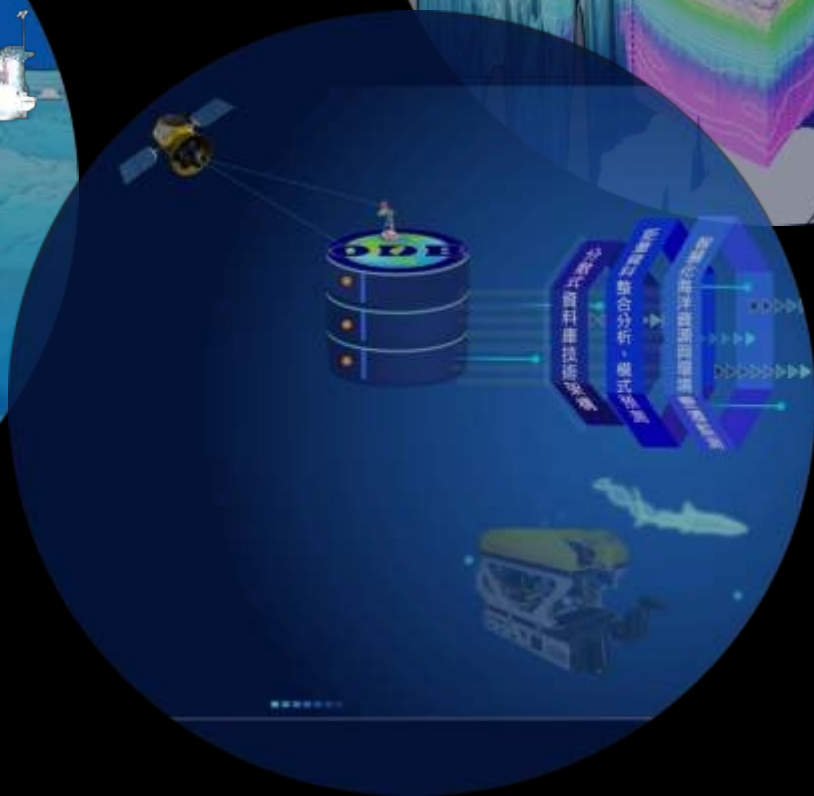
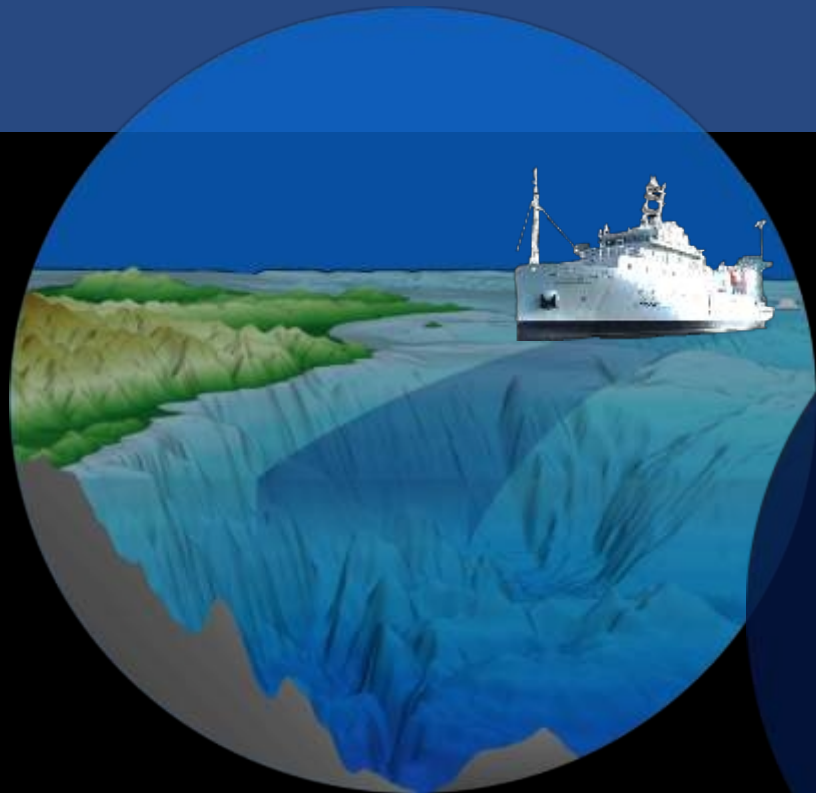
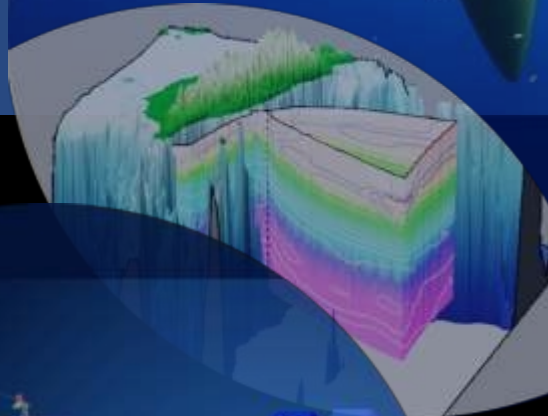


# 不只是資料

## 架構客製化的海洋科學資訊服務

海洋學門資料庫 (ODB)  
翁其羽





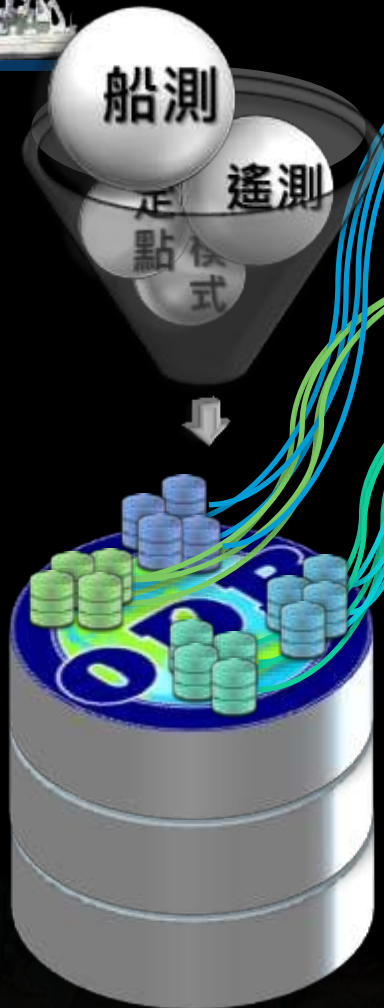
NOR 1

NOR 2

NOR 3

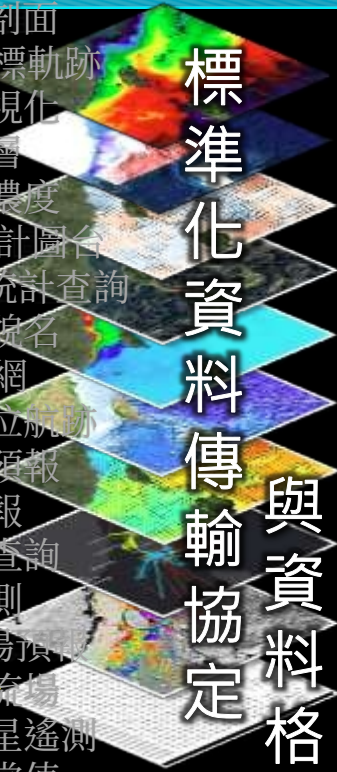


- 溫度 / 鹽度 / 深度
- 海流
- 多音束聲納
- 單音束聲納
- 重力
- 波浪雷達
- 海床底質剖面
- 二氧化碳分壓



- 物理海洋
- 地質地物
- 化學海洋
- 生物海洋

- ARGO 水文剖面
- SVP 漂流浮標軌跡
- 資料數據可視化
- 海面溫度圖層
- 海面葉綠素濃度
- CTD 溫度統計圖台
- ADCP 海流統計查詢
- 海底地形地貌名
- Glider 觀測網
- 海洋研究船位航跡
- 潮汐與潮流預報
- 海洋數值預報
- 統計平均場查詢
- 海洋渦旋偵測
- ECMWF 風場預報
- 視覺化動態流場
- 海面高度衛星遙測
- 海面高度異常值
- 地轉流向量場
- 海表溫度鋒面
- 表面漂流軌跡推算
- 水深斷面擷取
- 浮游動物群聚分析
- 海洋影像辨識資訊



標準化資料傳輸協定

與資料格式





# ODB Glider Pro

駕駛專用平台



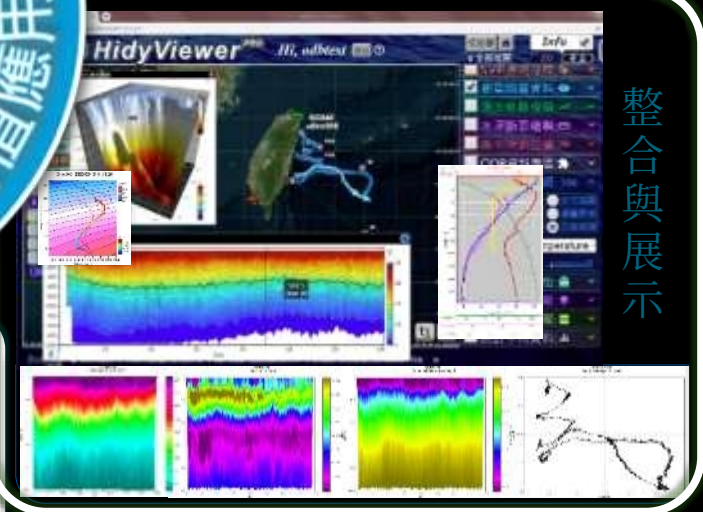
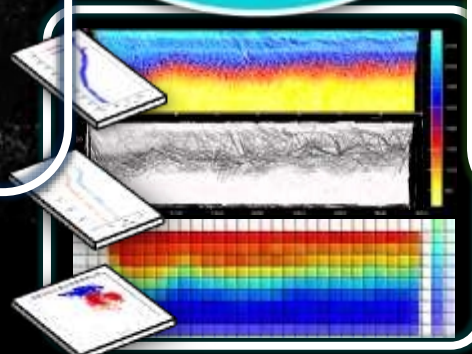
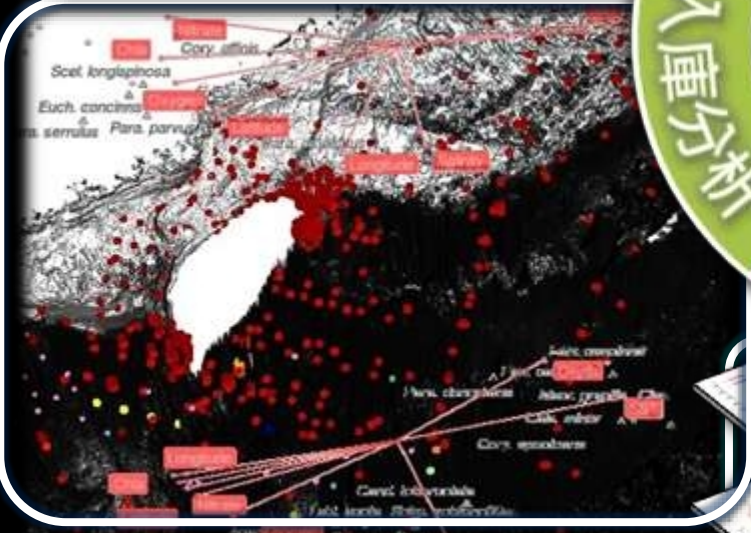
加海研1號海流浮標數據

NORLOR205Iwer19 Hhatacspah 2021/10/03 12:41:39 148505 緯度: 27 21.2134 經度: 121 48.8589 高度: 5.83 速度: 0.1 轉 日期:	NORLOR208Ise2H4Nme 2021/10/03 12:06:33 513603 513,46.5,24.8 522,46.5,24.8 521,46.4,24.4 520,46.1,24.4 526,45.7,24.4 526,45.6,24.8	NORLOR206Wester1 Rhaabpawu 2021/10/03 12:41:39 354205 IPORWIA, 003, 09698080 31,366,27138,12423,2 2243,60200,00014,390 62,00015,16474,03668 ,31343*31 IPORWIA, 003, 09698080 32,366,31141,12433,2 0267,60200,00014,390 62,00013,26474,03771 ,21451*37 IPORWIA, 003, 09698080 29,363,35138,12435,2 2604,60200,00014,390 62,00013,16474,03522 ,30451*31 IPORWIA, 003, 09698080 30,363,38244,12437,2 0450,60200,00015,390 62,90014,26474,03682 ,30397*34 IPORWIA, 003, 09698080 31,363,38379,12434,2 0467,60200,00014,390 62,00014,26474,03793 ,30928*38 IPORWIA, 003, 09698080 32,363,41345,12437,2	NOR 2021 5728
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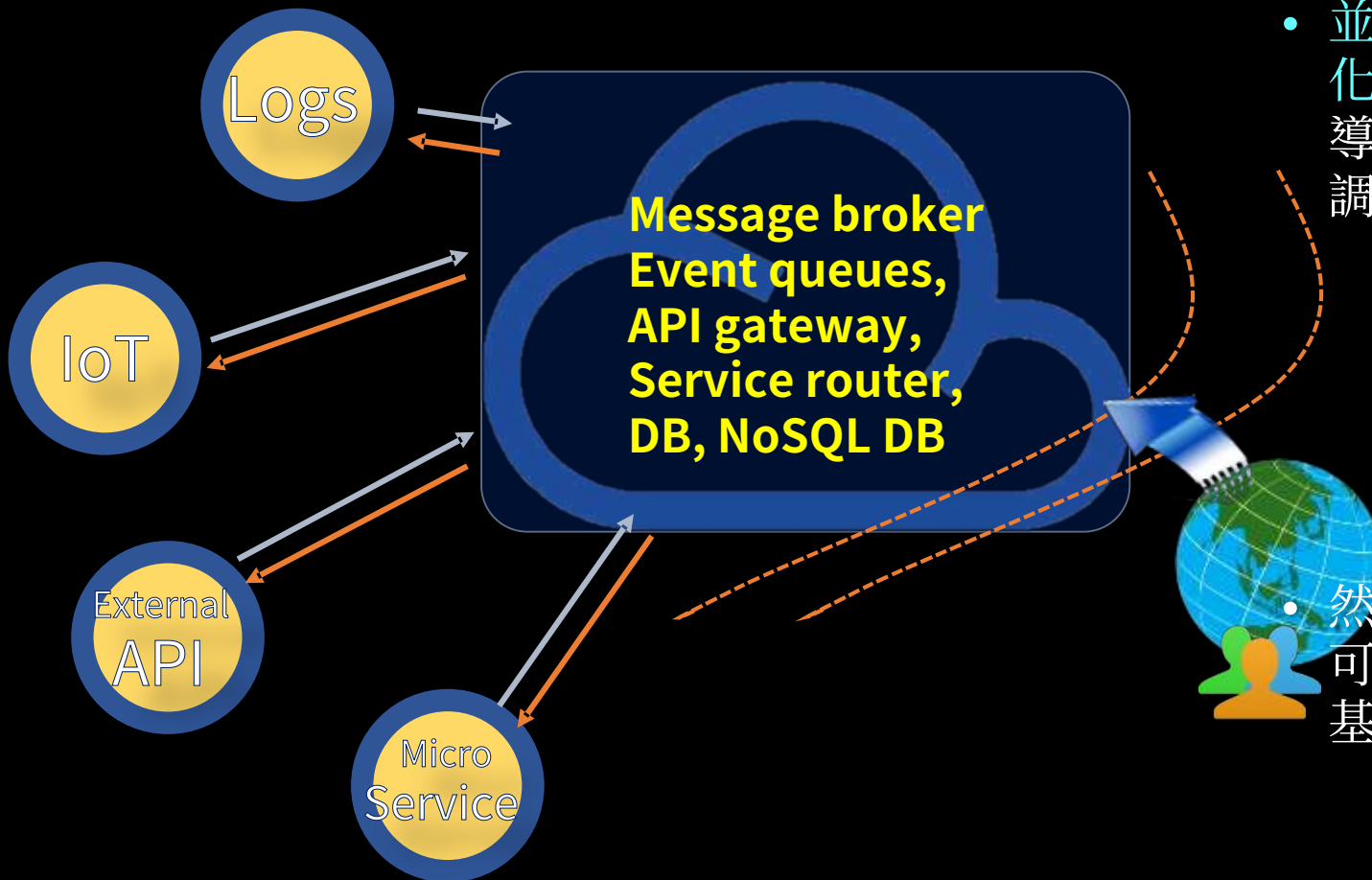
NORLOR205Iwer10Hatacspah 2021/10/03 12:41:39 484112 緯度: 27 21.2142 經度: 121 48.8593 高度: 5.88 速度: 0.1 轉 日期:	NORLOR205Iwer10Hatacshp 2021/10/03 12:41:39 138890 SETDT, 252.4, f, 76.9, M, 42.1, F*0E SETDT, 252.9, f, 77.1, M, 42.1, F*0A SETDT, 251.7, f, 76.7, M, 42.0, F*0I SETDT, 263.6, f, 80.4, M, 43.9, F*0J SETDT, 249.7, f, 76.3, M, 41.6, F*0B SETDT, 248.9, f, 79.9, M, 41.5, F*0C
---	--

019.70



整合與展示

# Stream of Information

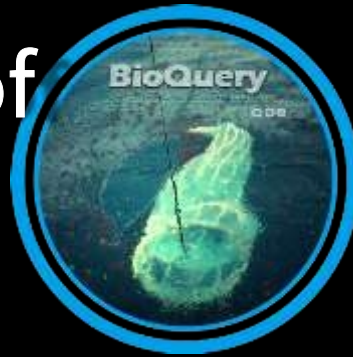


- 並非追求結構的複雜化而是以“完成任務”導向架構最簡化、可調性 (scalability) 結構
- 資料、服務分散化，有助於可調性架構。資訊在其中的“流動”是架構設計的考慮重點
- 然而資訊服務結構的可調性，完全取決於基礎 IT 軟硬體的配合
- 開源化、開放性架構會是長遠選擇

# IRIS 研究船即時資訊互動系統

Interactive Real-time Information System on NOR1

## Infrastructure of BioQuery API



## Identification Keys of Calanoid Copepods

# IRIS 研究船即時資訊互動系統

## Interactive Real-time Information System on NOR1

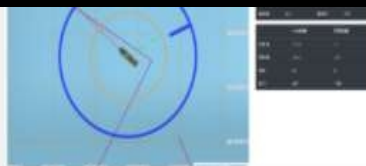
進行科研調查時協助船上作業人員

☒ 掌握即時船舶動態  
強化部門協同作業

☒ 資料即時檢視比對  
確保儀器運作正常

☒ 實時作業影像監看  
提升人員作業安全

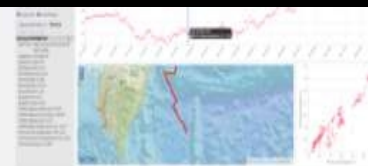
☒ 科研設備影像串流  
了解設備運作現況



新海研1號即時動態



儀器資訊看板文字版



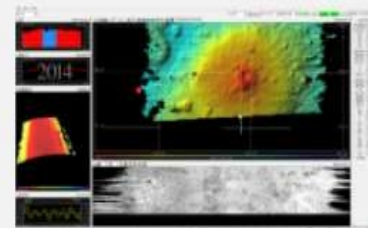
本航次資料展示



CTD畫面串流



TimeZero畫面串流



Multibeam畫面串流

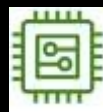
Data

Information

Strategy

# 研究船探測資訊系統 IRIS

感測器  
(提供資料)



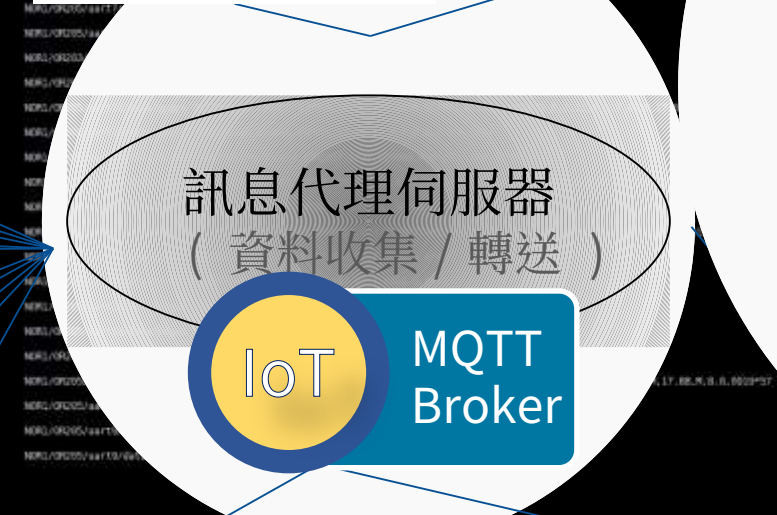
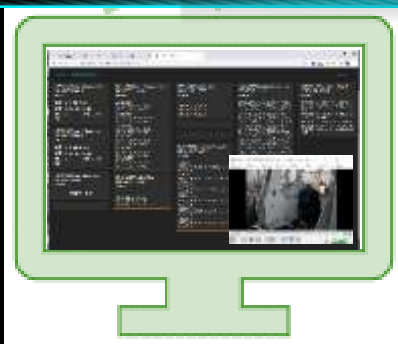
訊息代理伺服器  
(資料收集 / 轉送)

IoT

MQTT  
Broker

訊息代理伺服器  
可同時提供多位使用者依需求訂閱資料並呈現

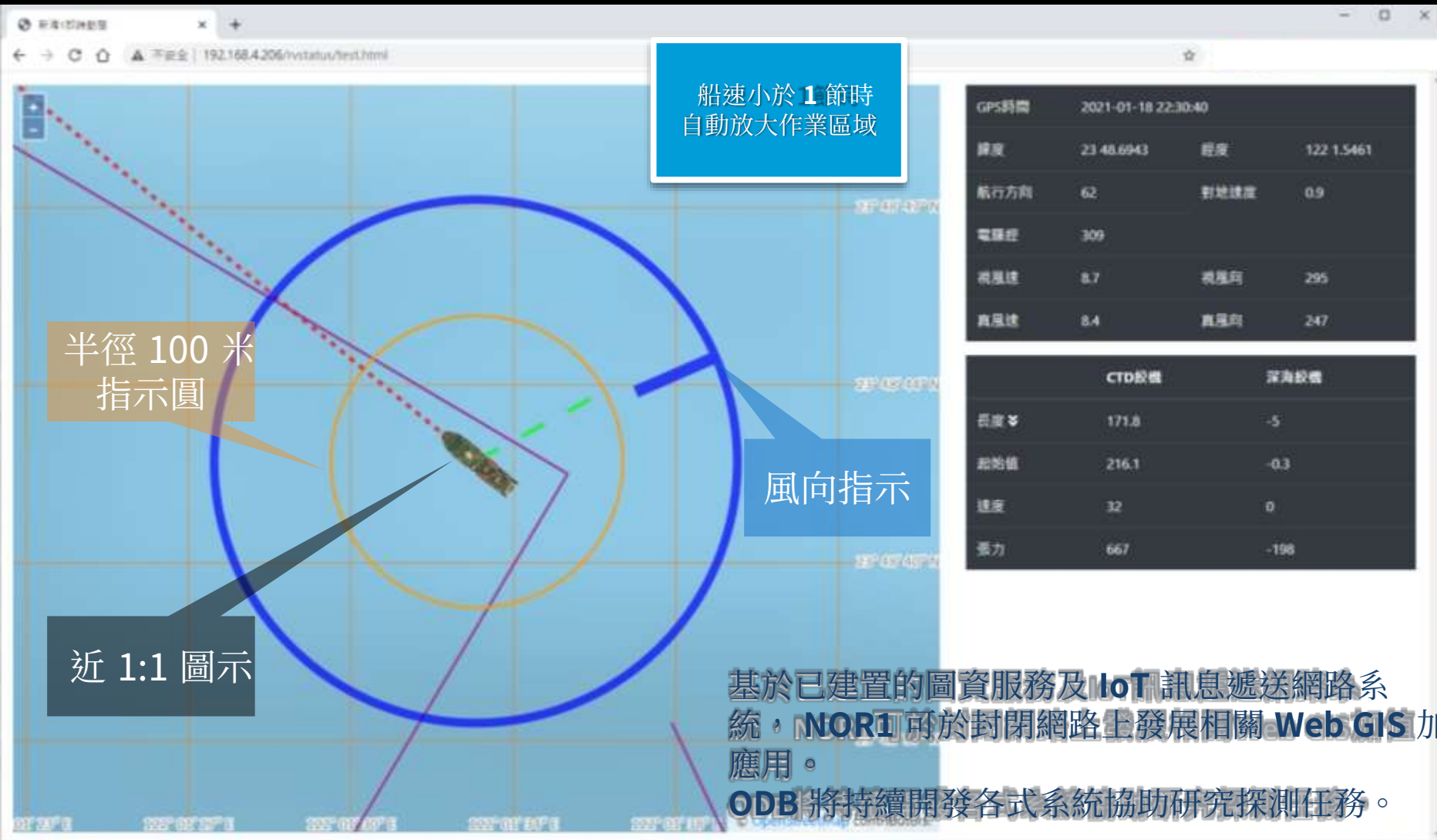
EX:  
研究船副控室  
電儀室  
濕式實驗室  
作業甲板  
匯入資料庫系統



# 研究船探測資訊系統建置 — 即時船舶動態

NOR1 已完成建置之圖資服務系統

- 開放街圖服務 (Open Street Map)
- ODBWMS 底圖服務 - 全球水深 (ETOPO1)
  - 臺灣週邊海域 200 公尺解析度水深





# IRIS 系統 - 儀器資訊看板／儀器串流畫面

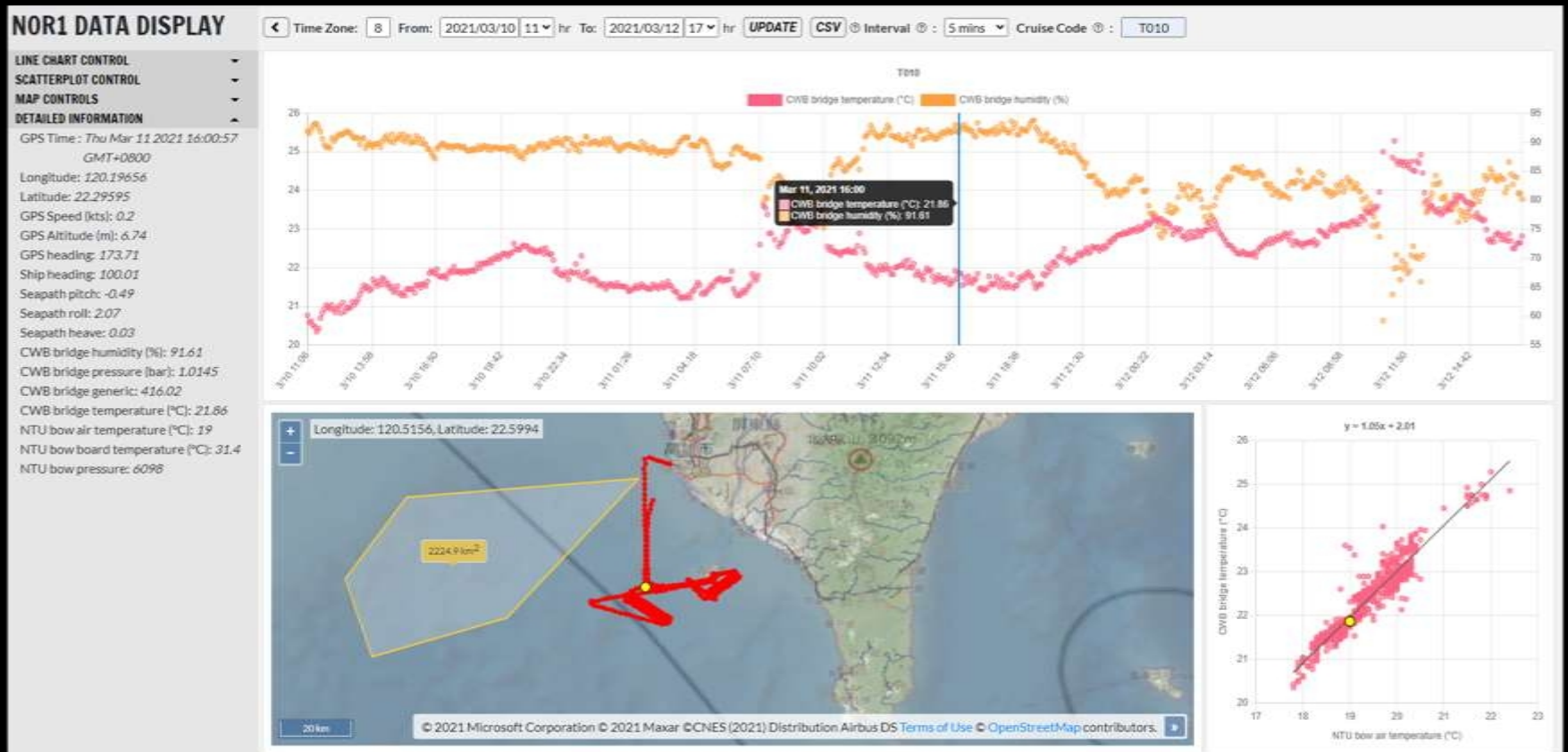
- ☒接收儀器原始資訊，即時檢查 IoT 運作
- ☒儀器串流畫面與電儀室電腦畫面近同步（有數秒延遲），可異地監控 CTD、Time Zero、EM2040、EM304、EA640、EK80、ADCP150K、SBP

The screenshot displays the IRIS system interface, which is divided into several sections. On the left, there are three panels showing instrument status and location data for different sensors. The top panel shows data for NOR1/OR205/uart9, including coordinates (25 9.2984, 121 45.5625) and a value of 972449. The middle panel shows data for NOR1/OR205/uart10, including coordinates and a value of 345301. The bottom panel shows data for NOR1/OR205/uart7, including coordinates and a value of 756397. In the center, there are two panels showing raw data streams for NOR1/OR205/uart10 and NOR1/OR205/uart7, displaying hexadecimal and ASCII data. On the right, there are two panels showing raw data streams for NOR1/OR205/uart13 and NOR1/OR205/weather1. At the bottom right, there are two video feeds showing live data from sensors, with depth readings of 3393 m and 3395 m. The interface also includes a top navigation bar with the title '新海研1號儀器資訊看板' and a date/time display '日/夜'.

# 海上作業後勤支援 — 研究船即時資料展示系統

## 供管理及研究人員查看下載最新資料

- ☒ 即時掌握資料品質
- ☒ 快速查詢過往時段之海氣象資訊
- ☒ 配合地圖掌握資料與位置關係



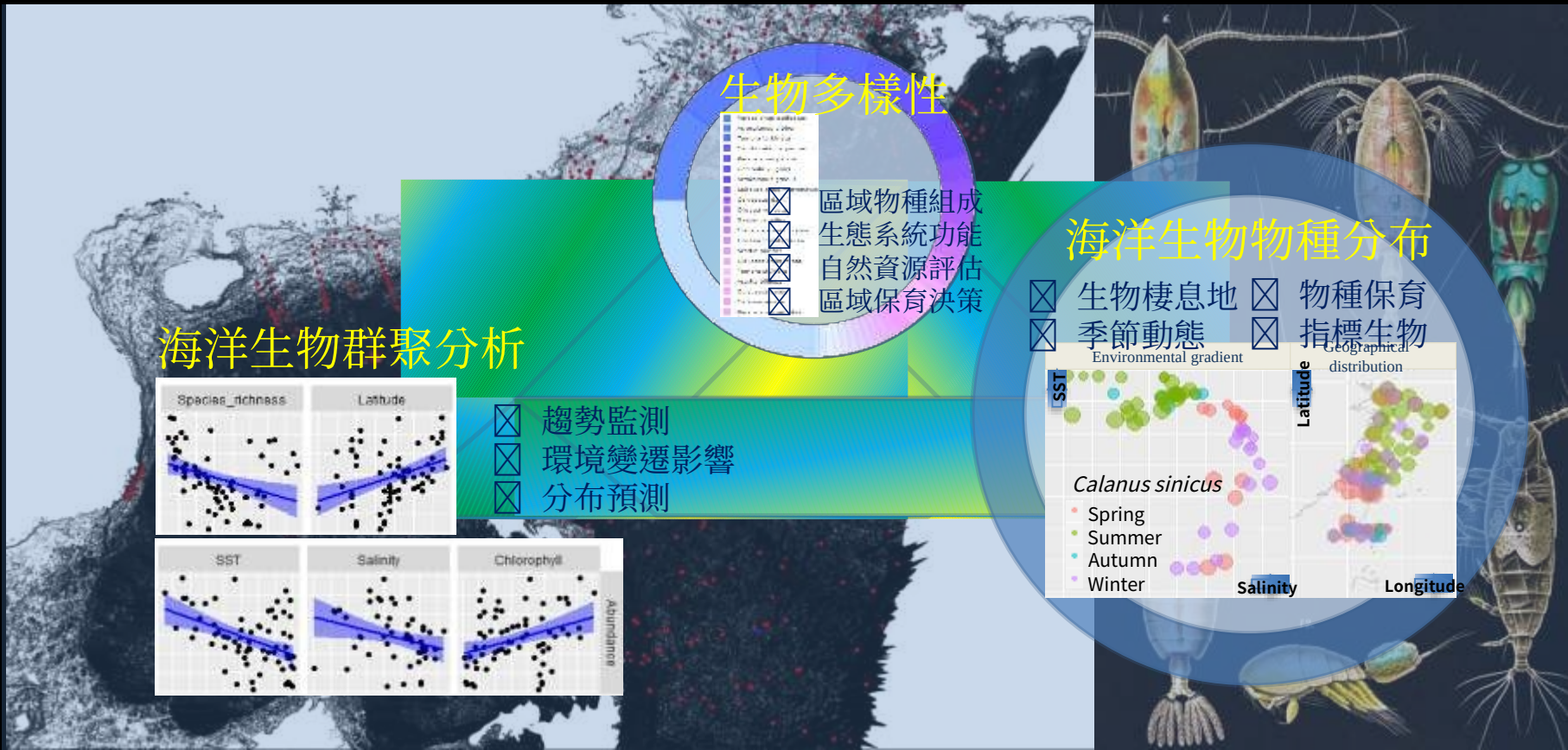
# 研究船探測資訊系統建置—影像串流系統

研究船內部網路提供

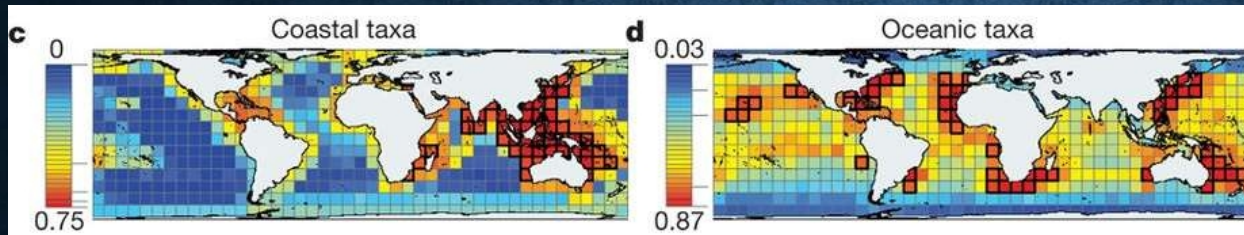
- 研究船作業區實時影像供操作人員使用，提升作業安全
- 軟體操控系統畫面推播供一般人員使用，了解作業進度



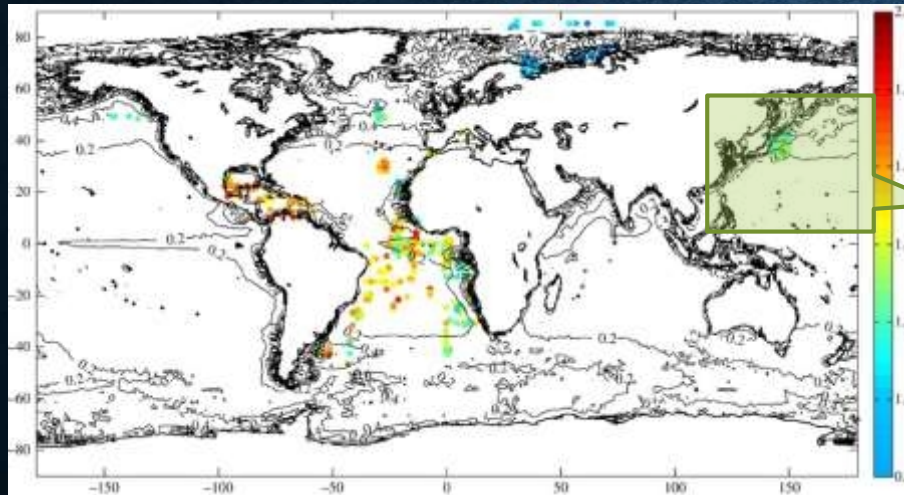
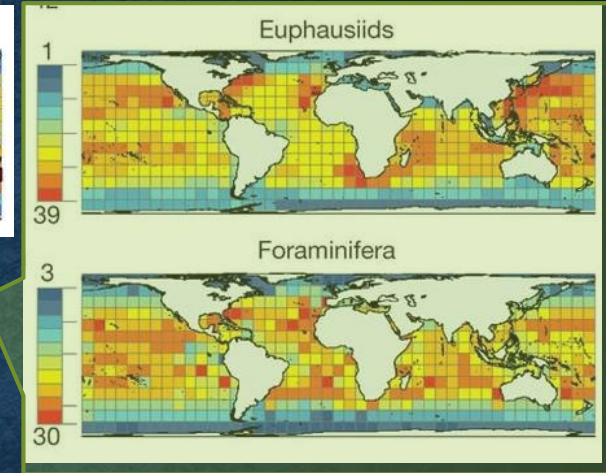
# Infrastructure of BioQuery API



# 西太平洋在全球海洋生物多樣性具重要地位



- 浮游生物物種類群資料明顯較不足
- 區域性尺度下，群聚豐度資料闕如



- ODB致力於蒐集東亞海域浮游動物、仔稚魚群聚豐度資料，將有助於理解浮游動物群聚生態在西太平洋所佔關鍵性連結的生態地位

Tittensor, D. P. D. et al., 2010. Global patterns and predictors of marine biodiversity across taxa. *Nature*, 466(7310):1098–

Rombouts, I., et al. 2009. Global latitudinal variations in marine copepod diversity and environmental factors. *Proceedings of the Royal Society B: Biological Sciences*, 276(1670):3053–3062.

# ODB Bio-database

資料來源、內容、  
採樣站點

科技部計畫成果

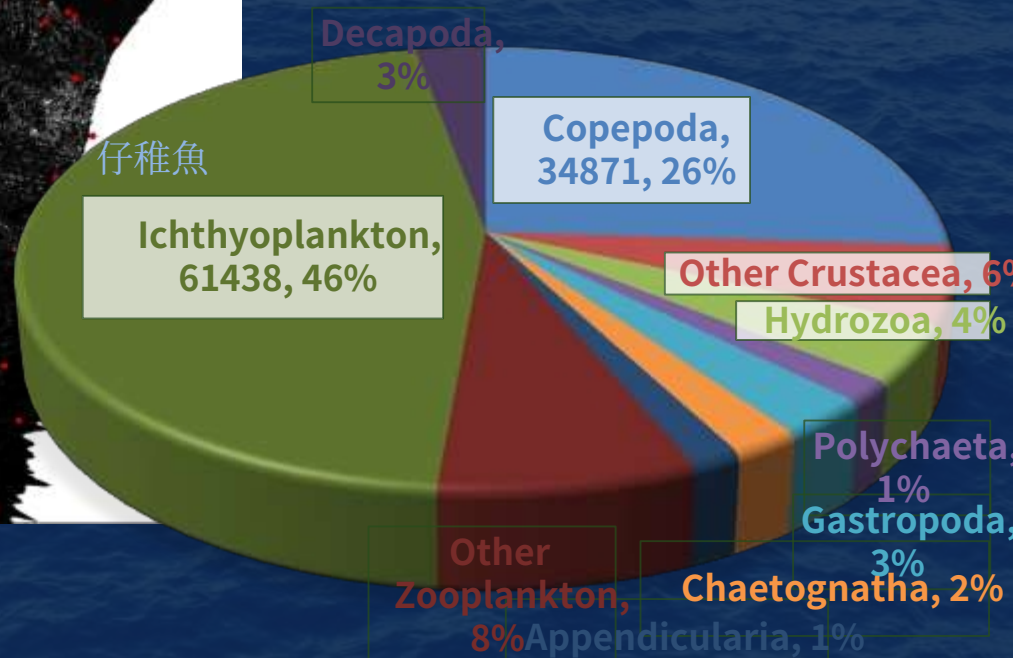
期刊論文

研究室資料共享

公開資料庫



彙整臺灣周遭海域的生物拖網資料，  
且具群聚豐度之記錄為主。生物類群  
則以海洋浮游動物、仔稚魚為主。經  
資料正規化、學名校正、品質控制之  
後進入關聯性資料庫。



仔稚魚

Ichthyoplankton,  
61438, 46%

Copepoda,  
34871, 26%

Other Crustacea, 6%

Hydrozoa, 4%

Polychaeta,  
1%

Gastropoda,  
1%

3%

Chaetognatha, 2%

Other

Zooplankton,  
8%

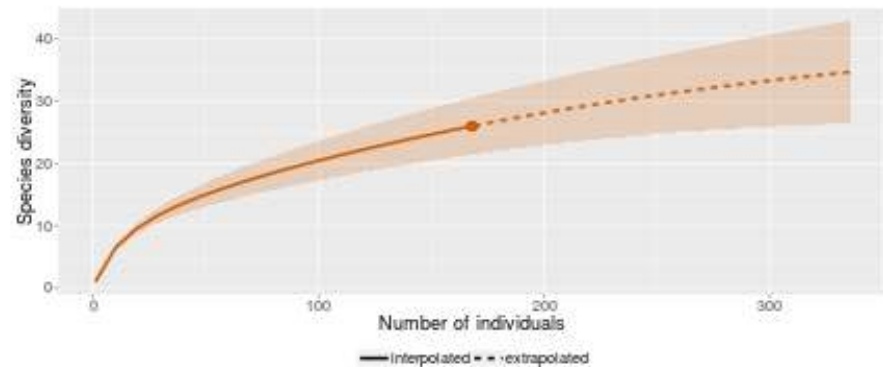
Appendicularia, 1%

Decapoda,  
3%

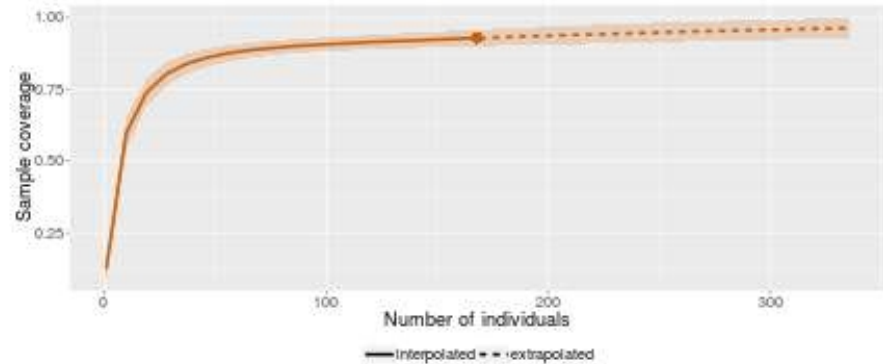
資料庫提供的資料服務，並非為了提出新理論或統計上新解法，而是讓使用者更便利、更快速使用資料、了解資料與檢視資料模式

- 不重複發明輪子
  - 更彈性地加入既有統計模組、套件
- 快速開發、部署
  - 多數生態研究者並非專業的程式人員，更希望彼此處理資料的方法可以共享，把時間花在其他研究刀口
- 讓資訊服務回到生態研究問題上
  - 尺度 **Scale** 以及區域間比較
  - 與環境因子的關聯性
  - 不同方法下是否得到**再現**、**一致**結果
- 資料模式、統計成果呈現

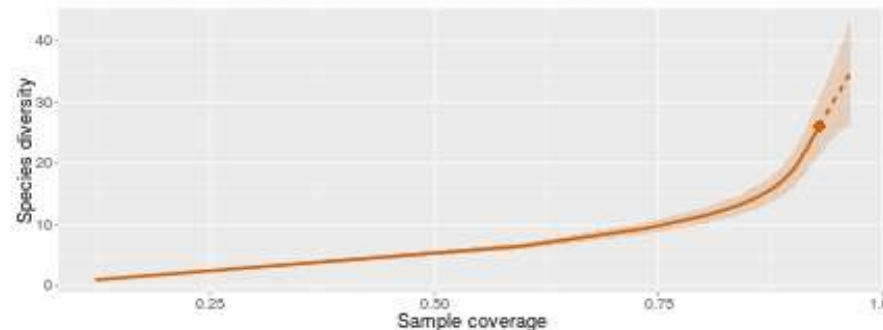
(1) Sample-size-based rarefaction and extrapolation sampling curve



(2) Sample completeness curve



(3) Coverage-based rarefaction and extrapolation sampling curve



# RESTful API: curl

<https://bio.odb.ntu.edu.tw/api/>

## ODB 生物海洋資料庫架構與資訊服務

### Meta Query API in Bio-database

```
root@bapp09 tnp]# curl http://192.168.2.29:8080/api/geo/bio/geojson?file=Shall_pts.txt -F "dbname='odbio2'" -v -o output07.json
```

透過API查詢區域 (設定經緯度範圍)

透過API所取得生物資料地理資訊示意 (黑點為所有採樣點 紅色為查詢區域)

```
date_start "1983-07-25"
date_end "2013-07-04"
lng_min "123.8136"
lng_max "135"
lat_min "26.267"
```

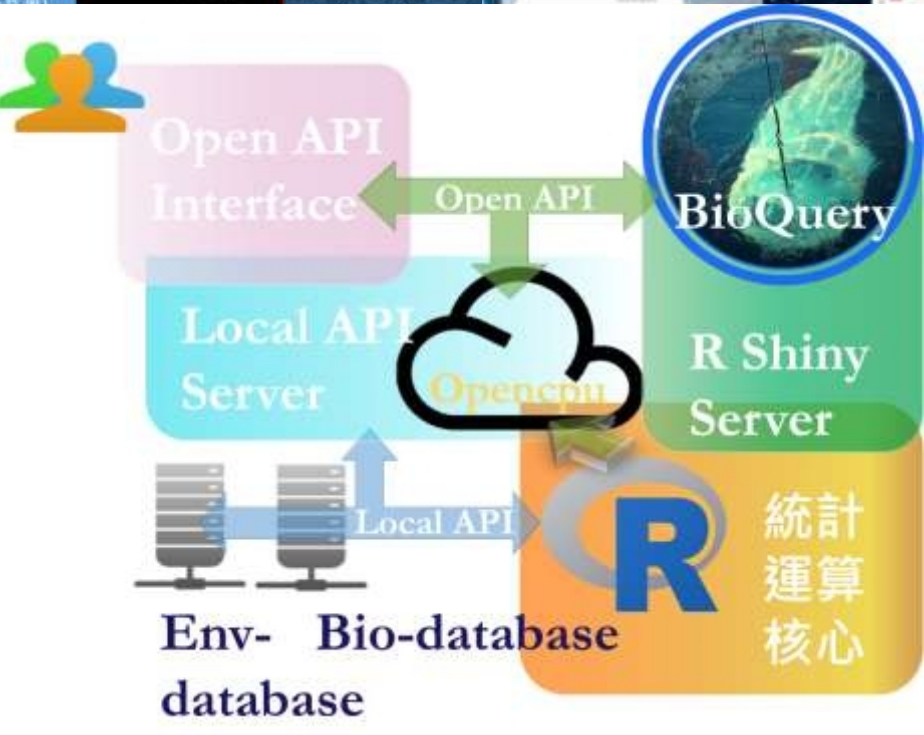
API實際在何處傳遞資訊掃描

Down Data Mark Access

Map of Taiwan with data points and plots.

```
# Requires Ubuntu 18.04 (Bionic) or 16.04
sudo add-apt-repository -y ppa:opencpu/opencpu
sudo apt-get update
sudo apt-get upgrade

# Installs OpenCPU server
sudo apt-get install -y opencpu-server
```



ggplot2

data.table

iNEXT

R

GeoComputation



# Identification Keys of Calanoid Copepods

非典型資料 Context → Key (Features) extraction

Taxonomy, key link

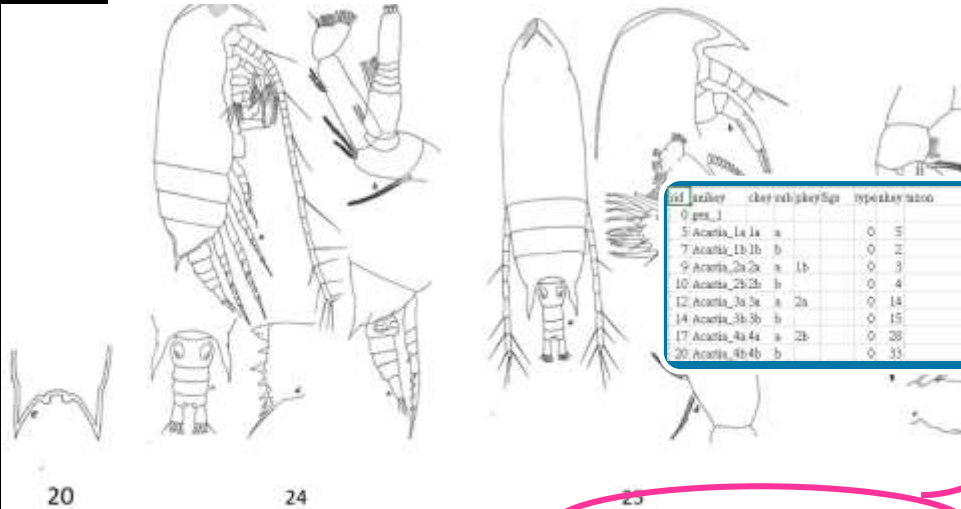
Identification key

Key to the species of *Aetideus* occurring in the China seas

*Aetideus acutus*(4a/10a/f), *armatus*(6b/8a/f), *bradyi*(3a/11b/f), *divergens*(6a/8b/f), *giesbrechti*(4b/11a/f), *truncatus*(5a/9a/f).

1a	Female.....	2
1b	Male.....	7
2a/1b	Posterolateral corners of prosome reaching at least posterior border of urosomite 2.....	3
2b	Posterolateral corners of prosome at most reaching midlength of urosomite 2.....	5
3a/2a	Base of rostrum without knobs.....	<i>Aetideus bradyi</i>
3b	Base of rostrum with 2 knobs.....	4

Context → Key  
→ HTML tags



id	author	key	keyfigs	typekey	axon	altree	fid	name	idgen	genus	family	order	keyid	key	sex	
0	gen_1									Acartia	Acartiidae	(Acartiaria) hirtellae				
5	Acartia_1a_1a	a		0	5					Acartia	Acartiidae	(Acartiaria) hirtellae				
7	Acartia_1b_1b	b		0	2					Acartia	Acartiidae	(Acartiaria) hirtellae				
9	Acartia_2a_2a	a	1b	0	3					Acartia	Acartiidae	(Acartiaria) hirtellae				
10	Acartia_2b_2b	b		0	4					Acartia	Acartiidae	(Acartiaria) hirtellae				
12	Acartia_3a_3a	a	2a	0	14					Acartia	Acartiidae	(Acartiaria) hirtellae				
14	Acartia_3b_3b	b		0	15					Acartia	Acartiidae	(Acartiaria) hirtellae				
17	Acartia_4a_4a	a	2b	0	28					Acartia	Acartiidae	(Acartiaria) hirtellae				
20	Acartia_4b_4b	b		0	33					Acartia	Acartiidae	(Acartiaria) hirtellae				

*Aetideus giesbrechti* Cleve, 1909

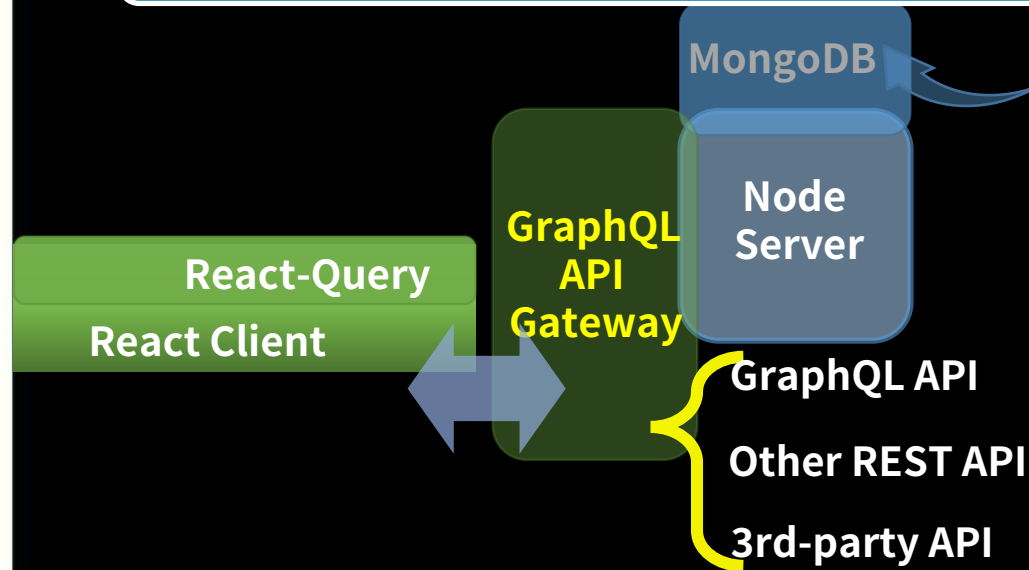
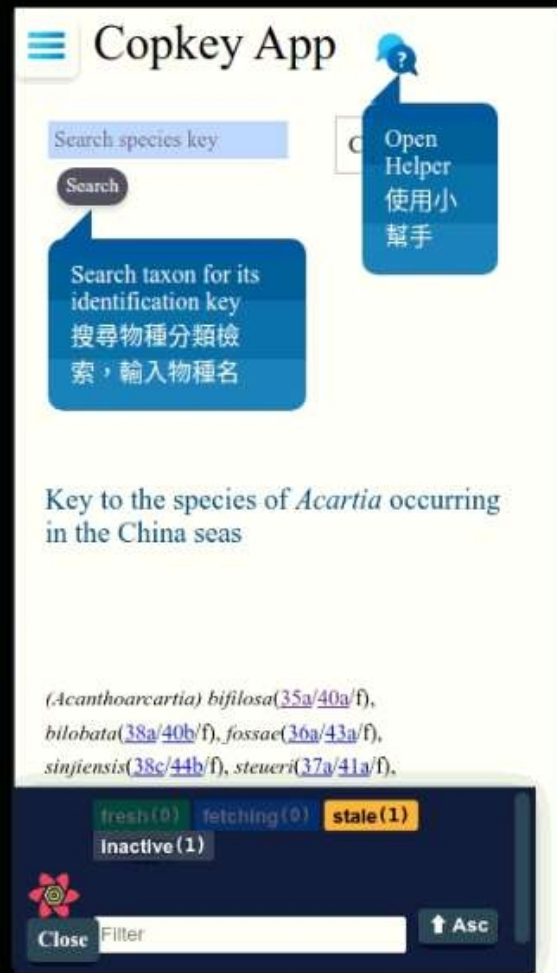
Figure corresponding

Reference, citation

Vervoort, 1957. As *Euaetideus giesbrechti*. Fig.20c. Female: distal portion of rostral plate. Fig.24 c/o. posterior part of prosome and urosome (dorsal/lateral); d, mandible (cutting edge). Fig.25

# Context → Key → HTML tags → Web rendering by user query

id	taxkey	class	phyletic	type	key	name	altname	idname	subgen	genus	family	synonym	keyid	ctrl	key	sex
0	gen_1									Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
5	Acartia_1a_1a	a		0	5					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
7	Acartia_1b_1b	b		0	2					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
9	Acartia_2a_2a	a	1b	0	3					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
10	Acartia_2b_2b	b		0	4					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
12	Acartia_3a_3a	a	2a	0	14					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
14	Acartia_3b_3b	b		0	15					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
17	Acartia_4a_4a	a	2b	0	28					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of
20	Acartia_4b_4b	b		0	33					Acartia	Acartiidae	(Acartiidae)	bifilosa	id=	key	to the species of <i>Acartia</i> occurring in the China seas of



- 群聚生態資料規模“成長”有一定限制，資料的**增值**，與多樣資料的整合，以及容納外部資料來源將是未來重點。反映在資訊服務的實作上，朝向彈性結構的微服務與應用程式介面。
- **需求與可調性**影響了資訊服務的基礎架構，也將影響資訊服務疊架的可能性，也常有取捨 e.g. 不重複發明輪子、快速部署開發 VS. 服務的效能與規模限制性

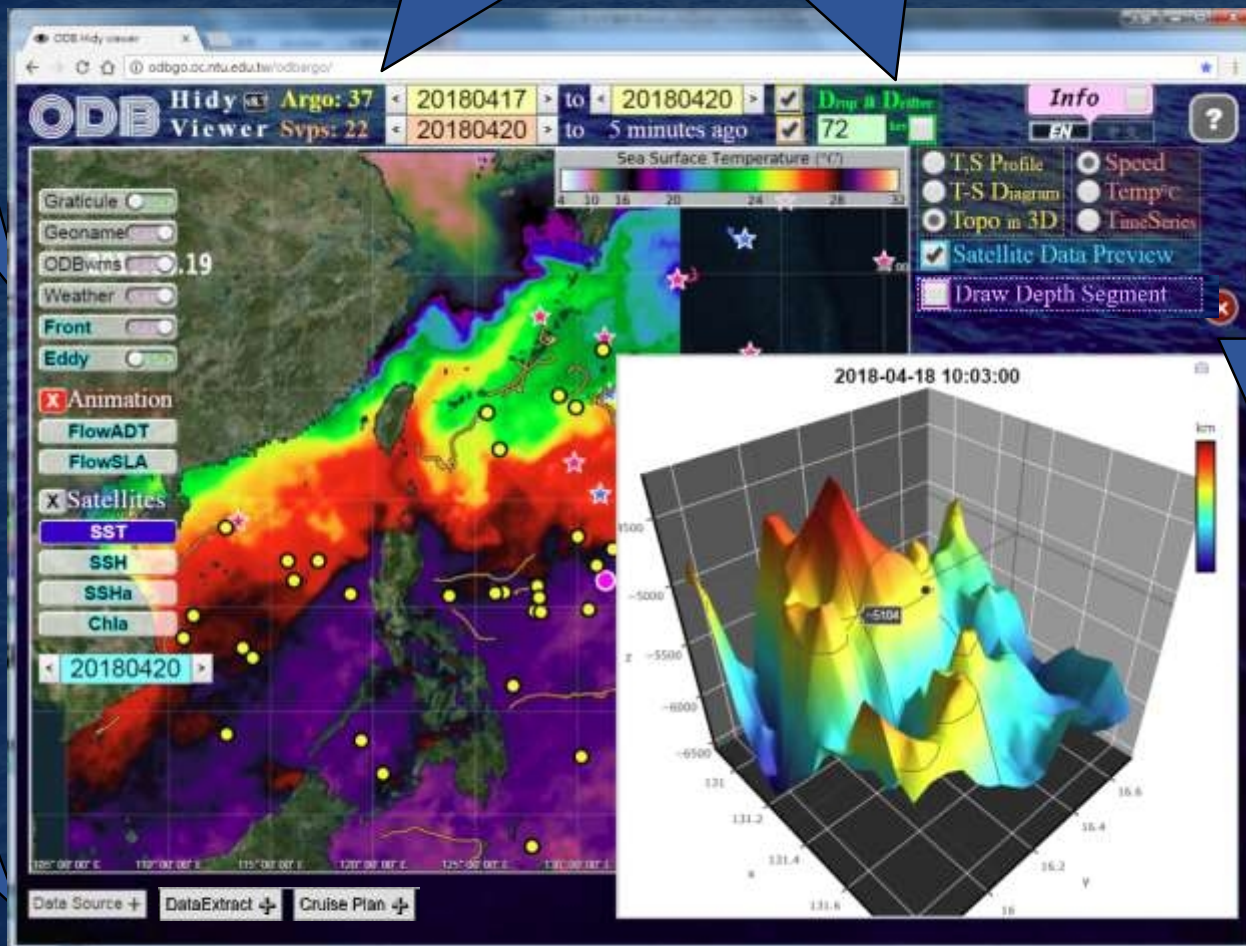
# ODBHidyviewer — 「海的」資料展示網頁

(<http://odbgo.oc.ntu.edu.tw/odbargo>)

臺灣周遭海域Argo、SVP  
數量與時間顯示/控制

表層平均場漂流軌跡模擬

海洋地名圖  
層、物理環境  
疊圖，如海表  
溫度、溫度鋒  
面、渦旋、海  
流等



Argo水文溫  
鹽深度剖面、  
溫鹽密  
度分布、附  
近3D地形、  
SVP漂流速  
度、其軌跡  
海水溫度、  
時間序列等  
圖資

資料來源、資  
料匯出、航次  
規劃工具

# 海上作業後勤支援 — 開發各式探測輔助工具

## C-Plan 航次規劃小幫手

- 快速製作出海申請單
- 協助海委會進行出海計畫審查

**Sites**

ID	經度	緯度	名稱
9	122.3516	23.7429	K105
10	122.6102	23.6953	K106
11	122.8261	23.6500	K107
12	123.0000	23.6170	K108
13	121.4103	22.7431	K1

**Schedule**

ID	距離	船速[節]	航時[hr]	作業時間	作業項目
1	8.0		0.0		O:出港
1B	46.7	9.4	5.0	0.0	點擊制設定工作項目
2	13.1	2.6	5.1	3	C,R,G,C,O,VMP-500
3	7.2	2.4	3.0	0.0	O:VMP-500
4	78.1	9.8	8.0	2	O:下放Glider
5	49.1	9.8	5.0	5	C,R,O,LADCP,VMP-500
6	7.9	3.0	2.6	5	C,R,O,LADCP,VMP-500
7	7.9	3.0	2.6	5	C,R,O,LADCP,VMP-500

**鍵產出**

ID	經度	緯度	名稱
1	122.3516	23.7429	K105
2	122.6102	23.6953	K106
3	122.8261	23.6500	K107
4	123.0000	23.6170	K108
5	121.4103	22.7431	K1

QR Code

**航次規劃輔助：颱風查詢**

Language	Latitude	Name
121.178	23.101	Amboya
121.460	23.007	...
121.708	23.117	...

**跨平台支援：Hidy 線上觀看**

ODS Hidy Viewer

### Meta Query API in Bio-database

透過API查詢區域 (設定緯經度範圍)  
取得範圍內檢樣資料

```

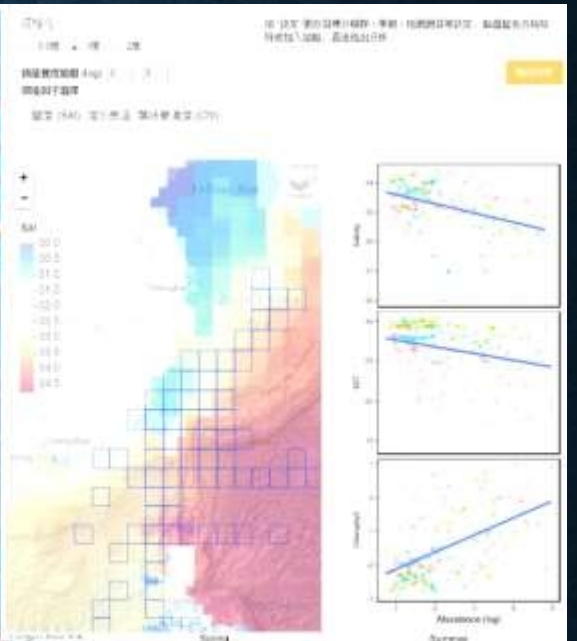
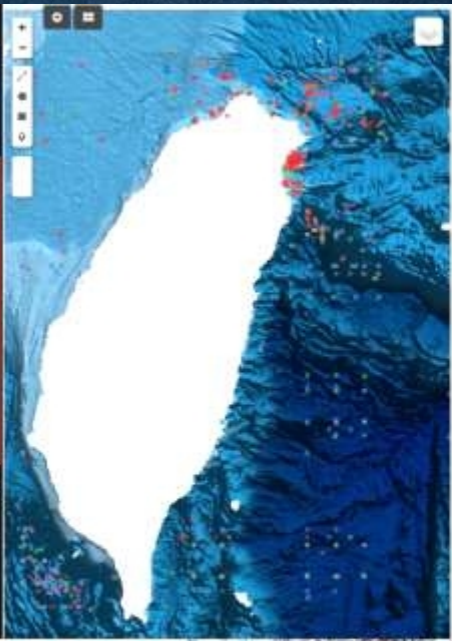
[root@pp09 tmp]# curl http://192.168.2.29:80/oddbapi/R/geoBio/json -F "file=@null_pts.txt" -F "dbname='oddbio2'" -v --output 02.json
Trying 192.168.2.29...
* Total   % Received % Xferd Average Speed      Time      Time      Time      Current
           Dloaded Upload Total      Spent      Left   Speed
0           0     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
Connected to 192.168.2.29 (192.168.2.29) port 80 (#0)
> POST /ocpu/library/oddbapi/R/geoBio/json HTTP/1.1
Host: 192.168.2.29

```

透過API所取得生物資料地理資訊示意 (黑點為所有採樣點 紅色為查詢範圍)

API實際在伺服器間傳遞資訊操作畫面

date_start	"1965-07-15"
date_end	"2013-07-04"
long_min	"123.8136"
long_max	"135"
lat_min	"26.267"
lat_max	"37.767"
records	"15612"
cruiises	"147"
sites	"1069"
taxons	"403"



# 謝謝指教!!

