

RV Cefas Endeavour FerryBox:- robust QA systems providing operational data for UK Eutrophication Assessments



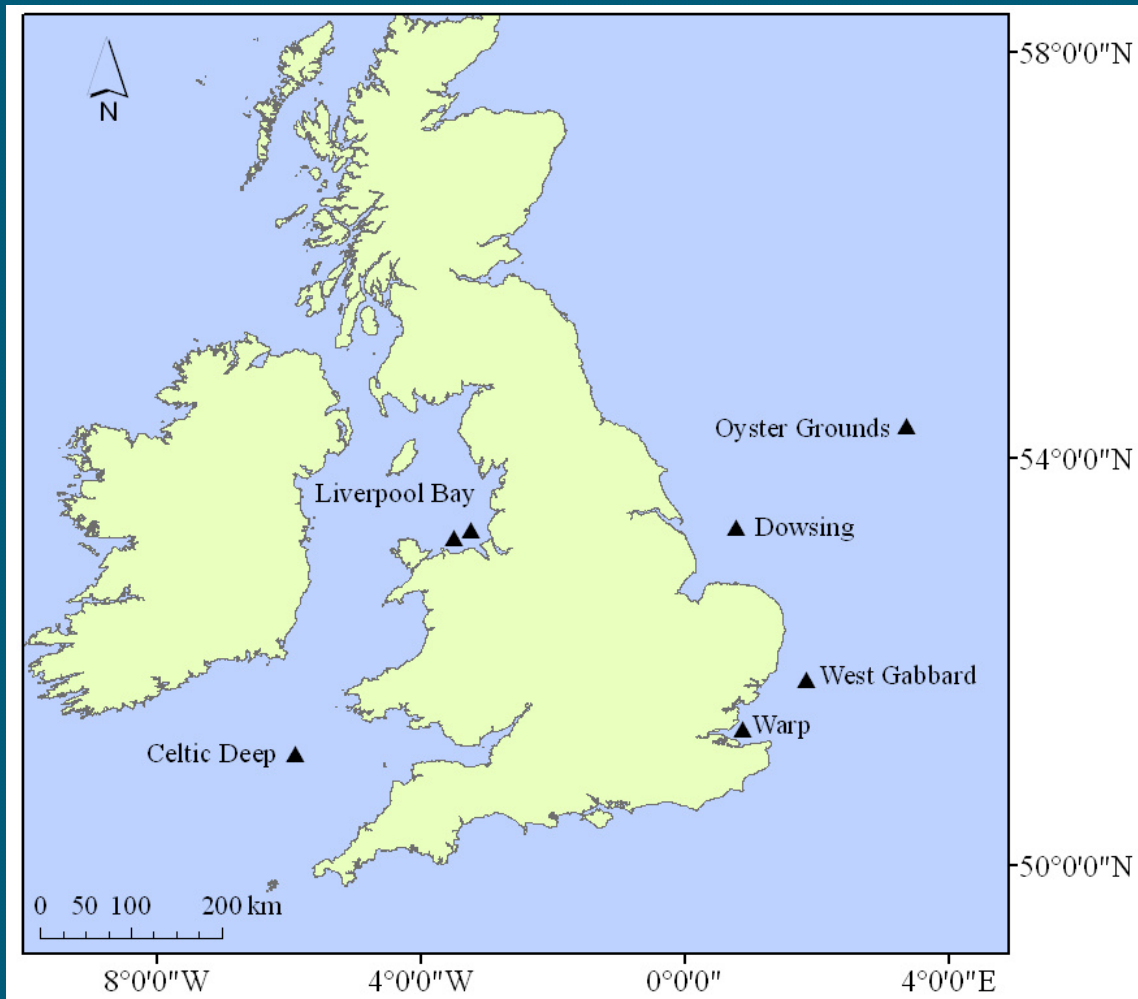
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Dave Sivyler, Jo
Foden, Tom Hull,
David Pearce, Terry
Gooding, Marc
Scriven, Dave Mills

Historical survey design

- Report to OSPAR
- Ship based observations
- Good spatial coverage
- Poor temporal resolution
 - Annual winter nutrient survey
 - Occasional summer survey
- Limited biological data
 - Chlorophyll, oxygen
- Labour intensive (expensive)

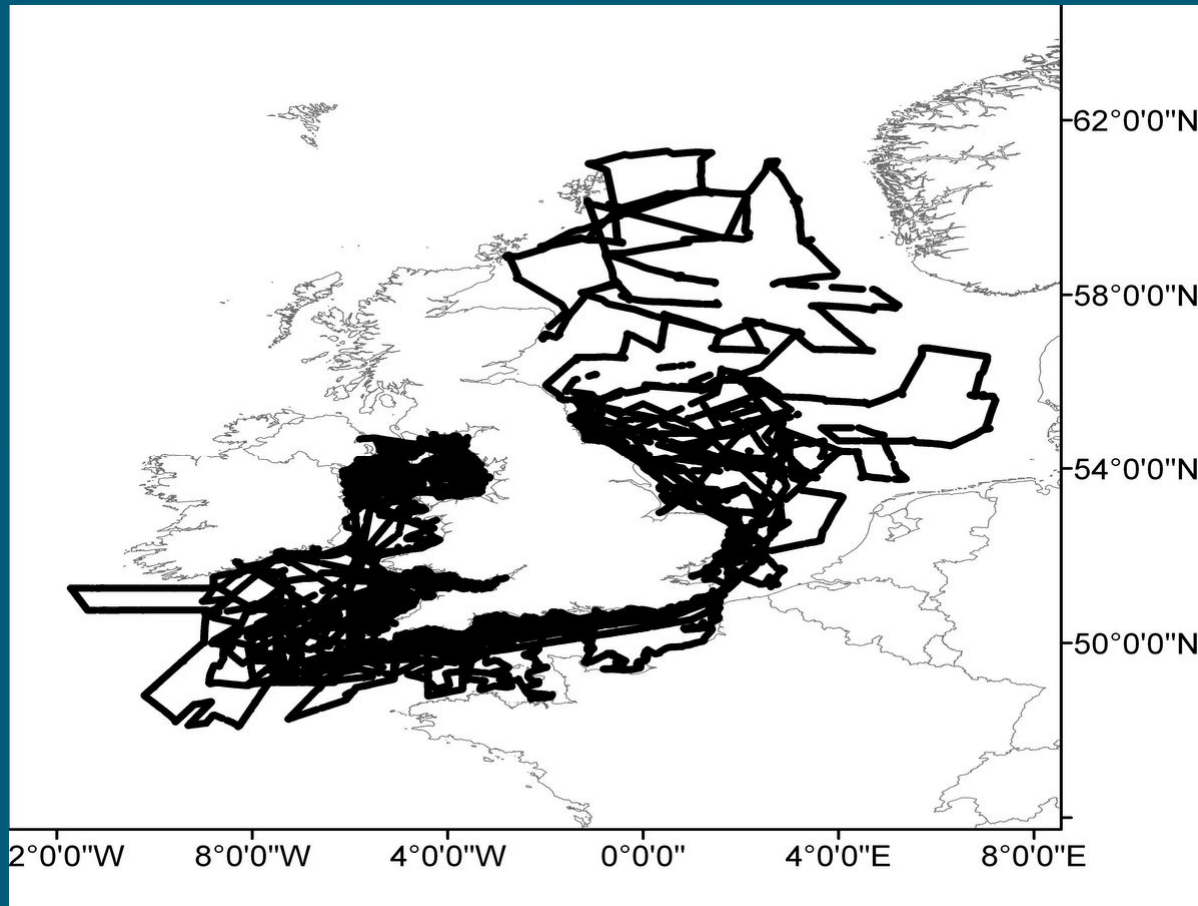


Cefas *in situ* monitoring - SmartBuoy network



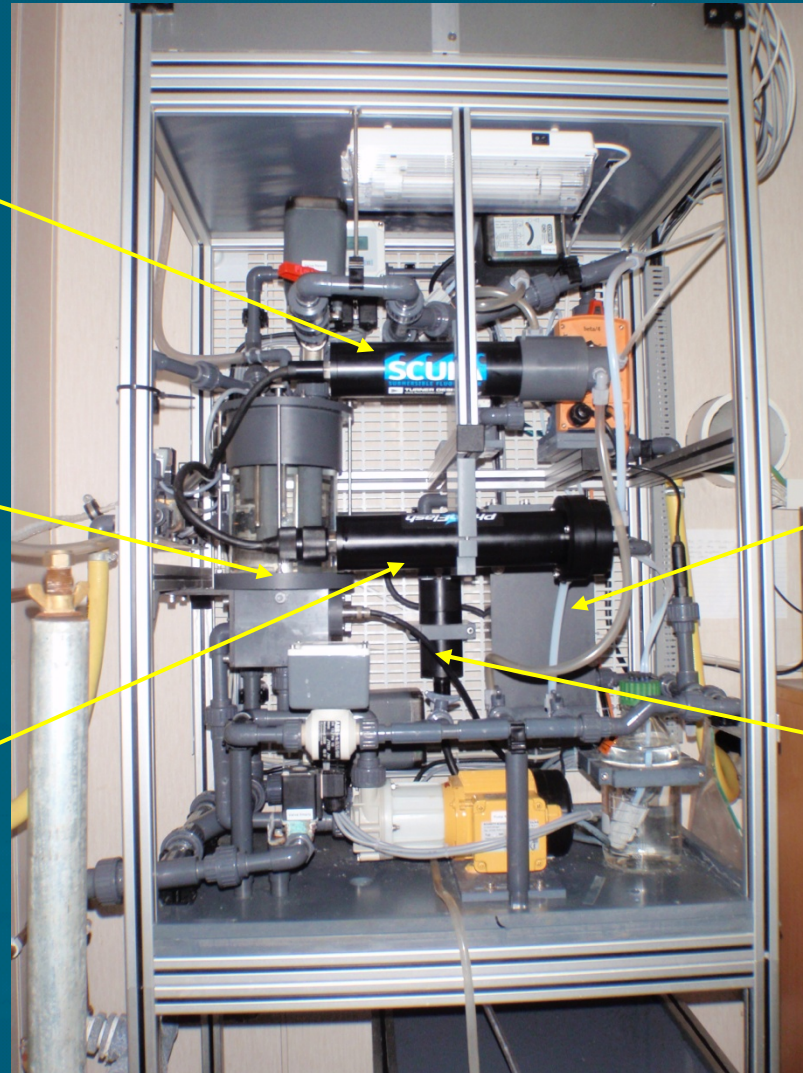
- Operational since Nov 2000
- Complement ship based measurements – good temporal resolution
- Discrete locations
- Data used for water quality assessments (OSPAR, MSFD)

RV Endeavour cruise track 2010



- Comprehensive cover of OSPAR regions in English and Welsh waters
- Ferrybox operational since January 2009

Ferrybox on RV Cefas Endeavour – 4H Jena



Chlorophyll
and turbidity
(Turner
SCUFA)

Oxygen
(Aanderaa
optode)

Turner Phytoflash

Hull mounted
PRT

Salinity and temp
(SBE45)

Chlorophyll
(Seapoint SCF)

Water sampler

- Samples preserved with mercuric chloride for nutrients analysis
- Collected in OSPAR winter (November to February)



Maintain sensor history

Select Sensors

Description:

Types:

- Platinum Resistance Thermometer
- Pressure / DAC Offset
- Roll / Pitch
- Satlantic SUNA Optical Nitrate Sensor (Analog)
- Thermosalinograph
- TriAxis Sensor

Display Current Records Only:

Display Selected Records (1)

Sensor Id	Descr	Type	Serial Number	Current?
530	Seabird SBE45 Thermosalinograph	Thermosalinograph	45523560261	Yes

Select Cancel

Sensor Details (ID 530)

General Declarations Parameters Service History Additional Comments Audit Details

Id:

Description:

Sensor Type:

Serial Number:

Sensor Handling Method:

Has Gain Control?:

Current Drawn (mA):

Service Interval (months):

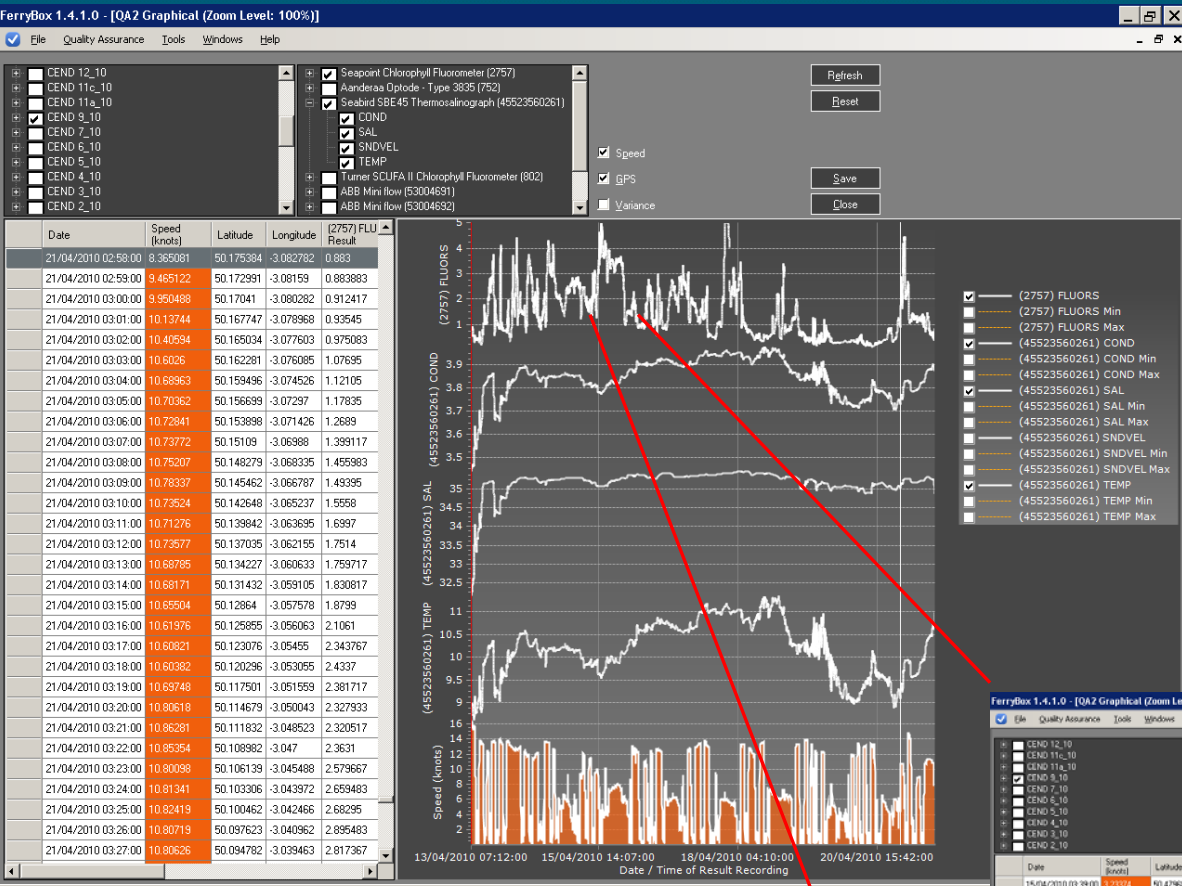
Calibration Interval (months):

Deployments Where This Sensor Has Been Used:

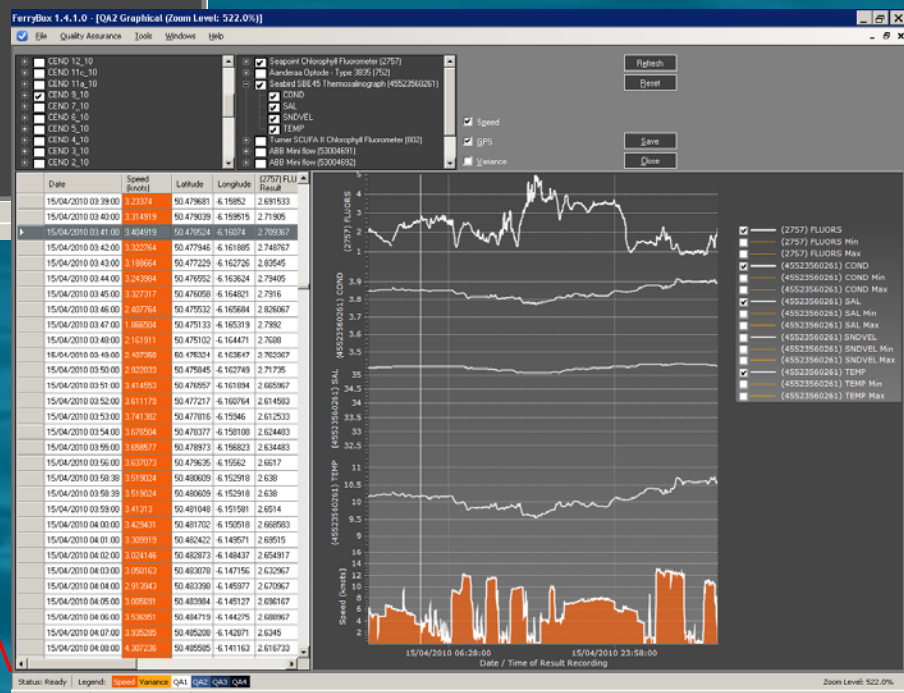
Current Record?:

OK Apply Cancel

- All sensors must be on database
- Calibrations and service details maintained
- Audit trail
- Configuration sent from Ferrybox



Quality assurance interface



• Data visualisation

QA level 2 – apply flags

FerryBox 1.4.1.0 - [QA2 Graphical (Zoom Level: 100%)]

File Quality Assurance Tools Windows Help

CEND 12_10
 CEND 11c_10
 CEND 11a_10
 CEND 9_10
 CEND 7_10
 CEND 6_10
 CEND 5_10
 CEND 4_10
 CEND 3_10
 CEND 2_10

Seapoint Chlorophyll Fluorometer (2757)
 Aanderaa Dptode - Type 3835 (752)
 Seabird SBE45 Thermosalinograph (45523560261)

COND
 SAL
 SNDVEL
 TEMP

Turner SCUFA II Chlorophyll Fluorometer (802)
 ABB Mini flow (53004691)
 ABB Mini flow (53004692)

Speed
 GPS
 Variance

Refresh

Reset

Save

Close

Date	Speed (knots)	Latitude	Longitude	(2757) FLU Result
15/04/2010 12:05:00	2.159756	50.649639	-5.200274	1.98905
15/04/2010 12:06:00	1.969797	50.649333	-5.201001	2.378367
15/04/2010 12:07:00	2.182358	50.649015	-5.201801	2.513967
15/04/2010 12:08:00	0.935122	50.648795	-5.202343	2.573833
15/04/2010 12:09:00	0.335691	50.648704	-5.202549	2.779183
15/04/2010 12:10:00	1.174024			
15/04/2010 12:11:00	1.879797			
15/04/2010 12:12:00	1.886789			
15/04/2010 12:13:00	1.369228			
15/04/2010 12:14:00	1.318374			
15/04/2010 12:15:00	1.307276			
15/04/2010 12:16:00	1.30561			
15/04/2010 12:17:00	1.109309			
15/04/2010 12:18:00	1.135325			
15/04/2010 12:19:00	1.06939			
15/04/2010 12:20:00	1.102927			
15/04/2010 12:21:00	1.135447			
15/04/2010 12:22:00	1.08126			
15/04/2010 12:23:00	1.111382			
15/04/2010 12:24:00	0.80435			
15/04/2010 12:25:00	0.591098			
15/04/2010 12:26:00	1.651545			
15/04/2010 12:27:00	2.329106			
15/04/2010 12:28:00	1.956707			
15/04/2010 12:29:00	2.220488			
15/04/2010 12:30:00	1.907317			
15/04/2010 12:31:00	1.22939			
15/04/2010 12:32:00	0.229756			
15/04/2010 12:33:00	0.093862			
15/04/2010 12:34:00	0.077602	50.649811	-5.199348	2.575417

Accept

Reject

Display Result Quality Details

Data failed QA - above maximum for parameter

Data failed QA - below minimum for parameter

Data failed QA - biofouled sensor

Data failed QA - dependency failure

Data failed QA - deviation from neighbouring point

Data failed QA - deviation from rolling mean

Data failed QA - discrepancy between two data sets

Data failed QA - hunting error on auto-ranging sensor

Data failed QA - light intrusion effect on optical sensor

Data failed QA - low battery voltage

Data failed QA - possible chlorophyll fluorescence quenching

Data failed QA - removed during Median filtering

Data failed QA - results outside limits (level 2)

Data failed QA - results outside specified concentration range (level 2)

Data failed QA - sensor flooded

Data failed QA - sensor is out of water

Data failed QA - sensor malfunction

Data failed QA - sensor not connected

Data failed QA - sensor platform out of position

Data failed QA - spike threshold exceeded

Data failed QA - suspicious data (unknown cause)

Data failed QA - Tpeak anomaly

Data failed QA - weed or debris on sensor / sensor obscured

Data failed QA - WMS bag not spiked with mercuric chloride

(2757) FLUORS
 (2757) FLUORS Min
 (2757) FLUORS Max
 (45523560261) COND
 (45523560261) COND Min
 (45523560261) COND Max
 (45523560261) SAL
 (45523560261) SAL Min
 (45523560261) SAL Max
 (45523560261) SNDVEL
 (45523560261) SNDVEL Min
 (45523560261) SNDVEL Max
 (45523560261) TEMP
 (45523560261) TEMP Min
 (45523560261) TEMP Max

13/04/2010 07:12:00 15/04/2010 14:07:00 18/04/2010 04:10:00 20/04/2010 15:42:00

Date / Time of Result Recording

Status: Ready Legend: Speed Variance QA1 QA2 QA3 QA4 Zoom Level: 100%

Server: lowsqlsta2 Database: FerryBoxJAT User ID: ng00

QA3 – apply calibrations

FerryBox 1.4.1.0 - [QA3b Derive Values]

File Quality Assurance Tools Windows Help

Reset
Get Excel
Undo
Save
Close

Date	Source (Pre-Factoring) (2757) FLUORS	Source (Post-Factoring) (2757) FLUORS	Result (Pre-Factoring) (2757) CHLOR	Result (Post-Factoring) (2757) CHLOR
13/04/2010 07:12:00	0.45155	0.45155	2.392549	2.392549
13/04/2010 07:13:00	0.50285	0.50285	2.509247	2.509247
13/04/2010 07:14:00	0.566233	0.566233	2.653431	2.653431
13/04/2010 07:15:00	0.633717	0.633717	2.806943	2.806943
13/04/2010 07:16:00	0.641783	0.641783	2.825292	2.825292
13/04/2010 07:17:00	0.626167	0.626167	2.789769	2.789769
13/04/2010 07:18:00	0.636383	0.636383	2.813008	2.813008
13/04/2010 07:19:00	0.6647	0.6647	2.877424	2.877424
13/04/2010 07:20:00	0.619333	0.619333	2.774223	2.774223
13/04/2010 07:21:00	0.7361	0.7361	3.039845	3.039845
13/04/2010 07:22:00	0.017433	0.017433	3.224061	3.224061
13/04/2010 07:23:00	0.814317	0.814317	3.217773	3.217773
13/04/2010 07:24:00	0.805883	0.805883	3.198587	3.198587
13/04/2010 07:25:00	0.77105	0.77105	3.119349	3.119349
13/04/2010 07:26:00	0.7951	0.7951	3.174058	3.174058
13/04/2010 07:27:00	0.8936	0.8936	3.398126	3.398126
13/04/2010 07:28:00	0.924467	0.924467	3.468342	3.468342
13/04/2010 07:29:00	0.91405	0.91405	3.444646	3.444646
13/04/2010 07:30:00	0.89435	0.89435	3.399832	3.399832
13/04/2010 07:31:00	0.876833	0.876833	3.359984	3.359984
13/04/2010 07:32:00	0.8835	0.8835	3.375151	3.375151
13/04/2010 07:33:00	0.896717	0.896717	3.405217	3.405217
13/04/2010 07:34:00	0.910133	0.910133	3.435735	3.435735
13/04/2010 07:35:00	0.919183	0.919183	3.456322	3.456322
13/04/2010 07:36:00	0.880817	0.880817	3.369047	3.369047
13/04/2010 07:37:00	0.85205	0.85205	3.303608	3.303608
13/04/2010 07:38:00	0.861333	0.861333	3.324725	3.324725
13/04/2010 07:39:00	0.876867	0.876867	3.360062	3.360062
13/04/2010 07:40:00	0.8853	0.8853	3.379245	3.379245
13/04/2010 07:41:00	0.913167	0.913167	3.442637	3.442637
13/04/2010 07:42:00	0.9118	0.9118	3.439527	3.439527

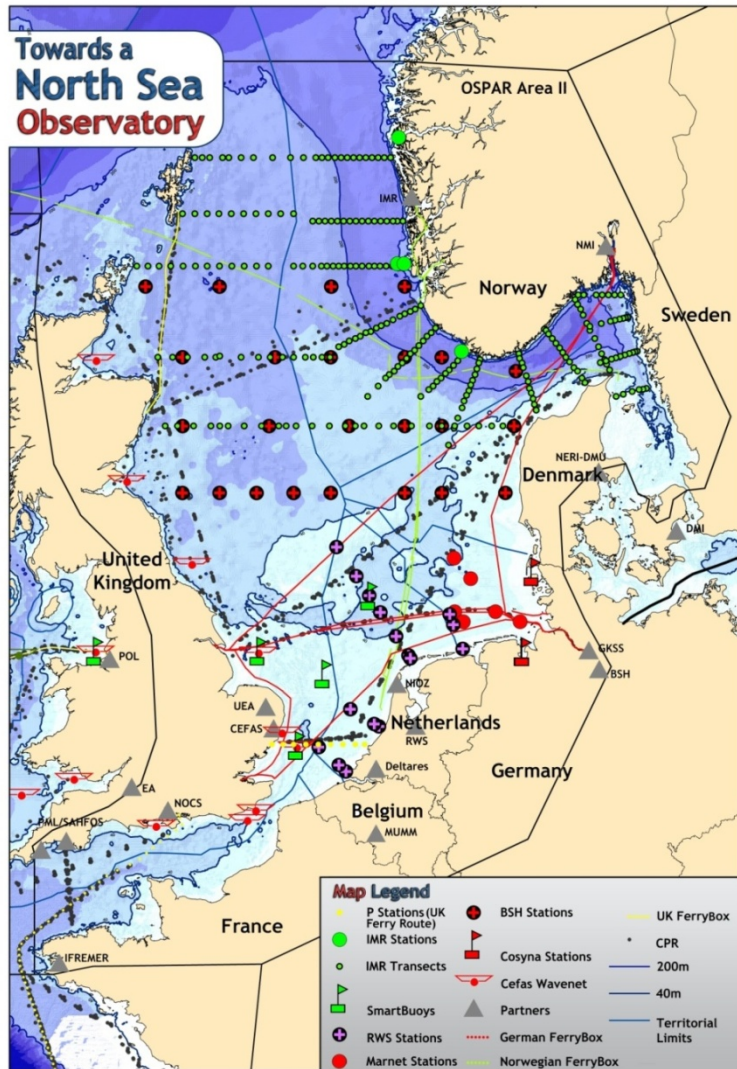
Status: Ready
Server: Inwsdsta2 Database: FerryBoxIAT User ID: n00

Cefas

EMECO



Models



Ferries



Buoys



Gliders



Satellites

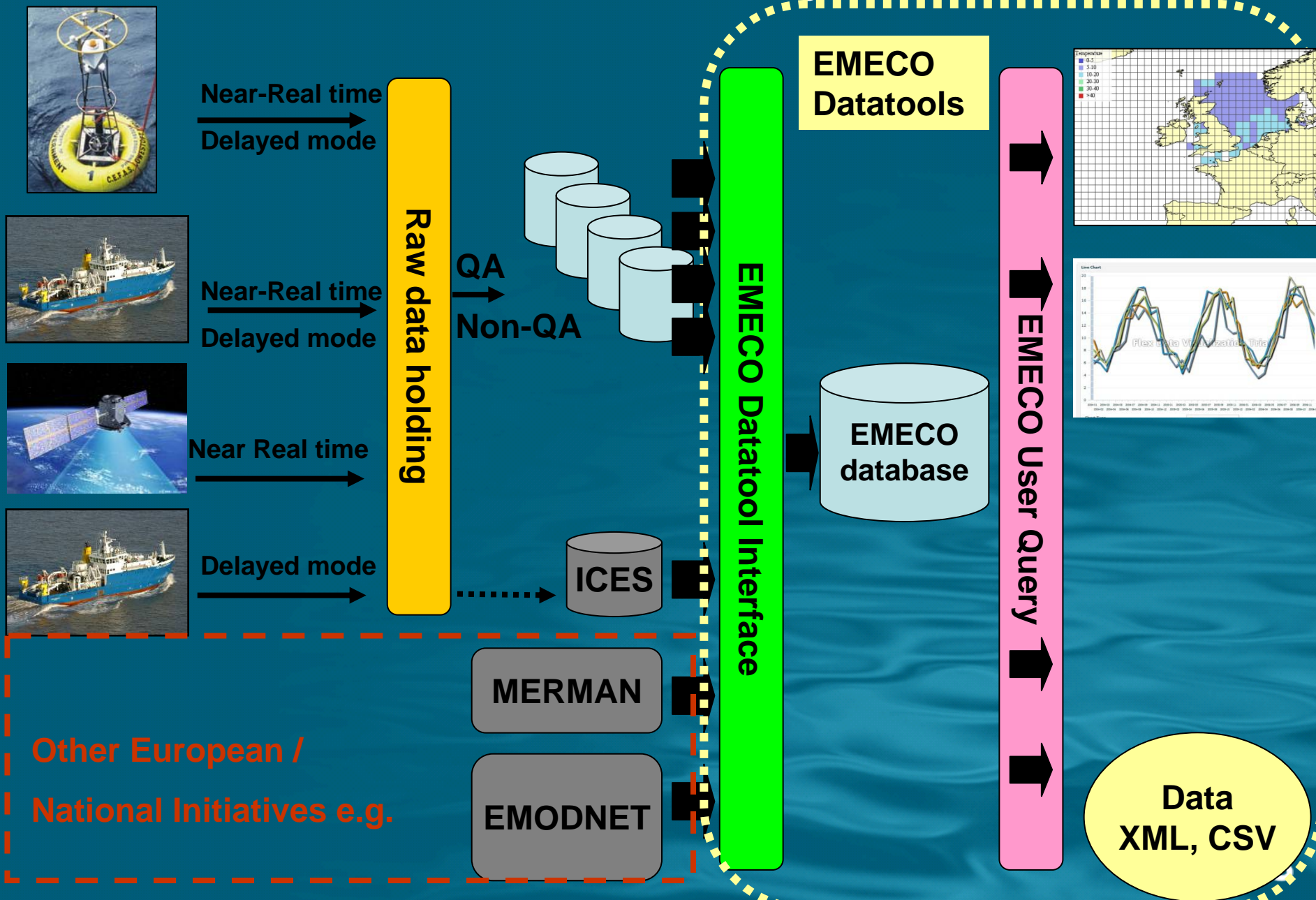


Research vessels

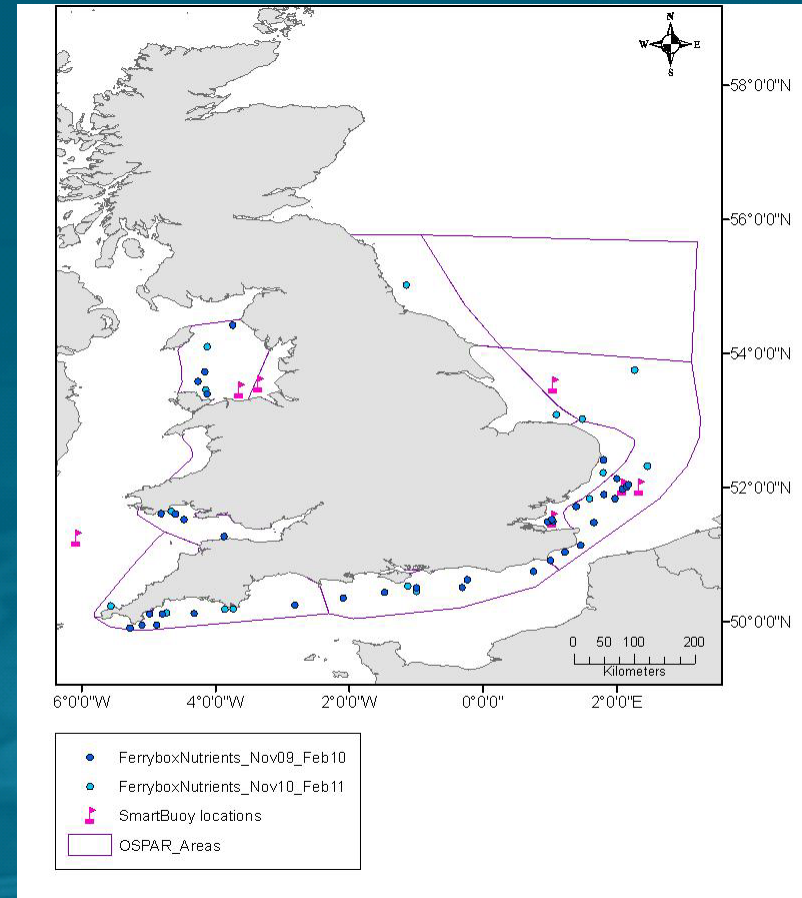
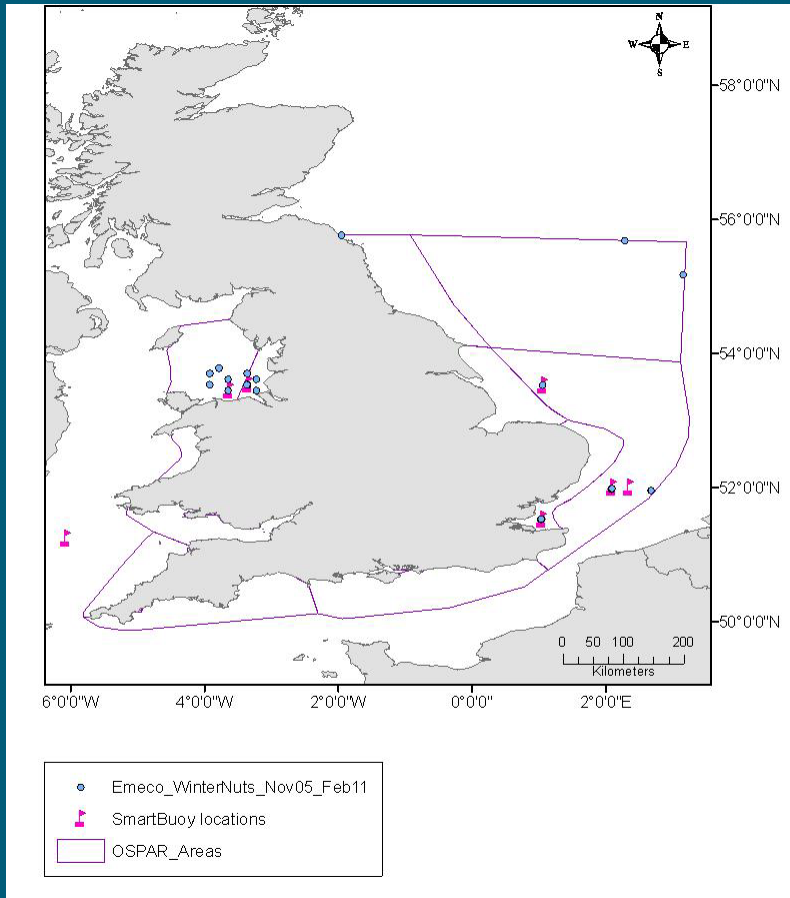


Towed bodies

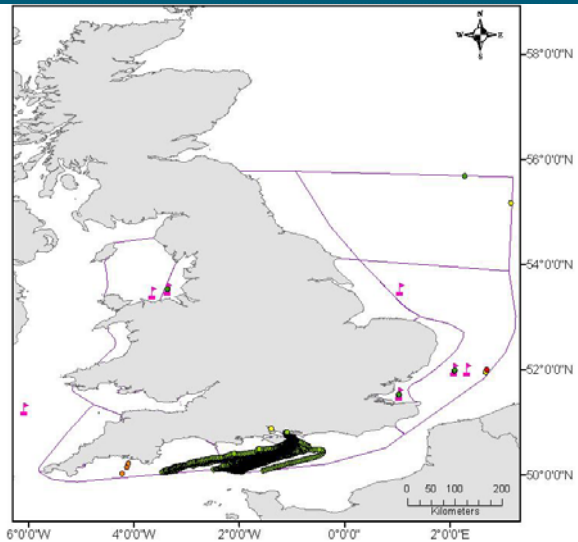
An end to end system



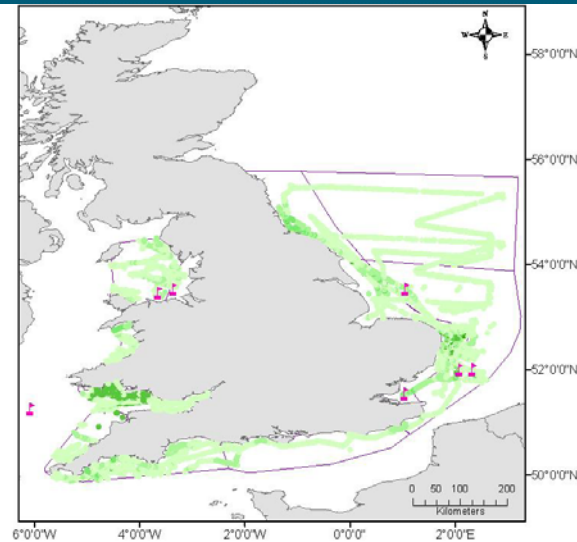
Contribution of Ferrybox nutrients to OSPAR assessment



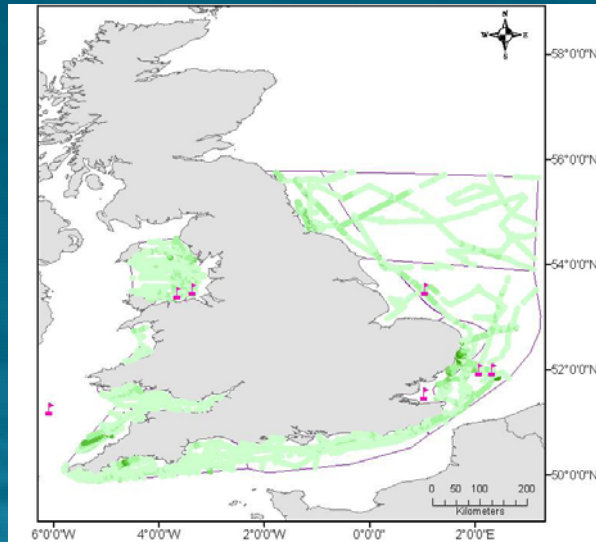
Contribution of Ferrybox chlorophyll to OSPAR CP



- Emeco_Chlorophyll_Mar06_Sep10**
- ICIES || CPHL ug/l (Micrograms per liter)
 - NOC FB || Fluorescence (arb. Units)
 - Research Vessel || Chlorophyll (Micrograms per liter)
 - SmartBuoy (calibrated archive) - NEW || Chlorophyll (Micrograms per liter)
 - WCO Buoy QC || Chlorophyll (Micrograms per liter)
 - SmartBuoy locations
 - OSPAR_Areas



- Seapoint Fluorometer Mar-Sept 2009 (arbitrary units)**
- 0.01 - 1.00
 - 1.01 - 2.00
 - 2.01 - 3.00
 - 3.01 - 4.00
 - 4.01 - 4.99
 - SmartBuoy locations
 - OSPAR_Areas



- Seapoint Fluorometer Mar-Sept 2010 (arbitrary units)**
- 0.11 - 1.09
 - 1.10 - 2.07
 - 2.08 - 3.05
 - 3.06 - 4.03
 - 4.04 - 5.01
 - SmartBuoy locations
 - OSPAR_Areas

Work to do

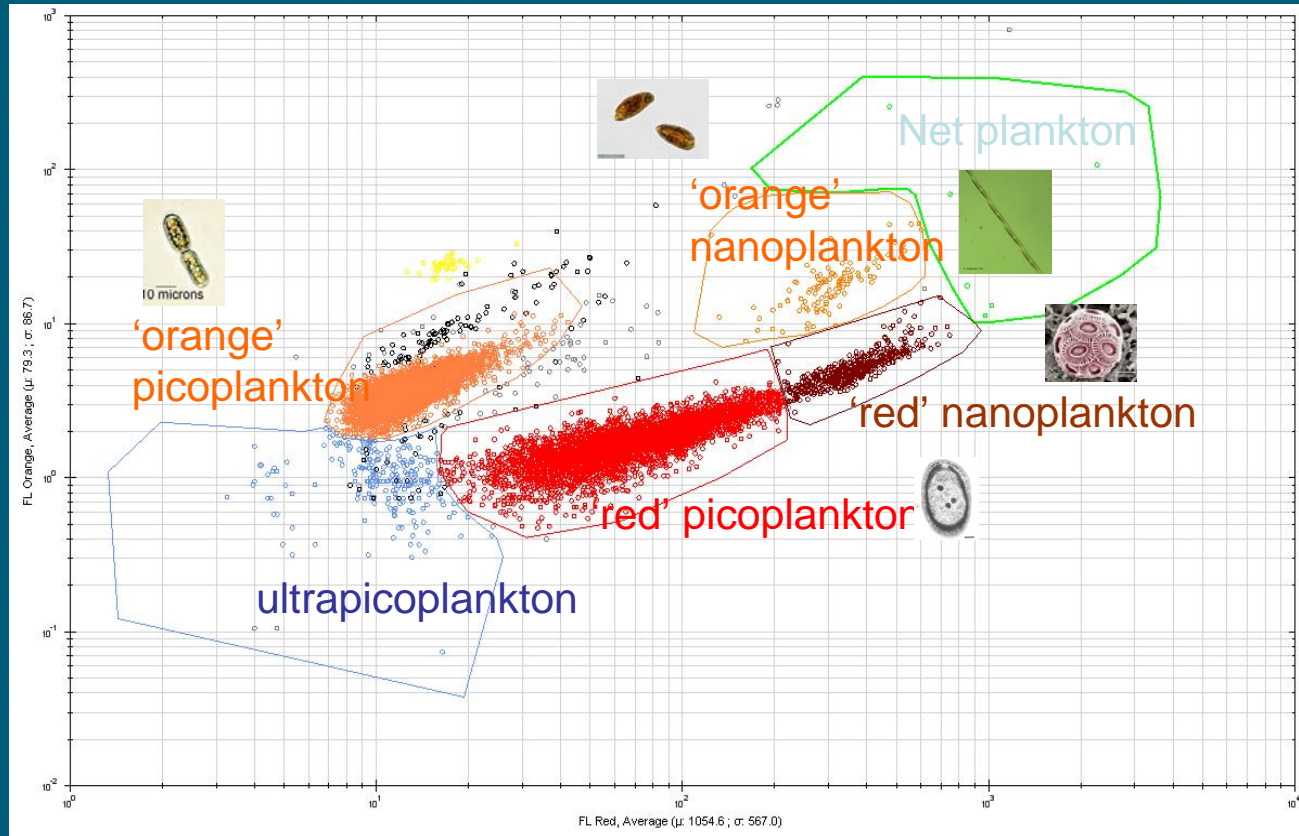
- QA of historic Ferrybox data
- Regular import of Ferrybox data into EMECO
- Install underway $p\text{CO}_2$ system (October 2011)



- Integration of flow cytometer – initial work in May 2011

Integration of flow cytometer

Orange fluorescence (phycobilins)



Red fluorescence (chlorophyll a)

Functional group classification

System set up

- Data logged every second – 1 minute averages created
- 10 minute files with 1 minute averages FTP'd to Cefas
- Data held on SQL database