

Redfish 2013 results

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This document

This document summarizes the results of the Redfish 2013 project. For the sake of transparency all relevant code has been included below. Future readers can recreate all of the following results by running the code found in the `/R_code` folder.

Project

The first phase of the Redfish project took place during the late spring and early summer of 2013. This phase of the project involved two separate cruises: Redfish Iceland (RFI) and Redfish German (RFG). RFI sampled the Irminger Sea and RFG sampled the Labrador Sea. Researchers collected chemical data from the upper 100m of the water column. Parameters of particular interest included the carbonate system and macronutrients. Chlorophyll imagery was used to enhance the results of the cruises.

Objective

The main objective of Redfish 2013 was to examine inorganic carbon and nutrient dynamics in the Irminger Sea and nearby waters. Researchers involved in the project hoped to establish a baseline for future testing in the study region.

Data and results

Results from Barkhouse's work have been recreated. To find the relevant code please refer to the updated directory.

Redfield drawdown

Part of the motivation for the Redfish 2013 project was to examine the drawdown ratios of C:N:P, which were expected to be in close agreement with the Redfield Ratio. By first loading the necessary data with

```
1 source('00.r')
1 redfield(dataset$C_drawdown,
2           dataset$N_drawdown,
3           dataset$P_drawdown,
4           subset = dataset$Expocode)
5
6 kable(redstats1, digits = 2, caption = 'Redfield statistics for RFI')
7
8 kable(redstats2, digits = 2, caption = 'Redfield statistics for RFG')
```

Table 1: Redfield statistics for RFI

Nutrient Ratio	Mean	Median	Standard deviation
C:N	6.38	6.44	2.16

Nutrient Ratio	Mean	Median	Standard deviation
C:P	100.07	98.97	34.38
N:P	15.71	15.33	3.06

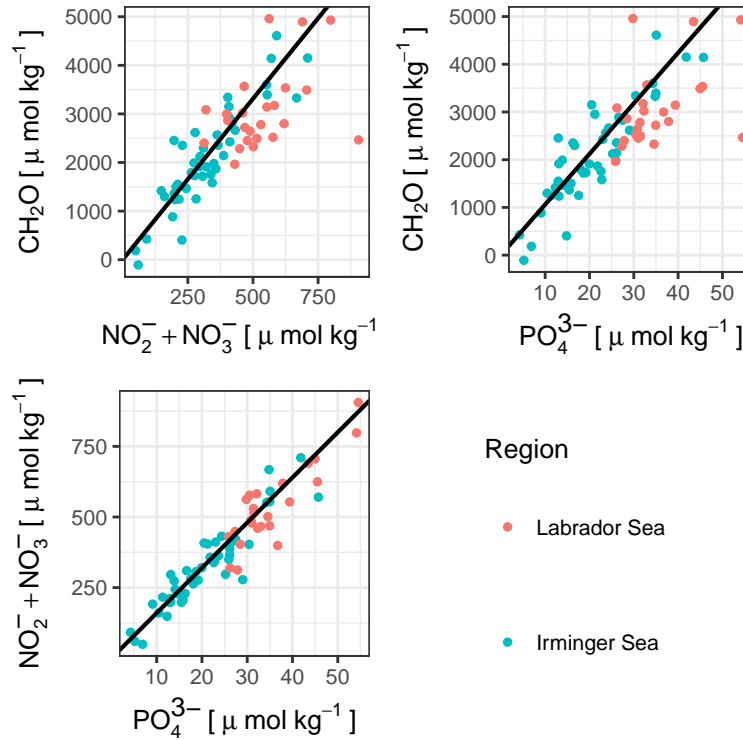
Table 2: Redfield statistics for RFG

Nutrient Ratio	Mean	Median	Standard deviation
C:N	5.93	5.55	1.57
C:P	88.80	83.09	22.45
N:P	15.23	15.57	2.11

```

1 redplot(dataset$C_drawdown,
2         dataset$N_drawdown,
3         dataset$P_drawdown,
4         dataset$Expocode, font.size = 10, size = 1, lwd = 0.75)

```



Nutrient ranges

```

1 nutrientRange(dataset[,10],
2               dataset[,15:21],
3               depth1 = 0,
4               depth2 = 15,
5               depth3 = 80,
6               depth4 = 115)
7

```

```

8 colnames(ranges1) <- c('Variable', 'Minimum', 'Maximum')
9 colnames(ranges2) <- c('Variable', 'Minimum', 'Maximum')
10
11 variables <- c('Alkalinity', 'pH', 'Organic carbon', 'pCO2', 'Nitrate', 'Phosphate', 'SiO2')
12 units <- c('umol/kg', '[in-situ]', 'umol/kg', 'uatm', 'umol/kg', 'umol/kg', 'umol/kg')
13
14 ranges1$Variable <- variables
15 ranges2$Variable <- variables
16
17 ranges1$Units <- units
18 ranges2$Units <- units
19
20 kable(ranges1, digits = 2,
21       caption = 'Nutrient ranges in the upper 15m of the water column for Redfish 2013')
22 kable(ranges2, digits = 2,
23       caption = 'Nutrient ranges between 80 and 115 meters for Redfish 2013')

```

Table 3: Nutrient ranges in the upper 15m of the water column for Redfish 2013

Variable	Minimum	Maximum	Units
Alkalinity	2194.02	2329.74	umol/kg
pH	8.03	8.21	[in-situ]
Organic carbon	2013.40	2150.40	umol/kg
pCO2	241.00	400.70	uatm
Nitrate	0.62	11.84	umol/kg
Phosphate	0.17	0.78	umol/kg
SiO2	0.02	9.34	umol/kg

Table 4: Nutrient ranges between 80 and 115 meters for Redfish 2013

Variable	Minimum	Maximum	Units
Alkalinity	2288.17	2331.28	umol/kg
pH	7.97	8.06	[in-situ]
Organic carbon	2144.60	2178.30	umol/kg
pCO2	367.80	462.30	uatm
Nitrate	10.32	16.95	umol/kg
Phosphate	0.80	1.24	umol/kg
SiO2	3.96	12.05	umol/kg

Depth profiles

```

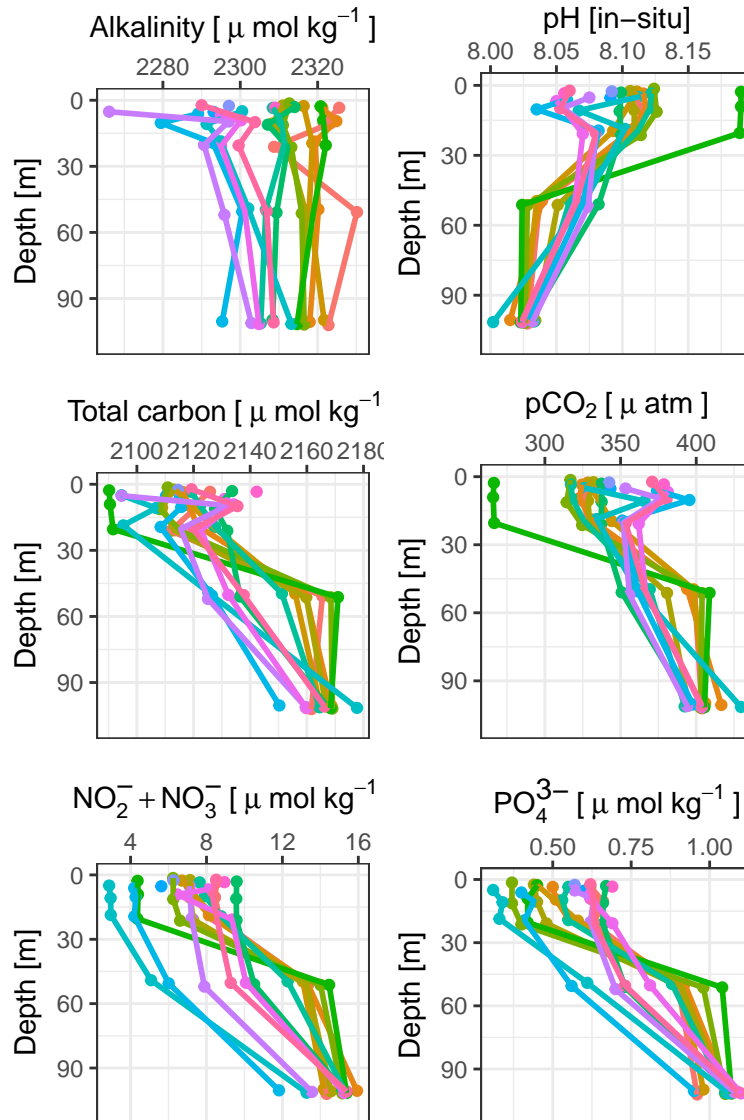
1 stations <- c(411, 416, 417, 419, 433, 434,
2             436, 454, 329, 308, 300, 294,
3             291, 269, 251, 244)
4
5 generateProfile(dataset[,10],
6               dataset[,15:20],
7               dataset$Station_number,
8               subsets = stations, size = 1.5, lwd=1)

```

```

9
10 profile1 <- profile1 +
11   xlab(expression("Alkalinity"~"["~mu~mol~kg^{-1}~"]"))
12 profile2 <- profile2 +
13   xlab("pH [in-situ]")
14 profile3 <- profile3 +
15   xlab(expression("Total carbon"~"["~mu~mol~kg^{-1}~"]"))
16 profile4 <- profile4 +
17   xlab(expression(pCO[2]~"["~mu~atm~"]"))
18 profile5 <- profile5 +
19   xlab(expression(NO[2]^{~{\textstyle("-)}}~}+
20     NO[3]^{~{\textstyle("-)}}~"~"["~mu~mol~kg^{-1}~"]"))
21 profile6 <- profile6 +
22   xlab(expression(PO[4]^{~{\textstyle("3-"))}}~"~"["~mu~mol~kg^{-1}~"]"))
23
24 grid.arrange(profile1,profile2,profile3,profile4,profile5,profile6,ncol=2)

```



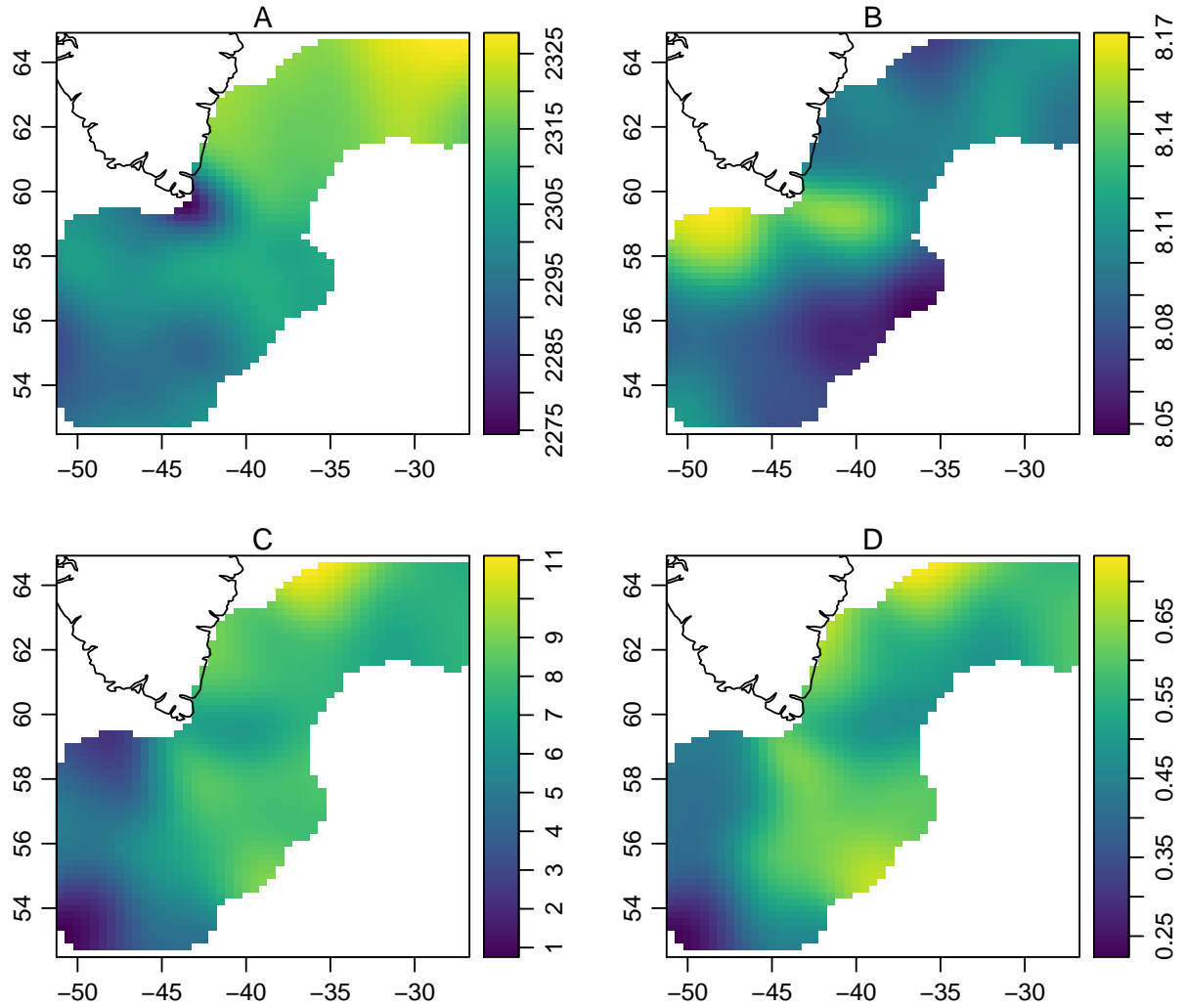


Figure 1: Surface plots of selected measurements in the Redfish 2013 sampling area. A is alkalinity in $\mu\text{mol/kg}$, B is in-situ pH, C is nitrate in $\mu\text{mol/kg}$, and D is phosphate in $\mu\text{mol/kg}$.

Surface plots

```
par(mfrow=c(2,2))

surfacePlot(dataset$Depth.m.,
            dataset$Latitude,
            dataset$Longitude,
            dataset[,c(15,16,19,20)],
            plot_depth = 10)
```