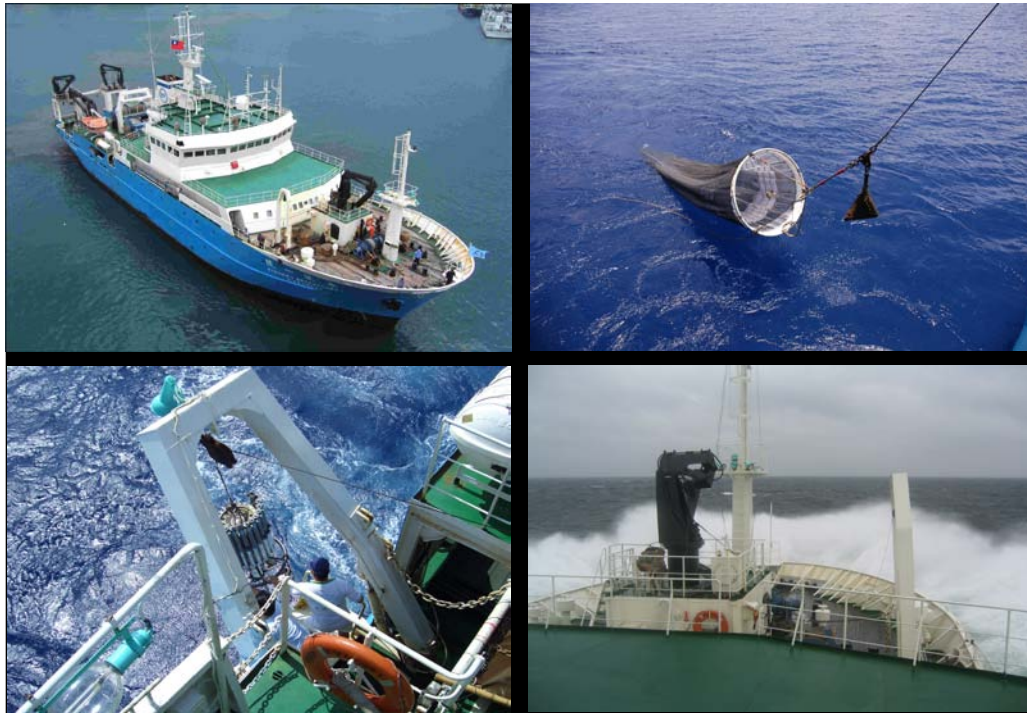




Cruise Report of TaiCOFI Surveys in 2008

2008 年台灣周邊海域漁場環境監測航次報告



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Fisheries Research Institute,
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序

台灣四面環海，緊鄰中國陸棚與西太平洋之交接處，東部岸峻水深，又有黑潮流經，是鯖、鰹、鰹、鮪、旗、鯊、鰻、鰱等洄游性魚類必經之路。西部位於中國陸棚的東陲，海底坡度較為平緩，黑潮支流與大陸沿岸流匯聚於此，孕育了豐富的刺鰩、白鰩、帶魚、海鰻、魷、鰮、鮑等底棲性魚類，實可謂得天獨厚。過去多利用傳統的漁撈經驗及規律來研判漁場位置，但隨著氣候變遷及其他因素，我國許多漁業的主要漁場及漁期已逐漸失去既有的準則，故亟待新模式的建立。

本人於民國 70 年代水產試驗所高雄分所擔任分所長期間，即曾經針對台灣西南部高屏沿海與南中國海海域之漁場環境及水文基礎資料進行調查，惟基於當時的時代背景，係以漁場開發為出發點進行調查；然近 30 年來隨著環境變遷與人類工業開發的影響，漁業資源管理研究已成為首要之務，故本所依據我國周邊海域環境特性，並多次邀請日本東北大學名譽教授川崎健以及美國西南漁業中心 Nancy Lo 博士提供寶貴建議，規劃出台灣周邊海域漁場環境監測計畫的架構，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。

為達到技術成果分享以提昇國內漁業研究能量，本所首次嘗試編撰「2008 年台灣周邊海域漁場環境監測計畫年度航次報告」，將調查成果供各界參考，希冀各界不吝賜教，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，為我國漁業資源的永續利用做出貢獻。同時，亦藉此衷心感謝所有編輯同仁的努力，使得本專輯得以順利付梓。

所長

蘇偉成 謹誌

中華民國九十八年十一月

Preface

Taiwan is an island in the western Pacific Ocean. The Kuroshio continuously flows through the east coast of Taiwan, which comprises a passage for many migratory fishes, such as mackerel, skip jack, tuna, billfish, shark, dolphinfish, etc. The west coast is much shallower and abundant in demersal fishes like Japanese butterfish, silver pomfret, ribbon fish, eels, flounders, croaker, etc. In the past, experience was a major way to determine the fishing ground. However, with the changing of climate, traditional criteria for fishing grounds and fishing season are gradually ineffective for all kinds of fisheries. As a result, a new model has to be established.

In my term as director of Coastal and Offshore Research Center, investigations in the environmental factors and hydrographic conditions in the coastal waters off southwestern Taiwan and South China Sea were conducted. Based on the background of the period, the investigations focused on the development of new fishing grounds. However, with the changing of climate and the development of industries, assessment of the fishery resources became the priority of fishery researches. Therefore, based on the characteristics of surrounding waters of Taiwan, FRI drew up the scheme of TaiCOFI survey to investigate in the dynamics between fishery resources and climate change.

In order to make advances in fisheries research in Taiwan, Fisheries Research Institute published 「Cruise Report of TaiCOFI Surveys in 2008」 to provide our investigation results to the public. Special thanks have to be expressed for the valuable advices given by Professor Emeritus Dr. Kawasaki of Tohoku University and Dr. Nancy Lo of the Southwest Fisheries Science Center generously. In addition, we will extent our special appreciation for your advices to improve this cruise report. In the future, we hope TaiCOFI program make greater contribution to the society, leading fisheries in Taiwan towards sustainability.

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 2008 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：97 農科-15.1.1-水-A1）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 marine environment and aquatic living resources database. 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 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 2008 of the TaiCOFI program. Data from the cruises were collected and processed by personnel of FRI and Dr. Cheng Shiue-Yuan of National Taiwan Ocean University participated in the analysis of primary production. 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.

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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 2008 年 1 月、3 月、7 月及 10 月，進行下列之工作項目：

1.CTD 溫鹽調查：

採用 Seabird9-11 Plus 溫鹽儀 (CTD)，每測站均投放一次(水深不足之測站則以實際水深少 5m 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、150m 等水層之海水各 2000ml。

3.葉綠素甲測定：

取各層海水 1000ml，利用 Millipore 濾紙過濾後，以 -70℃ 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 100ml，以液態氮(-196℃)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 200m 深(水深不足之測站則以實際水深少 5m 為原則)，以 1m/s 速度垂直上揚，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, March, July and October in 2008. The following procedures were conducted at each station.

1. Temperature and salinity: CTD, Seabird SBE-911PLUS, was lowered from the surface to 1000m (or 10m 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 10 liter water sample at specific target depths (5, 25, 50, 75, 100, 150m) as the CTD was raised.
3. Chlorophyll-*a* concentration measurement : 1 liter of sea water samples were immediately filtered through Whatman GF/F filter papers and then put in -70°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 for nutrients concentration measurement in the laboratory.
5. Sampling gear and methods for zooplankton: The ORI net, with a 1.6m diameter mouth opening, 6m in length and 0.333 mm meshes, was towed obliquely to 200m (for shallow areas, 10m 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

取不同海水層水樣低溫保存，另外再取各層海水，將海水經過不同孔徑的濾紙以減壓吸引方式過濾後冷凍保存，運送回研究室分析不同水層水樣之硝酸 (nitrate)、磷酸 (phosphate)、矽酸 (silicate) 等營養鹽、葉綠素甲 (chlorophyll a) 及基礎生產力 (primary productivity) 之濃度。

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 Potassium Persulfate-Molybdenum Blue 法測定，將過濾後之試水加入以 potassium persulfate、ammonia molybdate、硫酸、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，由各波長之吸光值換算為待測物之濃度。

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、NaSO₃ 及 NaHSO₃ 所配製的還原試劑，混合完成後於分光光度計上以 815 nm 測定其吸光值，由各波長之吸光值換算為待測物之濃度。

4. 葉綠素甲測定：

試水經過不同孔徑的濾紙分別取出加入丙酮研磨後，以封口膜封住試管，再以震盪器震盪 45-60 秒，最後放入冰箱冷藏 (-4°C) 24-48 小時，將樣品置於冷凍離心機 4°C、轉速 3000rpm 離心 15 秒後，取出上清液，加入 HCl 待酸化 5 分鐘後，再測其酸化後螢光吸收之值，由各波長之吸光值換算為待測物之濃度。

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，經由 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 150ml 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 150ml 的標本瓶（該瓶分量为 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 250ml 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 毫升沉澱管，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

Sea water sample were filterd through Whatman GF/F filters for inorganic nutrients (NO_3 、 PO_4 、 SiO_4)、Chlorophyll a (Chl-*a*) and primary productivity (PP) were collected at discrete depths (from 5 to 150m) and then were measured in the laboratory. Sea water samples are analyzed with a standard methods depending on variable chemical properties.

1.Nitrate

Nitrate (NO_3) was measured by reducing nitrate to nitrite (NO_2) and then determining the nitrite employing the pink azo dye method .The seawater samples were added with Sulfanilamide and NED solutions until analyzed. For the final the samples concentrations were measured by using a spectrophotometer analyzer at 543nm.

2.Phosphate

Phosphate (PO_4) was determined by the molybdenum blue method. The seawater samples were added with Potassium persulfate 、Sulfuric acid 、ascorbic acid and Potassium antimonyl-tartrat mixed solutions at room temperature. For the final the samples concentrations were measured by using a spectrophotometer analyzer at 885nm.

3.Silicate

Silicate (SiO_4) was measured by the molybdenum blue method. The seawater samples were immediately acidified with 50% Hcl and 10% oxalic acid then was added 1-amino-2-naphthol-4-sulfonic acid 、 NaSO_3 and NaHSO_3 mixed solutions until analyzed. For the final the samples concentrations were measured by using a spectrophotometer analyzer at 815nm.

4.Chlorophyll a

Sample of seawater were filtered through Whatman GF/F filters and preserved in liquid nitrogen until analysis. Pigments were extracted in cold acetone (90%) for 24-48 hours. For the final determination of Chl-*a*, the acetone extracts were acidified, allowing sample was centrifuged at 3000 rpm and 4°C for 15 seconds. For the final determination of chlorophyll and phaeopigments to be independently estimated.

5.Primary productivity

Sample of seawater were cultured in the light and dark tanks for 24h and then was

measured by using a DO meter analyzer in the laboratory. It was measured based on a method of Dissolved Oxygen.

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

<u>單</u>	<u>位</u>	<u>名</u>	<u>稱</u>	<u>研</u>	<u>究</u>	<u>人</u>	<u>員</u>	<u>職</u>	<u>稱</u>
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		李忠憲	Li Zhong-xian	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	約聘研究助理					
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		王友慈	Wang Yu-Tzu	約聘研究助理					
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	約聘研究助理					
農業委員會水產試驗所海洋漁業組		簡煌彬	Jen Hung-Bun	技工					
農業委員會水產試驗所海洋漁業組		張玉真	Chan Yu-Cheng	技工					
農業委員會水產試驗所海洋漁業組		楊珮芬	Yang Pay-Fen	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	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

2008-01-04 航次	所內人員		所外人員	
			海大環漁系研究	
	李忠憲	助理研究員	王河順	生
			海大環漁系研究	
	藍揚麒	聘用研究助理	吳念胤	生
2008-03-13 航次	所內人員		所外人員	
			海大環漁系研究	
	李忠憲	助理研究員	吳念胤	生
			海大環漁系研究	
	藍揚麒	聘用研究助理	劉百蟬	生
			海大環漁系研究	
	莊世昌	聘用研究助理	莊惠婷	生
2008-07-03 航次	所內人員		所外人員	
			海大環漁系研究	
	李忠憲	助理研究員	王河順	生
			海大環漁系研究	
	簡煌彬	專業技工	吳念胤	生
	張玉真	專業技工		
	楊佩芬	專業技工		
2008-10-14 航次	所內人員		所外人員	
			海大環漁系研究	
	莊世昌	聘用研究助理	王河順	生
			海大環漁系研究	
	蕭聖代	聘用研究助理	吳念胤	生
			聘用助理研究	
	潘佳怡	員		
水試一號試驗船人員	簡煌彬	專業技工		
	楊佩芬	專業技工		
	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
廖介生	輪機員
謝耀瑩	輪機員
蔡嘉進	二廚
羅勝義	漁航員
葉日信	漁航員
林冠宏	漁航員
許俊為	漁航員
陳柏青	漁航員

鄭清波	三管
丁振傑	輪機員
陳建良	大廚
林文賢	漁航員
李堂炯	漁航員
蔡安傑	漁航員
陳明展	漁航員
何國銘	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	藍揚麒、李忠憲、陳郁凱、簡煌彬
CTD 溫鹽探測	藍揚麒、李忠憲、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	林芝仔、潘佳怡、王友慈、簡煌彬、 張玉真、楊珮芬、蔣依依

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

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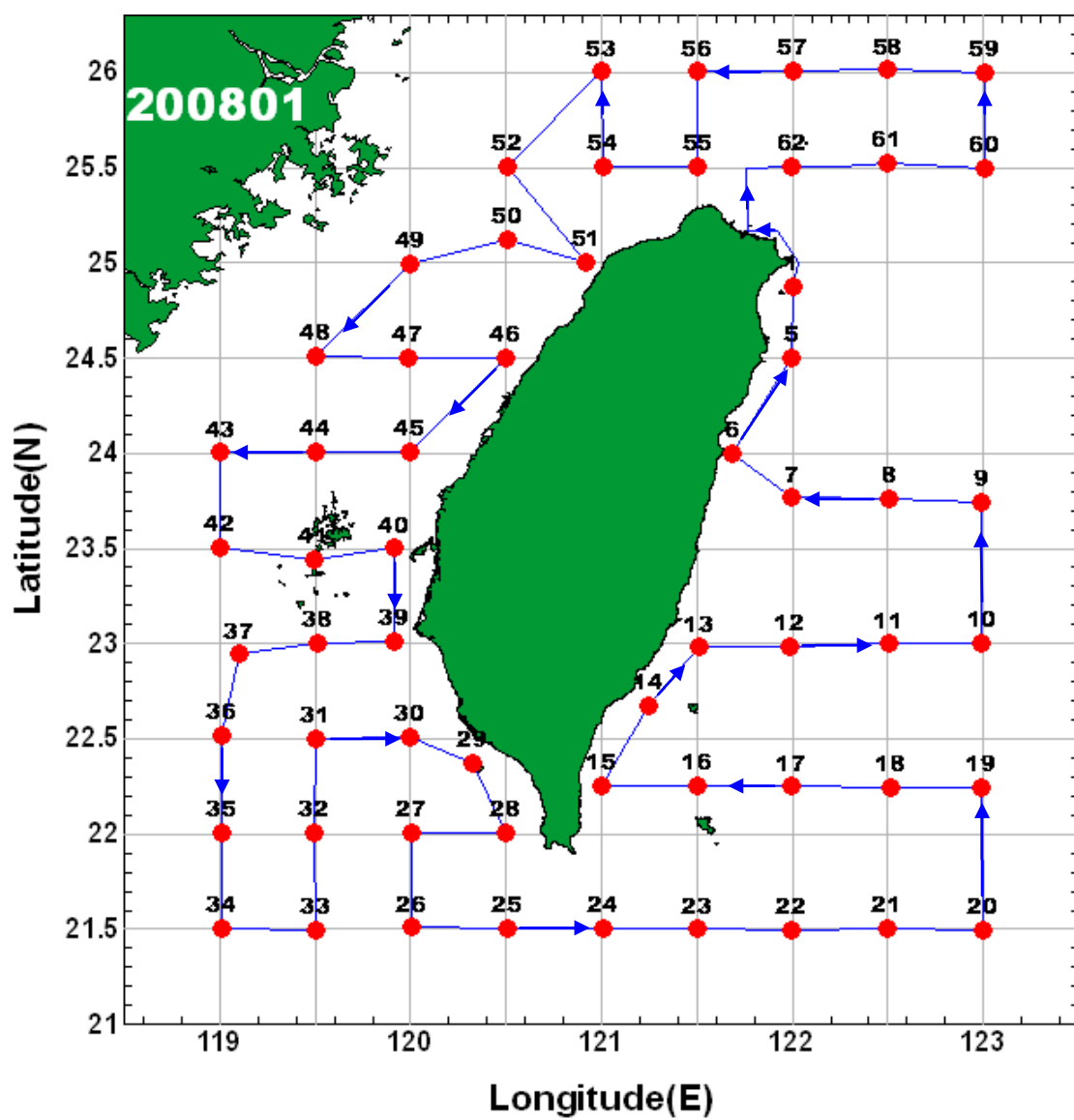


圖 1. 2008-01-04 航次航跡圖

Fig. 1. Stations and Cruise tracks for TaiCOFI Survey in Jan. 2008.

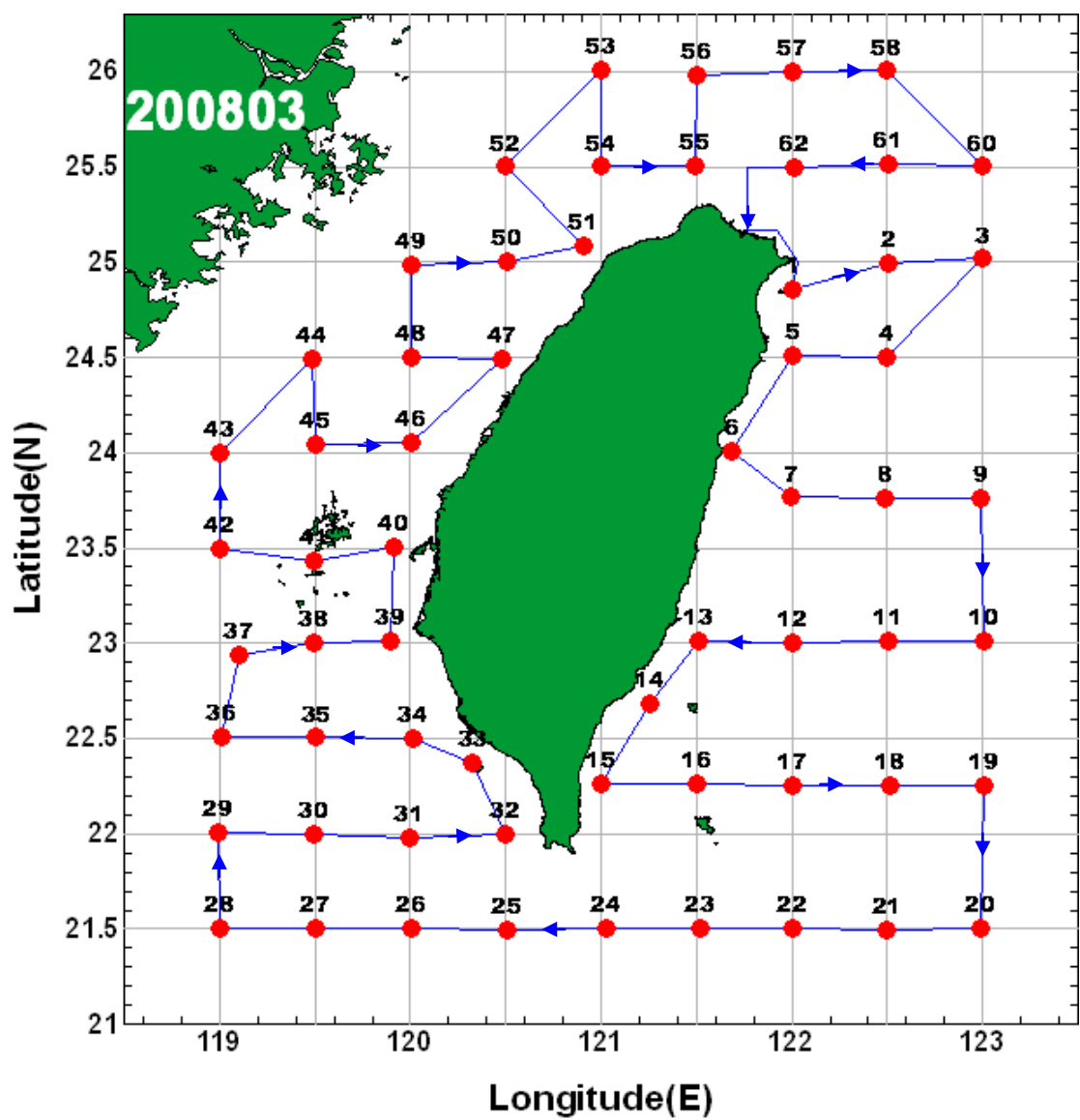


圖 2. 2008-03-13 航次航跡圖

Fig. 2. Stations and Cruise tracks for TaiCOFI Survey in Mar. 2008.

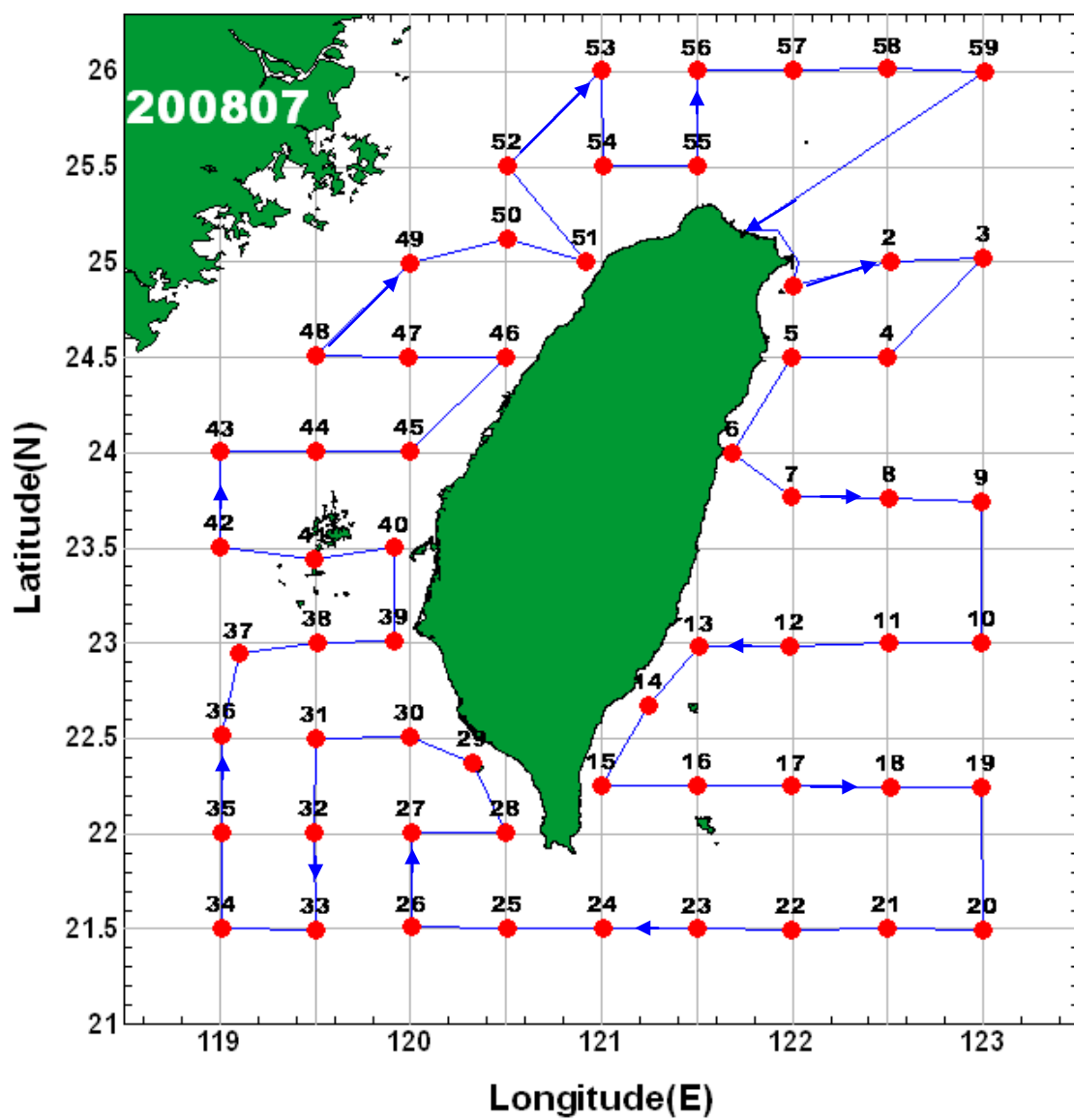


圖 3. 2008-07-03 航次航跡圖

Fig. 3. Stations and Cruise tracks for TaiCOFI Survey in Jul. 2008.

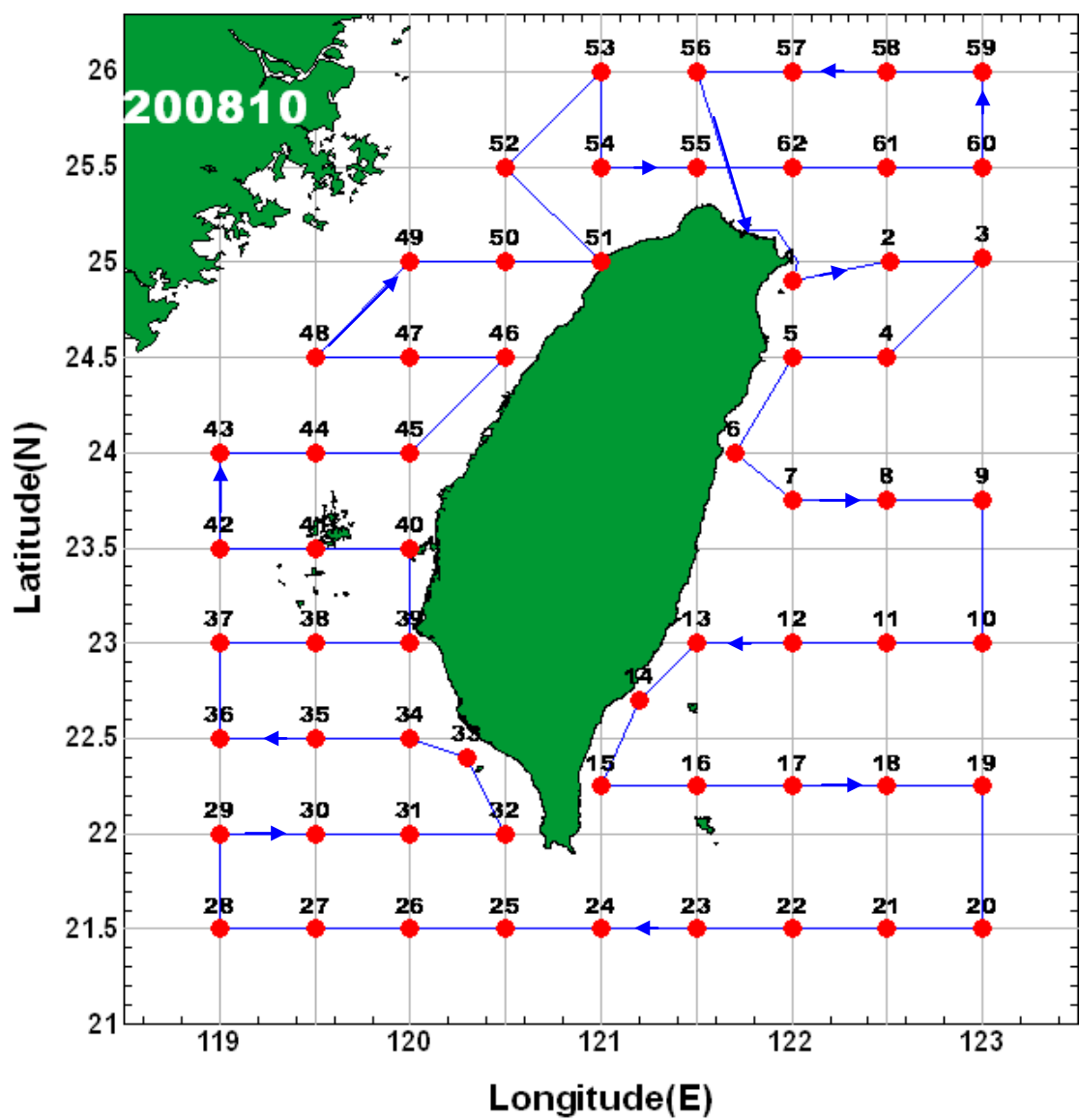


圖 4. 2008-10-14 航次航跡圖

Fig. 4. Stations and Cruise tracks for TaiCOFI Survey in Oct. 2008.

表 1. 2008-01-04 航次基礎觀測資料

Chart 1. Basic observation data in Jan. 2008.

Station	Date	SMT	Lat.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D.	Fl. Ct.	V.W.S.
St.01	20080113	1635	24.87	122.00	284	21.1	16.6	1019.00	011	9.9	200	1487	892.2
St.02													
St.03													
St.04													
St.05	20080113	1354	24.50	122.00	706	23.5	17.3	1018.00	006	15.1	200	1444	866.4
St.06	20080113	0910	24.00	121.68	337	24.4	18.8	1019.00	034	17.9	200	1568	940.8
St.07	20080113	0439	23.77	122.00	3116	25.2	19.3	1014.00	014	21.3	200	1776	1065.6
St.08	20080112	2350	23.76	122.51	3329	25.6	23.1	1015.00	006	16.3	200	1636	981.6
St.09	20080112	2017	23.75	122.99	3618	25.9	23.7	1015.00	020	10.1	200	1685	1011
St.10	20080112	1619	23.00	122.99	5275	26.6	23.8	1013.00	084	8.3	200	1331	798.6
St.11	20080112	1235	23.00	122.50	5532	26.5	23.7	1013.00	116	4.6	200	1464	878.4
St.12	20080112	0148	22.98	121.98	4906	27.1	25.1	1011.00	190	6.06	200	1556	933.6
St.13	20080111	2056	22.98	121.51	1953	26.7	23.9	1012.00	276	5.7	200	1512	907.2
St.14	20080111	1832	22.67	121.25	1119	26.5	23.2	1011.00	002	7	200	1030	618
St.15	20080111	1535	22.25	121.00	1209	26.2	23.1	1011.00	326	3.3	200	1451	870.6
St.16	20080111	1230	22.26	121.50	531	26.8	24.3	1012.00	021	4.6	200	1620	972
St.17	20080111	0914	22.25	122.00	4560	26.6	23.7	1015.00	259	6	200	1320	792
St.18	20080111	0600	22.24	122.51	4862	26.4	23.8	1013.00	114	6.7	200	1732	1039.2
St.19	20080111	0301	22.24	122.99	338	25.4	24.0	1013.00	091	4.2	200	1745	1047
St.20	20080110	2220	21.50	123.00	4917	27.3	24.3	1013.00	113	9.3	200	1285	771
St.21	20080110	1905	21.50	122.50	4790	27.3	24.9	1013.00	099	13	200	1285	771
St.22	20080110	1552	21.50	122.00	3460	27.2	24.6	1012.00	086	12.4	200	1493	895.8
St.23	20080110	1216	21.50	121.50	2126	27.8	24.9	1013.00	087	8.1	200	1237	742.2
St.24	20080110	0850	21.50	121.00	1019	27.0	25.0	1015.00	073	7.4	200	1443	865.8
St.25	20080110	0537	21.51	120.50	1776	27.1	25.0	1013.00	091	10	200	1568	940.8
St.26	20080110	0219	21.51	120.00	2958	25.8	24.6	1012.00	109	10.8	200	1462	877.2
St.27	20080108	0235	21.50	119.50	2990	25.4	24.0	1014.00	106	6.7	200	1574	944.4
St.28	20080107	2333	21.50	119.00	2800	25.4	24.0	1015.00	085	7.5	200	1722	1033.2
St.29	20080107	2010	22.01	119.01	1450	25.0	22.7	1016.00	023	7.5	200	1520	912
St.30	20080108	0605	22.00	119.50	2358	23.9	23.7	1014.00	107	5	200	1637	982.2
St.31	20080109	2210	22.00	120.00	1175	27.4	24.5	1014.00	081	9.6	200	1227	736.2
St.32	20080109	1940	22.01	120.50	312	26.7	24.2	1012.00	067	9.6	200	1646	987.6
St.33	20080109	1645	22.37	120.33	493	26.7	24.5	1012.00	167	4.2	200	1231	738.6
St.34	20080108	1214	22.51	119.99	730	26.3	23.0	1014.00	000	6.3	200	1466	879.6
St.35	20080108	0920	22.50	119.50	230	26.0	23.4	1016.00	016	5.7	200	1451	870.6
St.36	20080107	1724	22.52	119.01	82	24.9	21.9	1015.00	037	3.6	72	550	330
St.37	20080107	1507	22.94	119.10	28	24.1	21.0	1014.00	014	6.1	20	200	120
St.38	20080107	1250	23.00	119.51	72	25.4	22.8	1016.00	008	5.2	65	474	284.4
St.39	20080107	1030	23.01	119.92	124	25.0	23.0	1017.00	011	6.5	100	837	502.2
St.40	20080107	0700	23.50	119.92	121	24.1	20.5	1017.00	012	8.3	115	1427	856.2
St.41	20080107	0440	23.44	119.50	52	22.4	19.9	1016.00	009	8	48	402	241.2
St.42	20080107	0210	23.50	119.00	52	21.3	18.9	1016.00	021	8.1	45	346	207.6
St.43	20080106	2322	24.00	119.01	61	20.7	18.7	1018.00	354	3.6	40	257	154.2
St.44	20080106	2045	24.01	119.50	64	22.4	18.4	1017.00	033	6.6	60	532	319.2
St.45	20080106	1807	24.00	120.00	40	22.1	18.3	1017.00	014	9.2	35	382	229.2
St.46	20080106	1420	24.50	120.50	52	19.6	17.4	1016.00	021	10.7	47	450	270
St.47	20080106	1136	24.50	119.99	62	19.5	16.1	1018.00	032	12.3	55	386	231.6
St.48	20080106	0848	24.51	119.50	61	21.0	16.1	1019.00	030	14.3	45	247	148.2
St.49	20080106	0445	25.00	120.00	51	19.6	15.4	1017.00	020	12	45	231	138.6
St.50	20080106	0150	25.12	120.50	77	19.4	17.2	1018.00	032	10	70	525	315
St.51	20080105	2311	25.01	120.92	79	19.4	17.5	1018.00	058	11.9	70	440	264
St.52	20080105	1955	25.50	120.50	65	19.6	16.7	1019.00	050	9.7	45	255	153
St.53	20080105	1615	26.00	121.00	78	20.2	15.8	1019.00	045	9.6	73	575	345
St.54	20080105	1303	25.51	121.01	86	20.2	16.5	1018.00	024	12.8	85	1357	814.2
St.55	20080105	0950	25.50	121.51	120	20.2	17.2	1021.00	032	8.7	100	141	84.6
St.56	20080105	0720	26.00	121.50	68	20.8	16.5	1012.00	022	10.1	65	1092	655.2
St.57	20080105	0443	26.01	122.00	100	21.6	16.7	1018.00	004	8.5	80	681	408.6
St.58	20080105	0217	26.01	122.50	105	21.8	16.3	1018.00	009	12.4	99	653	391.8
St.59	20080104	2335	26.00	123.00	93	22.8	17.3	1017.00	015	9	75	662	397.2
St.60	20080104	2030	25.50	123.00	774	23.2	19.2	1018.00	216	7.2	200	1673	1003.8
St.61	20080104	1706	25.52	122.49	209	21.6	17.5	1018.00	278	3.1	200	1697	1018.2
St.62	20080104	1325	25.51	122.00	117	19.6	16.2	1018.00	044	8.4	110	906	543.6

表 2. 2008-03-13 航次基礎觀測資料

Chart 2. Basic observation data in Mar. 2008.

Station	Date	SMT	Lat.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D.	Fl. Ct.	V.W.S.
St.01	20080313	1645	24.52	122.00	377	23.0	20.6	1012.00	005	11.0	200	2157	1294.20
St.02	20080313	1949	24.60	122.30	1467	23.9	20.0	1013.00	130	6.0	200	1469	881.40
St.03	20080313	2257	25.01	122.60	1607	23.9	20.0	1013.30	329	9.8	200	1964	1178.40
St.04	20080313	0334	24.60	122.30	642	25.0	21.1	1012.00	351	10.9	200	1663	997.80
St.05	20080314	0704	24.31	122.00	876	23.9	20.0	1013.00	030	14.0	200	1347	808.20
St.06	20080314	1100	24.01	121.41	318	25.7	20.3	1015.00	070	11.0	200	1868	1120.80
St.07	20080314	1428	23.46	121.60	3112	25.5	20.0	1013.00	040	12.0	200	1653	991.80
St.08	20080314	1800	23.45	122.29	3218	25.2	21.2	1013.00	032	10.9	200	1809	1085.40
St.09	20080314	2138	23.46	122.59	3646	24.3	20.6	1015.00	019	11.0	200	1561	936.60
St.10	20080315	0240	23.01	123.00	5747	25.4	21.3	1013.00	270	9.0	200	1963	1177.80
St.11	20080315	0550	23.01	122.30	5522	25.1	21.8	1015.00	027	9.2	200	1469	881.40
St.12	20080315	0905	23.00	122.00	4884	25.8	23.3	1015.00	064	6.2	200	1598	958.80
St.13	20080315	1224	23.01	121.31	2057	25.9	21.6	1014.00	058	9.0	200	1426	855.60
St.14	20080315	1605	22.41	121.15	1084	26.9	22.6	1013.00	120	9.0	200	1440	864.00
St.15	20080315	1945	22.16	121.00	1116	22.6	22.0	1014.00	006	9.8	200	1490	894.00
St.16	20080315	2300	22.16	121.30	460	26.5	23.6	1013.00	044	7.8	200	1175	705.00
St.17	20080316	0157	22.15	121.60	4568	26.5	23.1	1012.00	130	6.0	200	1287	772.20
St.18	20080316	0515	22.15	122.31	4872	26.8	23.4	1011.90	125	5.0	200	1725	1035.00
St.19	20080316	0820	22.15	123.00	3623	27.1	23.9	1013.20	090	5.6	200	1291	774.60
St.20	20080316	1305	21.30	122.59	4655	27.1	25.7	1011.10	112	3.0	200	1530	918.00
St.21	20080316	1604	22.30	122.30	4789	27.4	24.1	1010.00	040	5.0	200	2030	1218.00
St.22	20080316	1909	21.30	122.00	3469	27.0	24.5	1011.10	095	5.0	200	1125	675.00
St.23	20080316	2228	21.30	121.31	2054	27.2	24.4	1011.00	095	7.8	200	1372	823.20
St.24	20080317	0210	21.30	121.01	894	27.4	24.6	1009.70	085	6.6	200	1935	1161.00
St.25	20080317	0534	21.30	120.30	1749	27.0	24.2	1010.10	090	5.0	200	1572	943.20
St.26	20080317	0854	21.30	120.00	2935	26.5	24.2	1010.60	080	5.0	200	1212	727.20
St.27	20080317	1210	21.30	111.30	2996	26.9	24.7	1010.00	048	4.8	200	1030	618.00
St.28	20080317	1523	21.30	119.00	2766	26.8	24.2	1007.60	033	7.3	200	1114	668.40
St.29	20080317	1940	22.00	118.60	1339	26.0	22.9	1009.70	028	8.5	200	1508	904.80
St.30	20080317	2341	22.00	119.29	2272	26.0	24.1	1010.30	150	4.6	200	1380	828.00
St.31	20080318	0330	21.59	119.60	1126	26.6	25.1	1008.50	145	3.6	200	1487	892.20
St.32	20080318	0719	21.60	120.30	245	27.0	25.0	1009.90	105	5.2	200	1246	747.60
St.33	20080318	1036	22.23	120.20	472	25.6	25.8	1010.30	121	2.2	200	1010	606.00
St.34	20080318	1304	22.30	120.01	618	25.4	25.1	1007.80	122	2.2	200	981	588.60
St.35	20080318	11631	22.30	119.30	233	25.8	23.8	1007.20	003	5.6	200	1186	711.60
St.36	20080318	150	22.30	119.00	85	25.4	22.8	1009.50	026	3.3	80	592	355.20
St.37	20080318	2238	22.56	119.06	30	24.8	22.0	1009.70	040	5.3	15	124	74.40
St.38	20080319	0102	23.00	119.30	77	25.1	23.2	1009.70	326	3.0	70	561	336.60
St.39	20080319	0346	23.01	119.54	122	25.4	22.9	1008.50	355	9.3	100	962	577.20
St.40	20080319	0650	23.30	119.55	121	25.4	23.1	1009.50	006	11.3	100	604	362.40
St.41	20080319	0936	23.26	119.30	58	24.5	21.9	1011.90	070	10.2	42	314	188.40
St.42	20080319	1211	23.30	119.00	54	24.2	21.4	1012.20	000	13.2	49	269	161.40
St.43	20080320	1816	23.60	119.00	58	22.2	16.6	1013.00	026	11.3	50	423	253.80
St.44	20080321	0215	24.03	119.30	69	23.0	16.9	1014.00	010	10.6	66	860	516.00
St.45	20080321	0507	24.03	120.00	42	23.2	18.8	1014.00	010	12.5	35	342	205.20
St.46	20080321	0838	24.29	120.29	52	23.8	21.8	1014.00	227	2.2	46	297	178.20
St.47	20080321	1105	24.30	120.00	63	22.6	17.2	1013.00	007	11.7	50	358	214.80
St.48	20080320	2340	24.30	119.29	72	22.5	16.9	1012.00	359	12.9	60	615	369.00
St.49	20080321	1449	24.59	120.00	50	21.1	14.9	1011.00	015	12.8	45	280	168.00
St.50	20080321	1726	25.00	120.31	74	21.5	17.5	1011.00	012	8.8	69	529	317.40
St.51	20080321	1955	25.05	120.54	72	22.9	19.9	1011.00	115	5.0	70	797	478.20
St.52	20080321	2337	25.30	120.30	66	21.4	16.5	1012.00	350	6.2	60	553	331.80
St.53	20080322	0309	26.00	120.60	78	20.8	15.1	1011.00	060	4.6	72	612	367.20
St.54	20080322	0613	25.30	120.60	90	21.9	18.4	1011.00	030	2.6	84	818	490.80
St.55	20080322	0916	25.30	121.30	116	22.6	20.2	1012.00	269	4.0	110	761	456.60
St.56	20080322	1209	25.59	121.30	68	23.2	18.3	1010.00	178	2.0	60	1012	607.20
St.57	20080322	1427	25.60	120.00	100	21.7	18.9	1009.00	121	0.0	95	338	202.80
St.58	20080322	1648	26.00	122.30	104	23.2	20.9	1009.00	230	4.2	98	631	378.60
St.59													
St.60	20080323	2109	25.30	122.60	775	25.6	23.2	1010.00	172	9.0	200	1511	906.60
St.61	20080323	0023	25.31	122.30	326	25.0	20.2	1009.00	120	8.1	200	1780	1068.00
St.62	20080323	0356	25.30	122.01	114	21.0	19.6	1010.00	035	11.2	105	617	370.20

表 3. 2008-07-03 航次基礎觀測資料

Chart 3. Basic observation data in Jul. 2008.

Station	Date	SMT	Lat.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D.	Fl. Ct.	V.W.S.
St.01	20080703	1320	24.52	122.01	0344	29.8	28.7	1002.19	185	7.5	200	2	1.2
St.02	20080704	1818	24.59	122.30	1469	29.7	28.7	1001.30	167	8.1	200	1089	653.4
St.03	20080704	2114	25.01	123.01	1633	30.2	29.1	1000.80	181	7.2	200	1237	742.2
St.04	20080704	0320	24.30	122.31	0595	28.3	28.0	1001.80	187	7.5	200	780	468.0
St.05	20080705	0800	24.31	122.01	1039	29.7	28.5	1000.20	200	6.4	200	1449	869.4
St.06	20080705	1330	24.01	122.41	0741	30.8	29.0	1000.70	169	6.0	200	972	583.2
St.07	20080705	1615	23.45	122.00	3445	31.4	29.3	999.90	172	6.5	200	1200	720.0
St.08	20080705	1917	23.45	122.30	3092	31.1	29.3	1001.10	166	6.0	200	991	594.6
St.09	20080705	2229	23.45	122.59	3618	30.8	29.8	1002.40	175	6.7	200	1121	672.6
St.10	20080706	0345	20.00	123.00	5566	30.8	27.8	1009.50	145	4.3	200	1092	655.2
St.11	20080706	0702	23.00	122.30	5533	30.7	28.0	1001.70	242	9.1	200	882	529.2
St.12	20080706	1003	23.00	122.00	4905	30.7	28.8	1001.10	134	0.0	200	941	564.6
St.13	20080706	1330	23.00	121.31	2130	31.4	28.8	1000.60	119	2.0	200	1091	654.6
St.14	20080706	1745	22.40	121.15	1174	31.2	27.9	1000.10	134	0.0	200	1001	600.6
St.15	20080706	2139	22.15	121.00	1210	30.2	27.2	1000.80	014	3.6	200	1128	676.8
St.16	20080707	0048	22.15	121.29	0484	30.4	27.6	999.90	042	0.0	200	1206	723.6
St.17	20080707	0352	22.15	121.59	4574	28.1	27.2	999.40	105	0.0	200	1221	732.6
St.18	20080707	0710	22.15	122.30	4871	30.0	29.6	999.50	065	0.0	200	1376	825.6
St.19	20080707	1020	22.15	122.60	3630	31.4	28.5	1000.20	100	0.0	200	990	594.0
St.20	20080707	1450	22.30	122.60	4973	31.8	29.0	999.50	190	3.6	200	1131	678.6
St.21	20080707	1750	21.30	122.30	4784	31.5	28.9	998.80	296	0.0	200	1324	794.4
St.22	20080707	2100	21.30	121.60	3464	31.0	26.7	1001.70	275	2.8	200	1110	666.0
St.23	20080708	2415	21.30	121.33	4178	30.4	28.4	1000.00	269	2.4	200	1142	685.2
St.24	20080708	0322	21.31	120.60	1209	30.3	25.9	1000.10	258	3.0	200	1321	792.6
St.25	20080708	0659	21.30	120.31	1888	30.4	28.4	1001.10	168	4.3	200	1054	632.4
St.26	20080708	1020	21.30	120.00	2946	30.8	27.4	1001.50	173	8.4	200	1062	637.2
St.27	20080708	1320	21.30	119.30	2975	30.7	25.1	1000.40	215	14.5	200	1148	688.8
St.28	20080708	1639	21.30	119.02	2815	29.1	28.3	1000.60	190	8.8	200	1049	629.4
St.29	20080708	1950	22.00	120.30	1472	30.5	25.2	1002.20	183	7.1	200	1217	730.2
St.30	20080708	2300	22.00	119.30	2432	30.2	26.6	1003.30	200	14.4	200	1224	734.4
St.31	20080710	1605	22.60	120.00	1184	29.2	26.7	999.70	188	2.2	200	1299	779.4
St.32	20080710	1310	22.00	120.30	0304	29.3	25.9	1000.60	266	1.0	200	991	594.6
St.33	20080710	1020	22.23	120.20	0326	29.5	25.1	1001.50	263	7.3	185	1300	780.0
St.34	20080710	1922	22.30	119.60	0634	29.3	27.0	1000.10	208	1.7	200	1002	601.2
St.35	20080710	2216	22.31	119.30	0241	29.0	24.5	998.80	034	0.0	200	996	597.6
St.36	20080711	0112	22.30	119.14	0086	29.3	27.7	999.40	025	0.0	80	511	306.6
St.37	20080711	0332	22.56	119.06	0027	29.3	25.6	999.40	031	2.0	22	160	96.0
St.38	20080711	0528	23.00	119.30	0073	28.8	25.6	998.30	129	4.2	68	282	169.2
St.39	20080711	0730	22.60	119.51	0121	29.6	26.9	998.40	160	3.1	120	579	347.4
St.40	20080711	1014	23.30	119.55	0094	30.1	27.0	998.30	214	4.2	105	638	382.8
St.41	20080711	1230	23.26	119.30	0051	28.8	26.2	997.60	206	5.2	45	296	177.6
St.42	20080711	1459	23.30	119.00	0051	29.0	26.1	995.00	214	5.9	47	223	133.8
St.43	20080711	1725	23.55	119.00	0060	29.5	28.2	995.30	200	7.6	55	213	127.8
St.44	20080711	1950	23.60	119.30	0063	29.2	25.9	996.50	177	5.8	48	215	129.0
St.45	20080711	2210	24.00	120.00	0040	29.2	27.2	997.60	186	6.4	30	180	108.0
St.46	20080712	0126	24.16	120.16	0042	29.5	26.1	997.20	189	5.7	45	293	175.8
St.47	20080712	0400	24.17	120.16	0060	29.5	26.1	997.20	208	8.5	50	207	124.2
St.48	20080712	0640	24.30	119.30	0060	28.8	26.6	996.00	232	3.4	55	207	124.2
St.49	20080712	0950	25.00	120.00	0051	29.4	27.8	955.00	306	0.0	46	252	151.2
St.50	20080712	1157	25.00	120.30	0076	28.9	27.7	997.10	034	0.0	65	333	199.8
St.51	20080712	1355	25.05	120.54	0075	29.9	28.4	996.00	283	4.0	60	239	143.4
St.52	20080712	1650	25.31	120.31	0066	29.5	27.1	995.50	160	2.4	60	206	123.6
St.53	20080712	2004	25.60	121.00	0080	29.2	28.1	997.60	114	3.6	69	272	163.2
St.54	20080713	0225	25.30	120.60	0090	29.2	26.4	997.60	247	4.3	85	150	90.0
St.55	20080713	0505	25.30	121.30	0115	29.6	26.8	998.10	358	0.0	105	292	175.2
St.56	20080713	0802	25.60	121.30	0068	29.5	26.9	999.90	245	1.7	63	188	112.8
St.57	20080713	1028	25.59	121.60	0100	29.9	26.7	999.90	197	4.3	90	348	208.8
St.58	20080713	1906	25.59	122.30	0106	30.5	28.4	999.40	149	4.7	100	226	135.6
St.59	20080713	2135	26.02	122.60	0097	29.8	28.2	1001.50	140	3.4	92	201	120.6
St.60													
St.61													
St.62													

表 4. 2008-10-14 航次基礎觀測資料

Chart 4. Basic observation data in Oct. 2008.

Station	Date	SMT	Lat.	Long.	Depth	SST	Air T.	Air P.	Wind D.	Wind F.	O.N.D.	Fl. Ct.	V.W.S.
St.01	20081014	1220	24.86	122.01	375	26.6	23.6	1014.52	166	1.7	200	1589	953.4
St.02	20081014	1604	25.00	122.51	1440	28.8	26.4	1013.63	053	9.0	200	1071	642.6
St.03	20081014	1917	25.02	123.00	1587	28.8	26.1	1015.76	047	8.8	200	1164	698.4
St.04	20081014	2350	24.50	122.50	595	29.2	26.3	1015.41	050	9.0	200	1055	633
St.05	20081015	0310	24.51	122.00	656	29.4	26.5	1015.00	042	5.6	200	1117	670.2
St.06	20081015	0806	24.01	121.69	504	28.8	26.2	1015.76	076	2.2	200	941	564.6
St.07	20081015	10045	23.77	121.99	3232	28.8	27.1	1014.52	066	8.6	200	1112	667.2
St.08	20081015	1400	23.76	122.49	3160	29.2	26.2	1012.38	061	13.4	200	889	533.4
St.09	20081015	1745	23.76	122.99	2700	28.1	26.7	1012.83	048	11.7	200	1036	621.6
St.10	20081015	2228	20.01	123.01	5408	29.1	25.8	1011.85	063	11.0	200	1136	681.6
St.11	20081016	0140	23.01	122.50	5508	29.7	27.2	1010.42	040	12.9	200	1482	889.2
St.12	20081016	0500	23.01	122.01	4878	29.9	26.5	1010.25	069	10.3	200	1482	889.2
St.13	20081016	0940	23.01	121.51	1982	29.7	24.2	1012.56	046	6.3	200	1442	865.2
St.14	20081016	1247	22.68	121.25	1176	28.5	26.3	1010.42	012	8.6	200	1172	703.2
St.15	20081016	1610	22.27	121.00	1208	28.9	27.0	1009.18	046	1.1	200	1192	715.2
St.16	20081016	1928	22.26	121.50	512	28.3	25.6	1011.67	025	7.1	200	1068	640.8
St.17	20081016	2242	22.25	122.00	4561	28.7	26.4	1011.37	066	5.4	200	1460	876
St.18	20081017	0150	22.25	122.51	4840	28.8	26.9	1010.60	056	5.7	200	1158	694.8
St.19	20081017	0500	22.25	123.01	3400	28.9	27.6	1009.53	032	3.4	200	1083	649.8
St.20	20081017	1000	21.50	122.99	5026	29.5	28.0	1010.78	324	2.2	200	1216	729.6
St.21	20081017	1305	21.49	122.50	4780	29.4	27.2	1009.19	009	2.2	200	1352	811.2
St.22	20081017	1610	21.50	122.00	3447	29.5	20.0	1008.80	063	10.9	200	1386	831.6
St.23	20081017	1900	21.50	121.52	2076	29.3	16.8	1009.89	063	9.6	200	1173	703.8
St.24	20081017	2216	21.50	121.02	1176	29.4	22.9	1010.96	062	10.8	200	1311	786.6
St.25	20081018	0200	21.50	120.51	1742	28.2	27.2	1009.53	064	10.4	200	510	306
St.26	20081018	0521	21.50	120.01	2947	29.4	27.7	1009.53	081	10.0	200	1770	1062
St.27	20081018	0830	21.50	119.51	2936	28.7	28.6	1012.20	235	2.2	200	1263	757.8
St.28	20081018	1150	21.50	119.00	2812	28.8	27.1	1011.31	343	5.0	200	1111	666.6
St.29	20081018	1510	22.01	118.99	1394	29.2	26.5	1010.66	351	6.4	200	1351	810.6
St.30	20081018	1753	22.00	119.49	2381	28.8	28.7	1011.49	286	0.0	200	1285	771
St.31	20081018	2106	21.98	119.99	1092	28.9	27.3	1012.20	181	0.0	200	1068	640.8
St.32	20081019	0014	21.99	121.50	270	29.1	27.3	1011.49	270	3.7	200	678	406.8
St.33	20081019	0245	22.38	120.33	149	28.6	26.2	1010.66	051	2.2	120	773	463.8
St.34	20081019	0442	22.50	120.01	677	28.8	26.7	1010.85	200	0.0	200	976	585.6
St.35	20081019	0740	22.51	119.51	218	28.8	26.7	1010.60	283	0.0	200	917	550.2
St.36	20081019	1005	22.51	119.01	85	28.3	26.7	1012.30	323	2.2	80	427	256.2
St.37	20081019	1241	22.94	119.10	30	28.3	28.1	1009.98	039	10.9	24	176	105.6
St.38	20081019	1450	23.00	119.49	76	28.8	26.5	1009.53	356	7.0	70	374	224.4
St.39	20081019	1705	23.01	119.90	126	28.8	26.9	1009.77	352	7.2	115	511	306.6
St.40	20081019	2018	23.51	119.91	104	28.3	26.5	1010.60	014	7.1	102	461	276.6
St.41	20081019	2240	23.44	119.50	50	27.3	25.7	1011.37	016	7.1	40	202	121.2
St.42	20081020	0110	23.50	119.00	54	27.7	25.6	1011.14	028	12.1	49	199	119.4
St.43	20081020	0430	24.00	119.00	61	27.3	25.5	1011.53	019	14.4	60	345	207
St.44	20081020	0735	24.04	119.50	66	27.0	25.6	1010.80	044	16.5	48	211	126.6
St.45	20081020	1010	24.05	120.00	38	27.0	26.3	1009.00	020	7.5	30	185	111
St.46	20081020	1330	24.49	120.48	54	27.9	26.5	1010.25	003	7.4	45	175	105
St.47	20081020	1605	24.50	120.01	62	27.2	25.4	1009.71	020	11.4	55	266	159.6
St.48	20081020	1830	24.49	119.48	67	27.0	25.1	1011.14	033	13.6	60	288	172.8
St.49	20081020	2250	24.99	120.00	54	25.2	23.9	1006.00	043	10.1	43	231	138.6
St.50	20081021	0207	25.00	120.51	77	25.7	23.9	1009.00	049	11.5	72	442	265.2
St.51	20081021	0419	25.09	120.91	74	26.9	24.7	1007.00	033	2.0	70	406	243.6
St.52	20081021	0733	25.50	120.50	62	26.9	24.7	1007.00	064	11.0	55	300	180
St.53	20081021	1111	26.01	121.00	76	27.9	25.4	1011.09	043	7.0	70	374	224.4
St.54	20081021	1406	25.50	121.00	89	27.7	25.5	1009.07	082	8.2	80	458	274.8
St.55	20081021	1650	25.50	121.49	118	26.4	25.6	1010.07	093	8.4	100	589	353.4
St.56	20081022	1214	25.98	121.50	68	27.4	26.2	1010.25	249	2.0	60	259	155.4
St.57	20081022	0940	26.00	120.00	99	27.0	26.2	1012.03	182	0.0	92	440	264
St.58	20081022	0708	26.00	122.50	103	28.3	26.7	1011.67	214	1.0	99	603	361.8
St.59	20081022	0420	26.00	123.00	94	28.1	25.7	1010.78	220	0.0	85	452	271.2
St.60	20081022	0114	25.50	122.98	776	28.2	26.3	1011.49	269	0.0	200	1096	657.6
St.61	20081021	2225	25.17	122.50	405	26.2	26.2	1012.74	092	2.0	200	1227	736.2
St.62	20081021	1934	25.50	120.00	116	25.5	24.8	1011.85	092	8.4	110	537	322.2

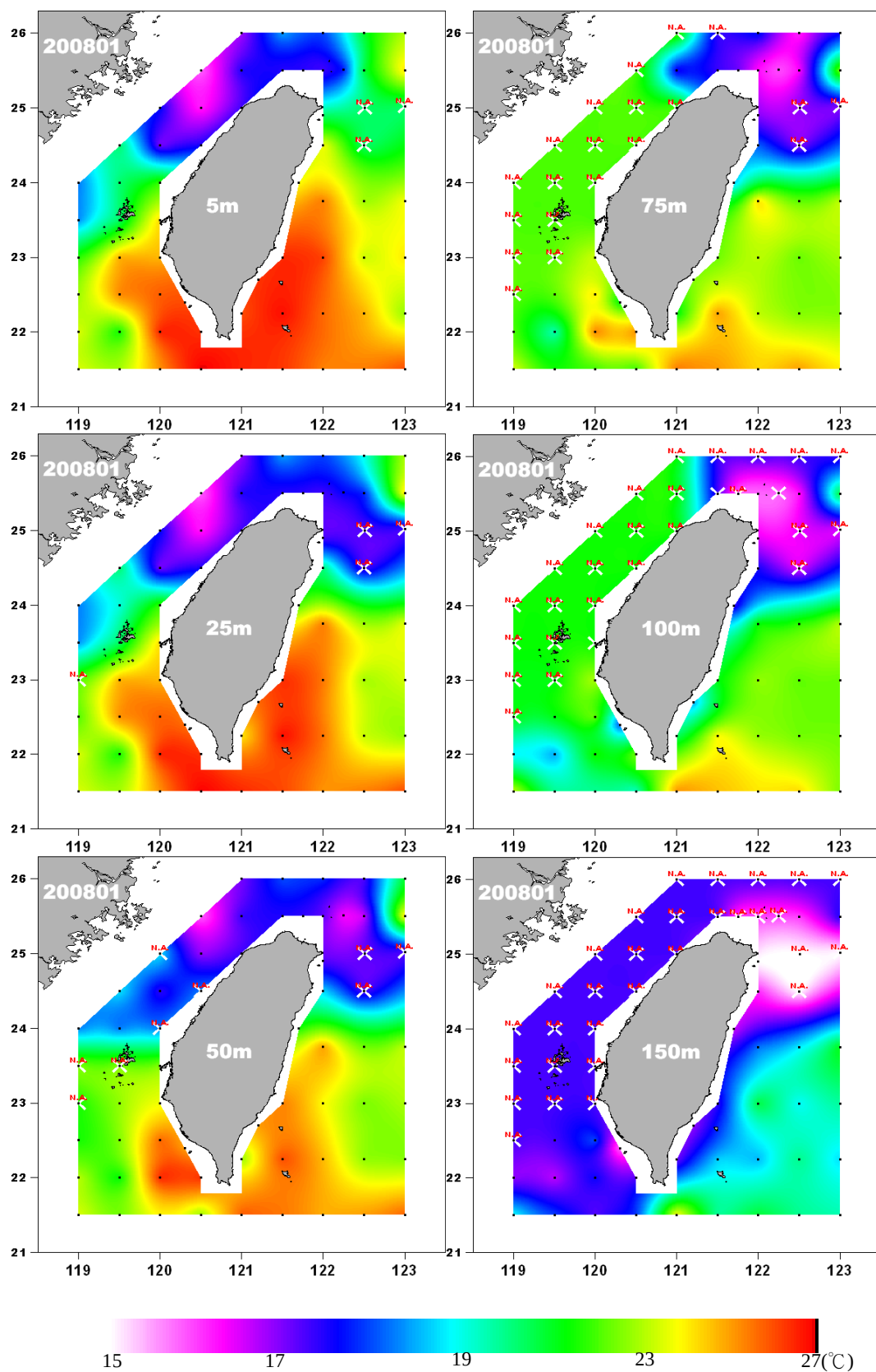


圖 5. 2008-01-04 航次水溫分布
Fig. 5. Temperature distribution in Jan. 2008.

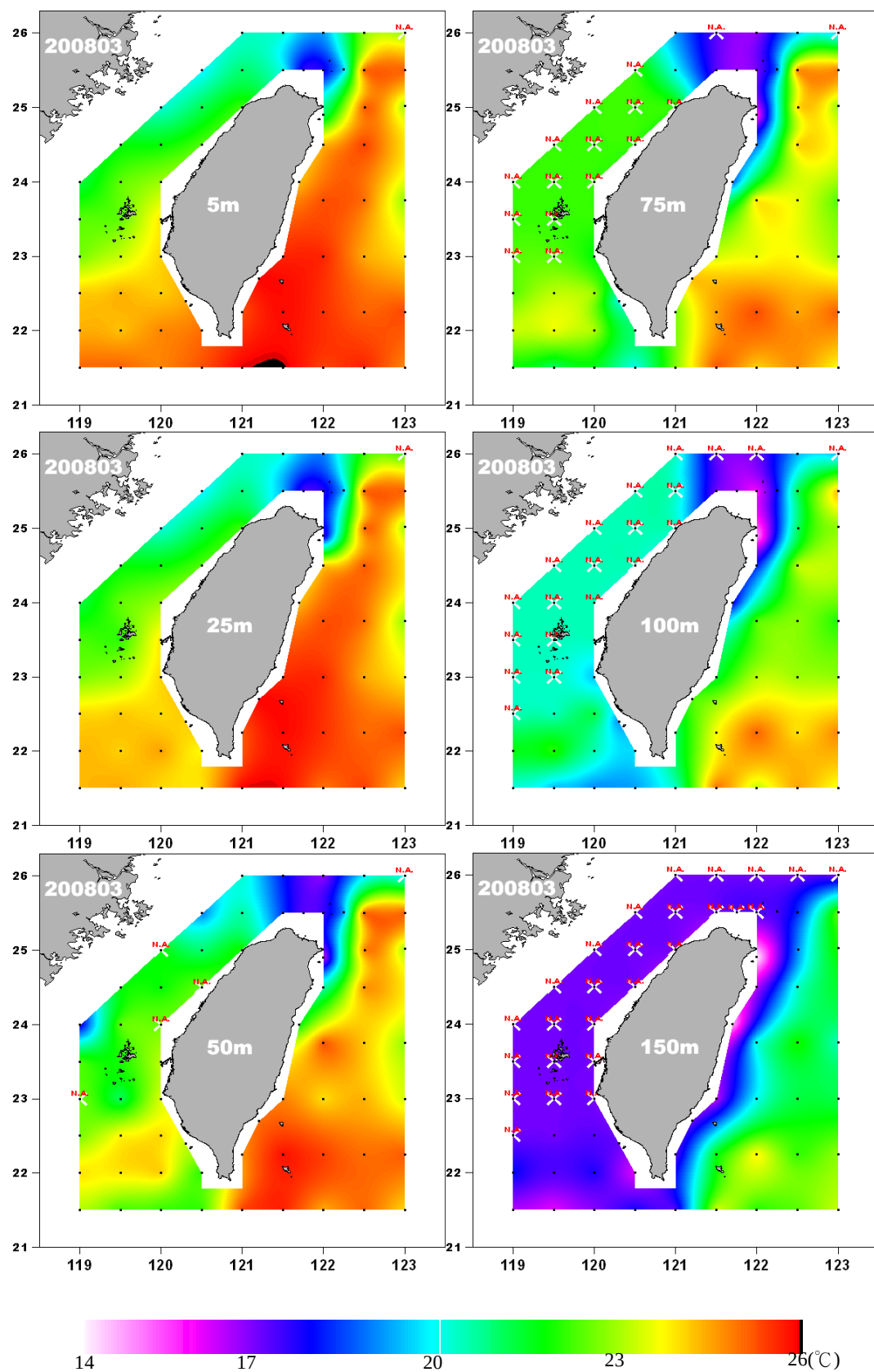


圖 6. 2008-03-13 航次水溫分布
Fig. 6. Temperature distribution in Mar. 2008.

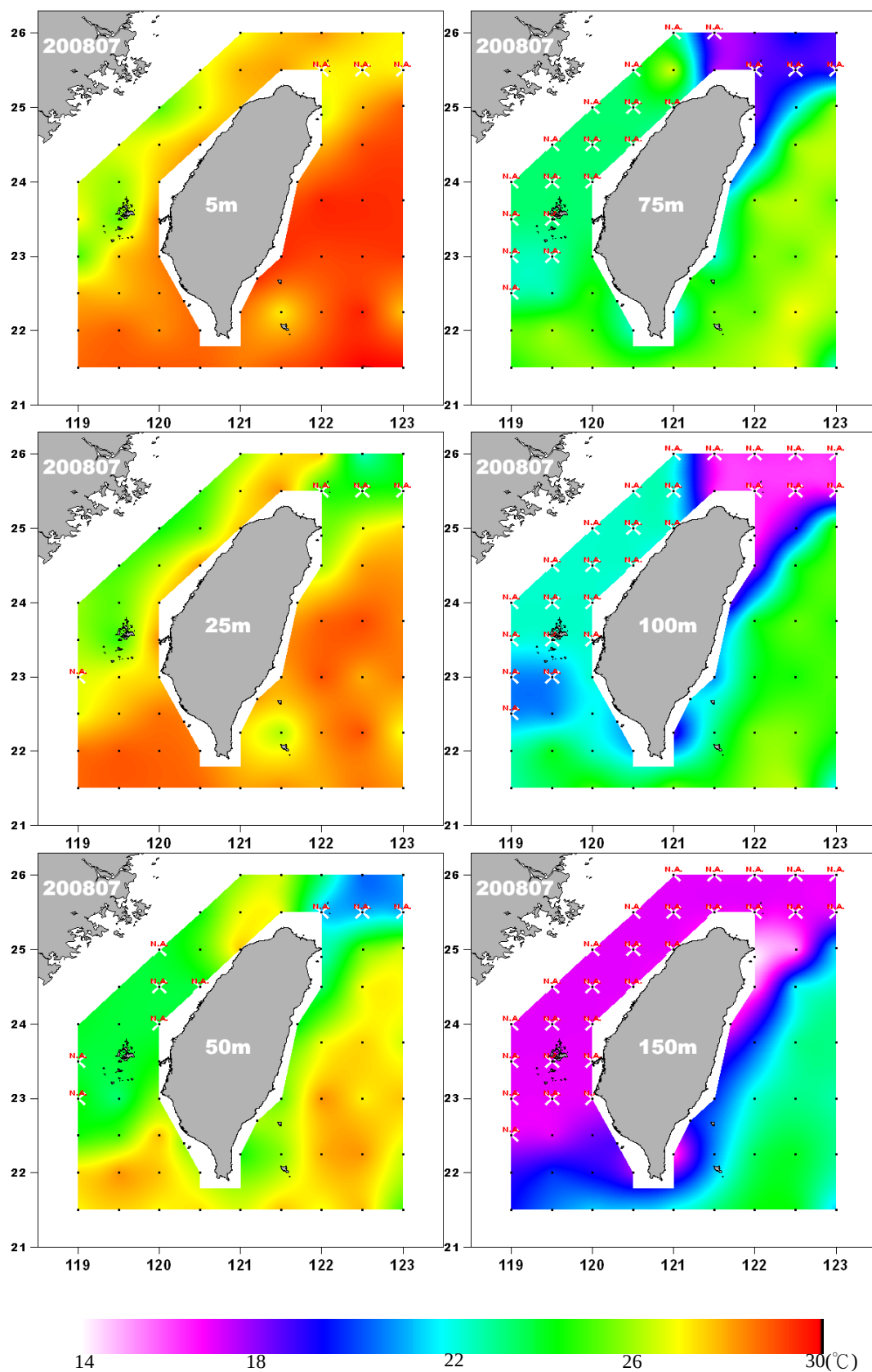


圖 7. 2008-07-03 航次水溫分布
Fig. 7. Temperature distribution in Jul. 2008.

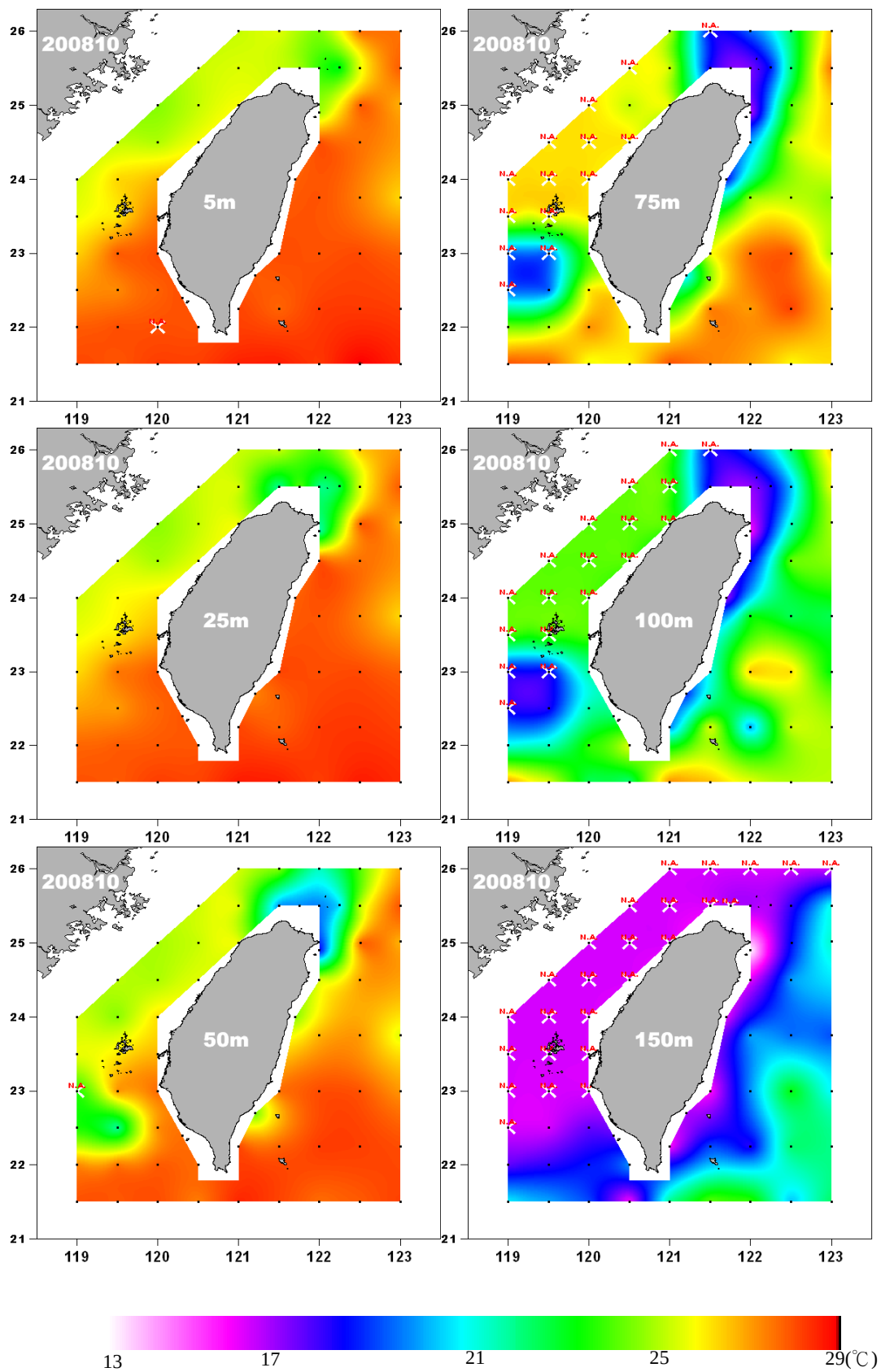


圖 8. 2008-10-14 航次水溫分布
Fig. 8. Temperature distribution in Oct. 2008.

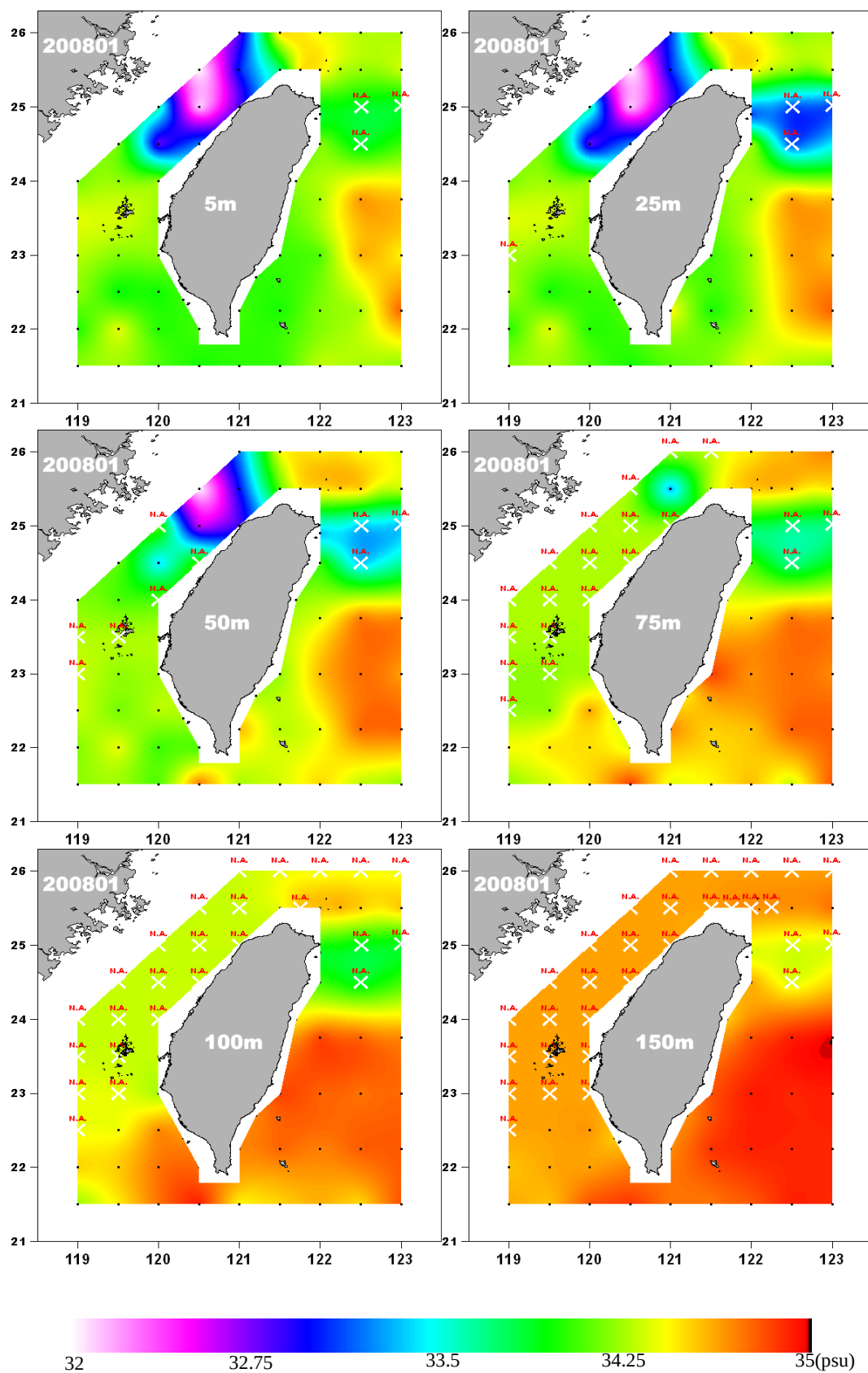


圖 9. 2008-01-04 航次鹽度分布
Fig. 9. Salinity distribution in Jan. 2008.

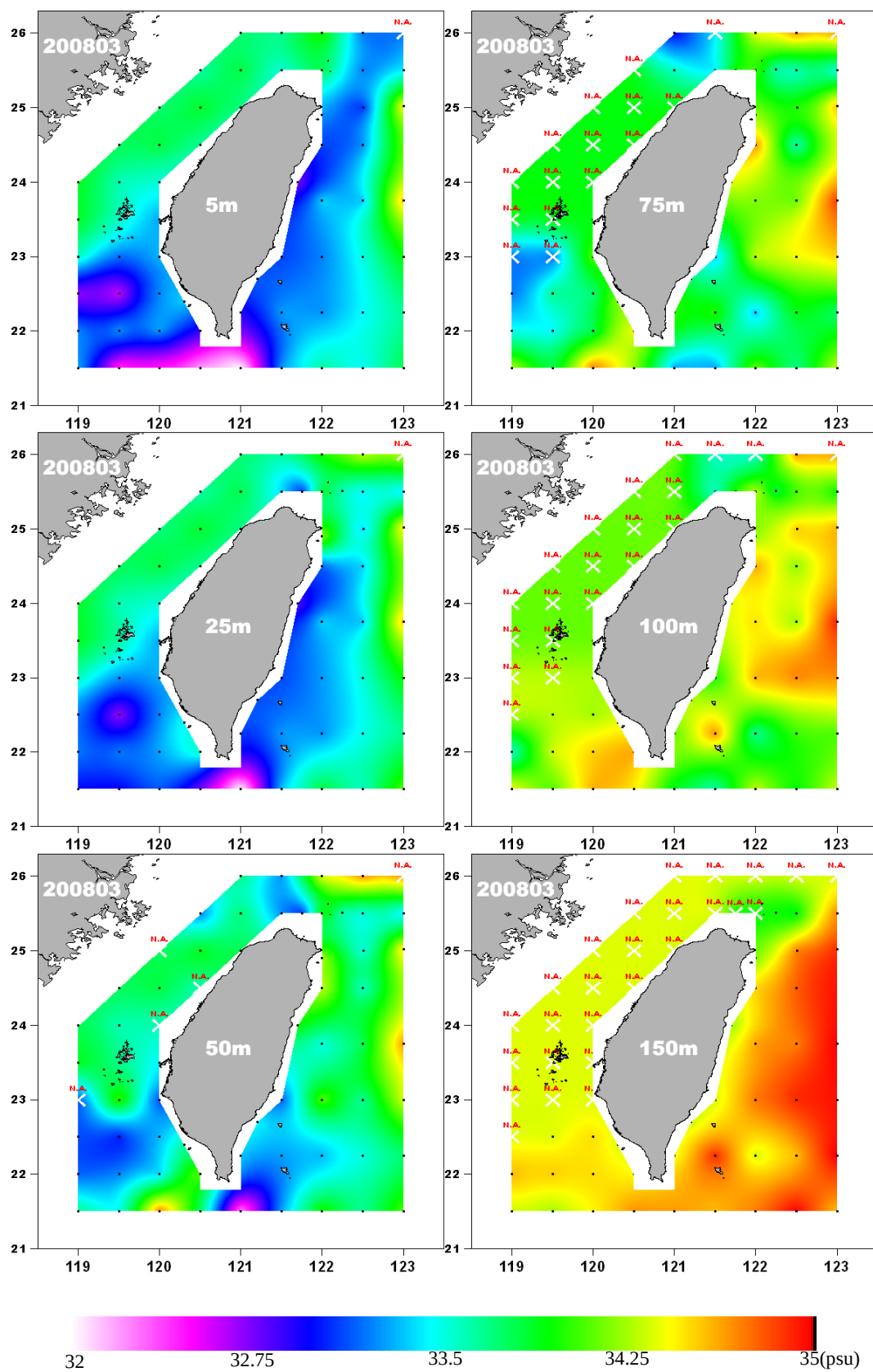


圖 10. 2008-03-13 航次鹽度分布
Fig. 10. Salinity distribution in Mar. 2008.

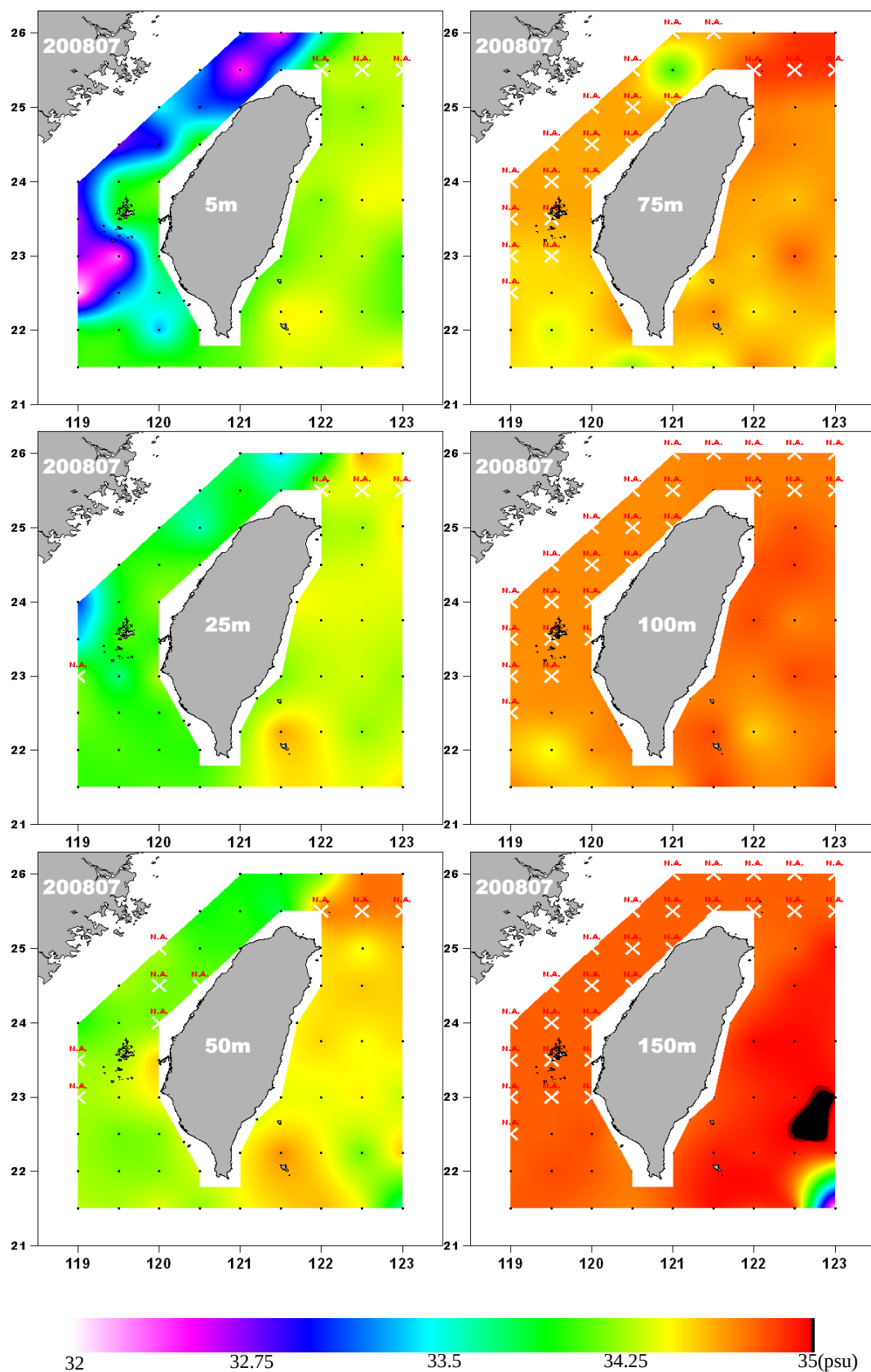


圖 11. 2008-07-03 航次鹽度分布
Fig. 11. Salinity distribution in Jul. 2008.

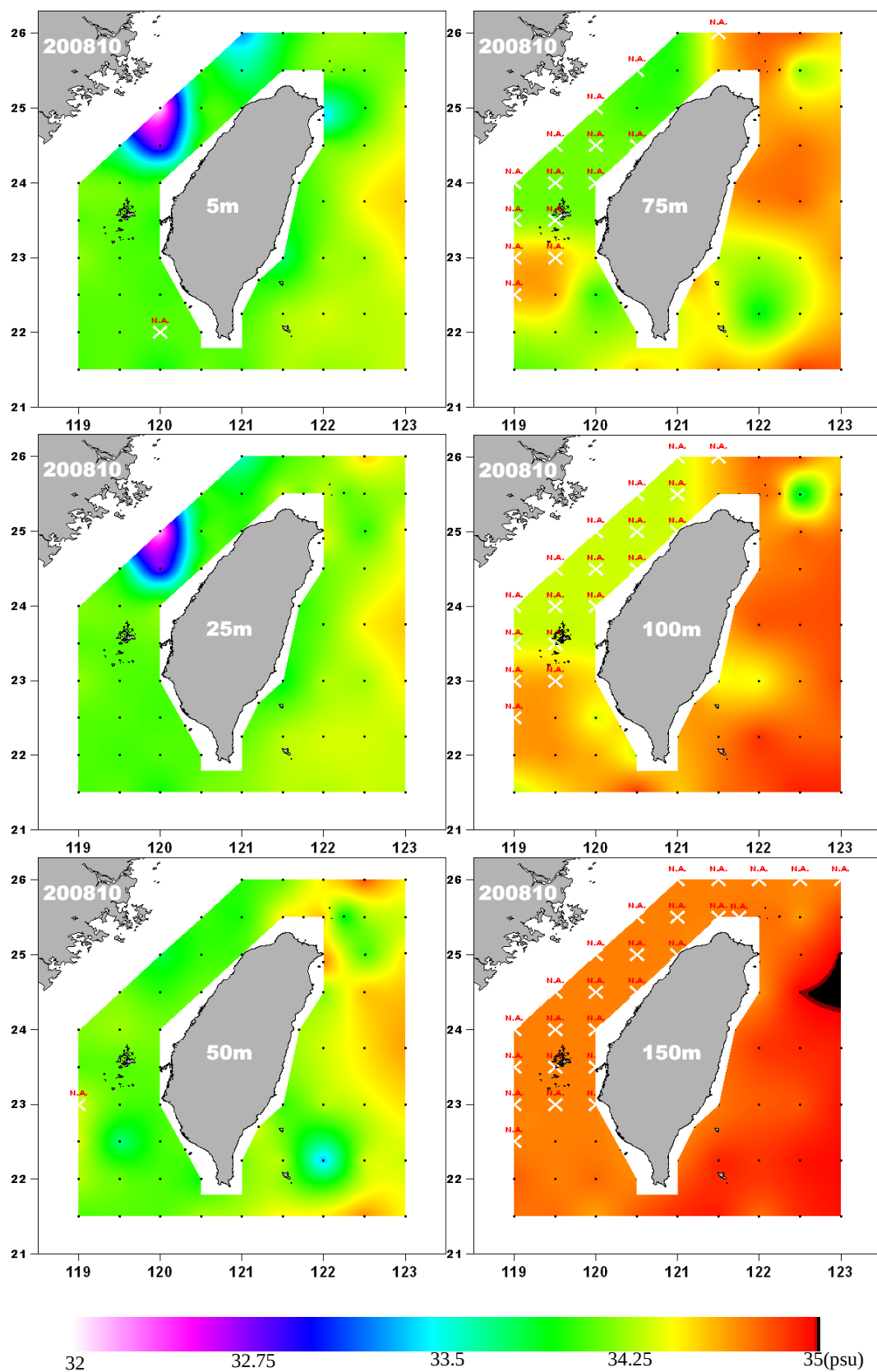


圖 12. 2008-10-14 航次鹽度分布
Fig. 12. Salinity distribution in Oct. 2008.

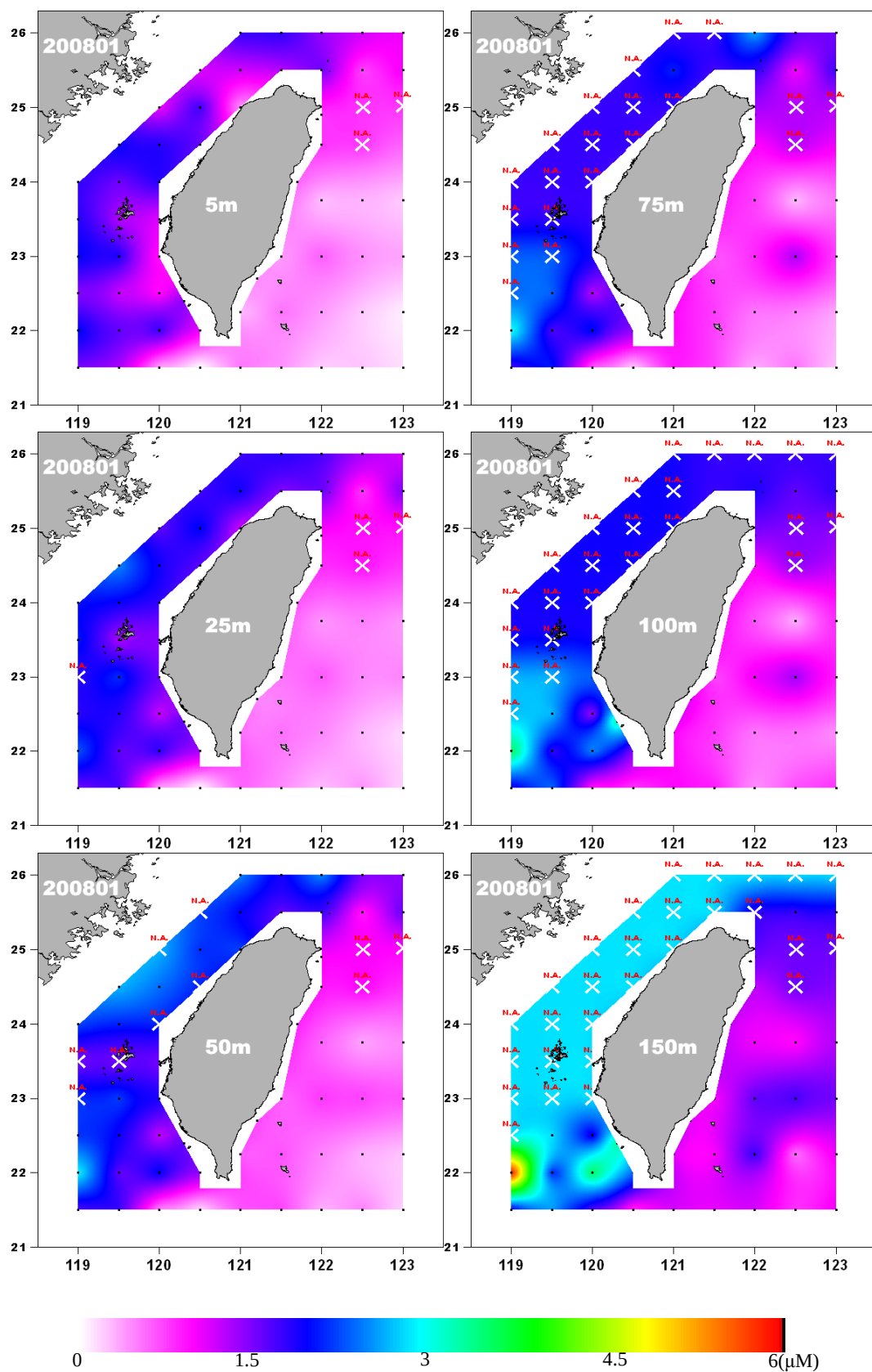


圖 13. 2008-01-04 航次硝酸鹽(NO_3)濃度分布
 Fig. 13. Nitrate (NO_3) distribution in Jan. 2008.

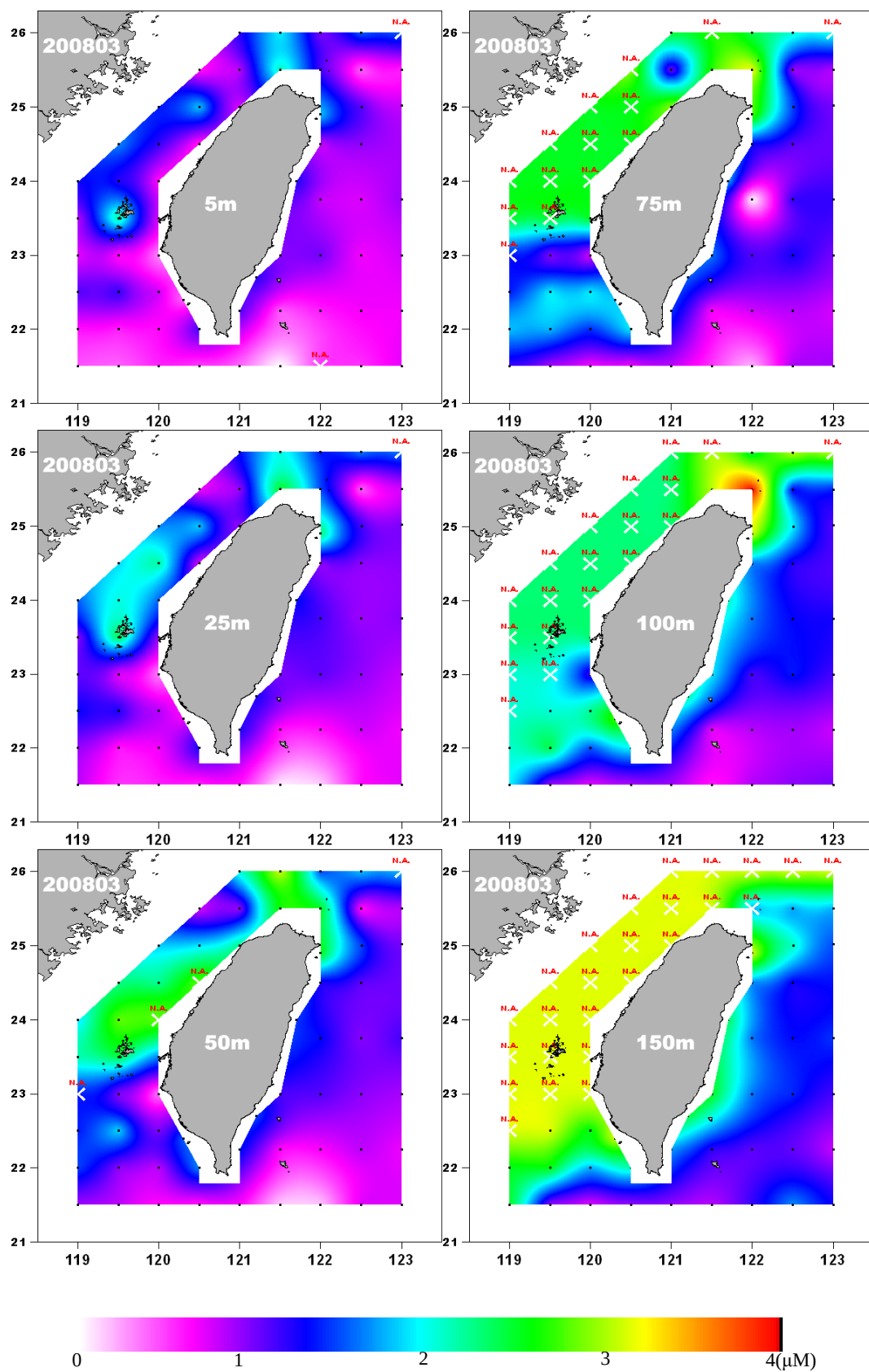


圖 14. 2008-03-13 航次硝酸鹽(NO₃)濃度分布
 Fig. 14. Nitrate (NO₃) distribution in Mar. 2008.

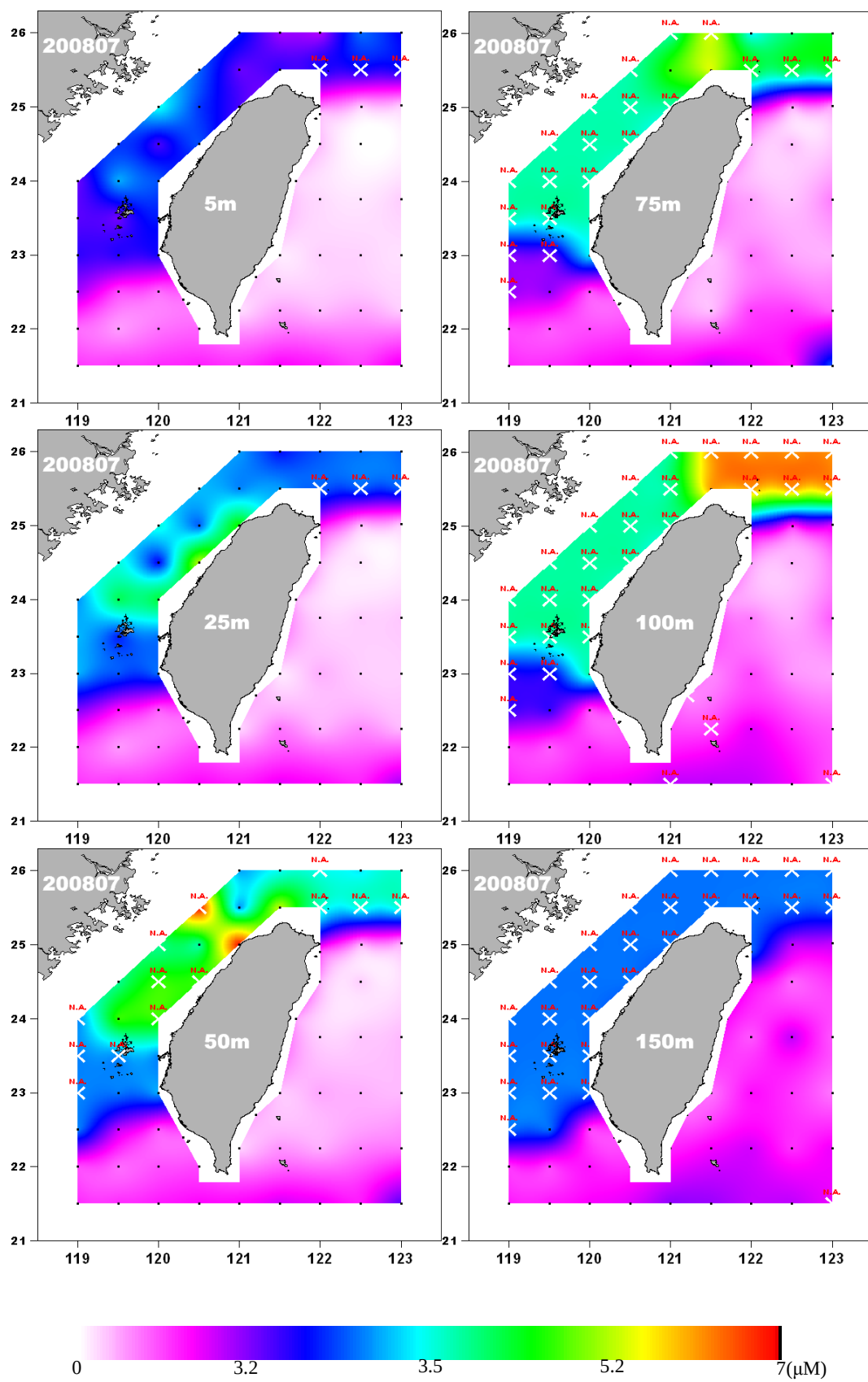


圖 15. 2008-07-03 航次硝酸鹽(NO₃)濃度分布
 Fig. 15. Nitrate (NO₃) distribution in Jul. 2008.

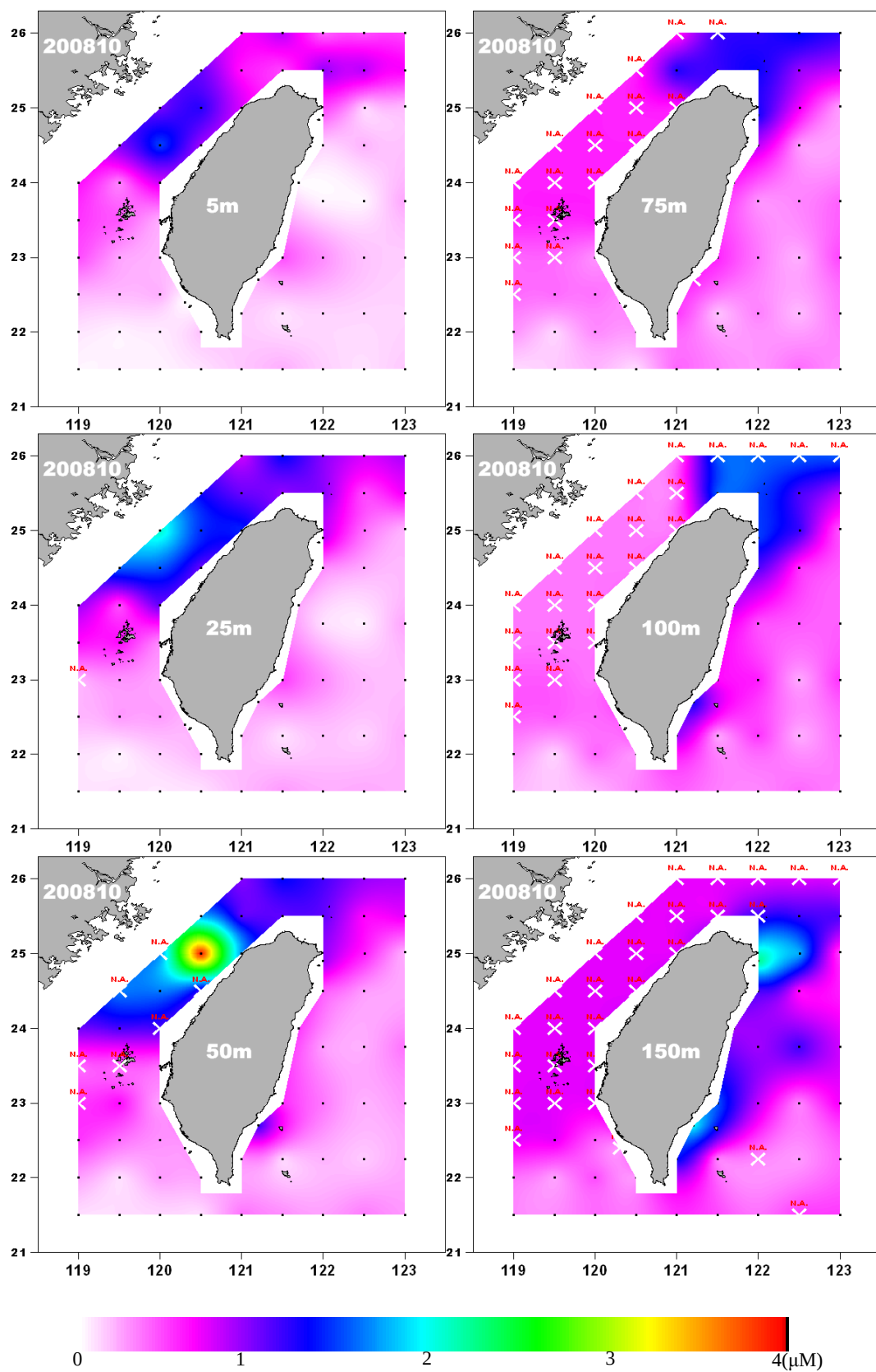


圖 16. 2008-10-14 航次硝酸鹽(NO_3)濃度分布
 Fig. 16. Nitrate (NO_3) distribution in Oct. 2008.

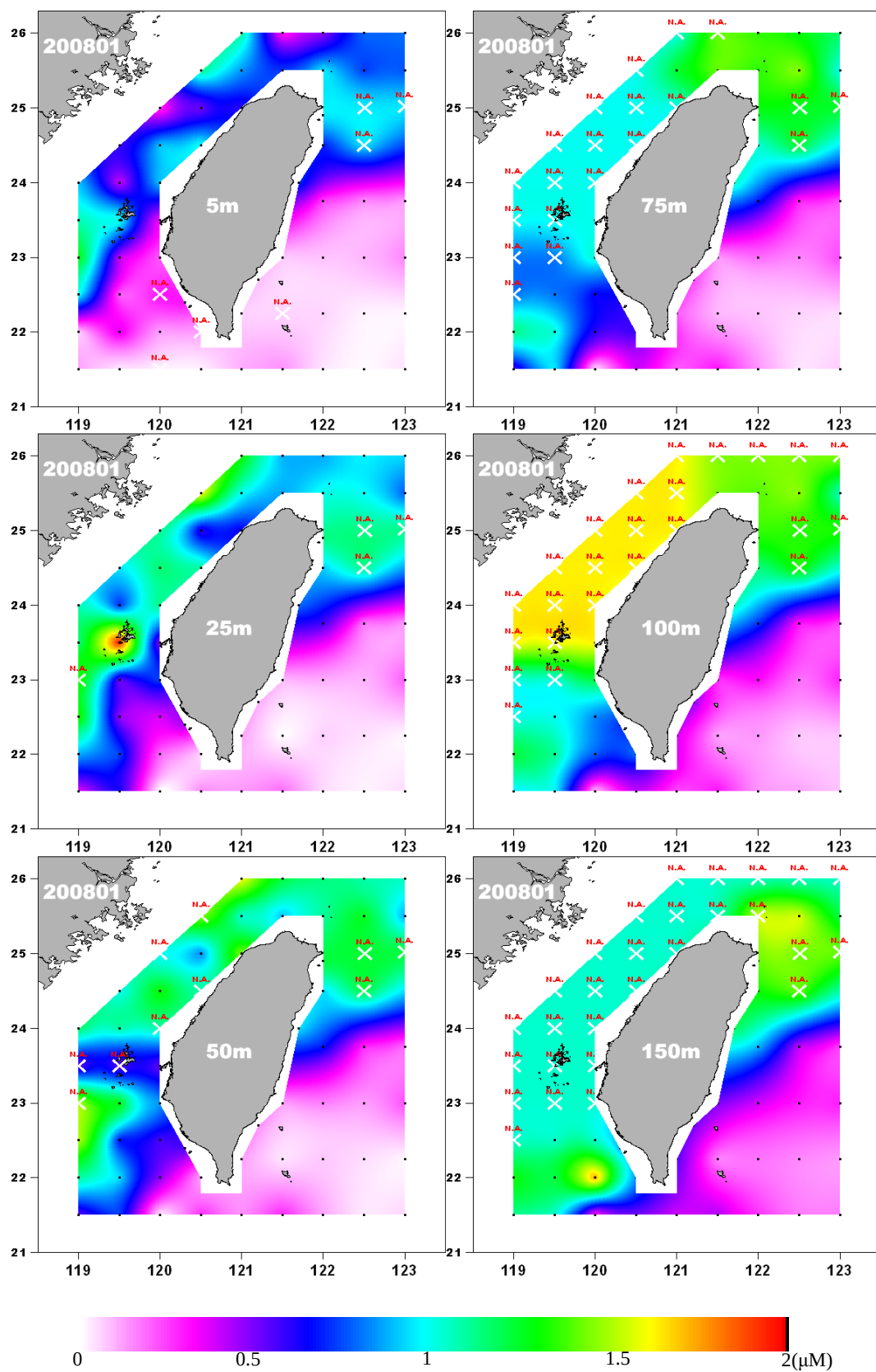


圖 17. 2008-01-04 航次磷酸鹽(PO_4)濃度分布
 Fig. 17. Phosphate (PO_4) data in Jan. 2008.

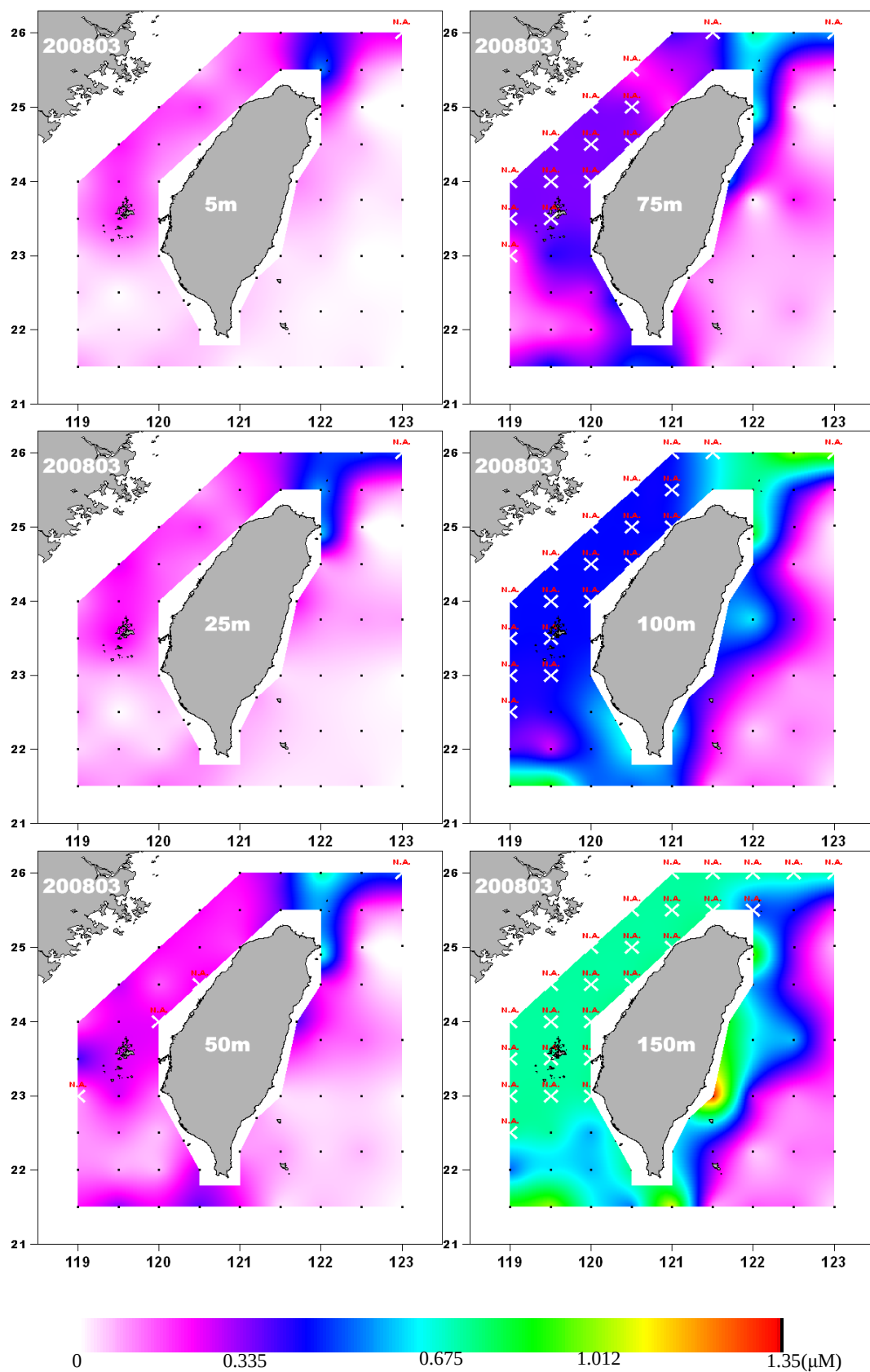


圖 18. 2008-03-13 航次磷酸鹽(PO_4)濃度分布
 Fig. 18. Phosphate (PO_4) distribution in Mar. 2008.

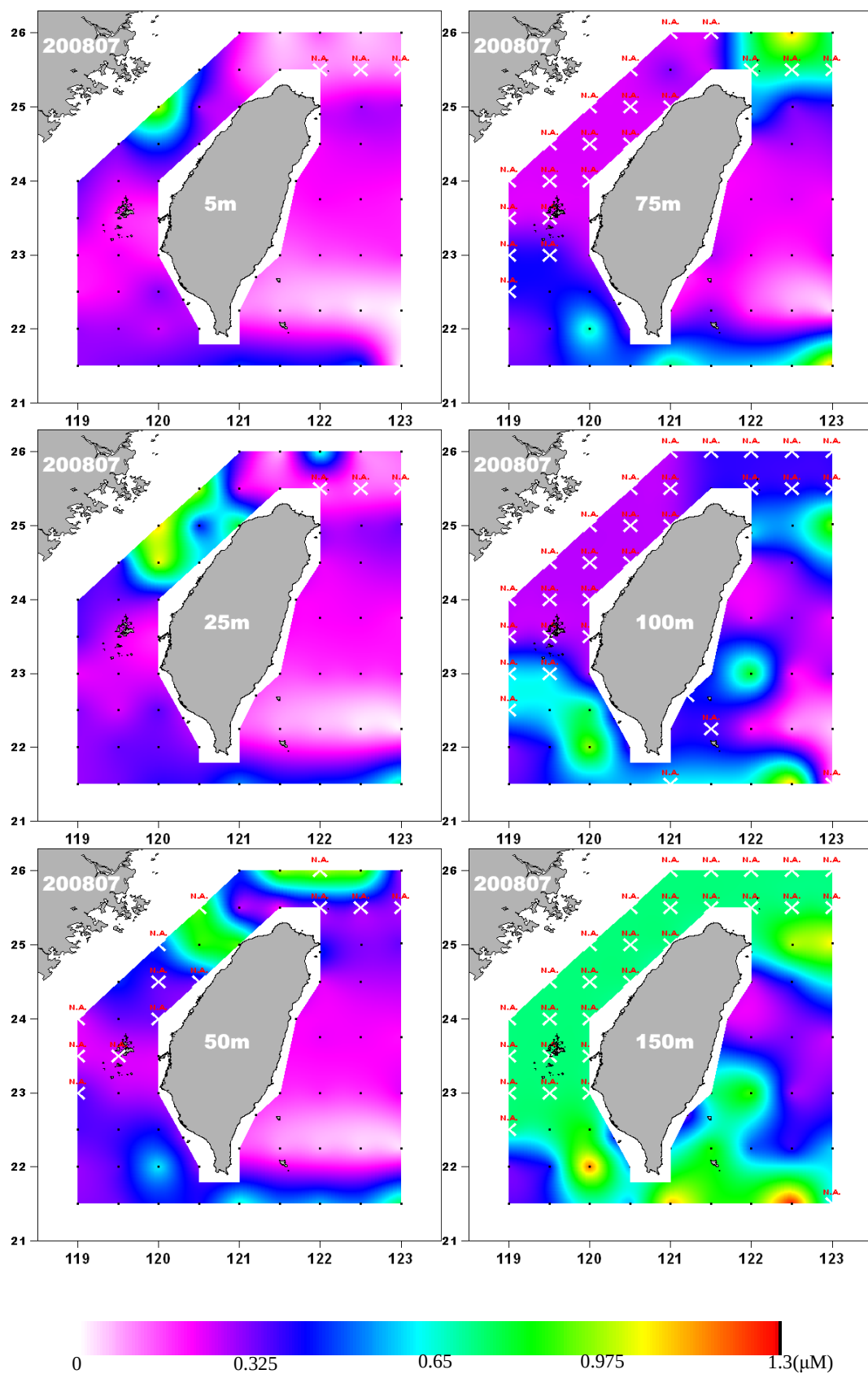


圖 19. 2008-07-03 航次磷酸鹽(PO_4)濃度分布
 Fig. 19. Phosphate (PO_4) distribution in Jul. 2008.

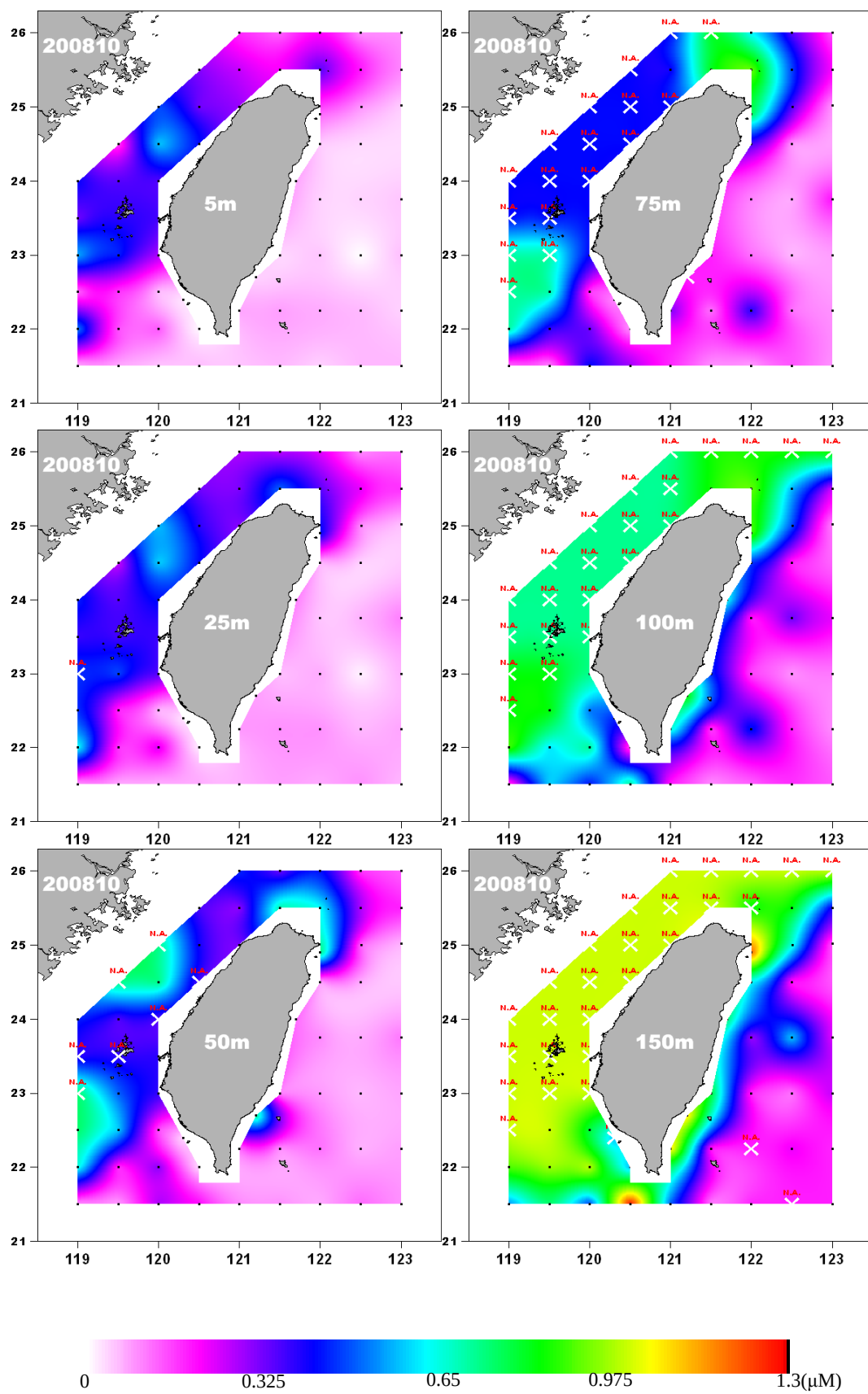


圖 20. 2008-10-14 航次磷酸鹽(PO_4)濃度分布
 Fig. 20. Phosphate (PO_4) distribution in Oct. 2008.

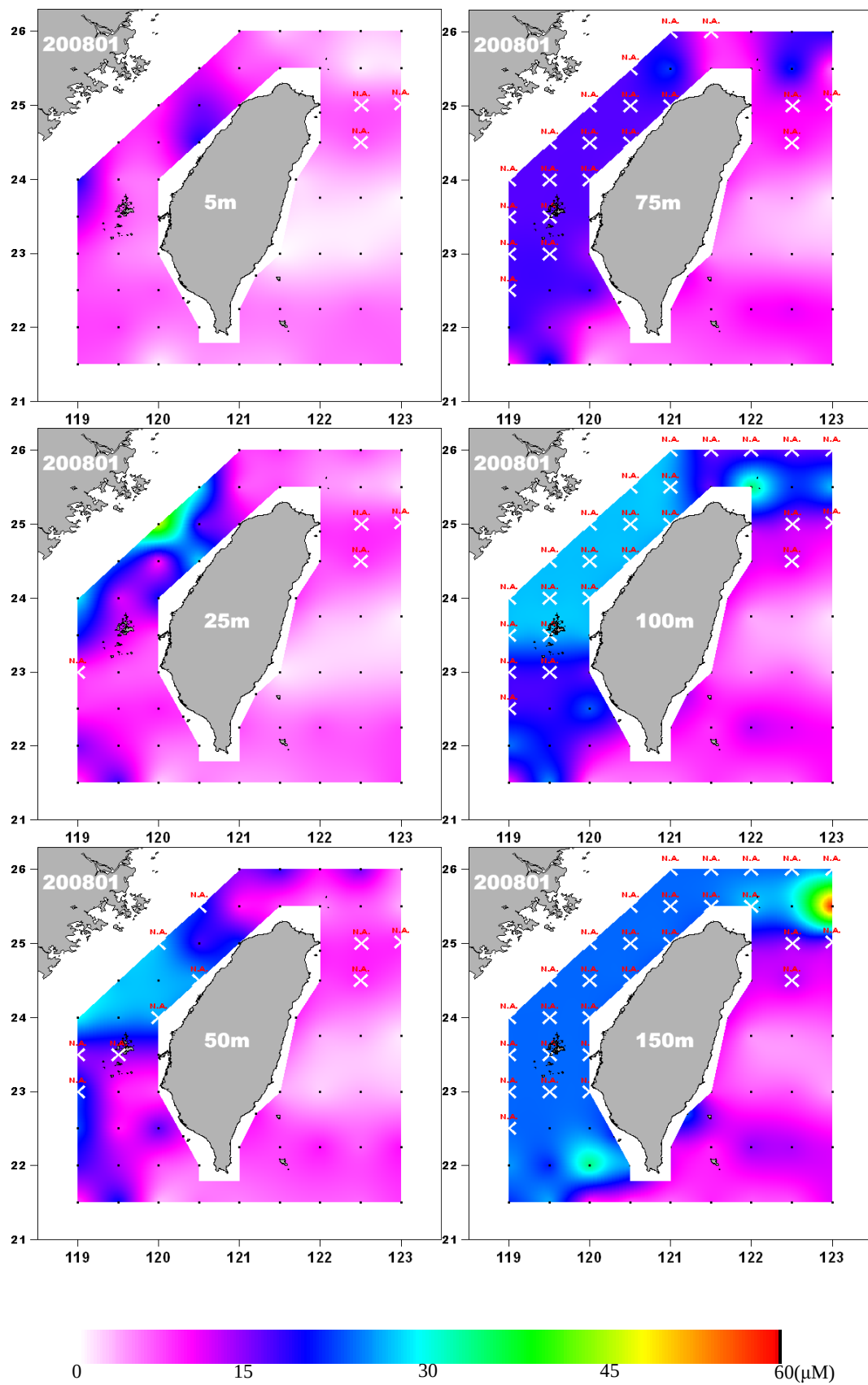


圖 21. 2008-01-04 航次矽酸鹽(SiO_4)濃度分布
 Fig. 21. Silicate (SiO_4) distribution in Jan. 2008.

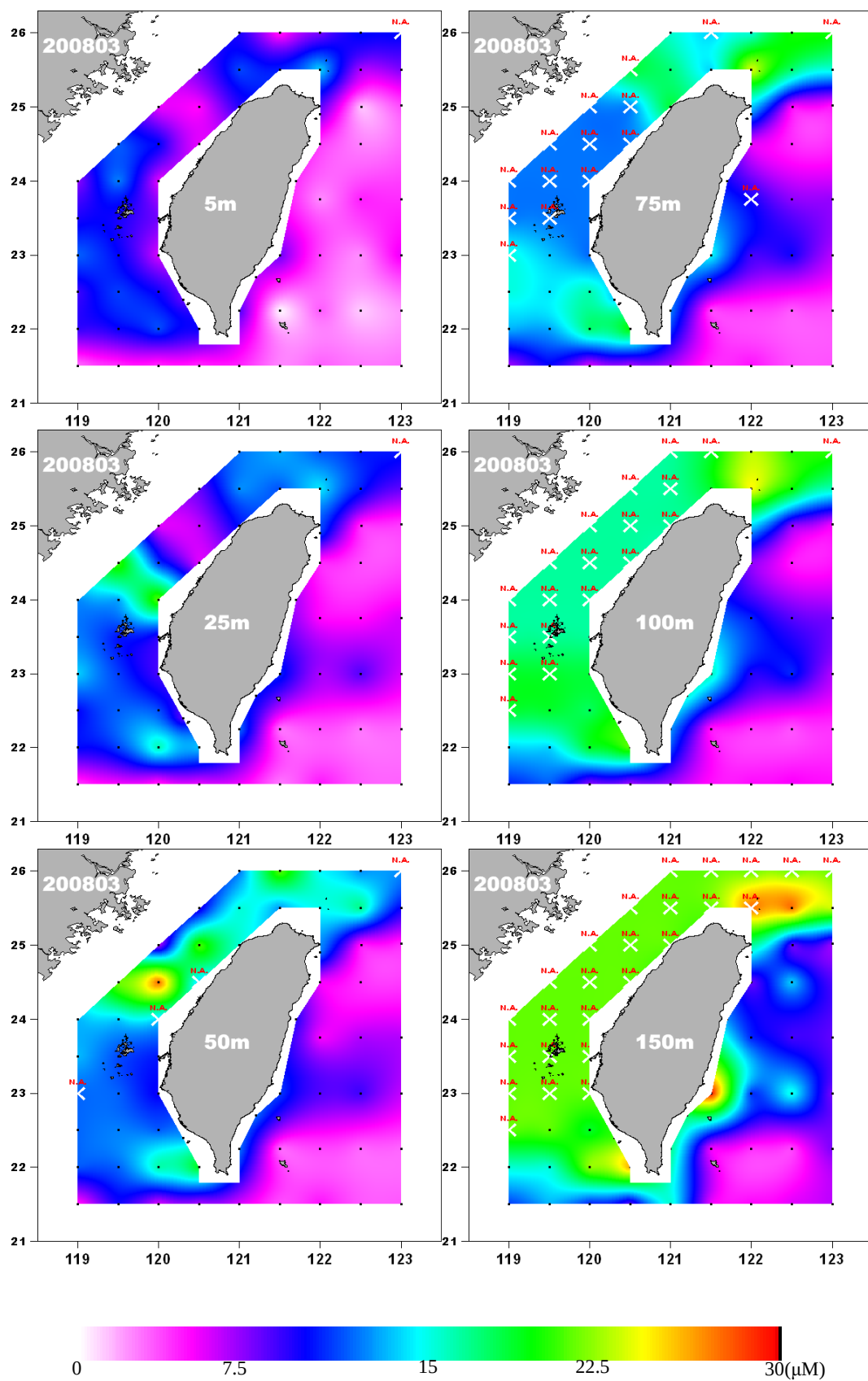


圖 22. 2008-03-13 航次矽酸鹽(SiO_4)濃度分布
 Fig. 22. Silicate (SiO_4) distribution in Mar. 2008.

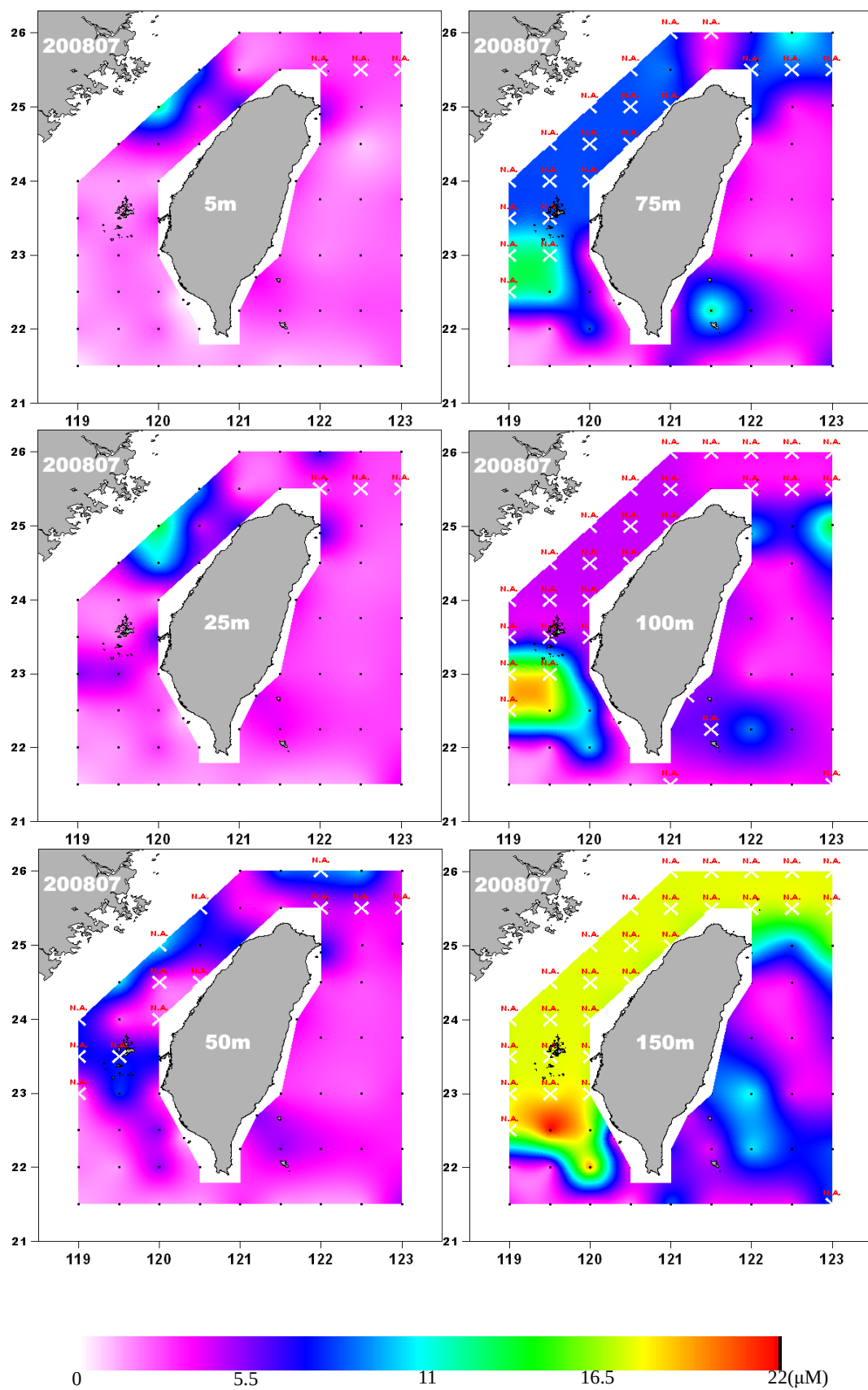


圖 23. 2008-07-03 航次矽酸鹽(SiO_4)濃度分布
Fig. 23. Silicate (SiO_4) distribution in Jul. 2008.

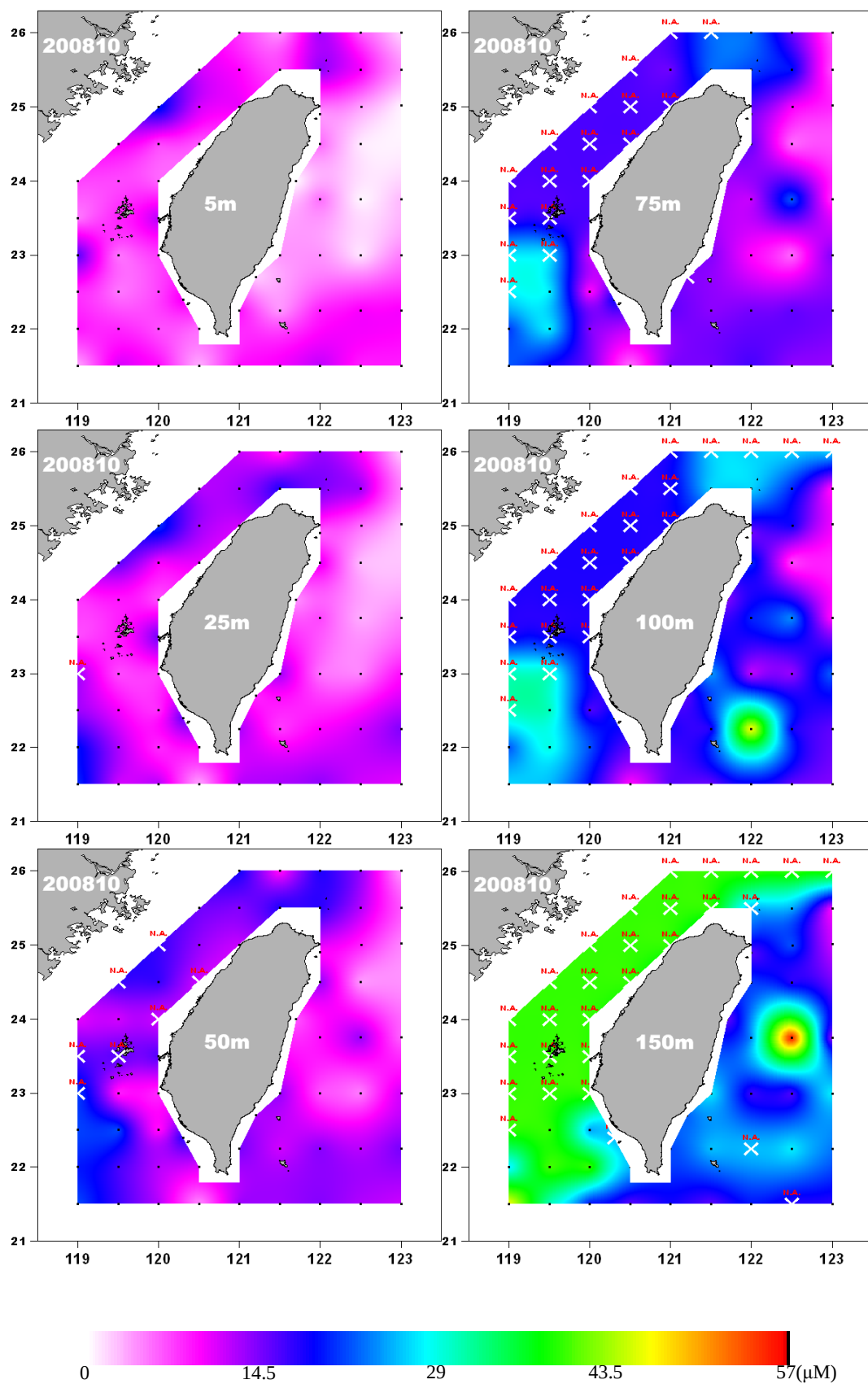


圖 24. 2008-10-14 航次矽酸鹽(SiO_4)濃度分布
 Fig. 24. Silicate (SiO_4) distribution in Oct. 2008.

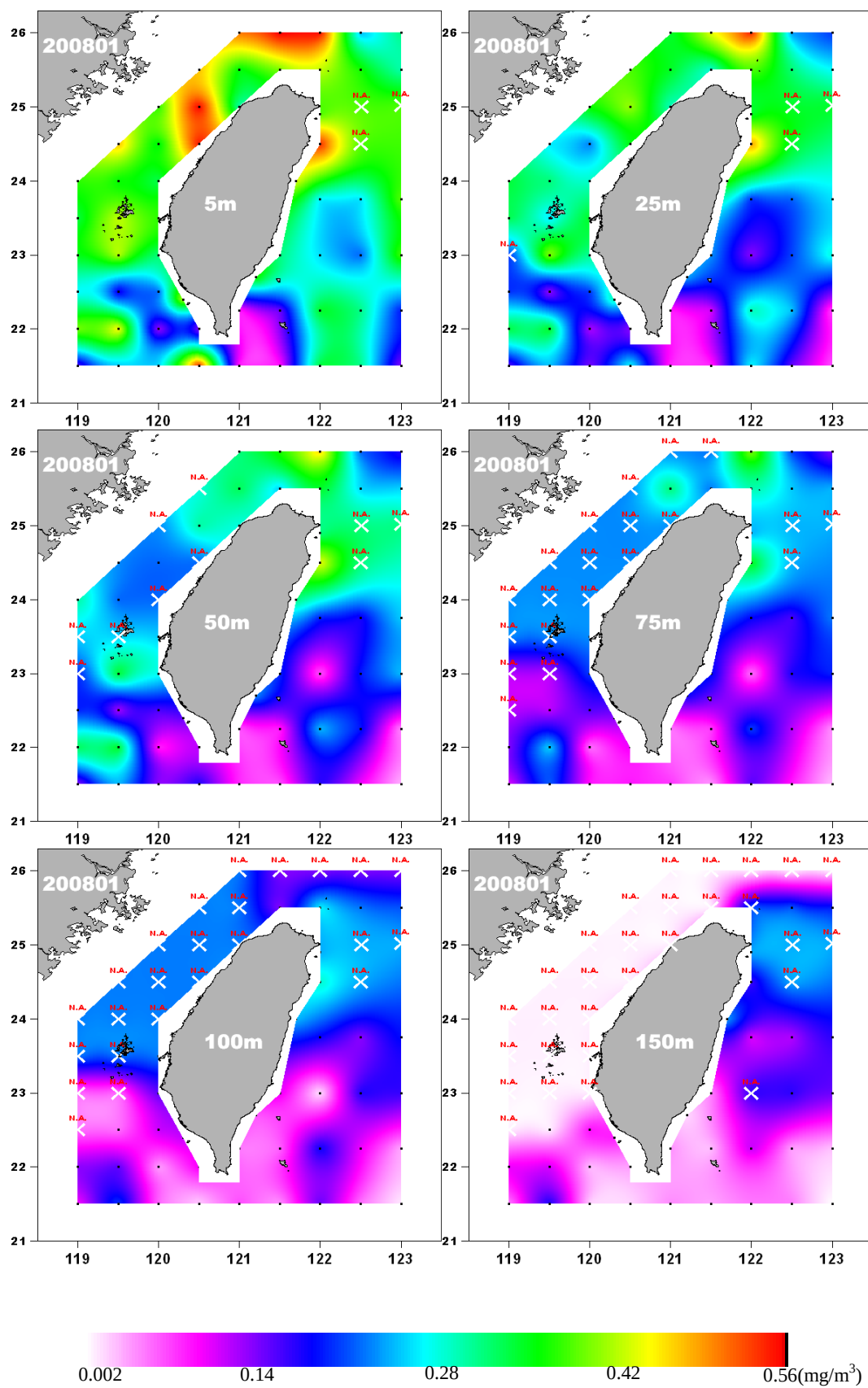


圖 25. 2008-01-04 航次葉綠素甲(chl-a)濃度分布
Fig. 25. chlorophyll(chl-a) distribution in Jan. 2008.

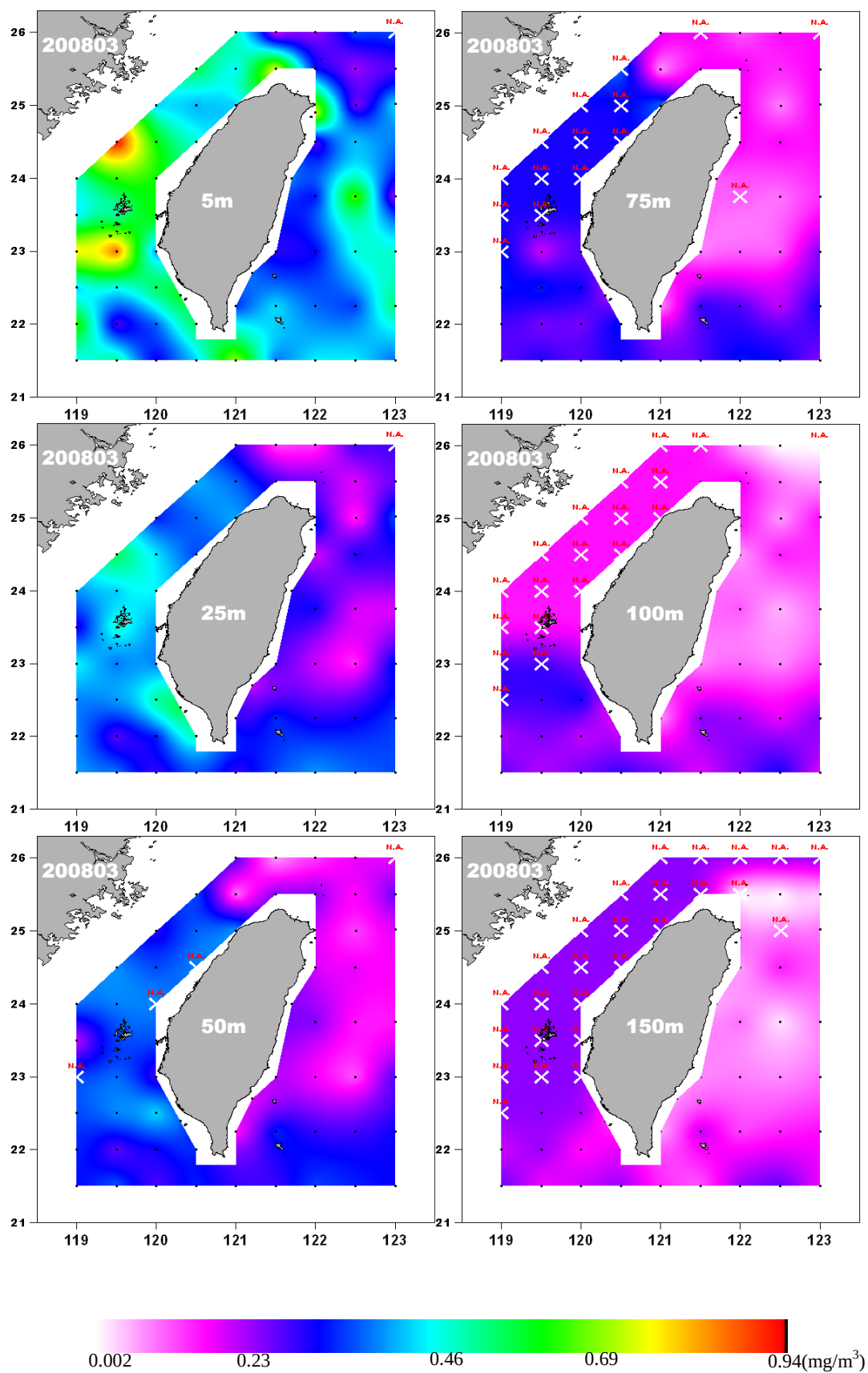


圖 26. 2008-03-13 航次葉綠素甲(chl-*a*)濃度分布
 Fig. 26. chlorophyll(chl-*a*) distribution in Mar. 2008.

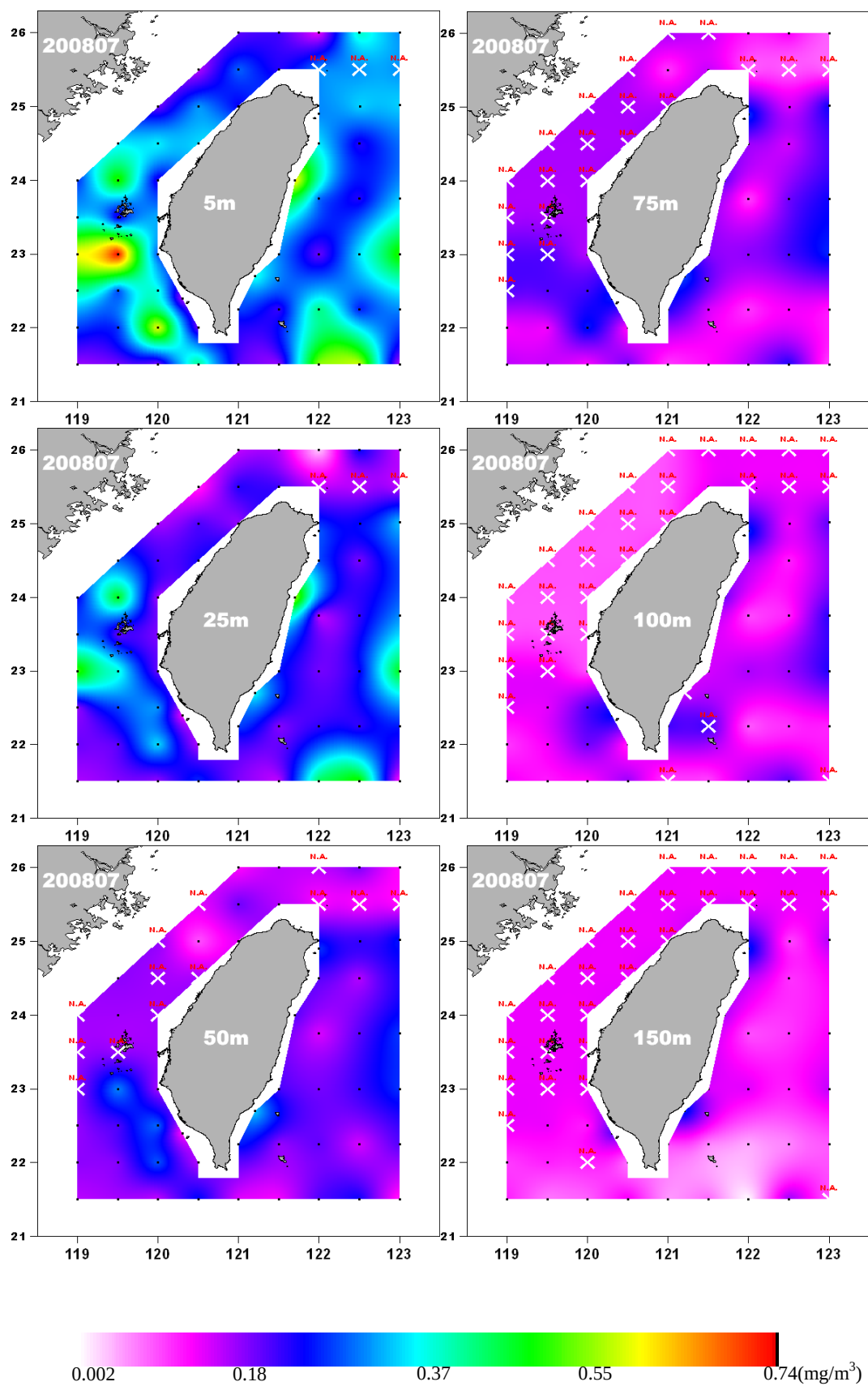


圖 27. 2008-07-03 航次葉綠素甲(chl-a)濃度分布
 Fig. 27. chlorophyll(chl-a) distribution in Jul. 2008.

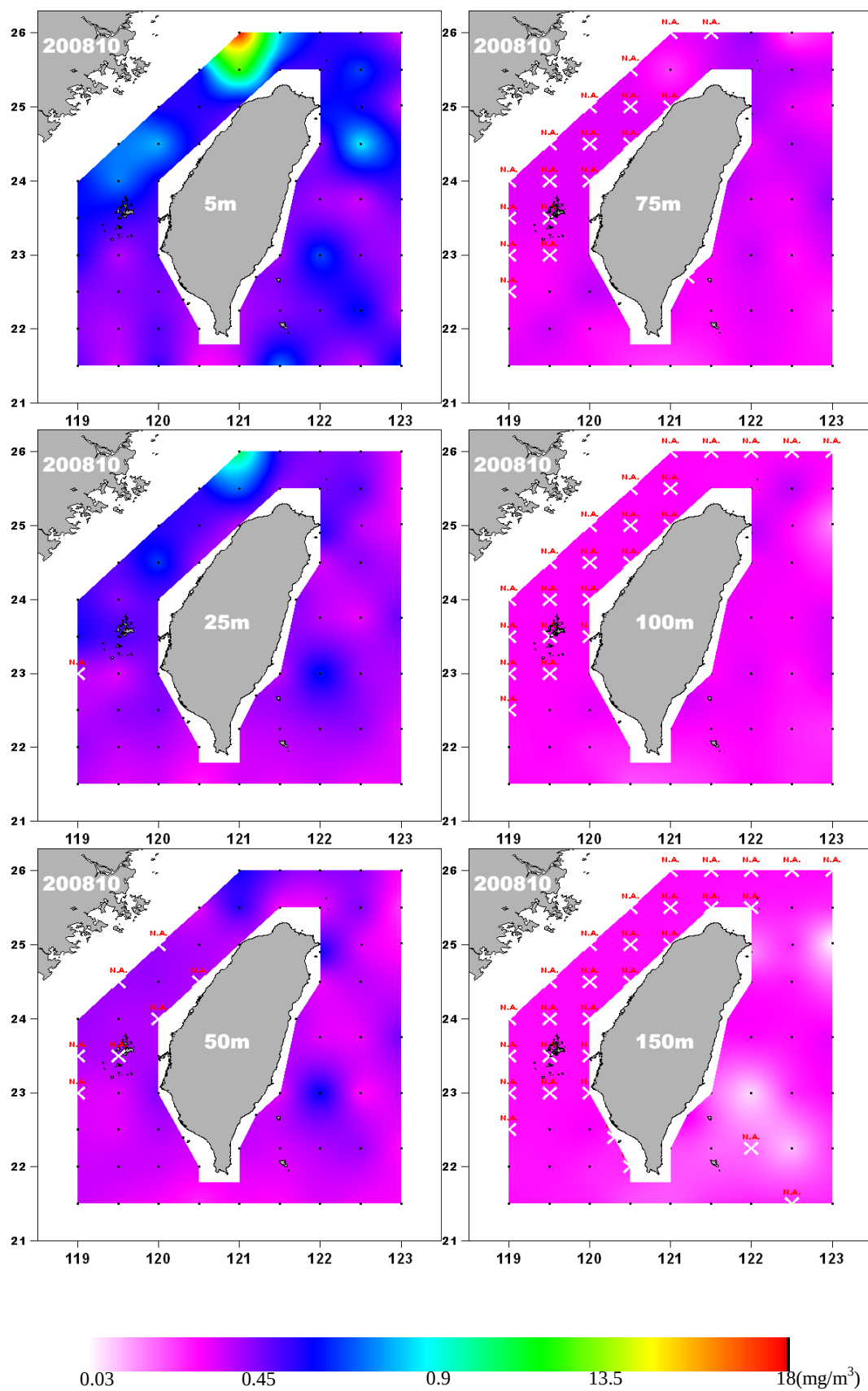


圖 28. 2008-10-14 航次葉綠素甲(chl-a)濃度分布
 Fig. 28. chlorophyll(chl-a) distribution in Oct. 2008.

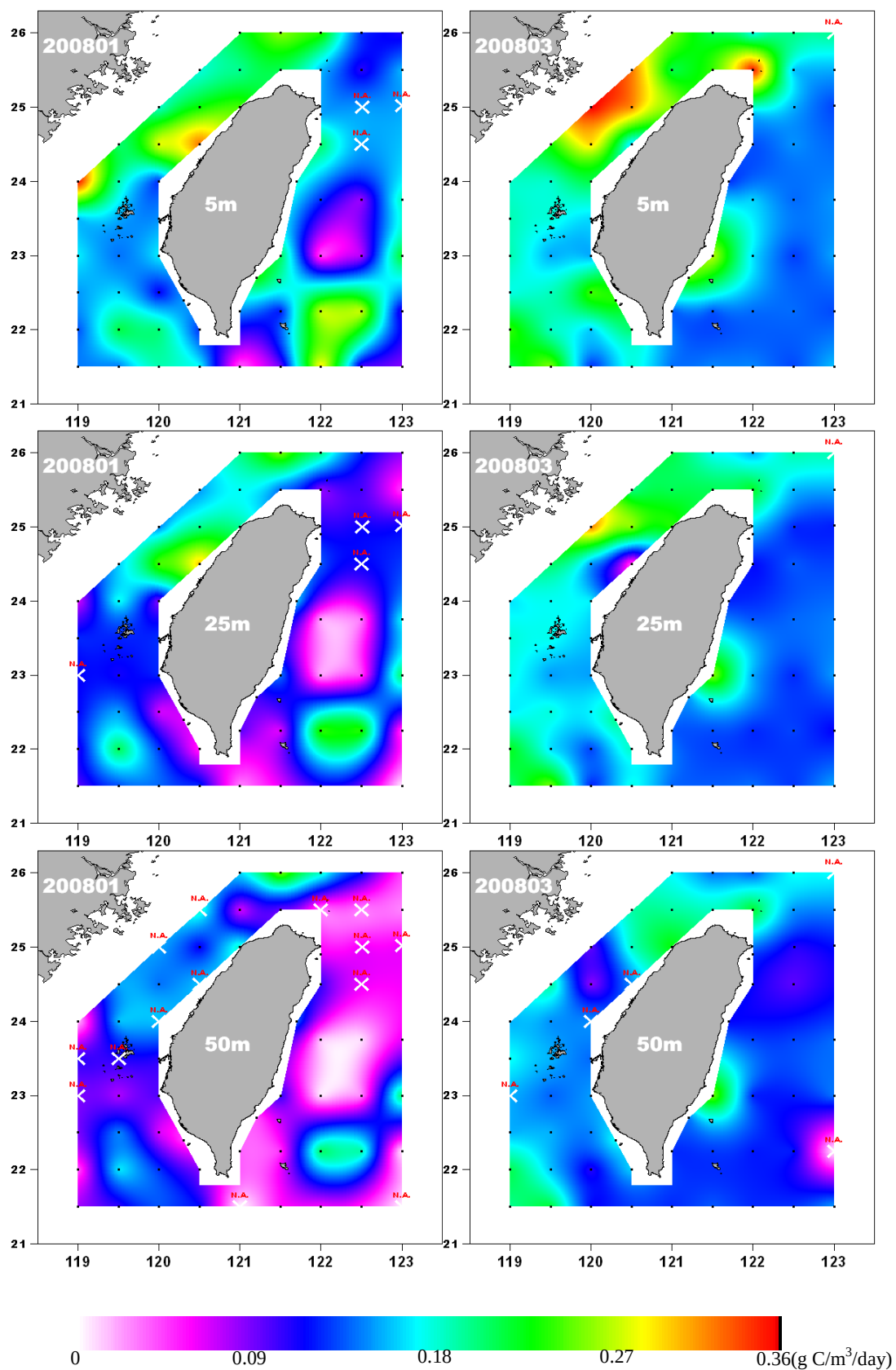


圖 29. 2008 年 1 月及 3 月基礎生產力分布

Fig. 29. Primary production distribution in Jan. and Mar. 2008.

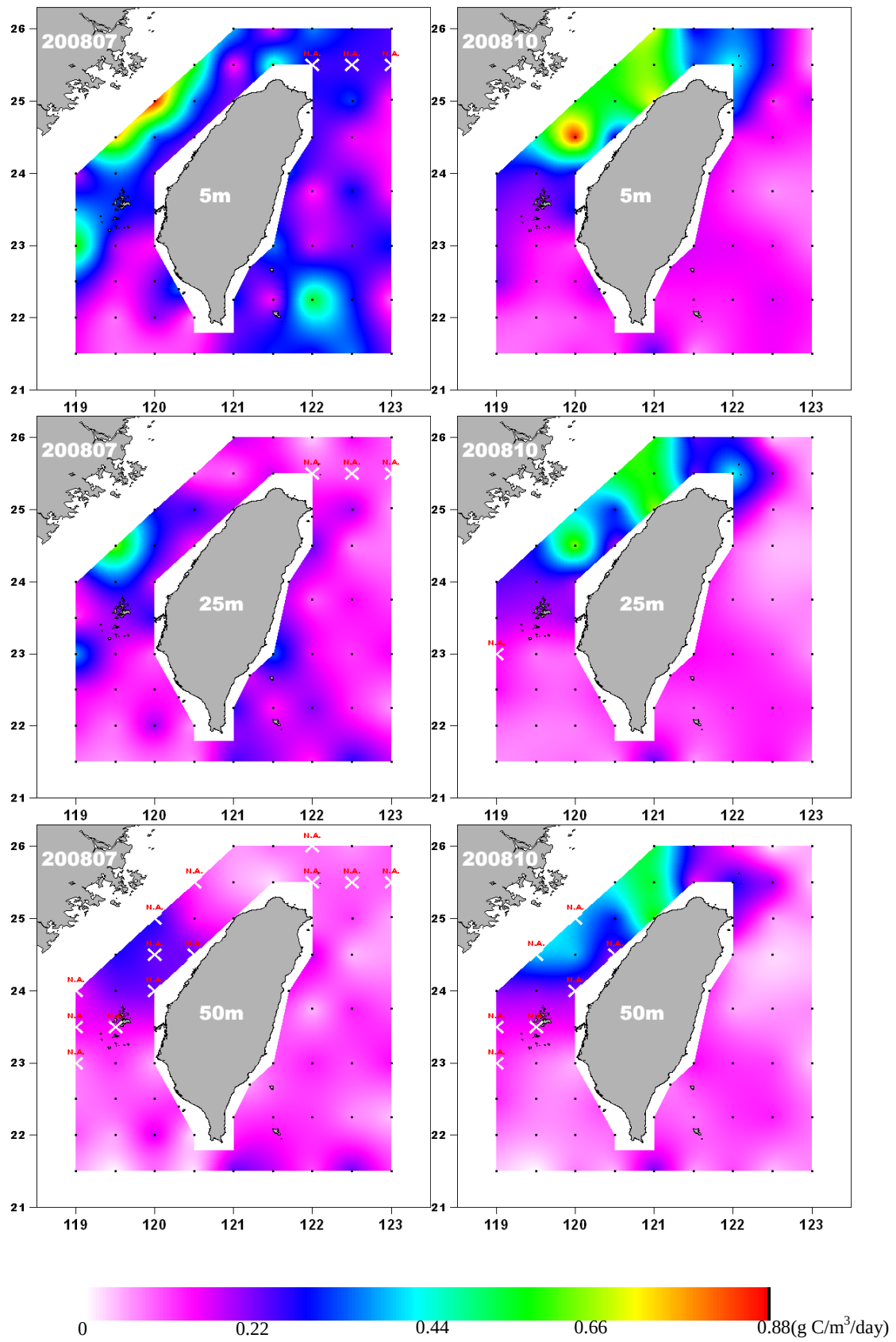


圖 30. 2008 年 7 月及 10 月基礎生產力分布
 Fig. 30. Primary production distribution in Jul. and Oct. 2008.

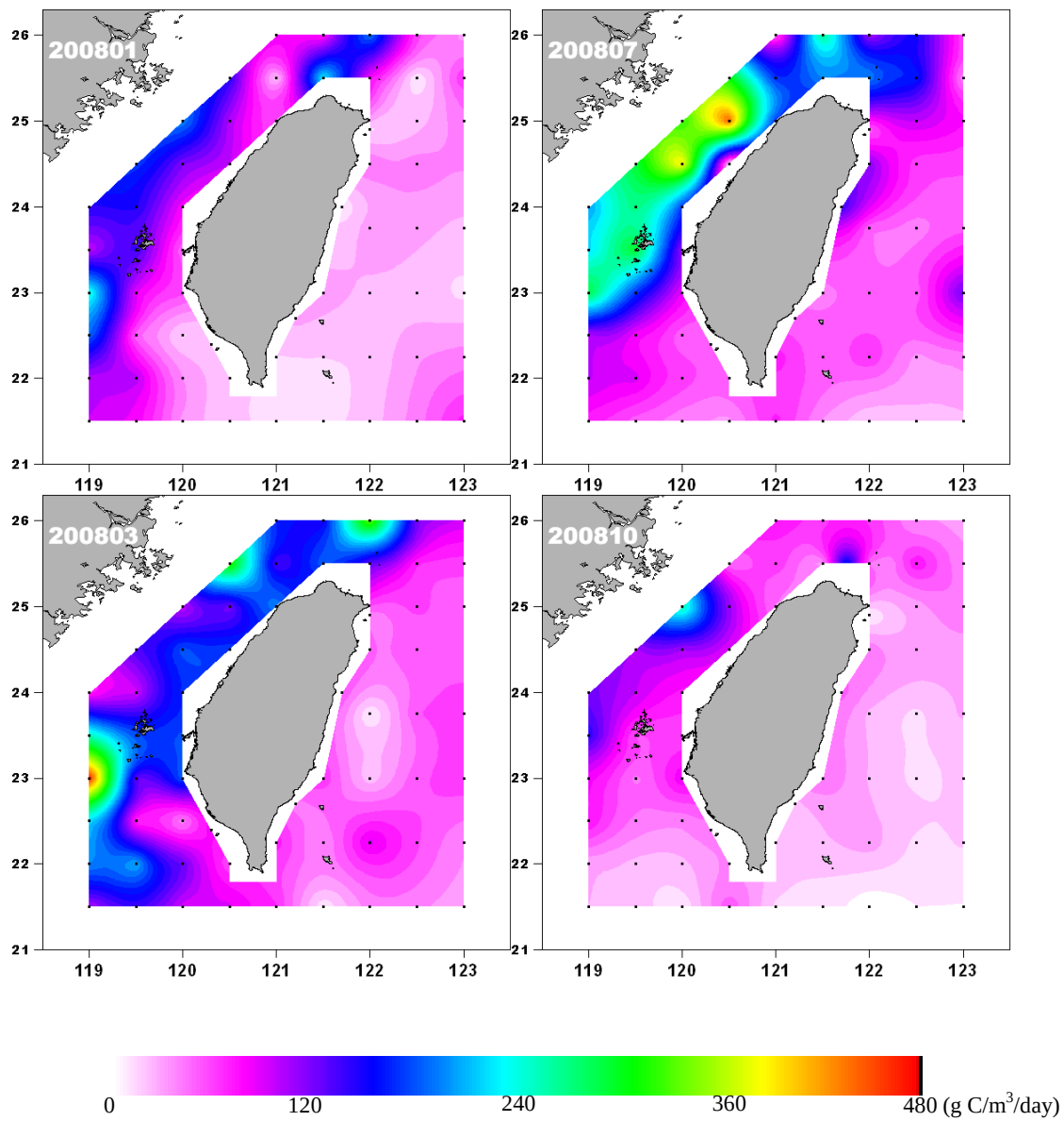


圖 31.2008 年 1 月、3 月、7 月及 10 月浮游動物生物量分布
 Fig. 31. Biomass of zooplankton sample in 2008.

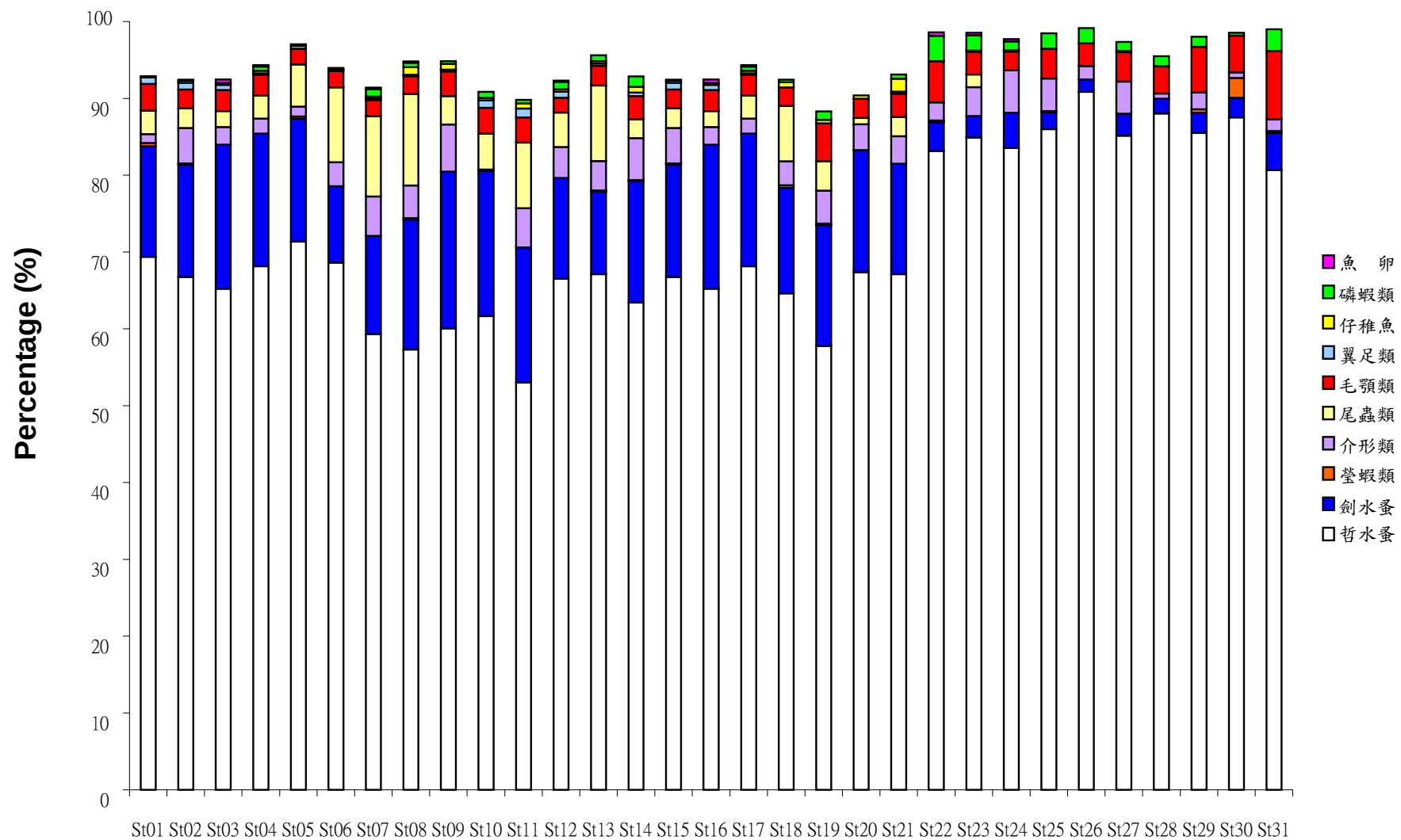


圖 32. 2008-01-04 航次浮游動物優勢大類出現百分率

Fig. 32. Percentage of the composition of zooplankton in Jan. 2008.

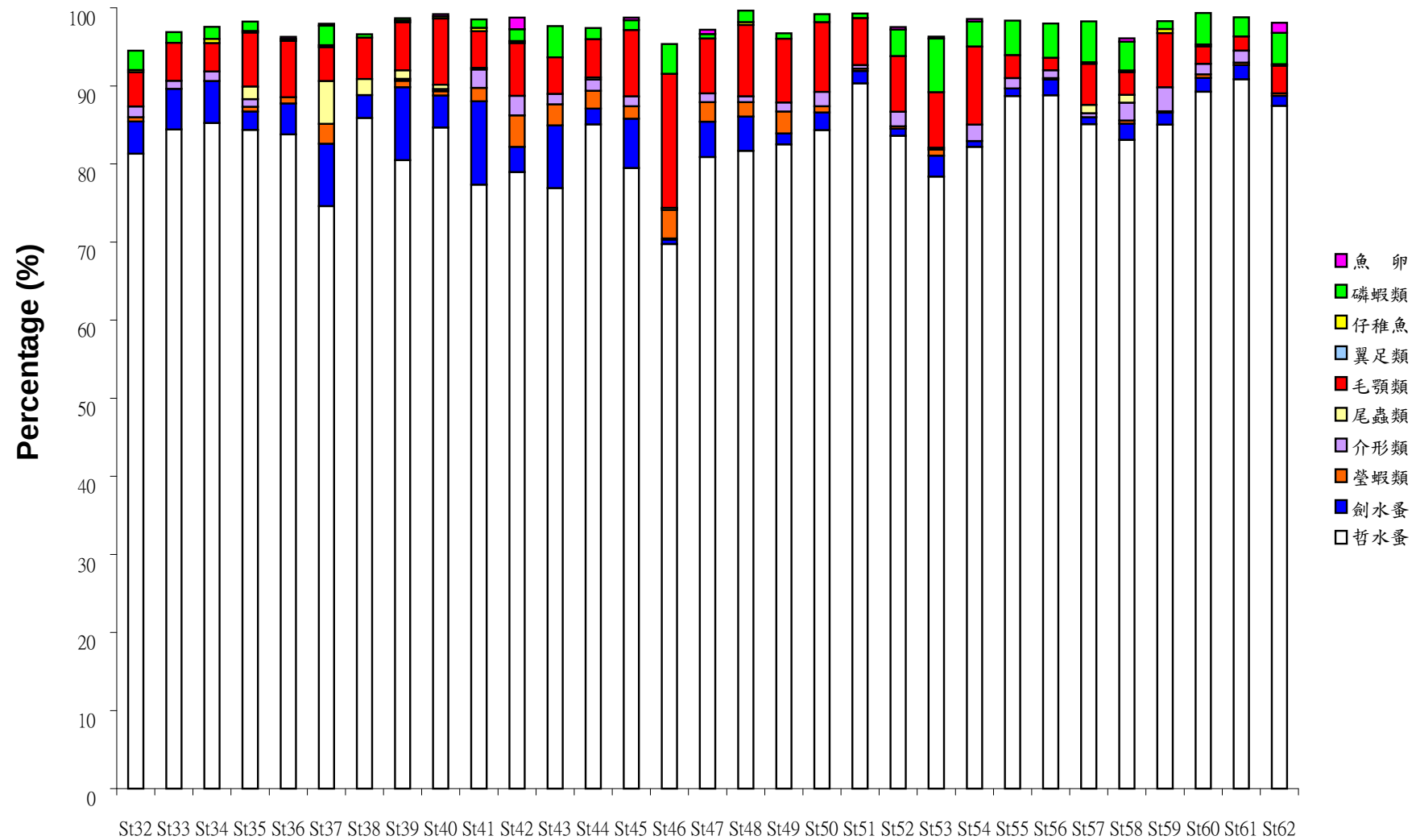


圖 33. 2008-01-04 航次浮游動物優勢大類出現百分率

Fig. 33. Percentage of the composition of zooplankton in Jan. 2008.

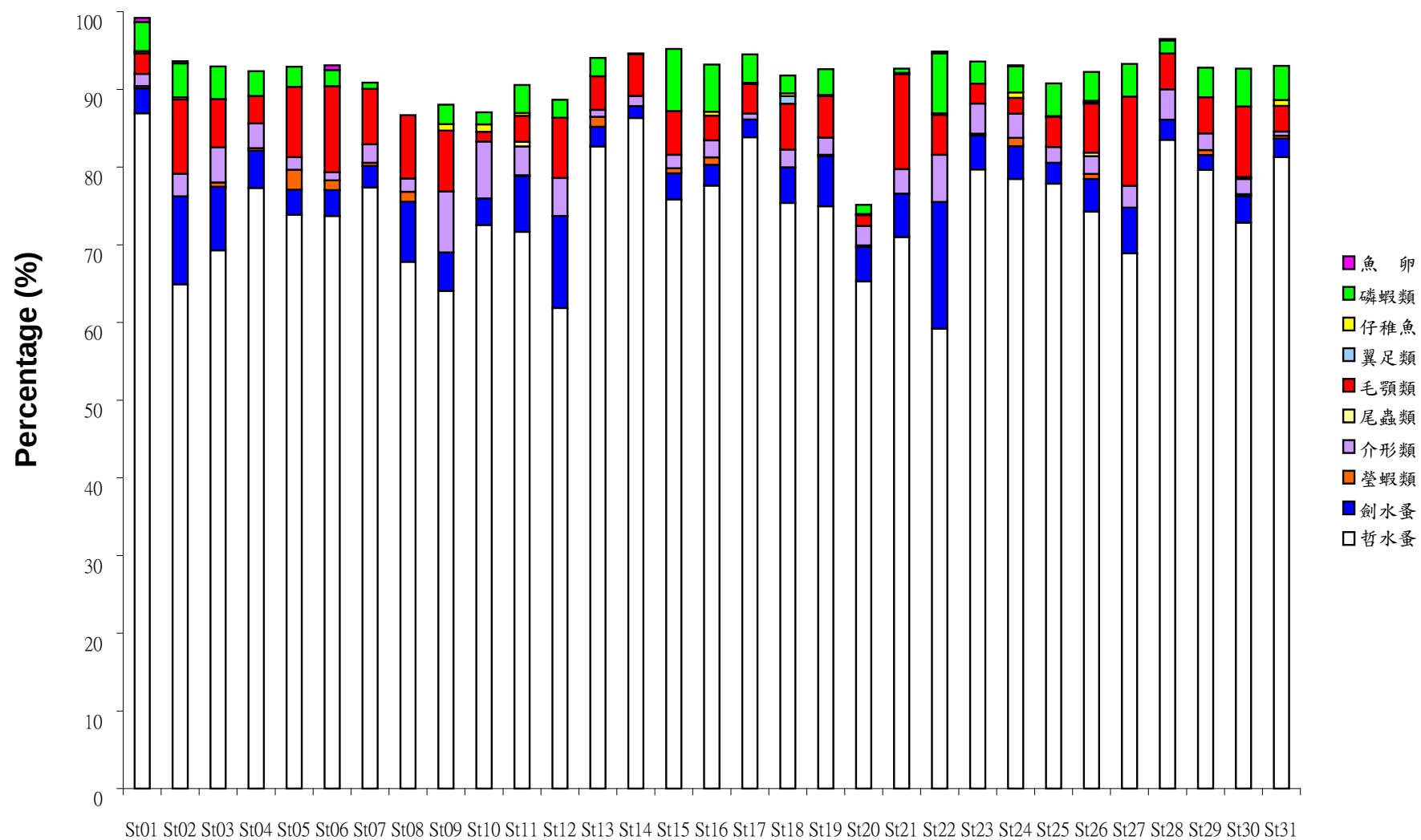


圖 34. 2008-03-13 航次浮游動物優勢大類出現百分率

Fig. 34. Percentage of the composition of zooplankton in Mar. 2008.

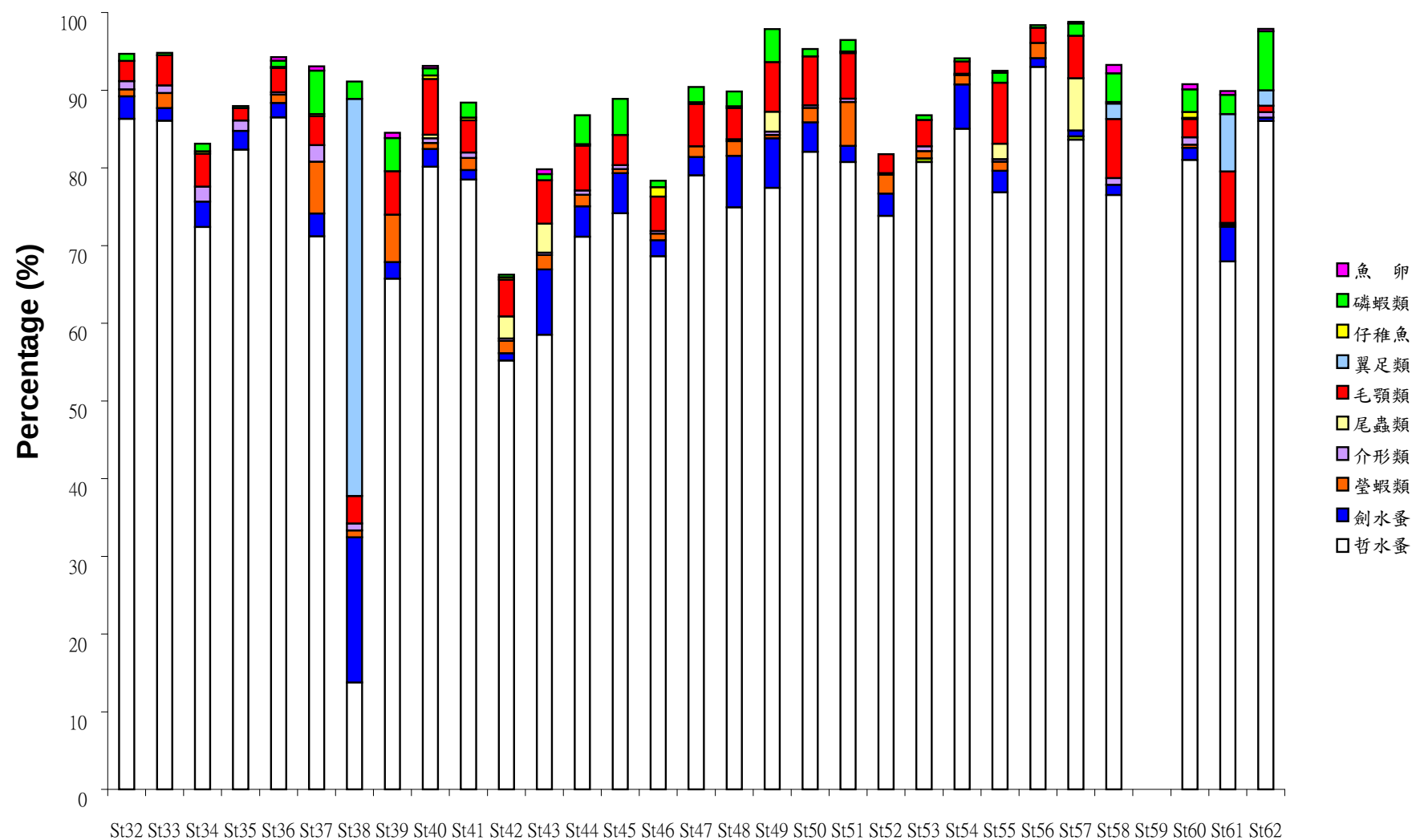


圖 35. 2008-03-13 航次浮游動物優勢大類出現百分率

Fig. 35. Percentage of the composition of zooplankton in Mar. 2008.

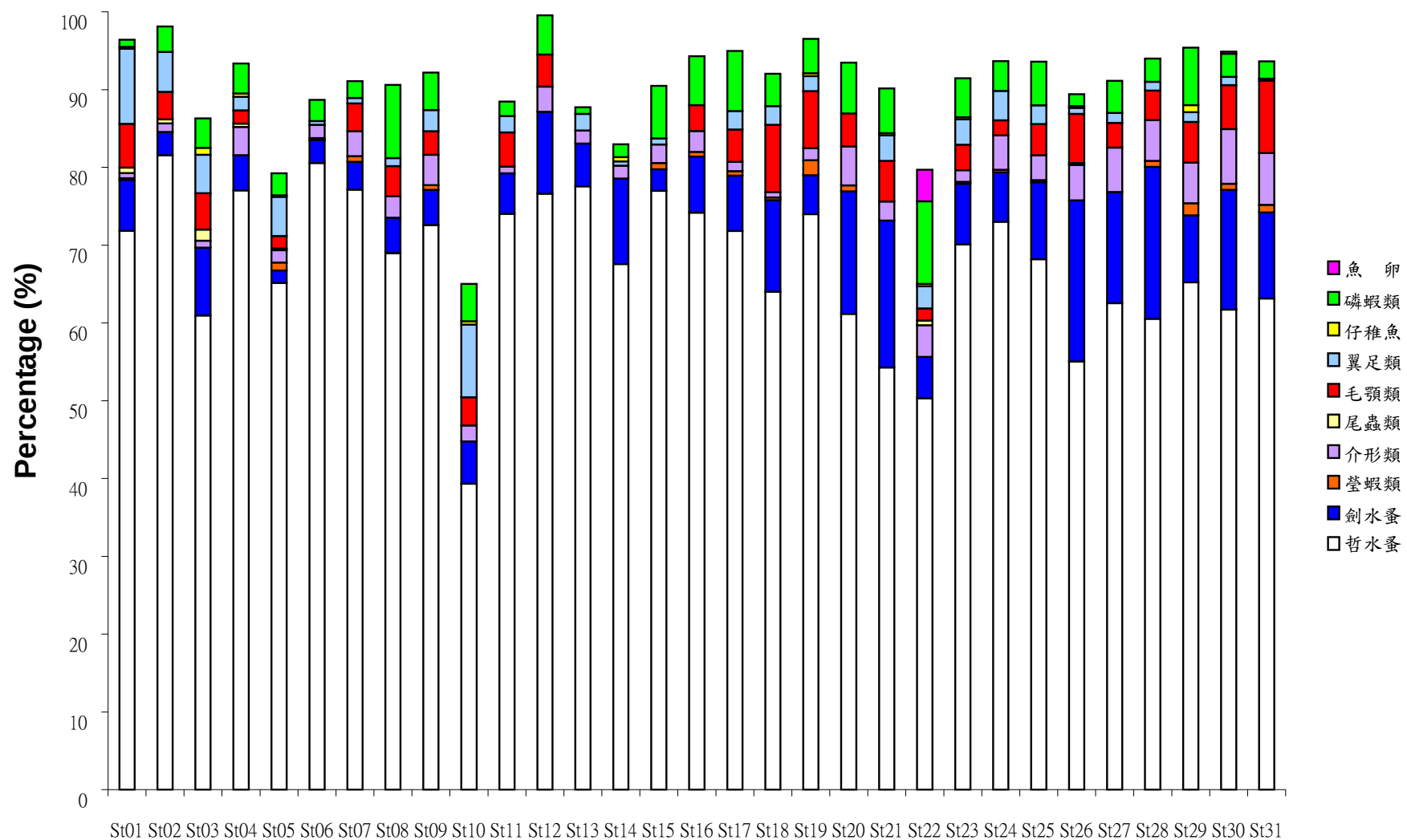


圖 36. 2008-07-03 航次浮游動物優勢大類出現百分率

Fig. 36. Percentage of the composition of zooplankton in Jul. 2008.

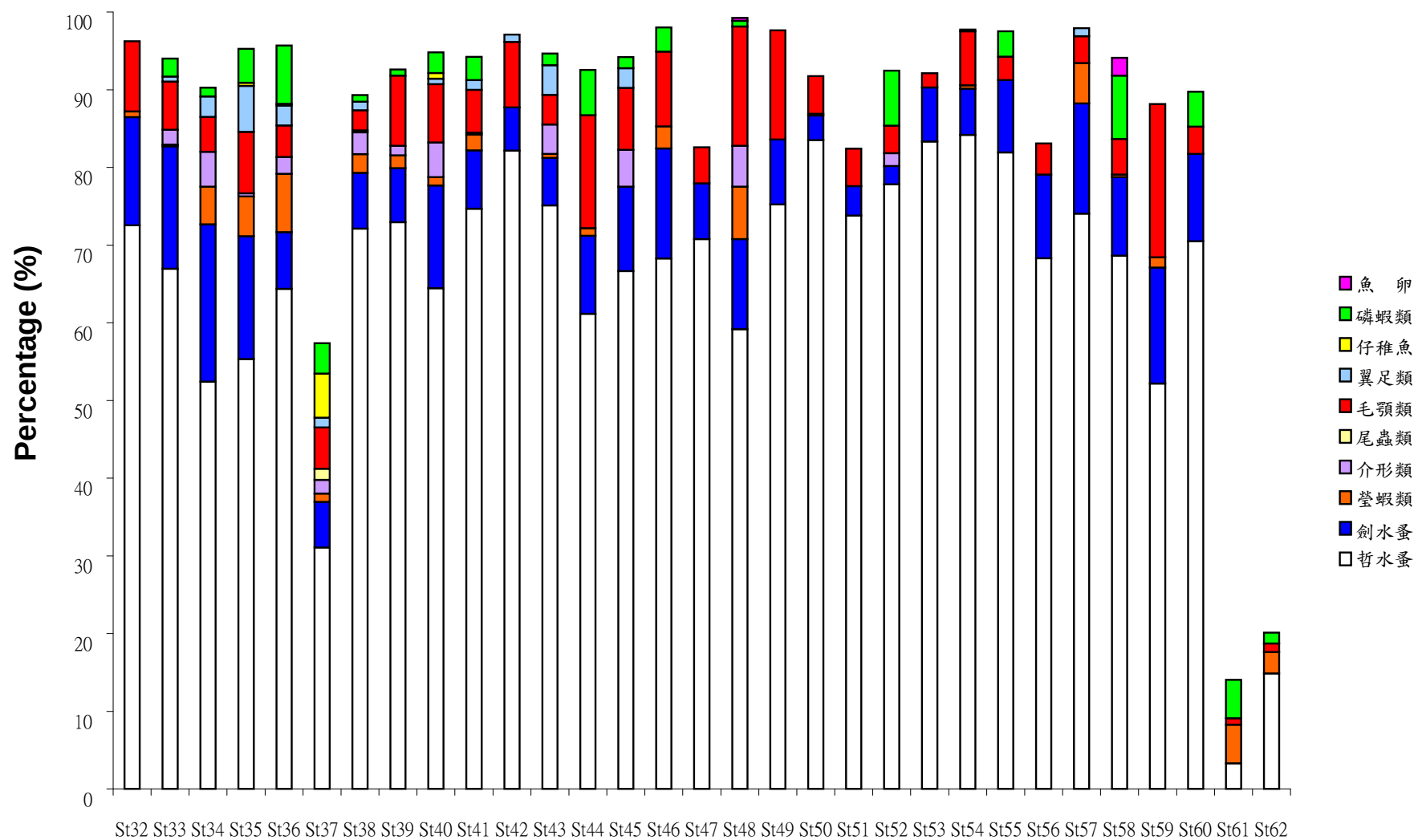


圖 37. 2008-07-03 航次浮游動物優勢大類出現百分率

Fig. 37. Percentage of the composition of zooplankton in Jul. 2008.

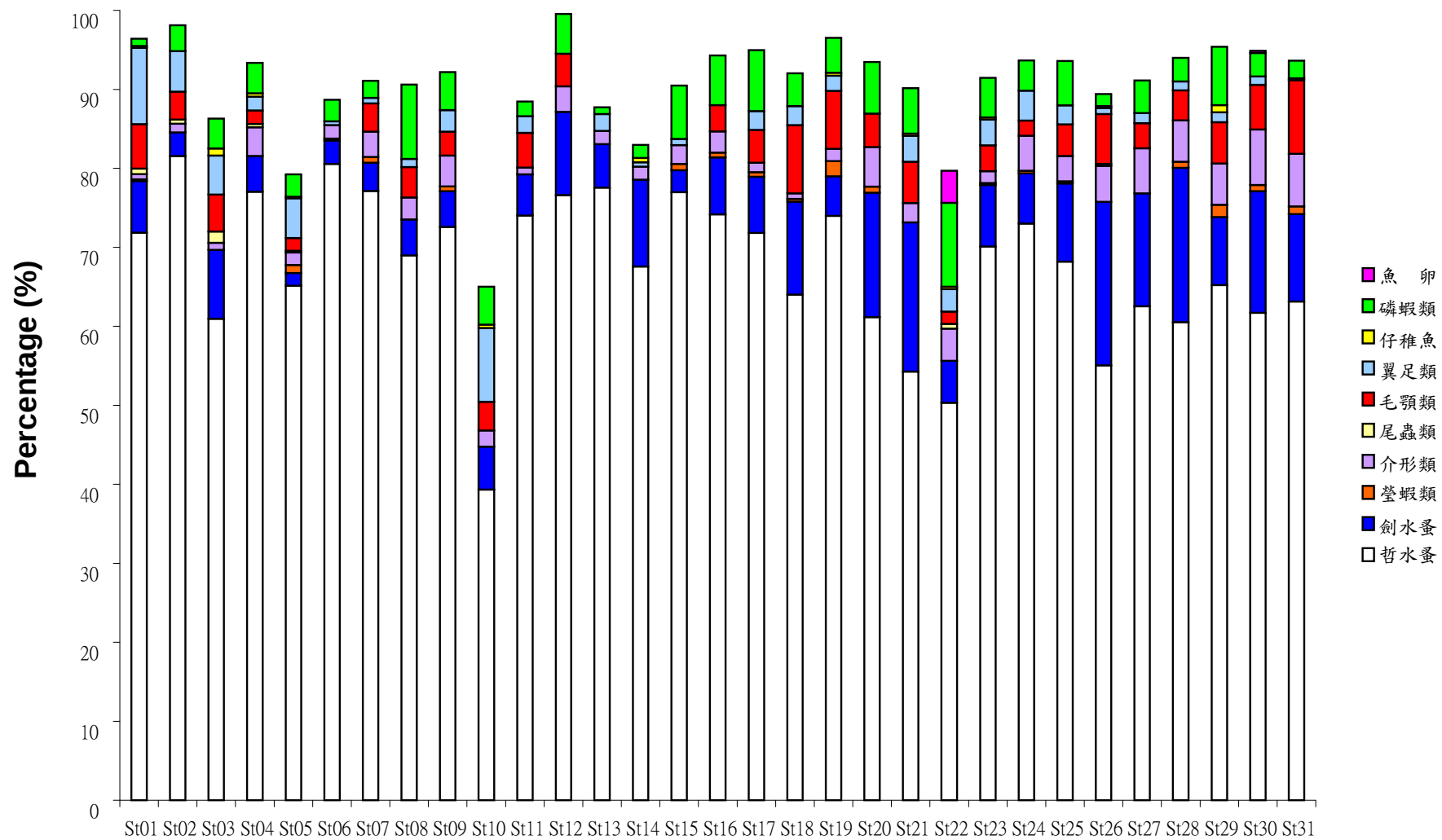


圖 38. 2008-10-14 航次浮游動物優勢大類出現百分率

Fig. 38. Percentage of the composition of zooplankton in Oct. 2008.

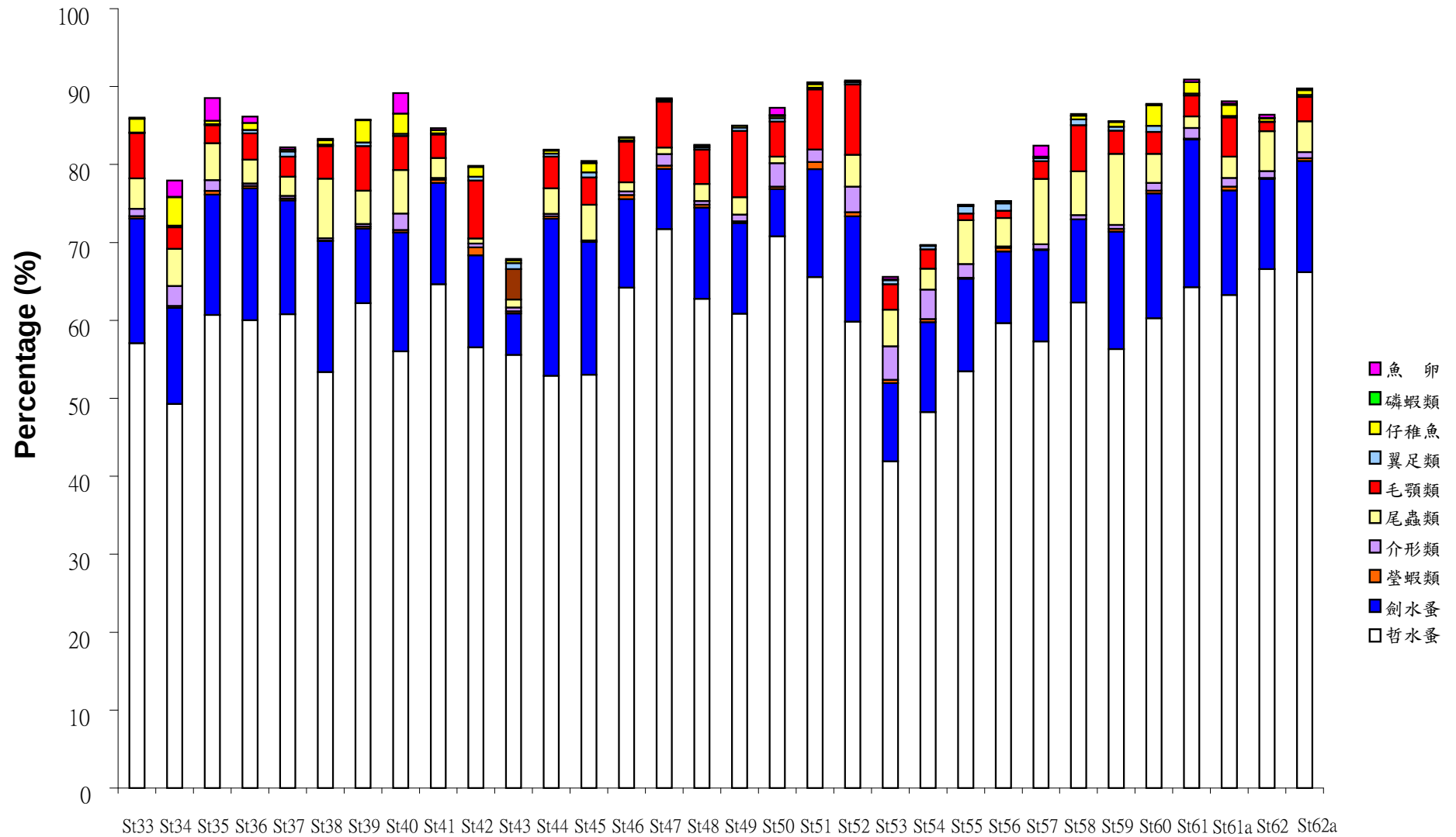


圖 39. 2008-10-14 航次浮游動物優勢大類出現百分率

Fig. 39. Percentage of the composition of zooplankton in Oct. 2008.

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----、----、----

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>

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