154.2
St.43	20090902	0930	24.00	119.00	60	29.6	27.3	1005.44	035	11.8	50	281	168.6
St.44	20090902	1227	24.00	119.50	61	29.6	27.6	1004.55	024	11.6	55	314	188.4
St.45	20090902	1550	24.00	119.99	41	30.2	28.3	1002.77	023	14.5	30	187	112.2
St.46	20090902	2146	24.50	120.50	54	30.3	28.6	1003.30	031	12.4	51	341	204.6
St.47	20090903	0027	24.50	120.00	62	29.3	27.2	1002.79	042	12.8	55	351	210.6
St.48	20090903	0305	24.51	119.50	63	29.1	27.2	1002.41	033	11.8	53	727	436.2
St.49	20090903	0852	25.00	120.00	54	30.3	27.8	1003.84	048	14.2	50	405	243.0
St.50	20090903	1210	25.00	120.50	79	29.5	28.0	1003.66	043	13.8	70	523	313.8
St.51	20090903	1440	25.09	120.92	76	29.9	27.9	1002.95	045	10.6	65	639	383.4
St.52	20090903	1806	25.49	120.50	63	19.9	27.4	1003.66	045	9.8	50	356	213.6
St.53	20090903	2250	25.99	120.99	80	29.8	27.5	1005.26	047	10.2	75	494	296.4
St.54	20090904	0152	25.52	121.01	88	29.9	28.1	1003.48	044	10.5	81	647	388.2
St.55	20090904	0440	25.50	121.49	113	29.8	27.7	1003.13	053	7.6	105	573	343.8
St.56	20090904	0754	25.98	121.50	68	29.5	27.1	1003.26	043	9.4	63	411	246.6
St.57	20090904	1104	26.00	122.00	100	30.2	28.3	1004.37	060	8.6	95	628	376.8
St.58	20090904	1400	26.00	122.50	104	30.4	28.4	1002.59	035	9.6	95	549	329.4
St.59	-	-	-	-	-	-	-	-	-	-	-	-	-
St.60	-	-	-	-	-	-	-	-	-	-	-	-	-
St.61	20090904	2055	25.50	122.50	400	30.7	28.0	1003.48	056	9.8	200	1454	872.4
St.62	20090904	2355	25.49	122.00	119	29.9	28.5	1003.13	040	7.0	110	1020	612.0

表 04.2009-10-13 航次基礎觀測資料
Chart 04. Basic observation data in Oct. 2009

Station	Date	SMT	Lati.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D	Fl. Ct.	V.M.S.
St.01	20091013	1925	24.88	122.01	326	25.6	22.6	1014.42	030	6.0	200	1491	894.6
St.02	20091013	2225	25.01	122.50	1448	27.3	25.4	1014.70	058	8.0	200	1247	748.2
St.03	20091014	0144	25.01	123.01	1602	27.6	25.3	1013.45	064	8.3	200	1515	909.0
St.04	20091014	0653	24.51	122.50	591	28.2	26.3	1014.34	025	13.4	200	1229	737.4
St.05	20091014	1010	24.51	122.01	800	27.6	25.4	1015.59	028	10.0	200	1556	933.6
St.06	20091014	1427	24.00	121.69	495	28.5	26.5	1012.20	052	10.1	200	1349	809.4
St.07	20091014	1717	23.77	121.99	3392	28.0	25.8	1012.92	036	12.4	200	1347	808.2
St.08	20091014	2110	23.77	122.50	3532	28.6	25.4	1015.05	054	13.6	200	1359	815.4
St.09	20091015	0054	23.75	123.00	3642	28.4	25.2	1014.16	008	9.1	200	1170	702.0
St.10	20091015	0554	23.00	123.00	5344	28.7	25.5	1012.92	041	8.3	200	1389	833.4
St.11	20091015	0915	23.01	122.51	5531	29.2	24.5	1013.63	069	8.0	200	1355	813.0
St.12	20091015	1238	23.01	122.01	4880	28.4	26.3	1011.67	048	2.4	200	1010	606.0
St.13	20091015	1618	23.02	121.51	2036	28.6	26.2	1011.14	025	17.2	200	1390	834.0
St.14	20091015	2008	22.68	121.25	1025	28.6	25.9	1013.45	037	14.8	200	1577	946.2
St.15	20091015	2340	22.26	121.01	1209	28.7	27.0	1012.20	032	11.5	200	1525	915.0
St.16	20091016	0300	22.26	121.50	493	28.5	26.3	1010.42	042	12.4	200	213	127.8
St.17	20091016	0620	22.26	122.00	4556	29.1	27.2	1010.78	024	5.0	200	256	153.6
St.18	20091016	0952	22.25	122.50	4846	29.9	27.1	1010.96	118	4.7	200	1489	893.4
St.19	20091016	1320	22.24	123.00	3488	29.7	26.9	1008.47	183	2.4	200	1142	685.2
St.20	20091016	1753	21.50	123.00	4919	29.6	26.5	1008.11	186	4.3	200	1559	935.4
St.21	20091016	2108	21.49	122.50	4788	29.2	25.4	1009.00	238	0.0	200	1603	961.8
St.22	20091017	0025	21.52	122.00	3472	29.4	25.8	1007.48	020	2.0	200	1754	1052.4
St.23	20091017	0355	21.51	121.50	2122	28.9	25.1	1006.51	014	1.0	200	1543	925.8
St.24	20091017	0720	21.50	121.00	1196	28.9	24.2	1007.22	310	7.0	200	1419	851.4
St.25	20091017	1033	21.51	120.50	1629	29.0	26.2	1007.40	041	7.9	200	1300	780.0
St.26	20091017	1325	21.51	120.00	2946	28.8	27.1	1005.97	024	4.4	200	1231	738.6
St.27	20091017	1625	21.51	119.50	2974	28.5	25.3	1005.80	024	2.1	200	1215	729.0
St.28	20091017	1930	21.50	119.00	2756	28.2	24.9	1006.86	046	6.3	200	1208	724.8
St.29	20091017	2255	22.01	119.00	1350	28.4	26.2	1007.93	018	6.4	200	1400	840.0
St.30	20091018	0223	22.00	119.50	2314	28.4	25.2	1007.40	202	2.0	200	1463	877.8
St.31	20091018	0556	22.01	120.00	1091	28.4	24.9	1008.29	338	3.3	200	1355	813.0
St.32	20091018	0908	22.00	120.51	364	28.3	25.4	1009.71	091	11.4	200	1376	825.6
St.33	20091018	1214	22.37	120.33	338	28.4	26.0	1008.47	256	3.7	200	1342	805.2
St.34	20091018	1440	22.49	120.00	562	28.5	25.4	1007.58	232	4.8	200	1344	806.4
St.35	20091018	1804	22.49	119.50	233	28.3	26.2	1008.47	275	4.3	200	1414	848.4
St.36	20091018	2055	22.51	119.02	84	27.4	25.6	1010.25	358	4.1	75	486	291.6
St.37	20091018	2323	22.94	119.10	28	27.2	20.8	1010.42	013	3.1	15	142	85.2
St.38	20091019	0131	23.00	119.50	77	27.0	21.2	1009.89	350	2.4	71	475	285.0
St.39	20091019	0405	23.01	119.91	126	26.9	22.7	1009.18	268	3.1	120	785	471.0
St.40	20091019	0655	23.50	119.92	121	27.3	24.3	1010.42	006	8.0	110	903	541.8
St.41	20091019	0928	23.44	119.45	50	26.6	21.9	1011.31	357	4.2	45	346	207.6
St.42	20091019	1202	23.50	119.00	53	26.7	23.3	1010.25	031	6.4	47	393	235.8
St.43	20091019	1525	24.00	119.00	59	26.1	24.1	1008.82	031	6.7	50	339	203.4
St.44	20091019	1815	24.14	119.50	60	26.4	24.5	1010.07	022	9.0	50	351	210.6
St.45	20091019	2058	24.00	120.00	41	26.9	24.2	1011.49	027	12.4	30	166	99.6
St.46	20091020	0054	24.50	120.50	53	26.7	23.4	1011.14	041	8.0	49	309	185.4
St.47	20091020	0350	24.50	120.00	58	26.6	22.7	1011.31	039	11.1	52	226	135.6
St.48	20091020	0645	24.51	119.51	63	26.8	24.2	1012.38	043	17.8	55	247	148.2
St.49	20091020	1227	25.00	119.99	56	26.3	23.2	1012.03	043	18.3	45	257	154.2
St.50	20091020	1600	25.00	120.50	74	25.4	22.9	1011.31	035	13.3	70	522	313.2
St.51	20091020	1915	25.08	120.91	72	25.6	23.1	1014.16	058	14.8	60	451	270.6
St.52	20091020	2240	25.50	120.50	66	25.4	22.7	1015.59	045	9.6	54	390	234.0
St.53	20091021	0302	26.00	121.01	76	25.9	21.9	1014.52	059	11.9	72	468	280.8
St.54	20091021	0613	25.51	121.00	87	25.9	22.6	1015.05	059	12.0	82	965	579.0
St.55	20091021	1003	25.51	121.49	114	25.8	22.1	1015.76	054	13.7	109	701	420.6
St.56	20091021	1320	26.00	121.50	68	25.9	22.4	1013.63	052	12.6	58	346	207.6
St.57	20091021	1618	26.00	122.00	100	25.1	22.2	1013.45	044	10.4	92	499	299.4
St.58	20091021	1950	26.01	122.49	103	26.2	23.6	1013.45	038	13.8	100	720	432.0
St.59	20091021	2328	26.00	123.00	95	27.1	24.7	1012.56	038	14.2	91	556	333.6
St.60	20091022	0250	25.51	123.00	776	28.1	25.3	1009.89	027	12.6	200	971	582.6
St.61	20091022	0612	25.51	122.50	324	27.4	24.1	1012.03	021	12.8	200	2130	1278.0
St.62	20091022	0855	25.50	122.00	116	25.9	25.1	1013.27	035	8.5	110	619	371.4

國家圖書館出版品預行編目資料

臺灣周邊海域漁場環境監測航次報告. 2009年
Cruise report of TaiCOFI surveys in 2009
劉燈城總編輯－基隆市 農委會水試所,
民100.12
126面; 21×29.7公分 參考書目: 4面
ISBN 978-986031287-4 (平裝)
1.漁場 2.海洋資源 3.環境監測 4.台灣
438.33 98021663

2009年台灣周邊海域漁場環境 監測航次報告

Cruise Report of TaiCOFI Surveys in 2009

發 行 所：行政院農業委員會水產試驗所

發 行 人：蘇偉成

編輯顧問：蘇茂森、劉燈城

總 編 輯：吳繼倫

編輯委員：陳世欽、吳龍靜、鄭學淵

地 址：基隆市中正區20246和一路199號

電 話：02-24622101

傳 真：02-24629388

網 址：<http://www.tfrin.gov.tw>

信 箱：service@mail.tfrin.gov.tw

執行單位：海洋漁業組

編 輯：陳郁凱、蘇博堃、張伯瑋

設計印刷：新視界國際文化(股)公司

電 話：07-3456131

定 價：新台幣200元

出版日期：一百年十二月

I S B N：978-986031287-4

G P N：1010004924



ISBN 978-956031287-4



9 789860 131287

定價 200 元



00200