BUNDESAMT FÜR
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HYDROGRAPHIE

North Sea Atlas

Temperature, Salinity, Density and Heat Content

Monthly Means for the Period 1902 to 1954

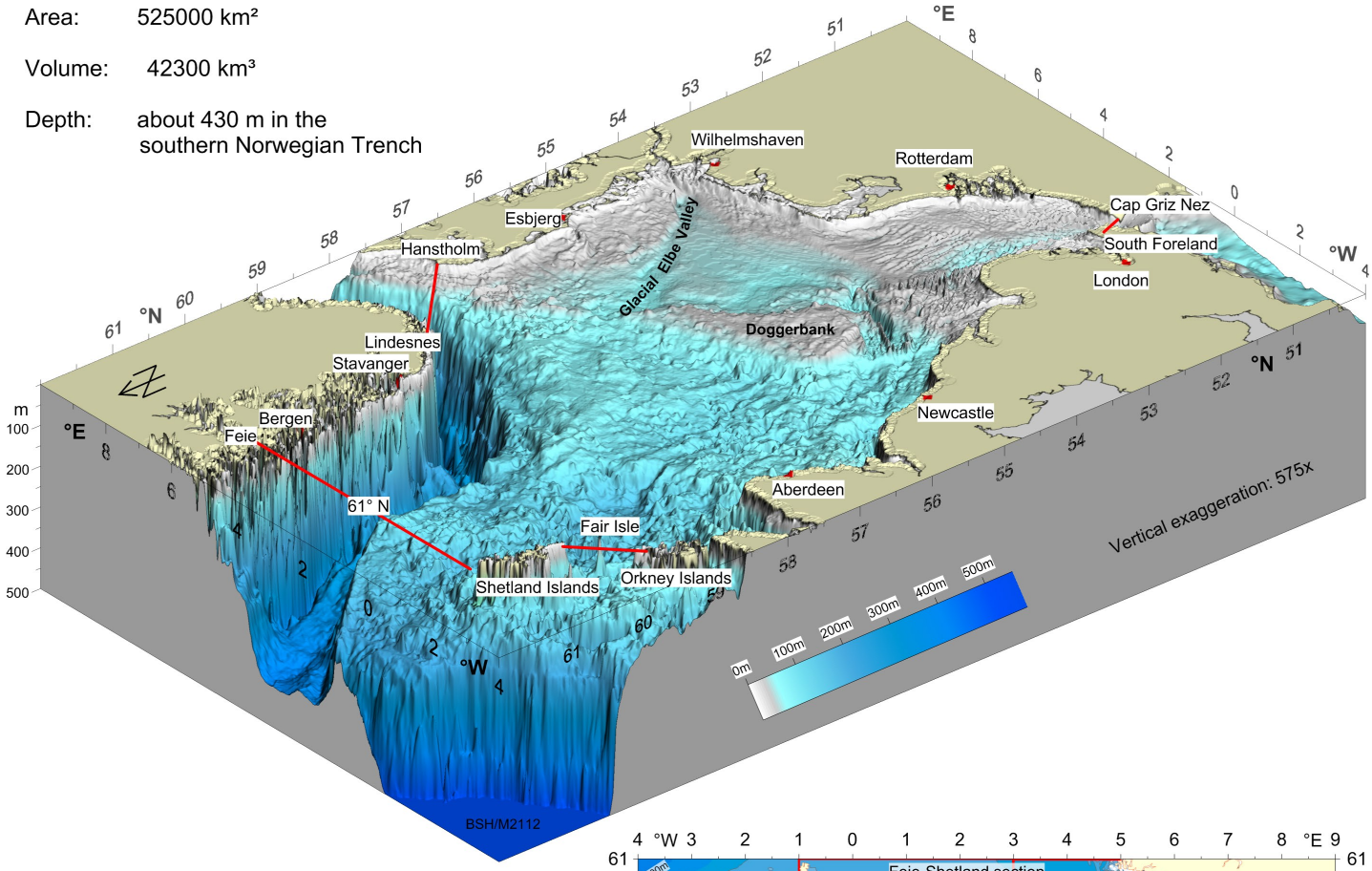
The North Sea is an adjacent sea to the North Atlantic Ocean
and part of the European continental shelf

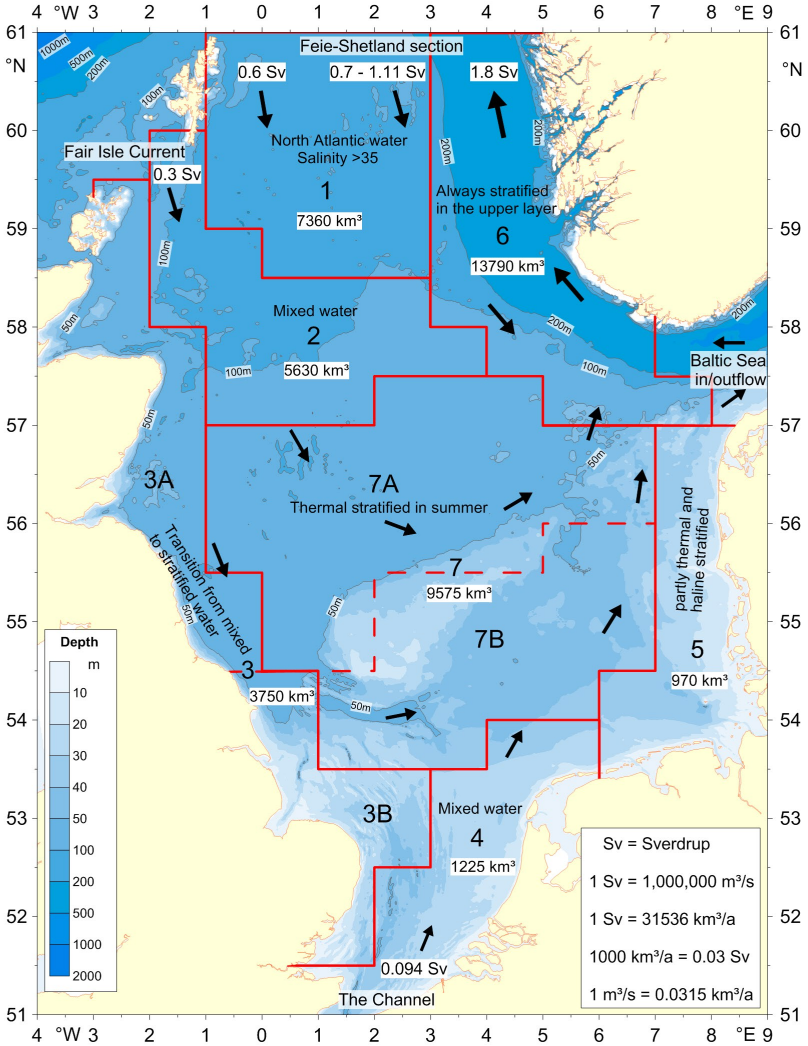
North Sea Limits
(International Hydrographic Bureau (IHB), Monaco)

Area: 525000 km²

Volume: 42300 km³

Depth: about 430 m in the
southern Norwegian Trench





Hydrographic regions (1 to 7)
(ICES Study Group, 1977)

Volumes of the hydrographic regions (km³)
(Backhaus, 1978)

Mean currents (→)

Volume transport (Sv, observed)

Feie-Shetland section and Fair Isle Current:
Otto et al. (1990);
[JONSDAP current meter moorings March-June 1976]

The Channel:
Prandle et al. (1996);
[1 year of HF radar and bottom-mounted
acoustic doppler current profiler 1990/91]

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Monthly means for the period 1902 to 1954

Preface

This atlas is based on two publications.

1. G. Tomczak und E. Goedecke
'Die thermische Schichtung der Nordsee auf Grund des mittleren Jahresganges der Temperatur in 1/2°- und 1°-Feldern', (DHZ 1964, Ergänzungsheft Reihe B, Nr. 8).

The **temperature figures** of Tomczak and Goedecke represent mean monthly vertical sections and horizontal charts of the North Sea, based on 122151 temperature data of the years 1902 to 1954

Accuracy of the monthly mean values:

	Total:	+/- 0.9 K
	Bottom:	+/- 0.8 K
Areas of shallow water:	Surface:	+/- 1.2 K
	Bottom:	+/- 1.2 K
Areas of deeper water:	Surface:	+/- 0.8 K
	Bottom:	+/- 0.6 K

Absolut highest differences of single years from the mean values: +4.6 K and -5.3 K.

For more details see tabel 1 and 2 of their publication.

2. Erich Goedecke, Jens Smed und Gerhard Tomczak
'Monatskarten des Salzgehaltes der Nordsee dargestellt für verschiedene Tiefenhorizonte', (DHZ 1967, Ergänzungsheft Reihe B, Nr. 9).

The mean monthly **salinity charts** for the depth layers 7,5m, 20m, 30m, 40m, 60m, 80m, 100m and the bottom were analysed from 146287 data of the years 1902 to 1954.

Accuracy of the monthly mean values:

zonal	at 59.5°N:	Surface:	+/- 0.2 bis 0.4
		Bottom:	+/- 0.1
meridional	at 2°E:	Surface:	+/- 0.2 bis 0.3
		Bottom:	+/- 0.1

Accuracy of the yearly mean values:

zonal	at 59.5°N:	Surface:	+/- 0.2 bis 0.8
		Bottom:	+/- 0.2
meridional	at 2°E:	Surface:	+/- 0.2 bis 0.4
		Bottom:	+/- 0.2 bis 0.3

For more details see tabel 3 and figures 1 and 2 of their publication.

Analysis:

A Figures of temperature:

The digitized temperature contour lines of the **zonal vertical sections** from **51.5 °N to 61.5 °N** (distance:1 °N) were gridded by using the Kriging method.

Settings:

number of sectors = 4;
number of nearest points for search = 1;
max number of empty sectors = 3;
min number of data points for a valid sector = 2;
max number of data points from all sectors = 4;
search ellipse radius 1 = 2.5;
search ellipse radius 2 = 30;
search ellipse angle = 0;

Gridpoint distance:	dx = 0.05 °E/W	(3km)
	dz = 1m	

The grid points were used to produce meridional sections from 2° W to 8° E every half degree. Method and settings see above.

Gridpoint distance:	dy = 0.1° N	(11.1km)
	dz = 1m	

Finally a second set of zonal sections from 52° N to 61° N (distance: 1° N) was gridded. Method and settings see above.

Gridpoint distance:	dx = 0.05 °E/W	(3km)
	dz = 1m	

Result is a 3 dimensional data set of 4309812 temperature data (359151 per month).

The **horizontal charts** of temperature base on this dataset (except for Fig. 2.2.2 and Fig. 2.2.3) as well as the **isopleths** and **profiles** in Fig. 3.1 and Fig. 3.2.

B Figures of salinity:

The **horizontal charts of the salinity** for the depth layers 7.5m, 20m, 30m, 40m, 60m, 80m, 100m and the Bottom within the area **51 °N to 61.5 °N and 4 °W to 11 °E** were digitized and gridded by using the Kriging method.

Settings horizontal:

no Search	0 (use all data)	
Gridpoint distance:	dx = 0.25 °E/W	(15.0km)
	dy = 0.20 ° N	(22.2km)

These calculated horizontal areas were used to create **meridional vertical sections** from **3.5 °W to 9 °E** (distance: 0,5 °E/W) by using the Kriging Methode.

Settings vertikal-meridional:

no Search	0 (use all data)	
Gridpoint distance:	dy = 0.1 °N	(11.1km)
	dz = 1m	

At least **zonal vertical sections** from **51.5 °N to 61 °N** (distance: 0.5 °N) by using the Kriging method were created.

Settings vertical-zonal:

no Search	0 (use all data)	
Gridpoint distance:	dx = 0.05 °E/W	(3 km)
	dz = 1m	

Result is a 3 dimensional data set of 4753656 salinity data (396138 per month).

C Figures of density and heat content:

The above temperature and salinity data were used to derive the density and the heat content.

The atlas is still in progress and will be complemented by more charts and basic informations; suggestions are welcome.
Many thanks to Petra Einfeldt, who took so much care in digitizing the original charts.

Acknowledgement:
The atlas and the data have been created by the Federal Maritime and Hydrographic Agency (BSH) and are free of charge for non-commercial purposes.

Please quote BSH, when using the files:
Schulz, A., North Sea Atlas - Temperature, Salinity, Density and Heat Content - Monthly Means for the Period 1902 to 1954, Bundesamt für Seeschifffahrt und Hydrographie, Hamburg und Rostock 2009

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Nordsee Atlas

Temperatur, Salzgehalt, Dichte und Wärmeinhalt

Monatsmittelwerte für den Zeitraum 1902 bis 1954

Vorwort

Der vorliegende Atlas basiert auf zwei Publikationen.

1. G. Tomczak und E. Goedecke
'Die thermische Schichtung der Nordsee auf Grund des mittleren Jahresganges der Temperatur in 1/2°- und 1°-Feldern', (DHZ 1964, Ergänzungsheft Reihe B, Nr. 8).

Die Abbildungen der Monatsmittelwerte der **Temperatur** der Nordsee von Tomczak und Goedecke zeigen Vertikalprofile und Horizontalkarten, die auf der Grundlage von **122151 Daten** aus den Jahren 1902 bis 1954 erstellt wurden.

Streuung der Monatsmittelwerte:

	Gesamt:	+/- 0,9 K
	Boden:	+/- 0,8 K
Gebiete geringer Wassertiefe:	Oberfläche:	+/- 1,2 K
	Boden:	+/- 1,2 K
Gebiete größerer Wassertiefe:	Oberfläche:	+/- 0,8 K
	Boden:	+/- 0,6 K

Absolut größten Abweichungen einzelner Jahre von den Mittelwerten: +4,6 K und -5,3 K.

Weitergehende Informationen sind in den Tabellen 1 und 2 der Publikation zu finden.

2. Erich Goedecke, Jens Smed und Gerhard Tomczak
'Monatskarten des Salzgehaltes der Nordsee dargestellt für verschiedene Tiefenhorizonte', (DHZ 1967, Ergänzungsheft Reihe B, Nr. 9).

Die Horizontalkarten der Monatsmittelwerte des **Salzgehaltes** für die Tiefenstufen 7,5m, 20m, 30m, 40m, 60m, 80m, 100m und den Boden beruhen auf **146287 Daten** der Jahre 1902 bis 1954.

Streuung der Monatsmittelwerte:

zonal	bei ca. 59,5°N:	Oberfläche:	+/- 0,2 bis 0,4
		Boden:	+/- 0,1
meridional	bei ca. 2°E:	Oberfläche:	+/- 0,2 bis 0,3
		Boden:	+/- 0,1

Streuung der Jahresmittelwerte:

zonal	bei ca. 59,5°N:	Oberfläche:	+/- 0,2 bis 0,8
		Boden:	+/- 0,2
meridional	bei ca. 2°E:	Oberfläche:	+/- 0,2 bis 0,4
		Boden:	+/- 0,2 bis 0,3

Weitergehende Informationen sind in der Tabelle 3 und den Abbildungen 1 und 2 der Publikation zu finden.

Analyse:

A Abbildungen der Temperatur:

Die Temperatur-Isolinien der **zonalen Vertikalschnitte** von **51,5 °N bis 61,5 °N** (Abstand:1 °N) wurden digitalisiert und anschließend mittels der Kriging-Methode gegriddet.

Settings:

number of sectors = 4
number of nearest points for search = 1
max number of empty sectors = 3
min number of data points for a valid sector = 2
max number of data points from all sectors = 4
search ellipse radius 1 = 2.5
search ellipse radius 2 = 30
search ellipse angle = 0

Gridpunkt Abstand:	dx = 0,05 °E/W	(ca. 3km)
	dz = 1m	

Mit den berechneten Gridpunkten wurden **meridionale Vertikalschnitte** von **2 °W bis 8 °E** (Abstand: 0,5 °E/W) erstellt.
Methode und Settings siehe oben.

Gridpunkt Abstand:	dy = 0,1 °N	(ca. 11,1km)
	dz = 1m	

Schließlich wurde ein zweiter Satz **zonaler Vertikalschnitte** von **52 °N bis 61 °N** (Abstand: 1 °N) erzeugt. Methode und Settings siehe oben.

Gridpunkt Abstand:	dx = 0,05 °E/W	(3km)
	dz = 1m	

Das Resultat ist ein 3 dimensionaler Datensatz mit 4309812 Temperaturwerten (359151 je Monat).

Die **Horizontalkarten der Temperatur** (mit Ausnahme Abb. 2.2.2 und Abb. 2.2.3) und die Darstellungen der **Isoplethen** und **Profile** in Abb. 3.1 und Abb. 3.2. basieren auf diesem Datensatz.

B Abbildungen des Salzgehaltes:

Die Karten der **Horizontalverteilungen des Salzgehalte**s in 7,5m, 20m, 30m, 40m, 60m, 80m, 100m und am Boden wurden für das Gebiet **51 °N bis 61,5 °N und 4 °W bis 11 °E** digitalisiert und mit der Kriging Methode gegriddet.

Settings horizontal:

no Search	0 (use all data)	
Gridpunkt Abstand:	dx = 0,25 °E/W	(15,0km)
	dy = 0,20 °N	(22,2km)

Aus den so erhaltenen gleichverteilten Salzgehaltswerten auf den Horizontalflächen wurden zunächst **meridionale Vertikalschnitte** von **3,5 °W bis 9 °E** (Abstand: 0,5 °E/W) mit der Kriging Methode erstellt.

Settings vertikal-meridional:

no Search	0 (use all data)	
Gridpunkt Abstand:	dy = 0,1 °N	(11.1km)
	dz = 1m	

Abschließend wurden **zonale Vertikalschnitte** von **51,5 °N bis 61 °N** (Abstand: 0,5 °N) mit der Kriging Methode erzeugt.

Settings vertikal-zonal:

no Search	0 (use all data)	
Gridpunkt Abstand:	dx = 0,05 °E/W	(3 km)
	dz = 1m	

Das Resultat ist ein 3 dimensionaler Datensatz mit 4753656 Salzgehaltswerten (396138 je Monat).

C Abbildungen der Dichte und des Wärmeinhaltes:

Für die Berechnungen der Dichte und des Wärmeinhaltes wurden die Werte der Temperatur und des Salzgehaltes aus obigen Datensätzen herangezogen.

Der vorliegende Atlas soll durch zusätzliche Abbildungen und Basisinformationen ergänzt werden; Anregungen sind willkommen.
Besonderer Dank gilt Petra Einfeldt, die mit großer Sorgfalt die Originalabbildungen digitalisiert hat.

Vereinbarung:
Der Atlas und der Datensatz wurden durch das Bundesamt für Seeschifffahrt und Hydrographie (BSH) erzeugt und stehen für nicht kommerzielle Nutzung unentgeldlich zur Verfügung.

Bitte zitieren Sie das BSH bei Gebrauch:
Schulz, A., North Sea Atlas - Temperature, Salinity, Density and Heat Content - Monthly Means for the Period 1902 to 1954, Bundesamt für Seeschifffahrt und Hydrographie, Hamburg und Rostock 2016

mail: achim.schulz@bsh.de

Figures

Monthly means for the period 1902-1954

1 Vertical sections of temperature (a) and salinity (b)

1.1 Zonal sections 51.5 °N to 60.5 °N 10 sections per month

1.1.01 a/b	January
1.1.02 a/b	February
1.1.03 a/b	March
1.1.04 a/b	April
1.1.05 a/b	May
1.1.06 a/b	June
1.1.07 a/b	July
1.1.08 a/b	August
1.1.09 a/b	September
1.1.10 a/b	October
1.1.11 a/b	November
1.1.12 a/b	December

1.2 Zonal sections 51.5 °N to 60.5 °N all months per section

1.2.01 a/b	51.5 °N
	52.5 °N
1.2.02 a/b	53.5 °N
1.2.03 a/b	54.5 °N
1.2.04 a/b	55.5 °N
1.2.05 a/b	56.5 °N
1.2.06 a/b	57.5 °N
1.2.07 a/b	58.5 °N
1.2.08 a/b	59.5 °N
1.2.09 a/b	60.5 °N

1.3 Meridional sections 1.5 °W to 7.5 °E 10 sections per month

1.3.01 a/b	January
1.3.02 a/b	February
1.3.03 a/b	March
1.3.04 a/b	April
1.3.05 a/b	May
1.3.06 a/b	June
1.3.07 a/b	July
1.3.08 a/b	August
1.3.09 a/b	September
1.3.10 a/b	October
1.3.11 a/b	November
1.3.12 a/b	December

1.4 Meridional sections 1.5 °W to 8.0 °E all months per section

1.4.01 a/b	1.5 °W
1.4.02 a/b	0.5 °W
1.4.03 a/b	0.5° E
1.4.04 a/b	1.5 °E
1.4.05 a/b	2.5 °E
1.4.06 a/b	3.5 °E
1.4.07 a/b	4.5 °E
1.4.08 a/b	5.5 °E
1.4.09 a/b	6.5 °E
1.4.10 a/b	7.5 °E
1.4.11 a/b	8,0 °E

2 Layer distributions of temperature and salinity

2.1 Temperature (a) and salinity (b) all months per layer

2.1.01 a/b	7.5 m
2.1.02 a/b	20 m
2.1.03 a/b	30 m
2.1.04 a/b	40 m
2.1.05 a/b	60 m
2.1.06 a/b	80 m
2.1.07 a/b	100 m
2.1.08 a/b	Bottom
2.1.09 a/b	Difference surface to bottom

2.2 Temperature

2.2.1	Vertical mean	January to December
2.2.2	Maximum	surface and bottom
	Minimum	surface and bottom
	Amplitude of the annual cycle	surface and bottom
2.2.3	Date of maximum	surface and bottom
	Date of minimum	surface and bottom
2.2.4	Thermocline ($\Delta T > 0.2$ K/m)	July, August, September
	Depth of upper level	
	Depth of lower level	
	Strength [m]	lower minus upper level
	Intensity [K]	upper minus lower level

3 Density distributions

3.1 Layer

3.1.1	Surface	January to December
3.1.2	Bottom	January to December
3.1.3	Difference surface to bottom	January to December

3.2 Sections

3.2.1	Pycnocline (∆rho/m)	10 zonal sections in August

4 Isopleths and profiles

4.1 Isopleths of temperature

4.1.1	5 depths along 56.5 °N	(5m, 15m, 20m, 30m, 50m)
4.1.2	5 positions in different regions	
		1) 59.5 °N / 1.0 °E
		2) 58.0 °N / 0.0 °E
		3) 58.0 °N / 5.0 °E
		4) 56.0 °N / 1.0 °E
		5) 54.5 °N / 5.0 °E

4.2 Profiles of temperature and salinity

4.2.1	Temperature	(same Positions as in 4.1.2)
4.2.2	Salinity	(same Positions as in 4.1.2)

5 Heat content

5.1 Layer distributions

5.1.1	Heat content per unit volume	January to December
5.1.2	Total heat content in the water column	January to December

5.2 Time series

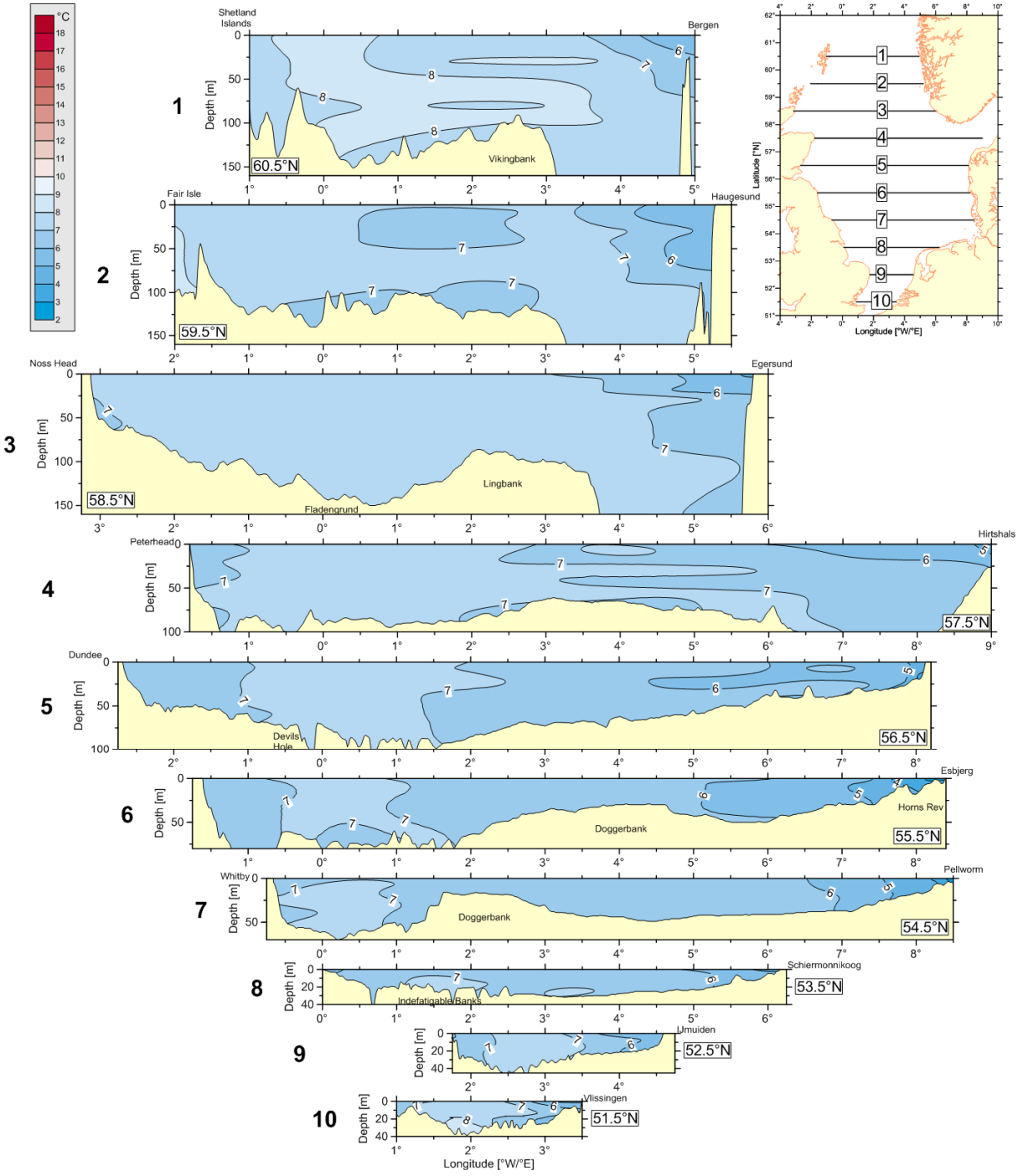
5.2.1	Total heat content in the North Sea	January to December

6 Annex

6.1	Data distributions of sections and areas

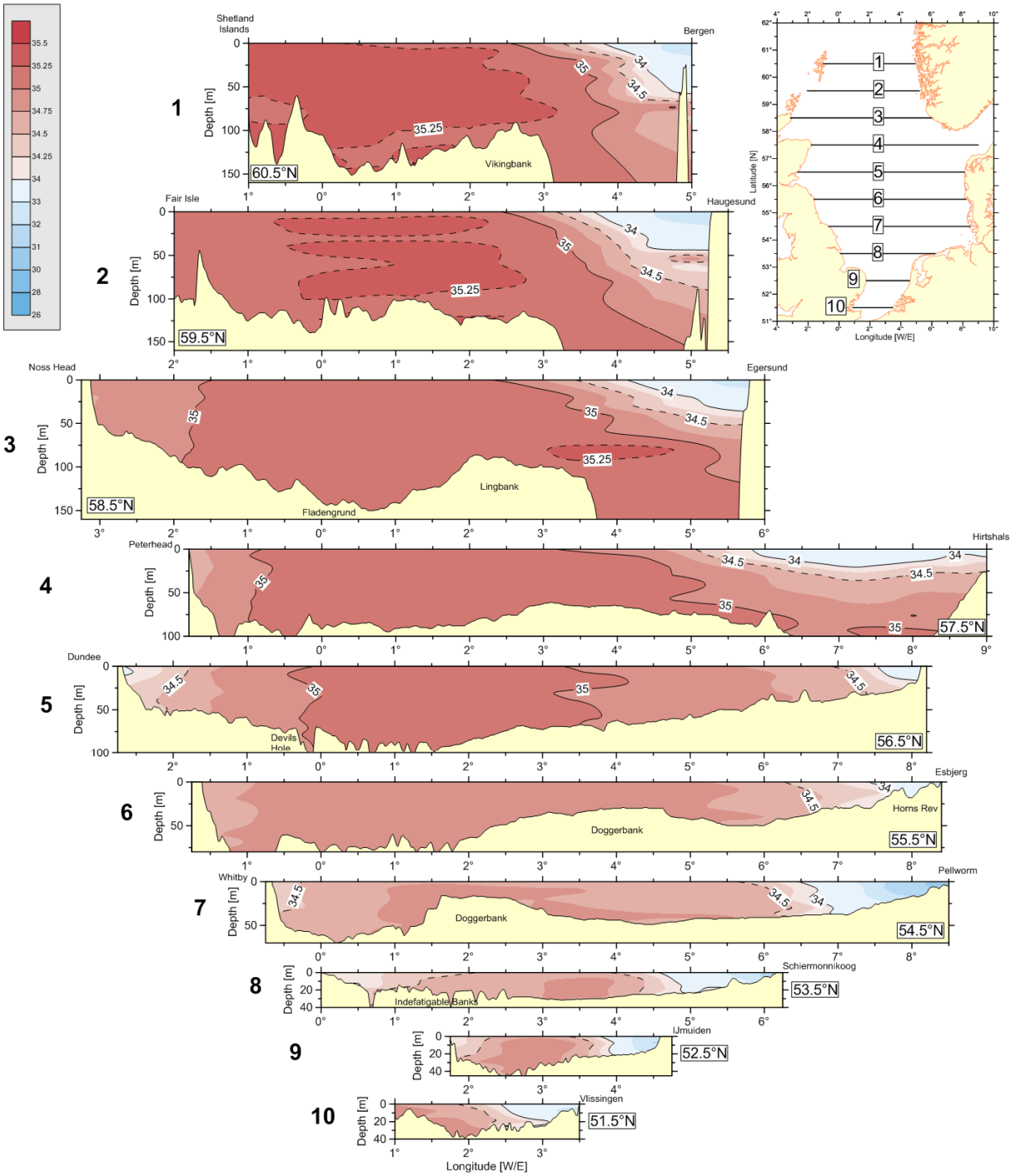
Monthly mean temperature (1902 - 1954) on 10 zonal sections

January



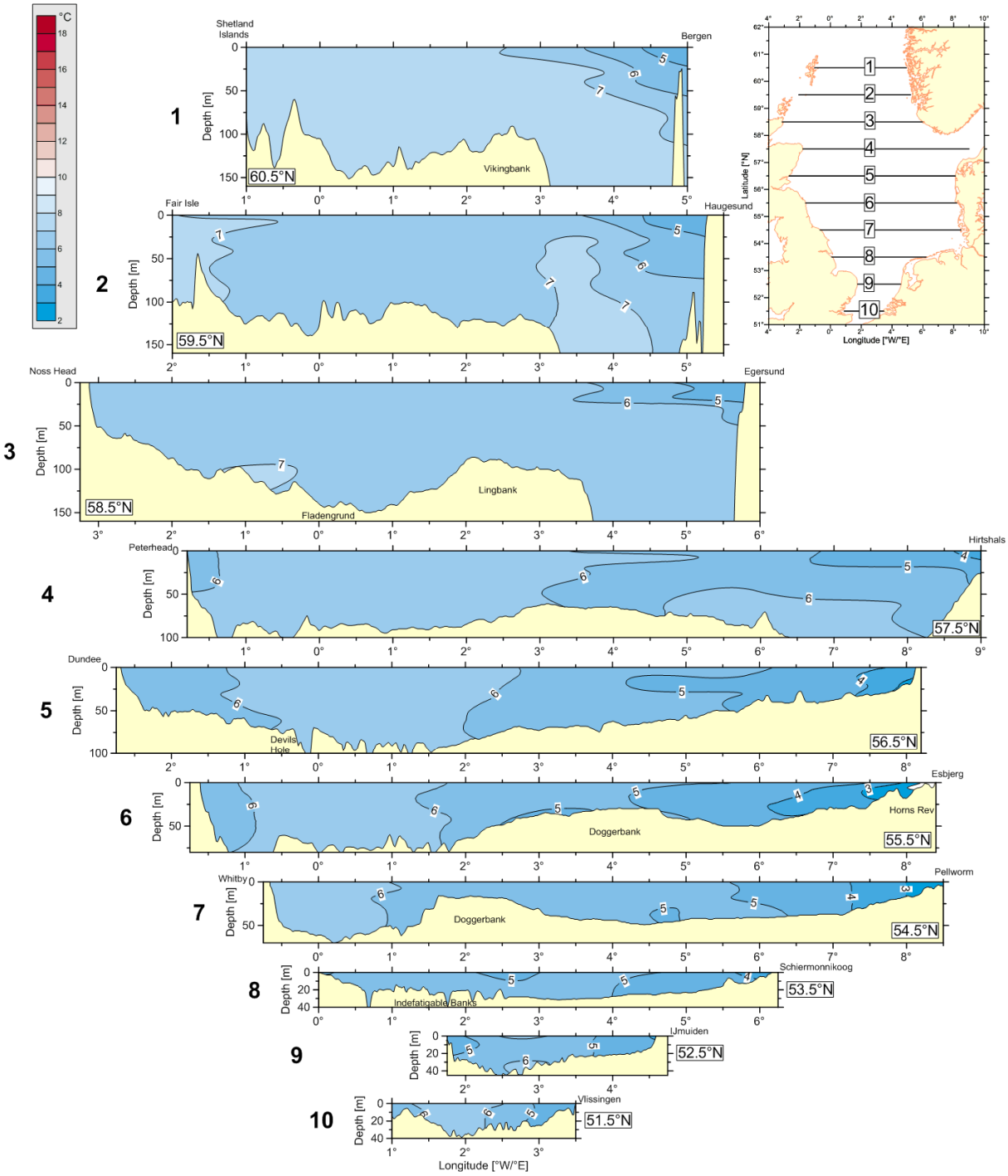
Monthly mean salinity (1902 - 1954) on 10 zonal sections

January



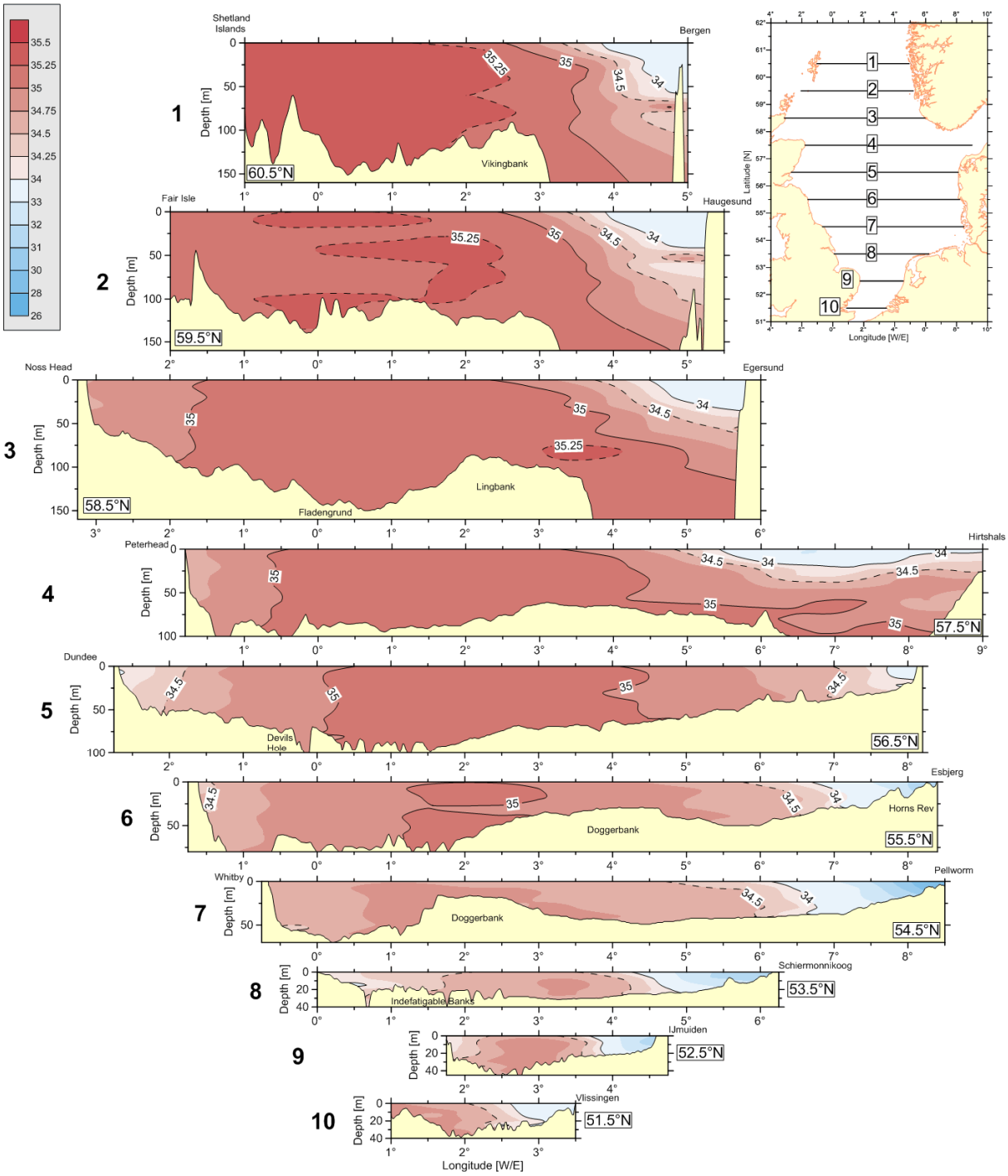
Monthly mean temperature (1902 - 1954) on 10 zonal sections

February



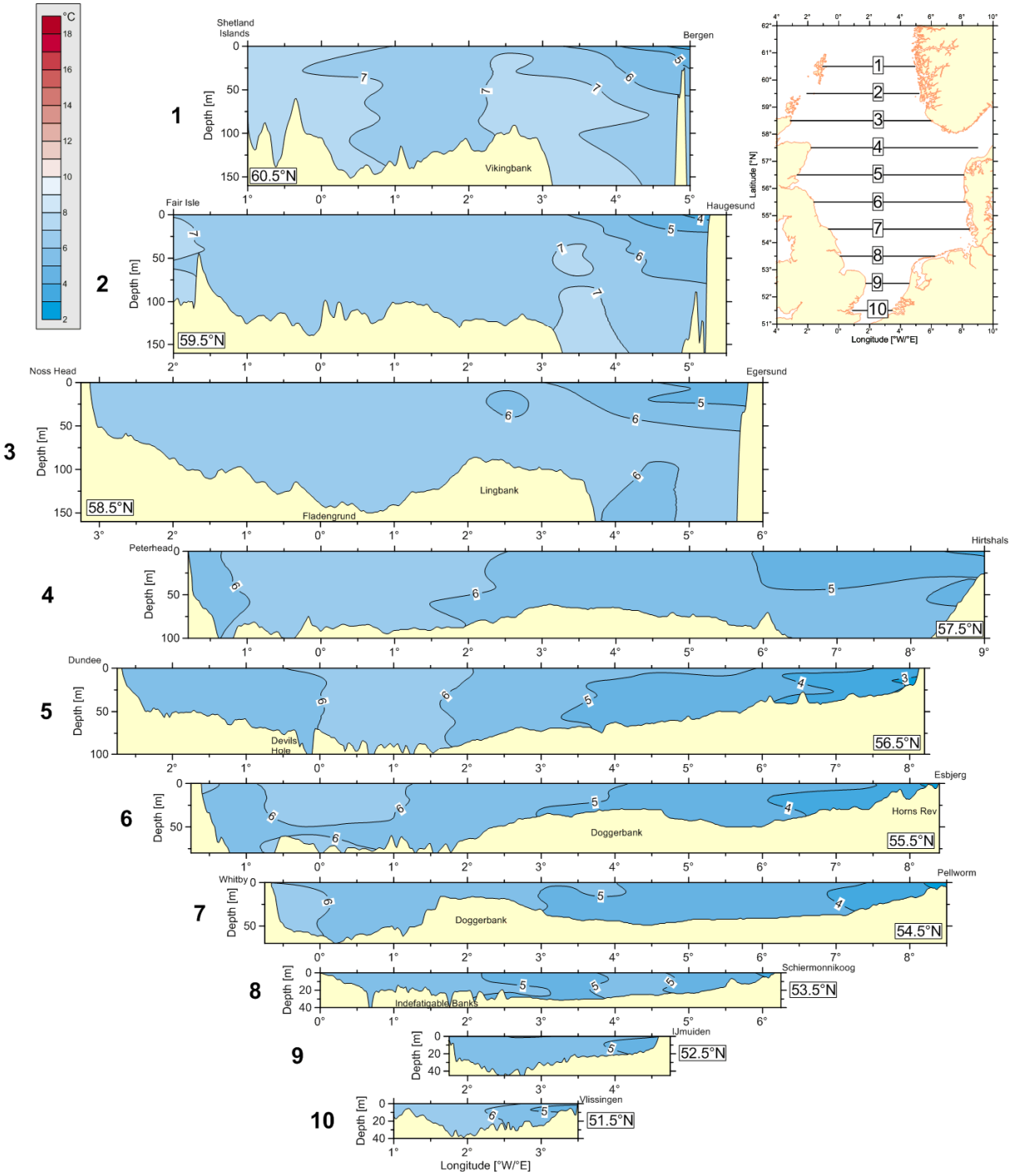
Monthly mean salinity (1902 - 1954) on 10 zonal sections

February



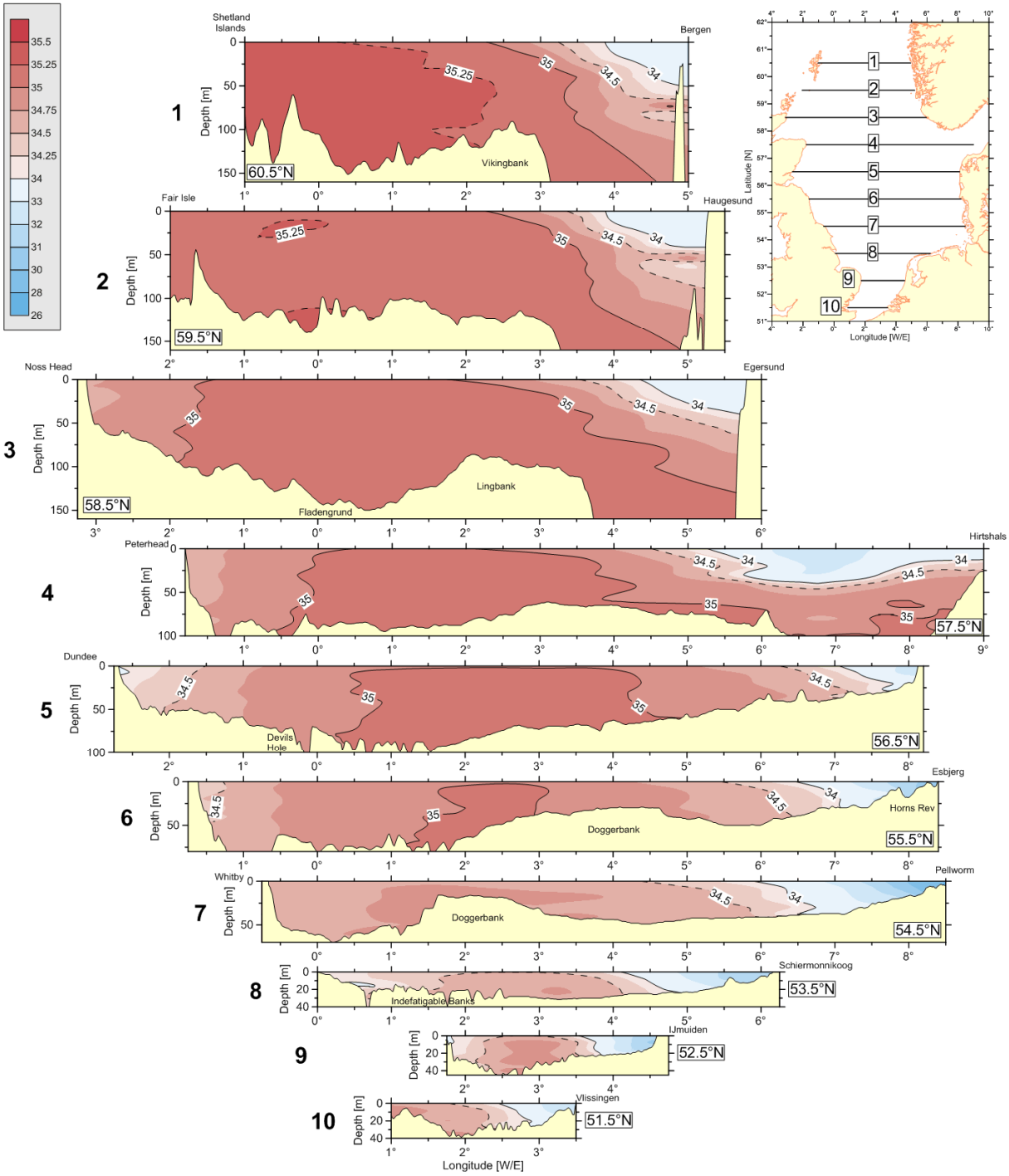
Monthly mean temperature (1902 - 1954) on 10 zonal sections

March



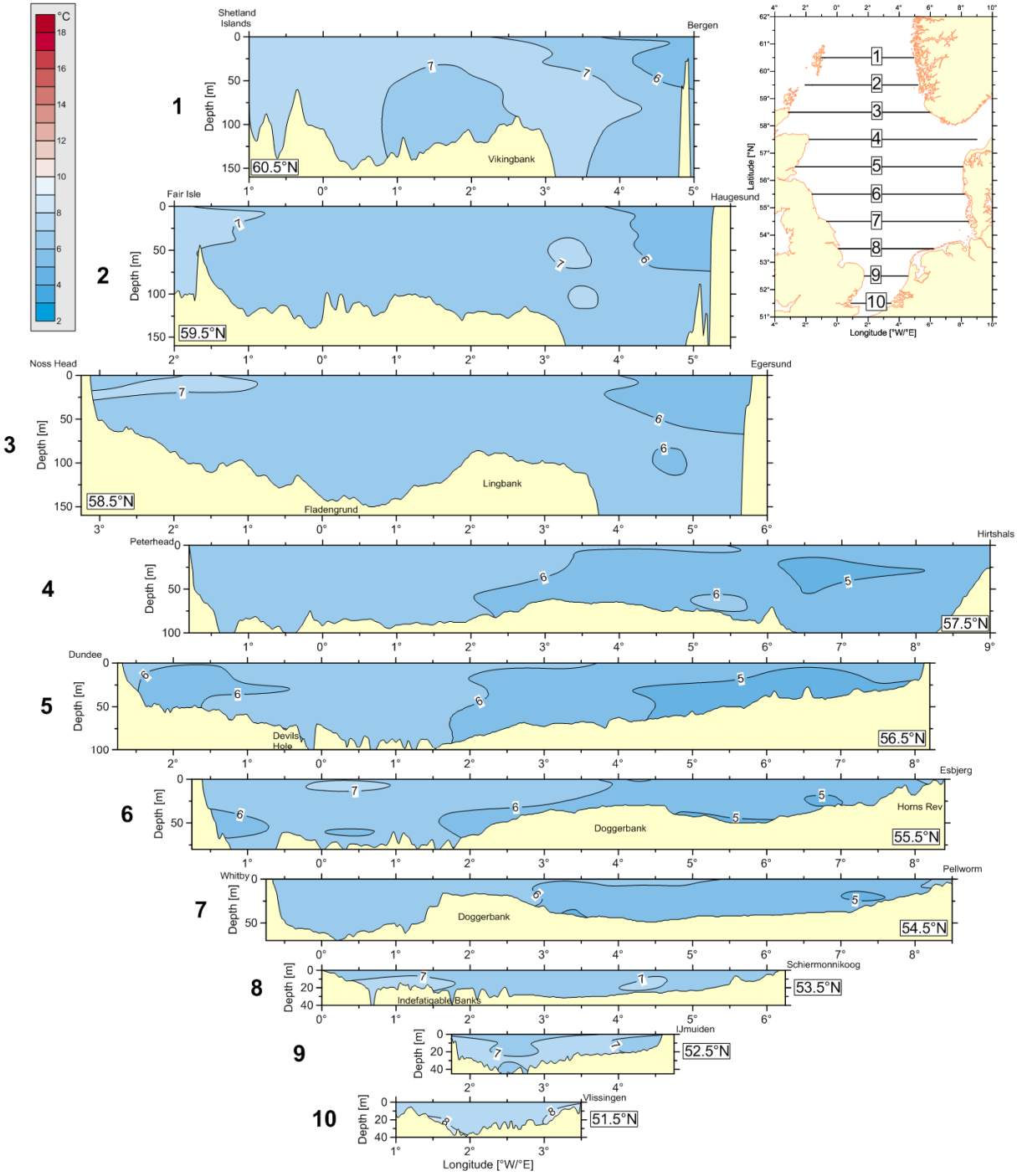
Monthly mean salinity (1902 - 1954) on 10 zonal sections

March



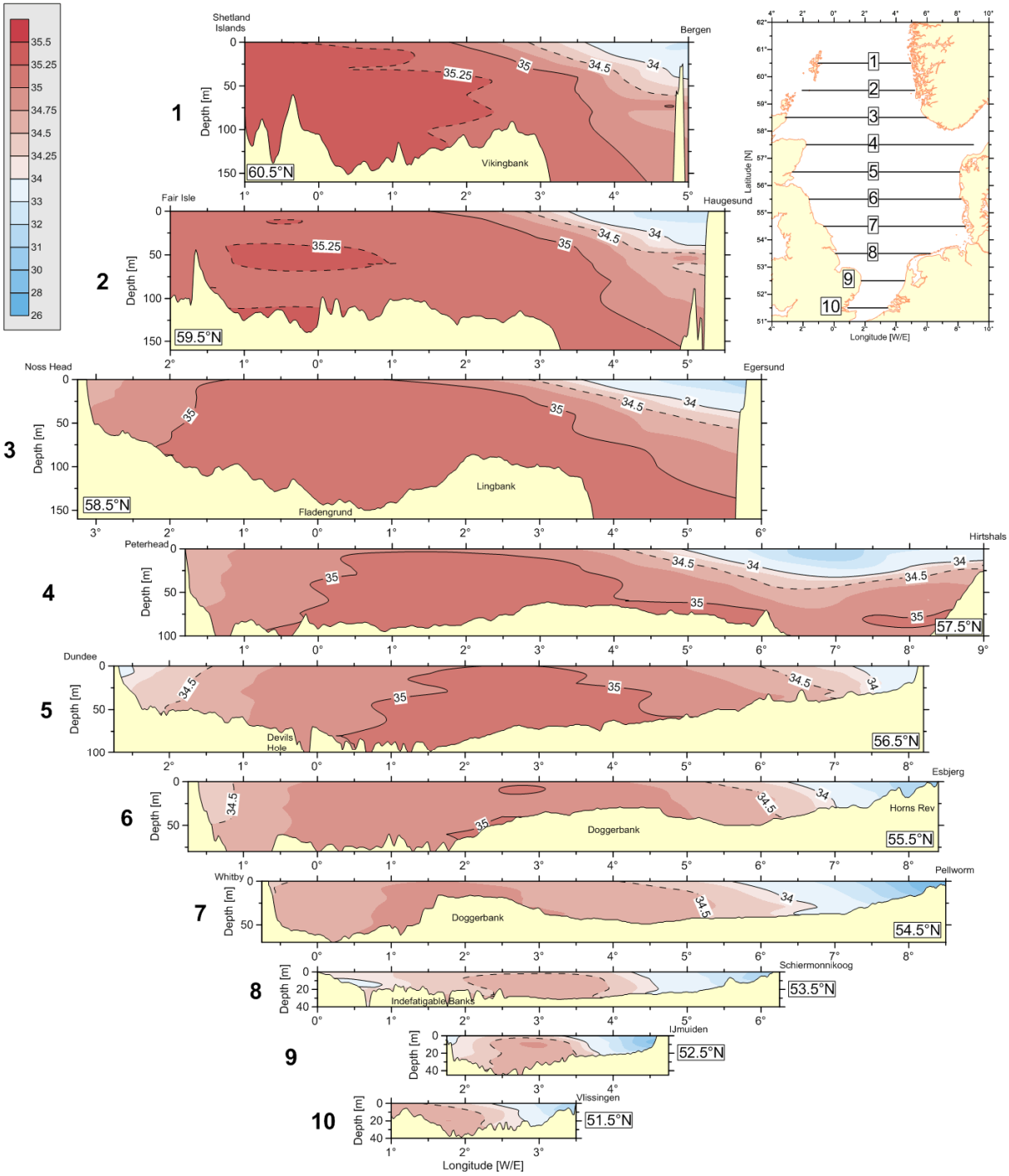
Monthly mean temperature (1902 - 1954) on 10 zonal sections

April



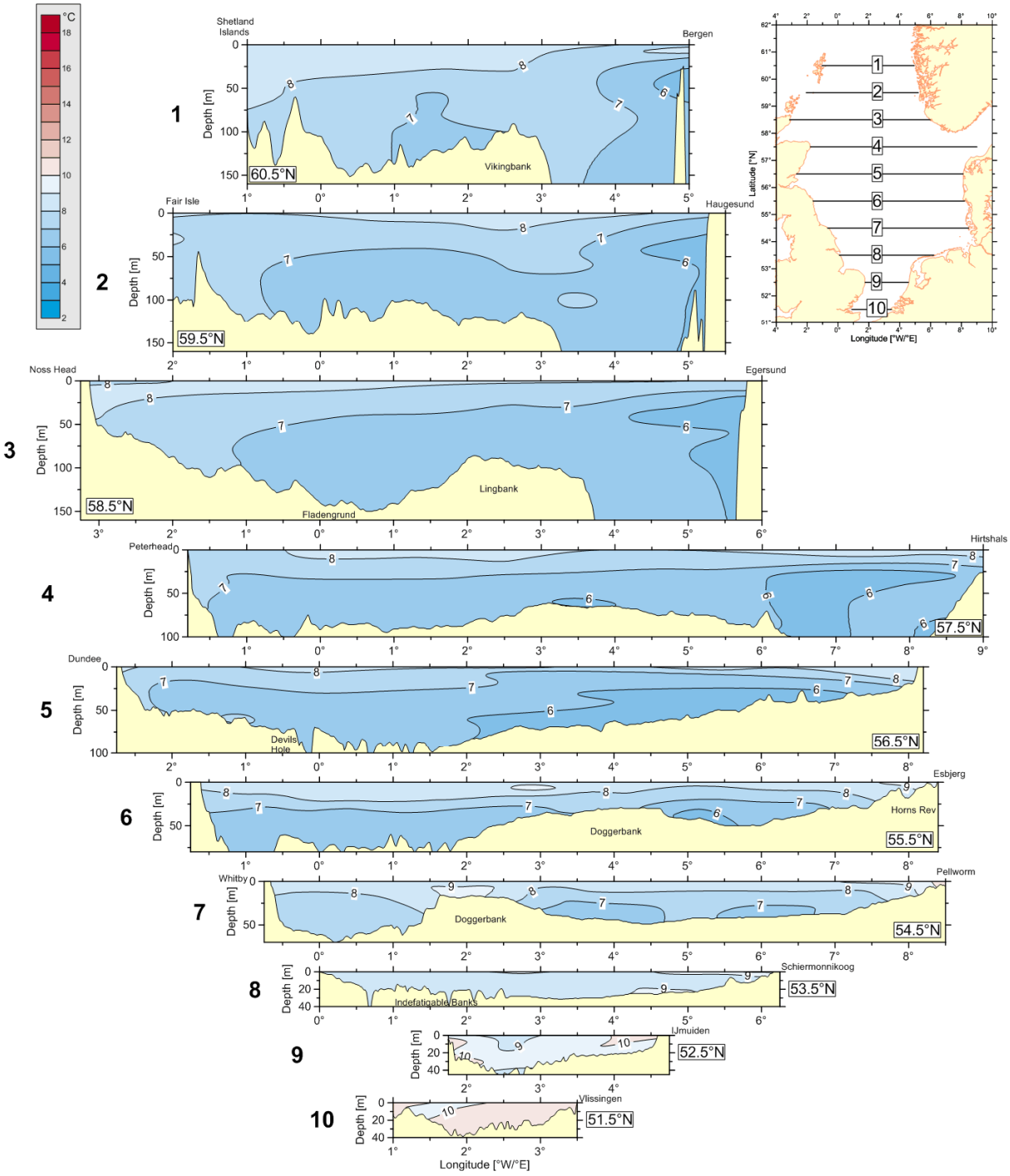
Monthly mean salinity (1902 - 1954) on 10 zonal sections

April



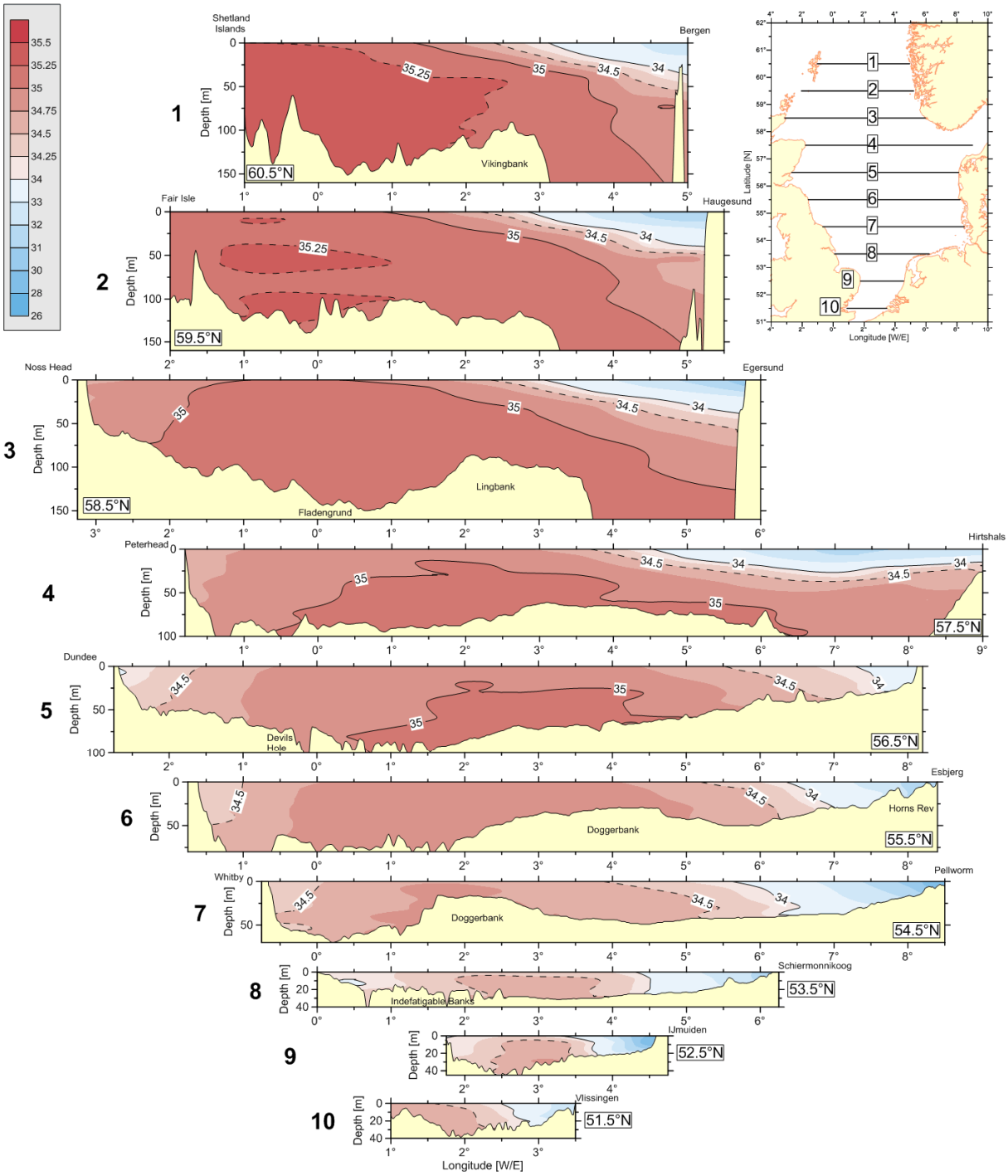
Monthly mean temperature (1902 - 1954) on 10 zonal sections

May



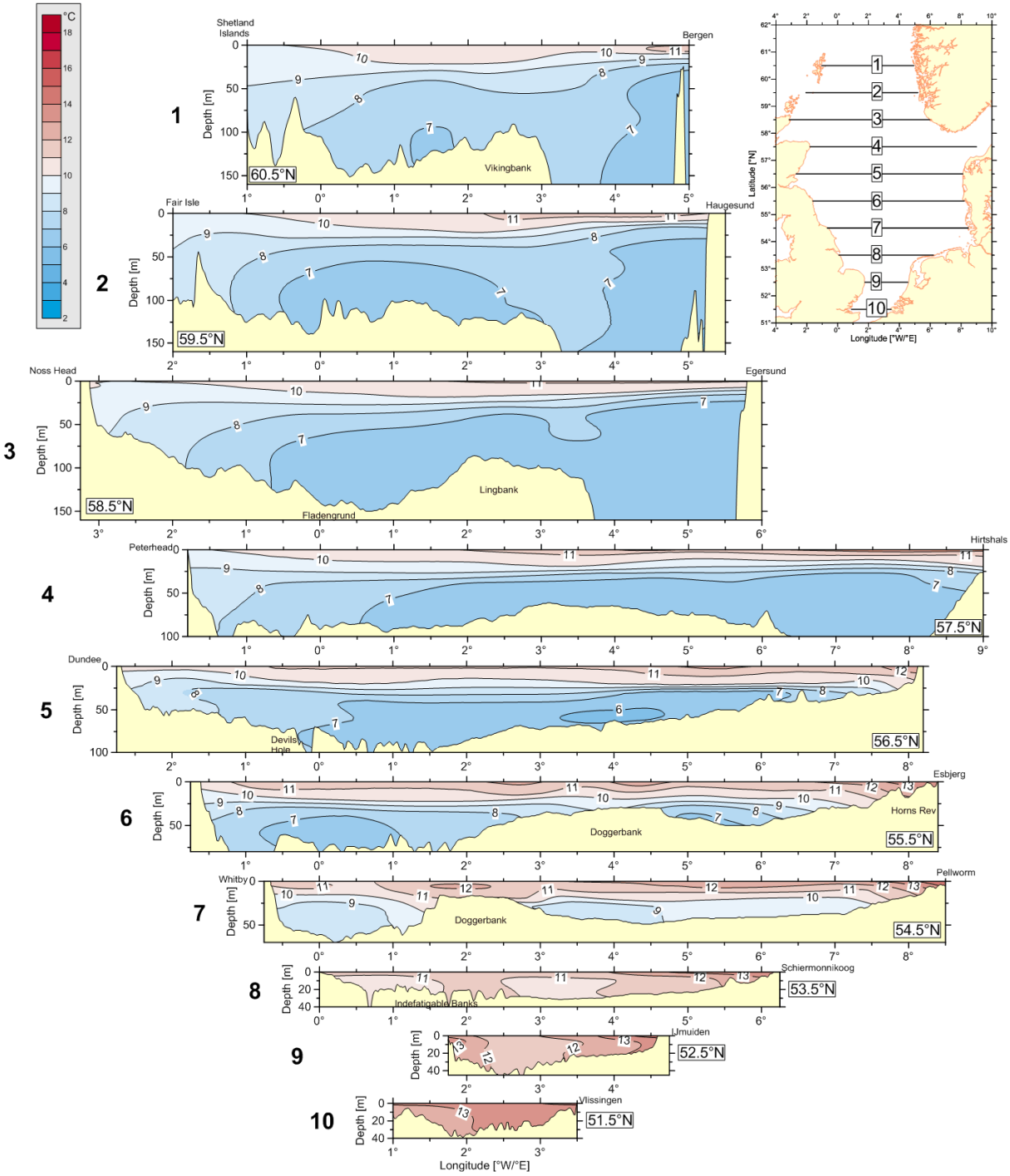
Monthly mean salinity (1902 - 1954) on 10 zonal sections

May



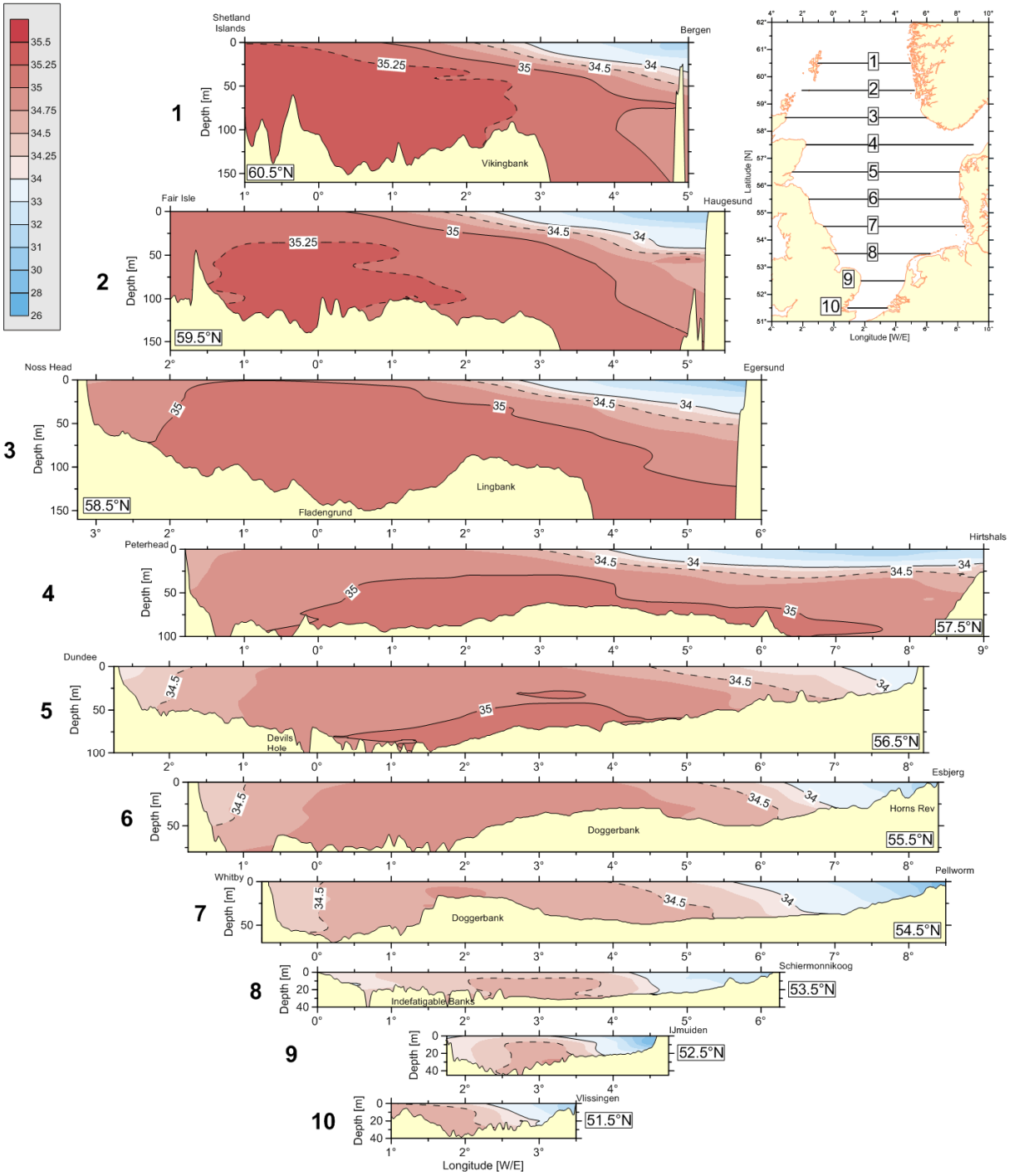
Monthly mean temperature (1902 - 1954) on 10 zonal sections

June



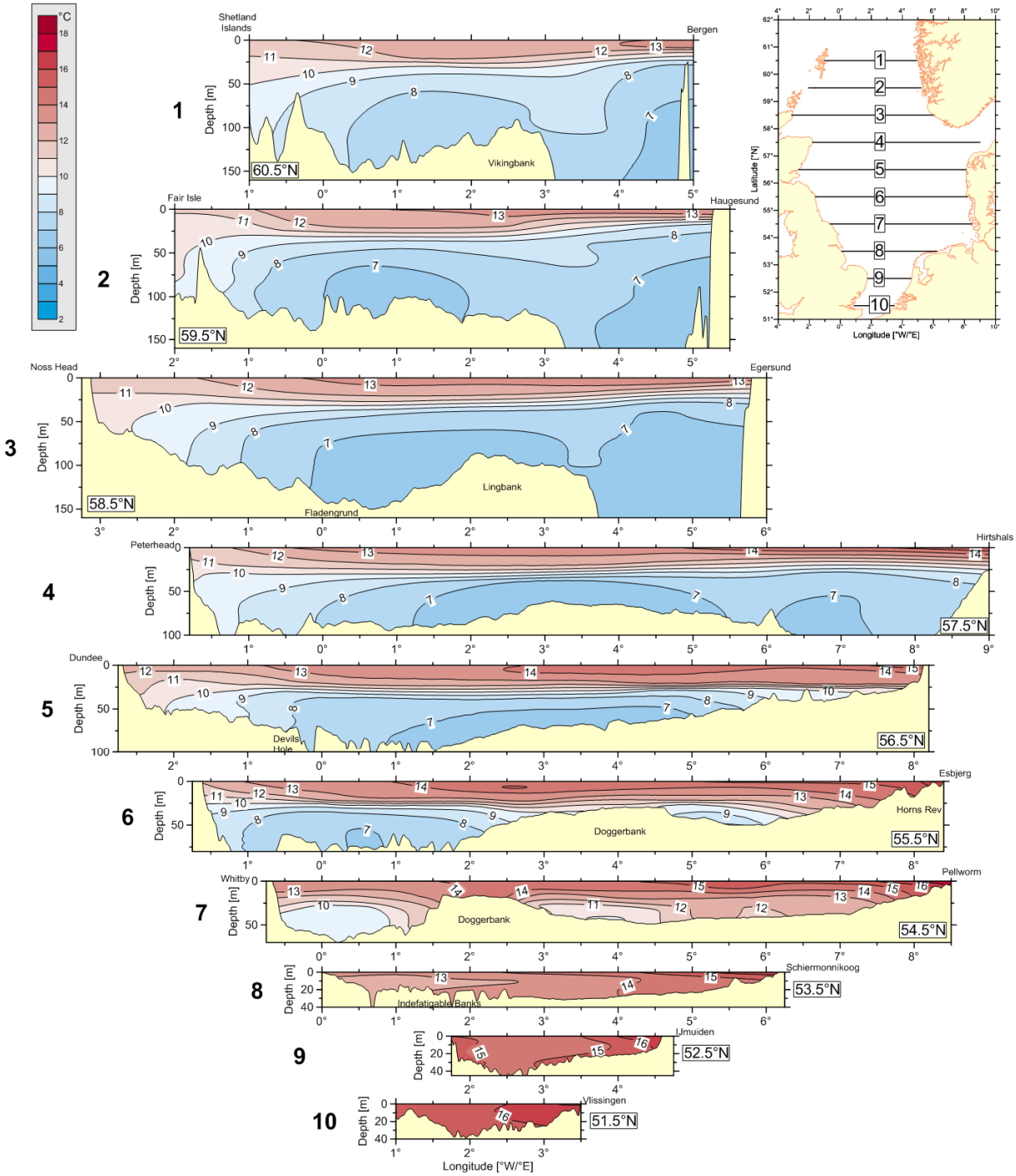
Monthly mean salinity (1902 - 1954) on 10 zonal sections

June



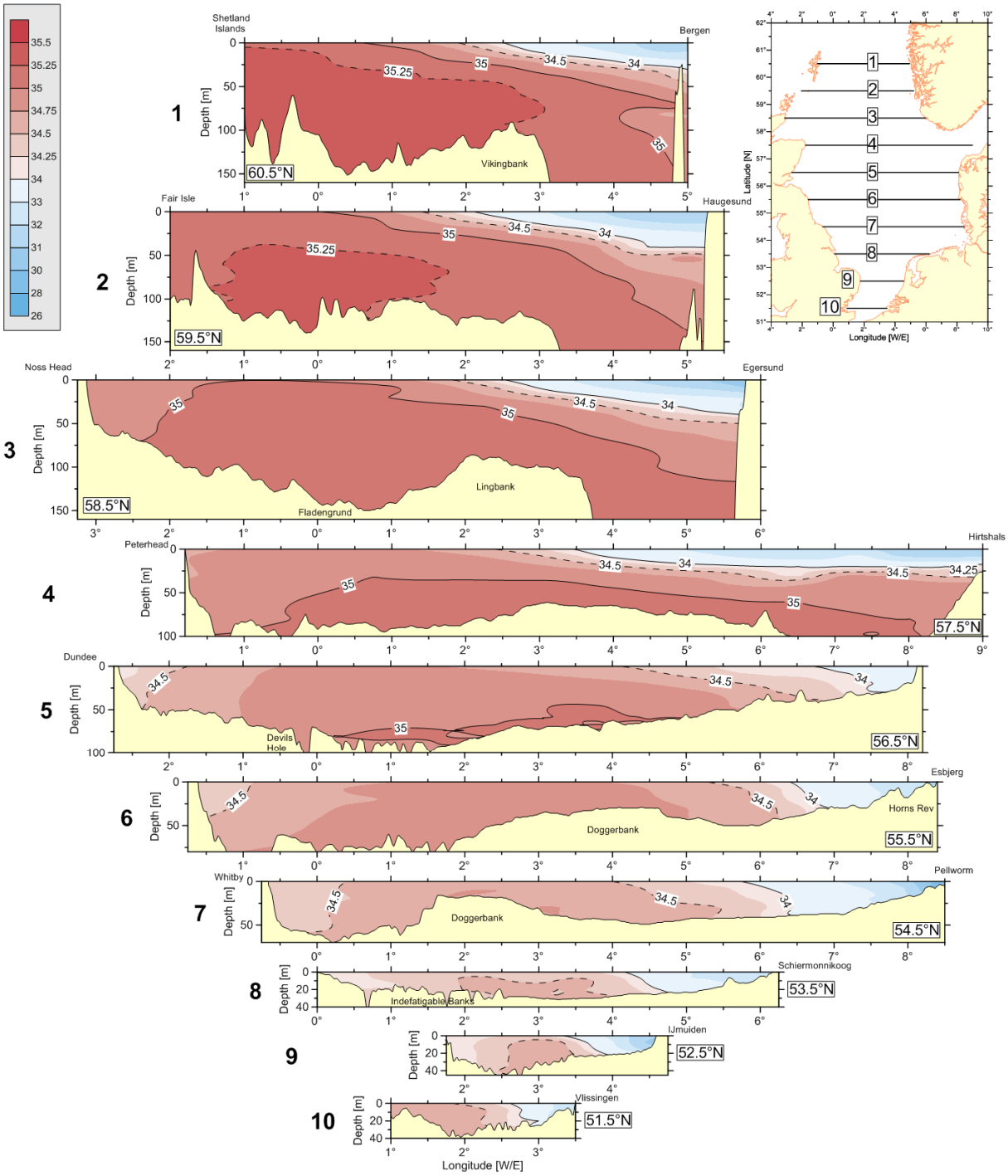
Monthly mean temperature (1902 - 1954) on 10 zonal sections

July



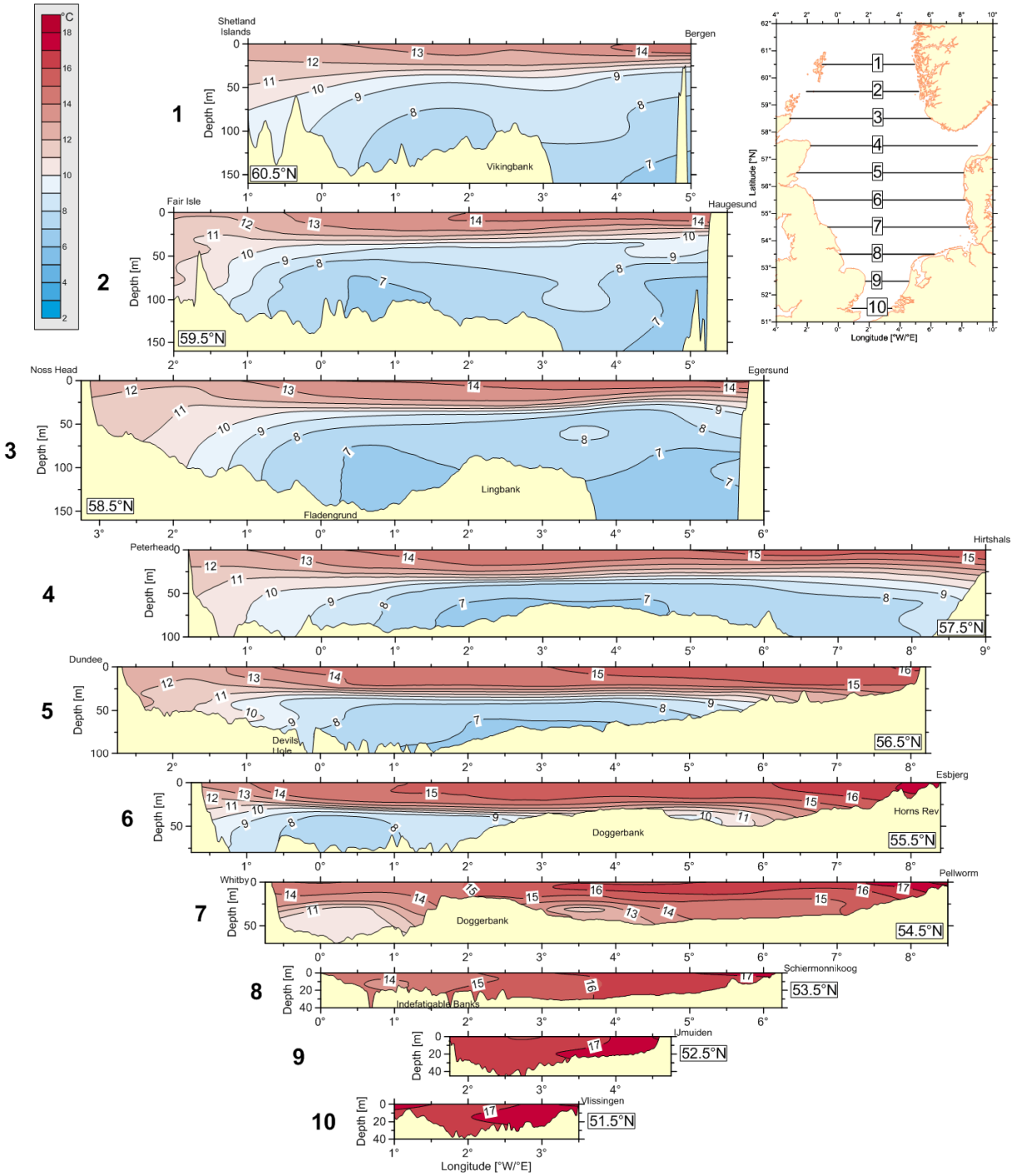
Monthly mean salinity (1902 - 1954) on 10 zonal sections

July



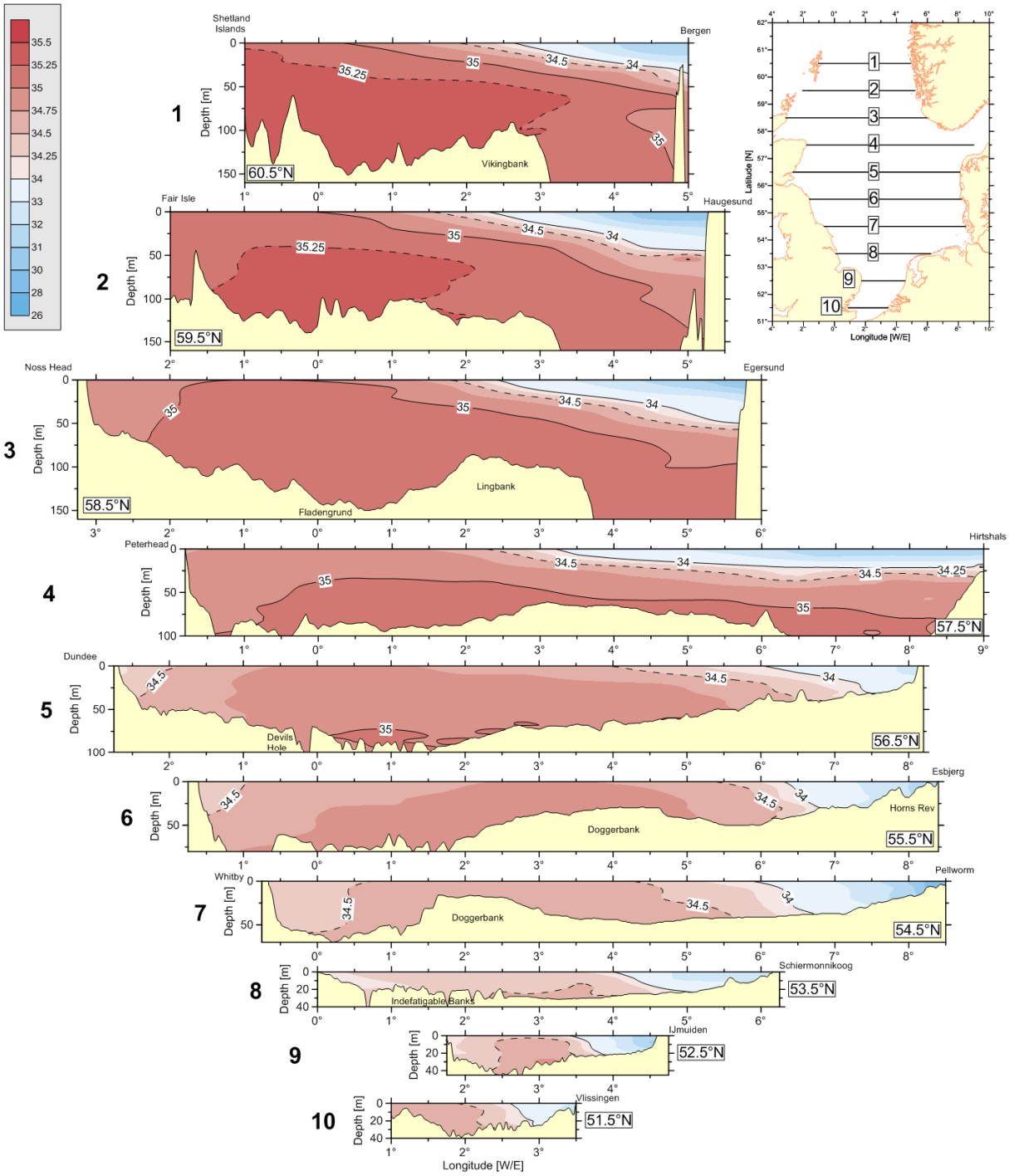
Monthly mean temperature (1902 - 1954) on 10 zonal sections

August



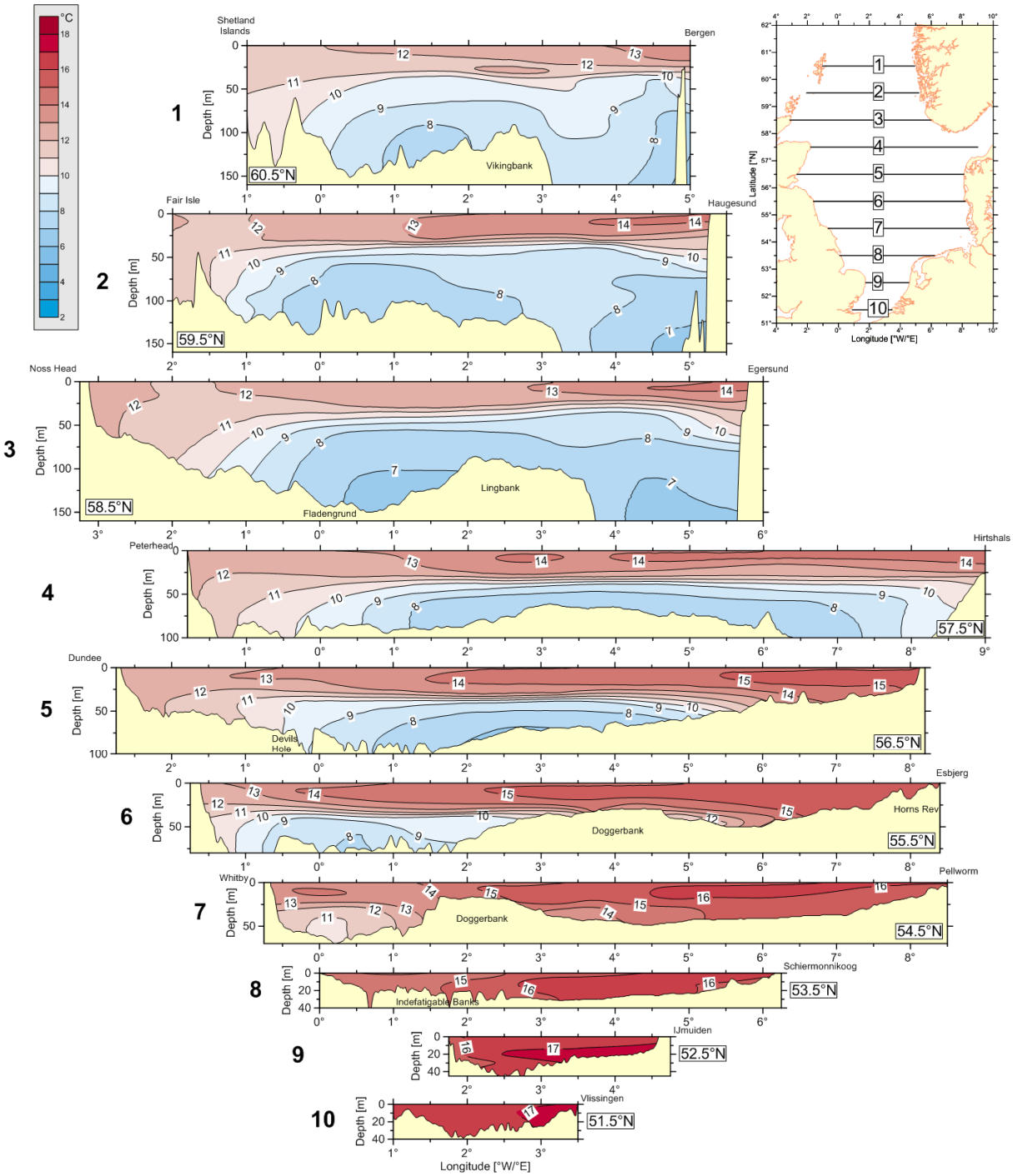
Monthly mean salinity (1902 - 1954) on 10 zonal sections

August



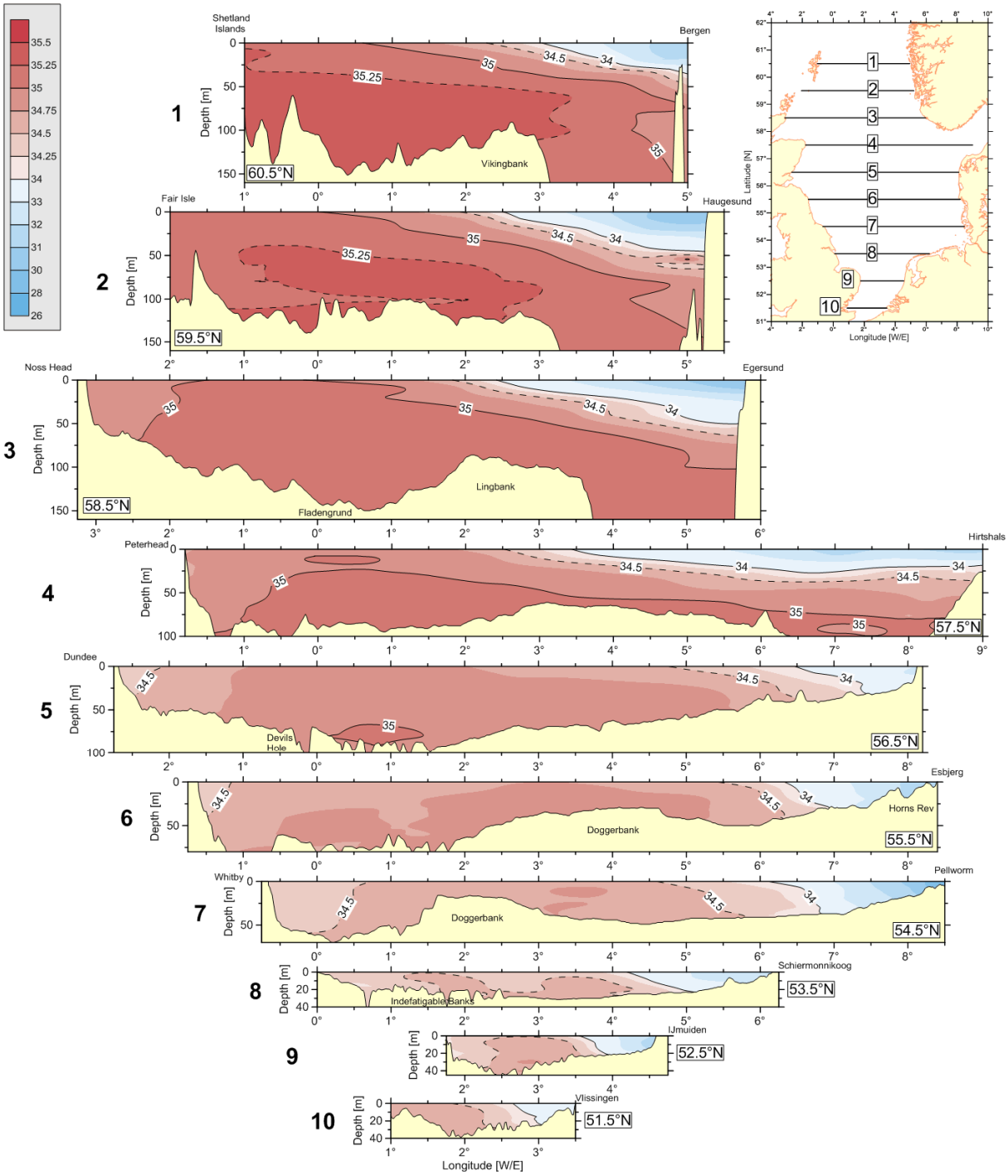
Monthly mean temperature (1902 - 1954) on 10 zonal sections

September



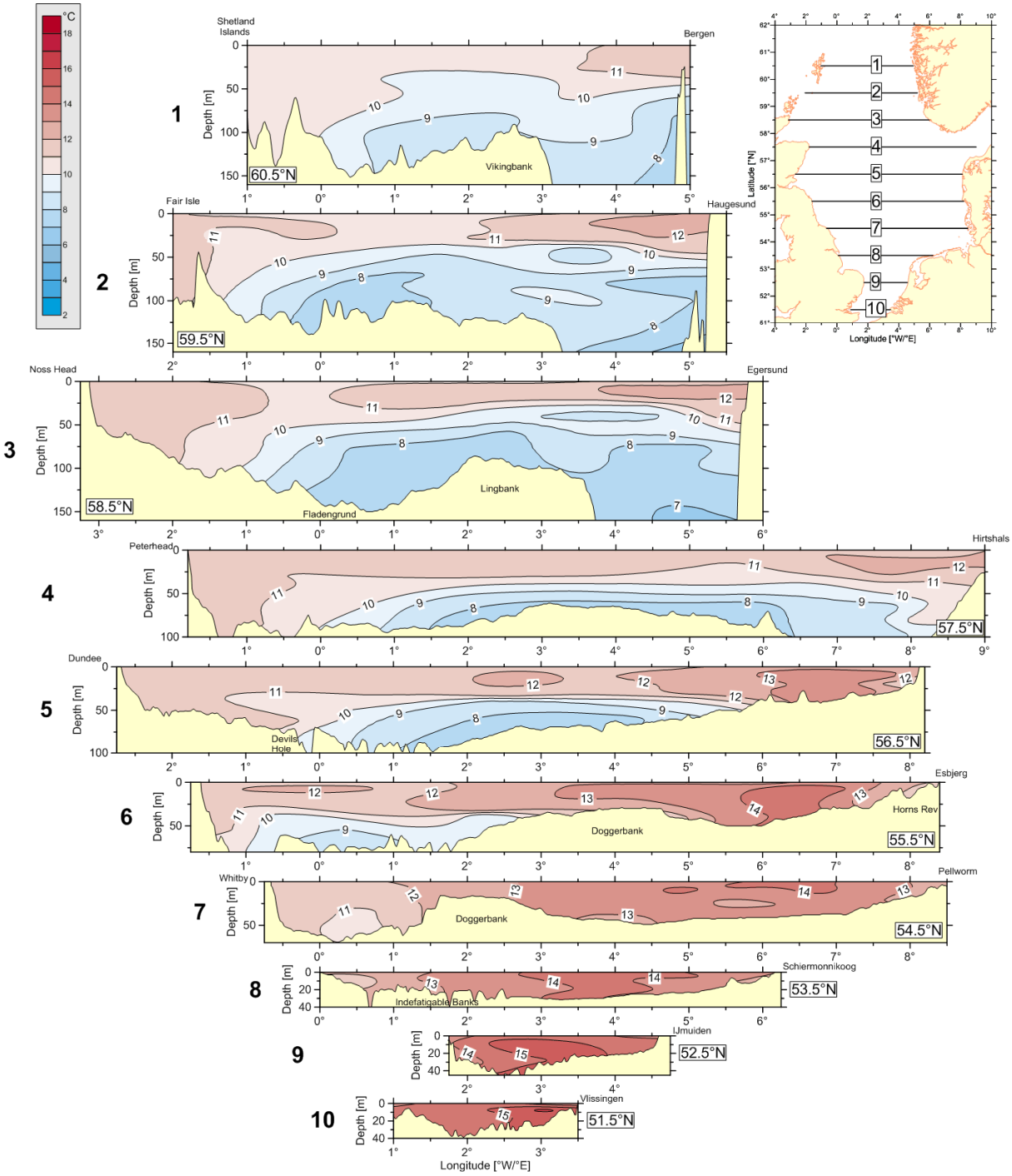
Monthly mean salinity (1902 - 1954) on 10 zonal sections

September



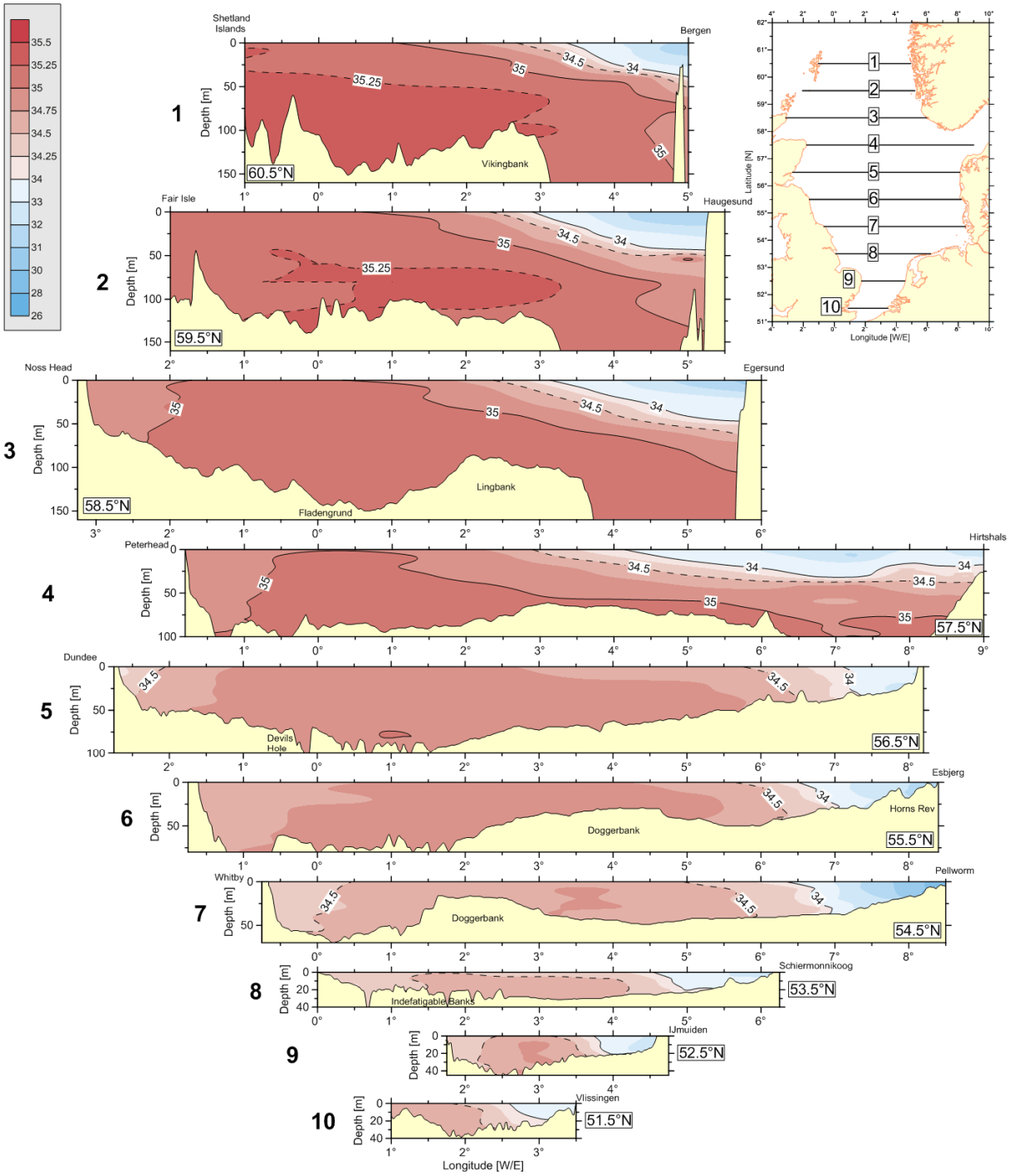
Monthly mean temperature (1902 - 1954) on 10 zonal sections

October



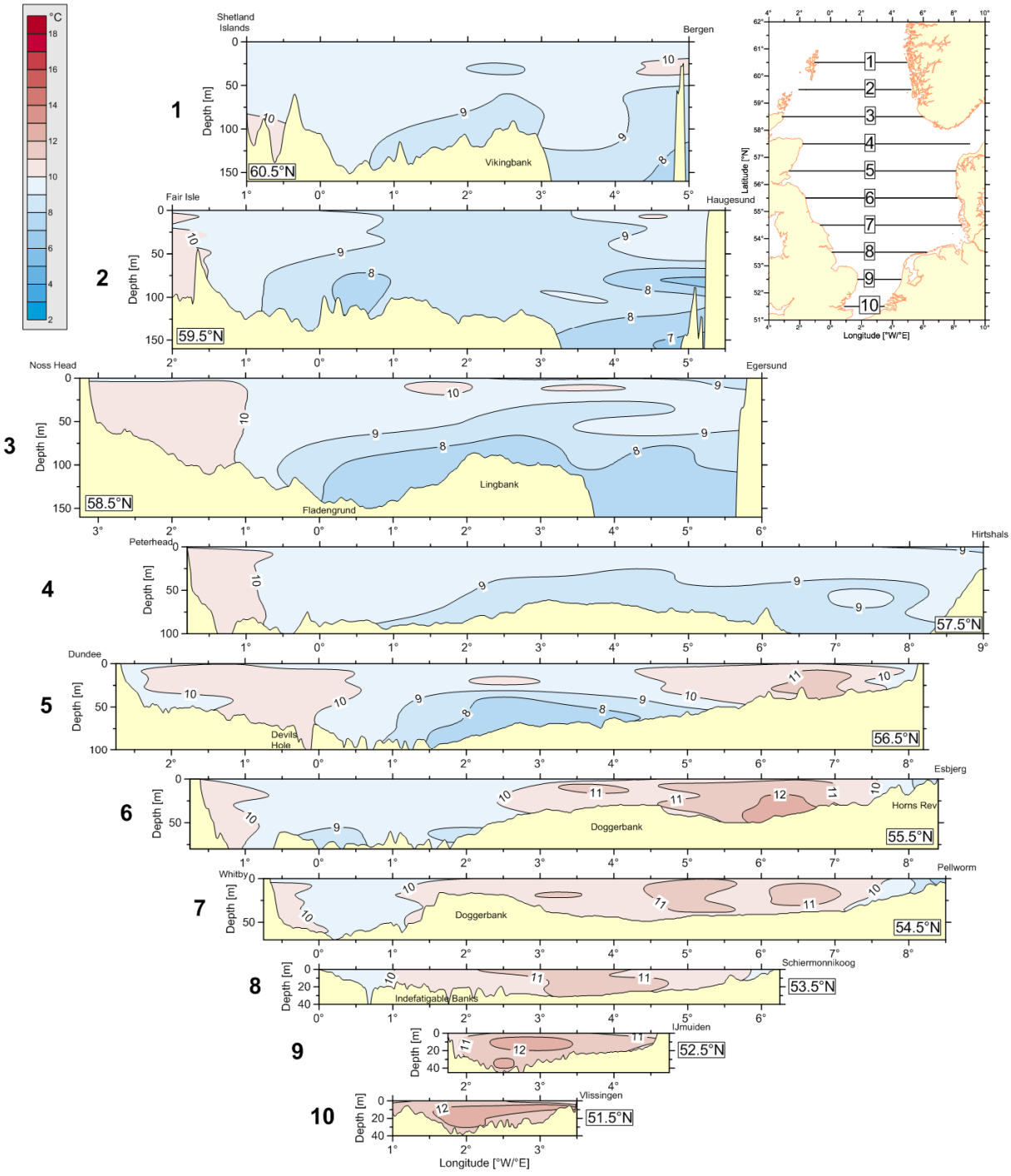
Monthly mean salinity (1902 - 1954) on 10 zonal sections

October



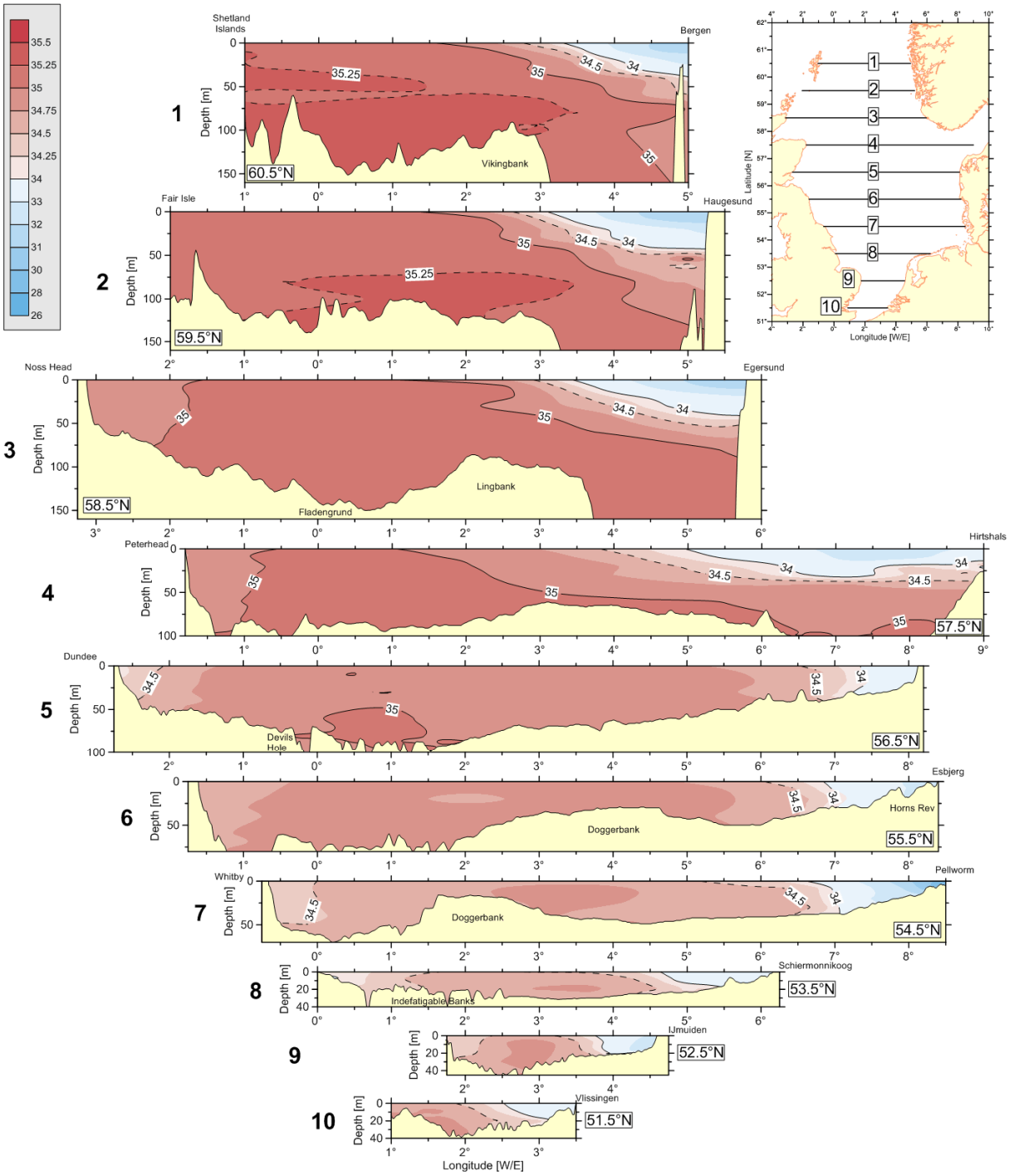
Monthly mean temperature (1902 - 1954) on 10 zonal sections

November



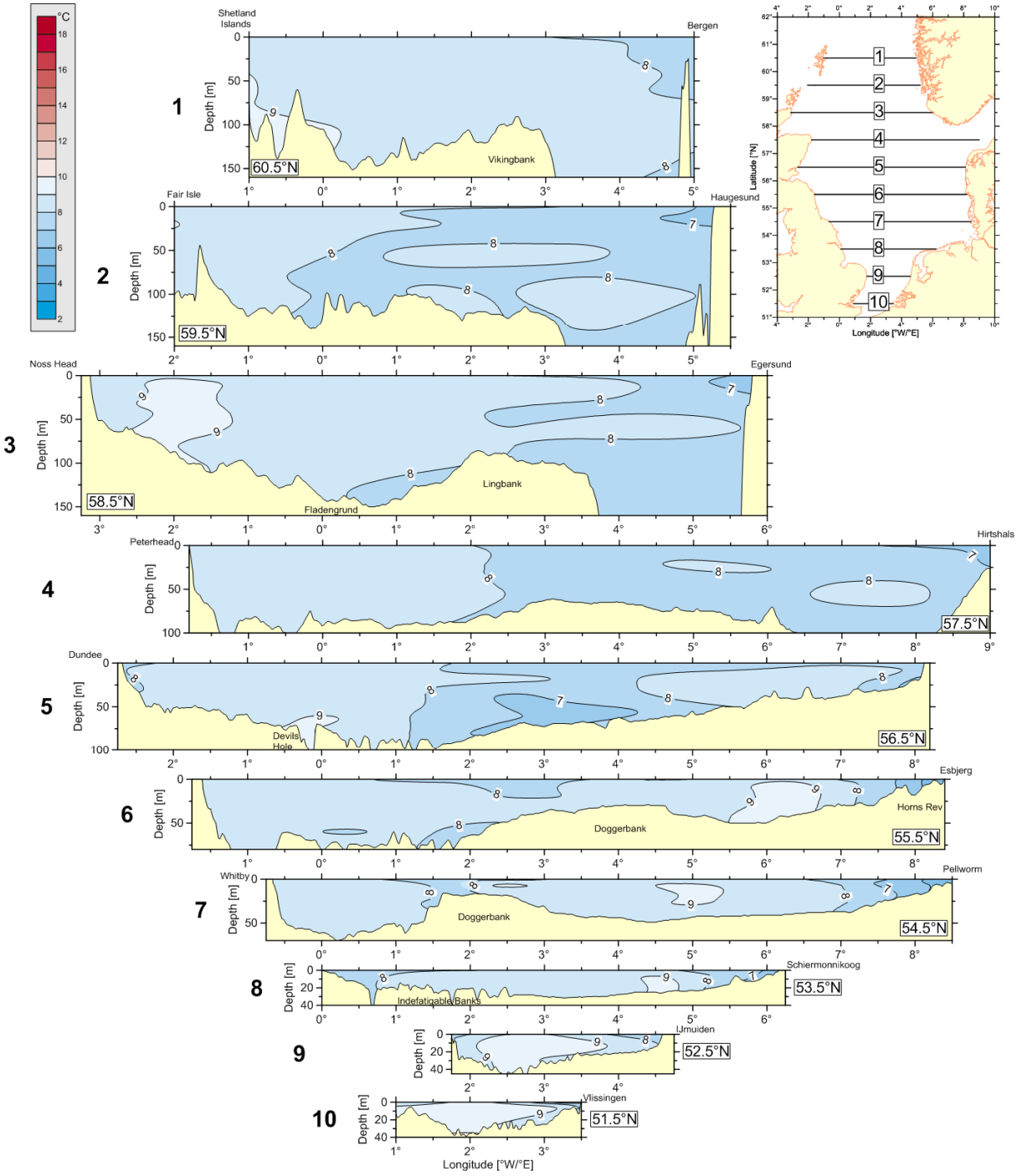
Monthly mean salinity (1902 - 1954) on 10 zonal sections

November



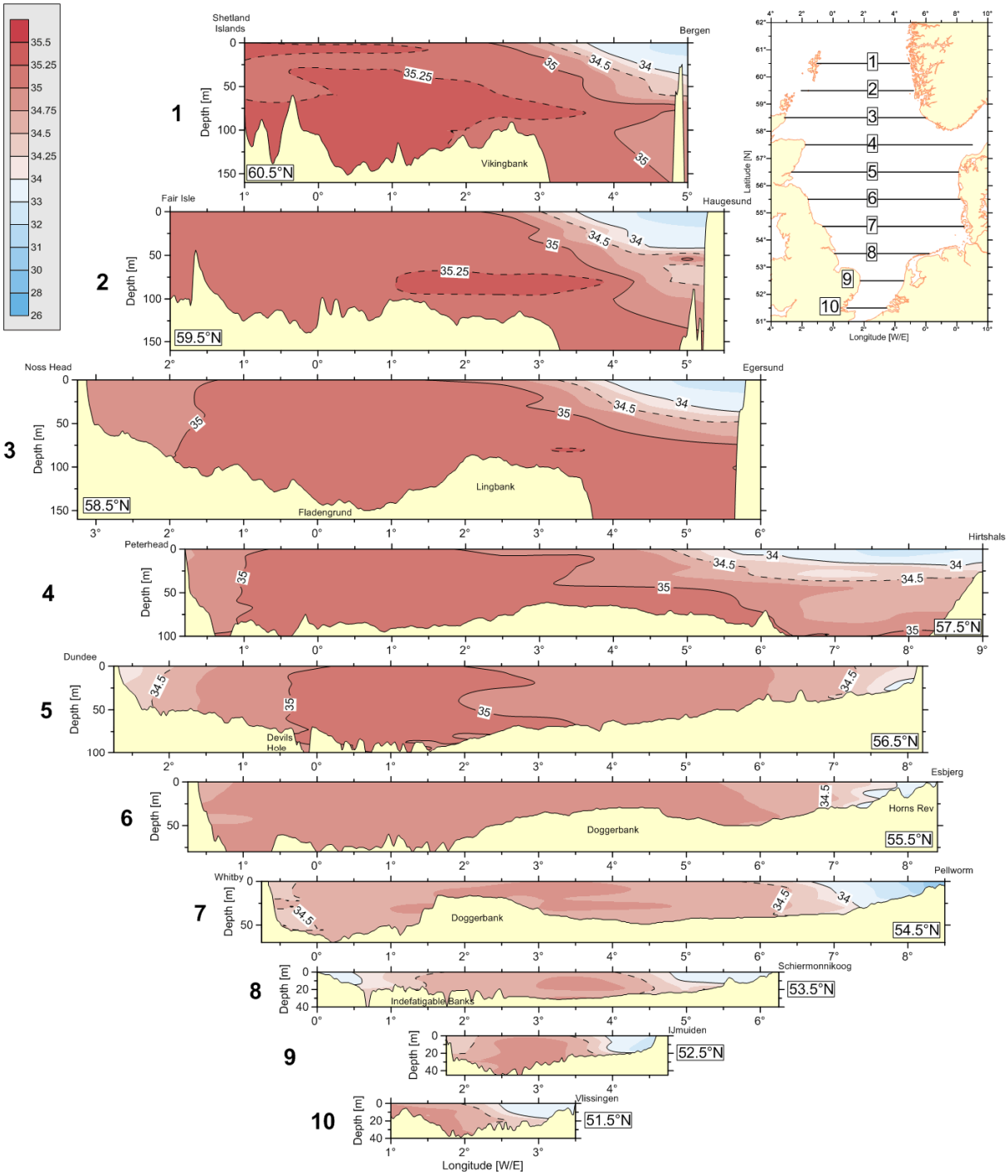
Monthly mean temperature (1902 - 1954) on 10 zonal sections

December

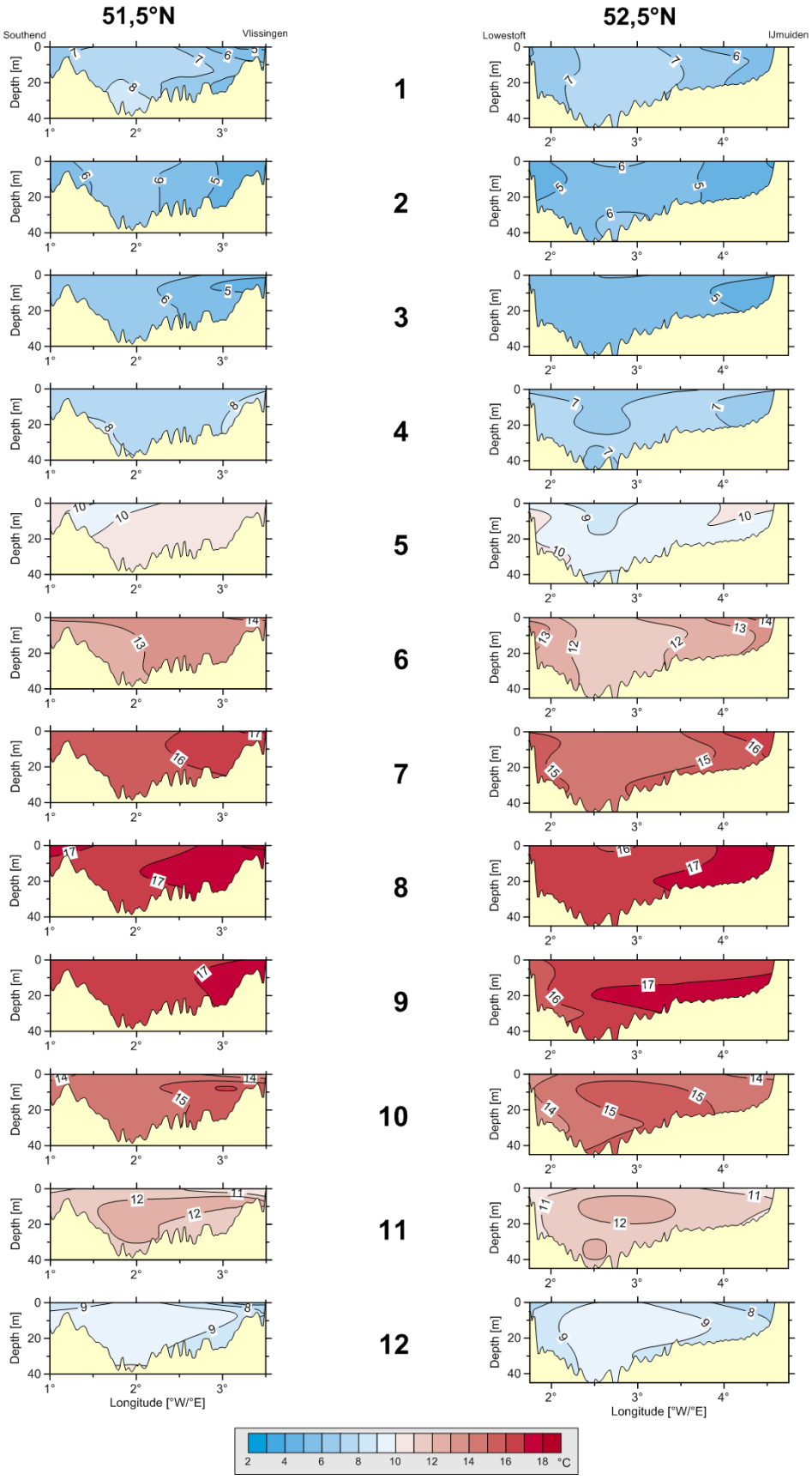


Monthly mean salinity (1902 - 1954) on 10 zonal sections

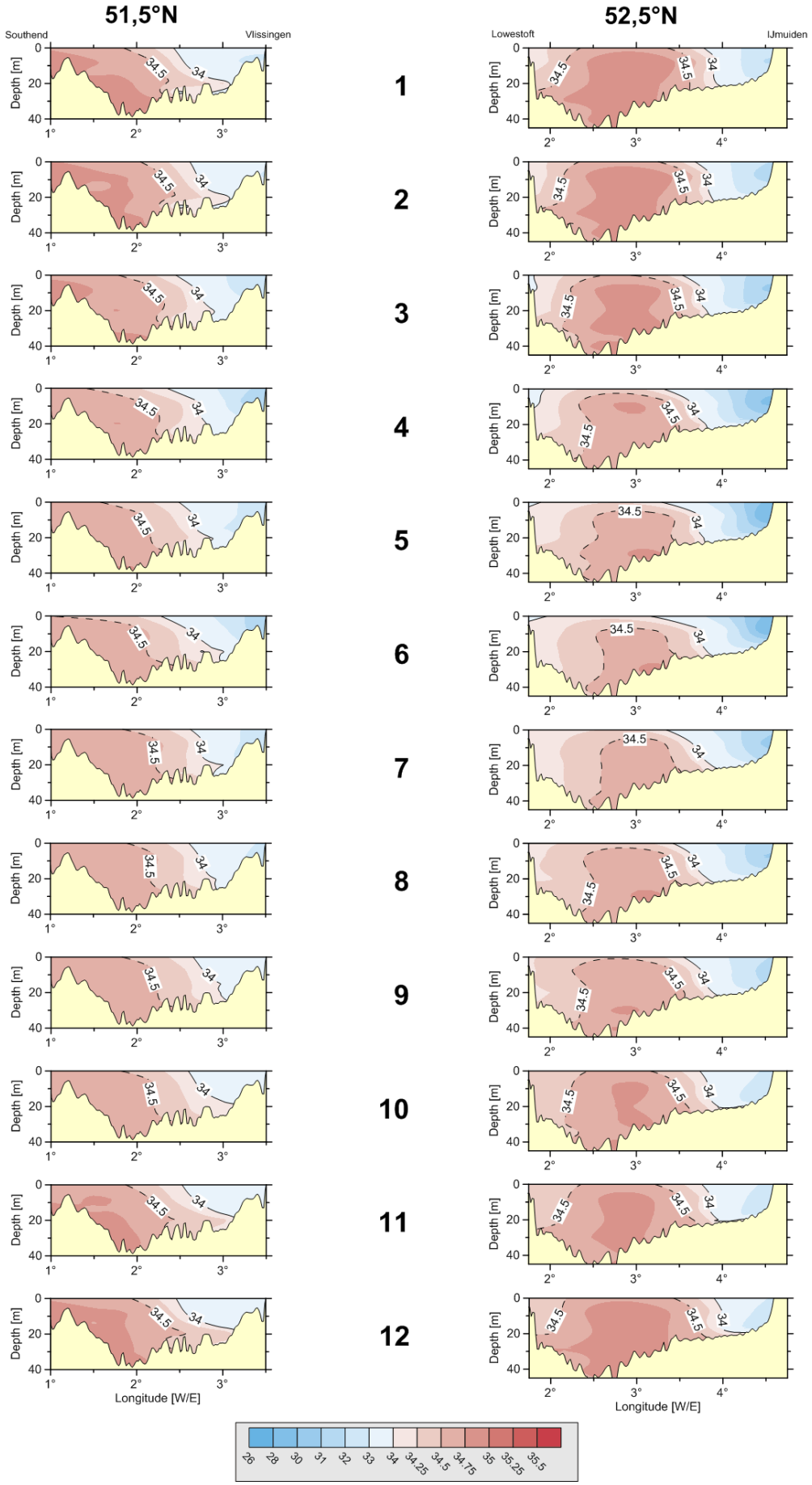
December



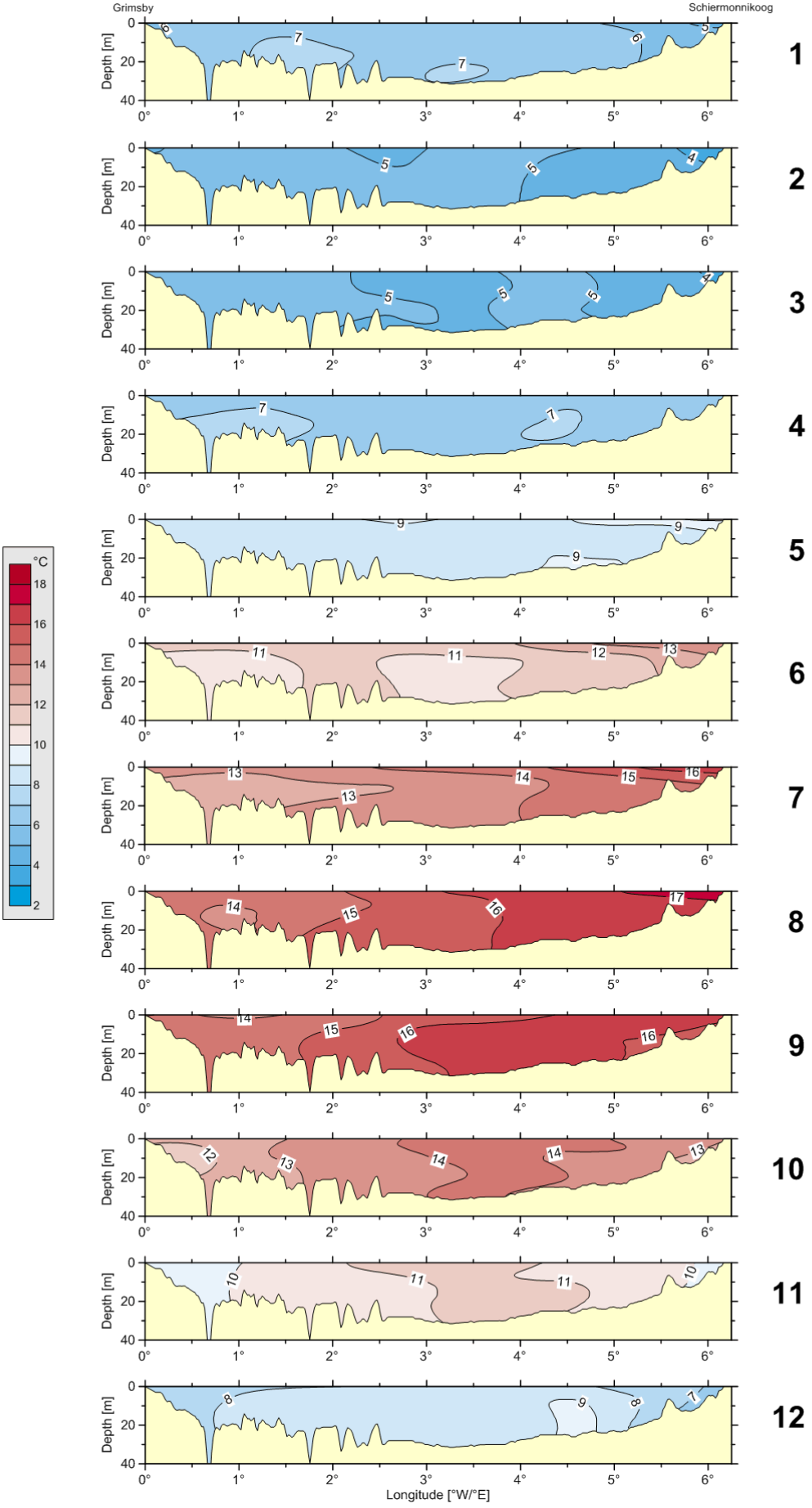
Monthly mean temperature (1902 - 1954) at 51,5°N and 52,5°N - January to December (1-12)



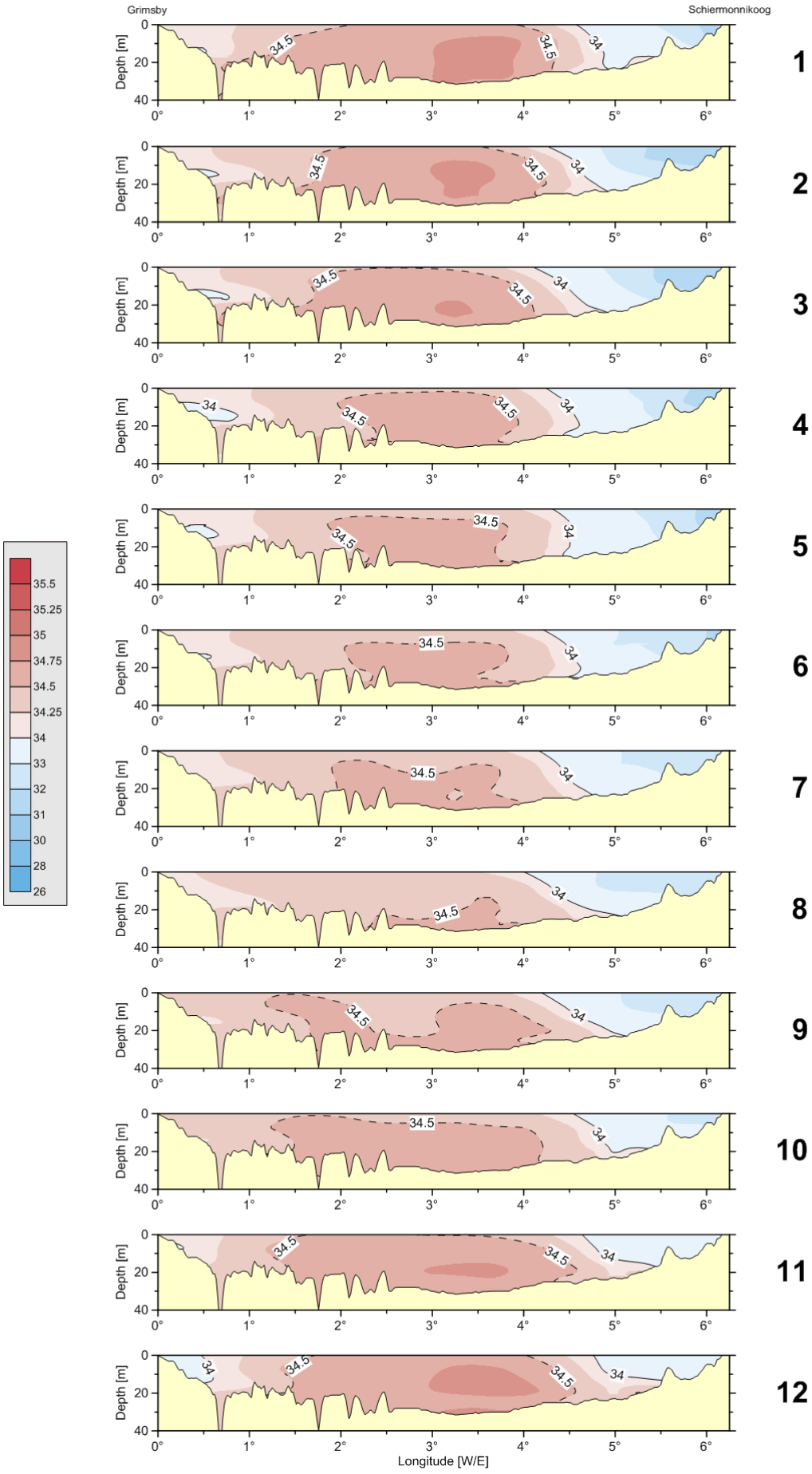
Monthly mean salinity (1902 - 1954) at 51,5°N and 52,5°N - January to December (1-12)



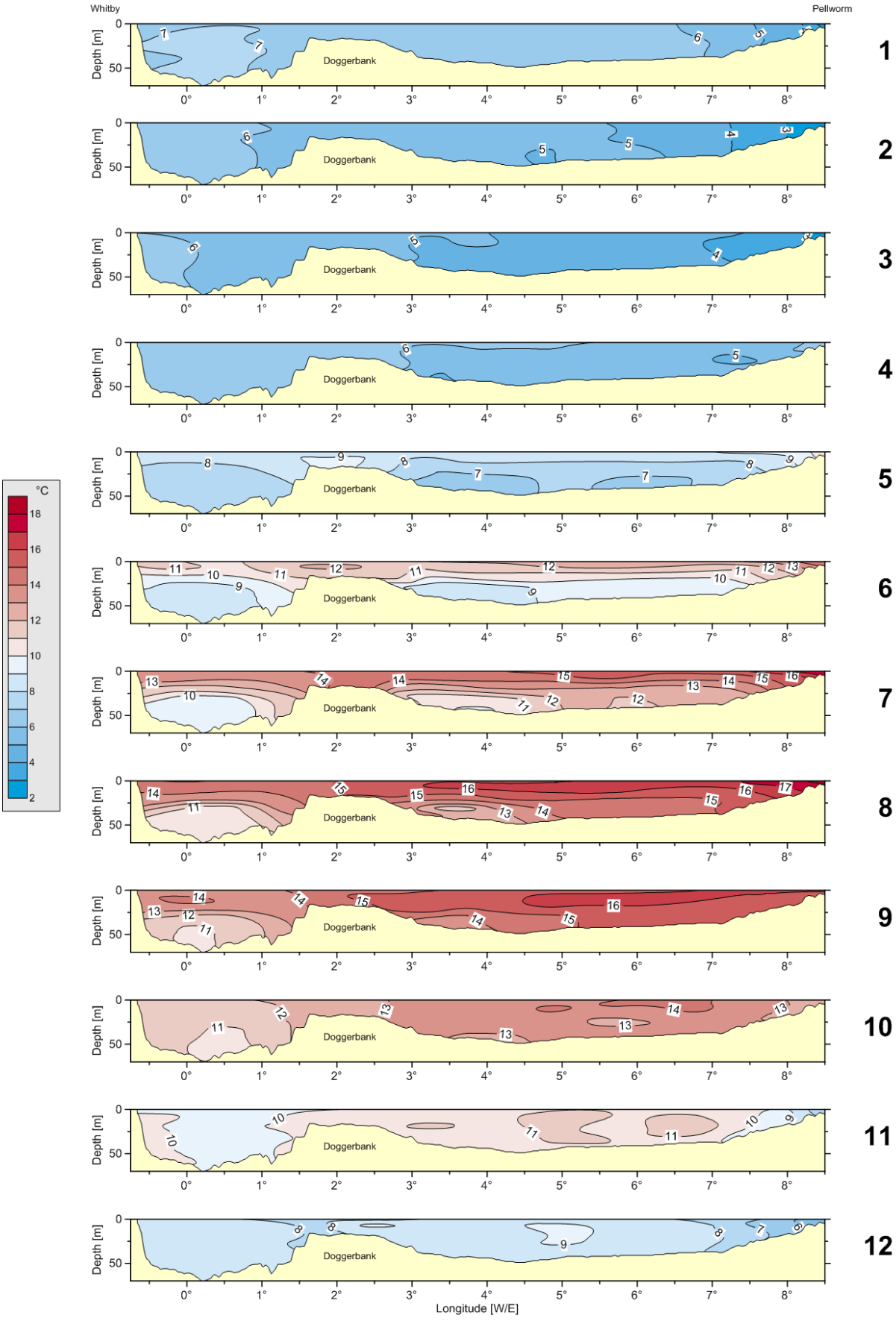
Monthly mean temperature (1902 - 1954) at 53,5°N - January to December (1-12)



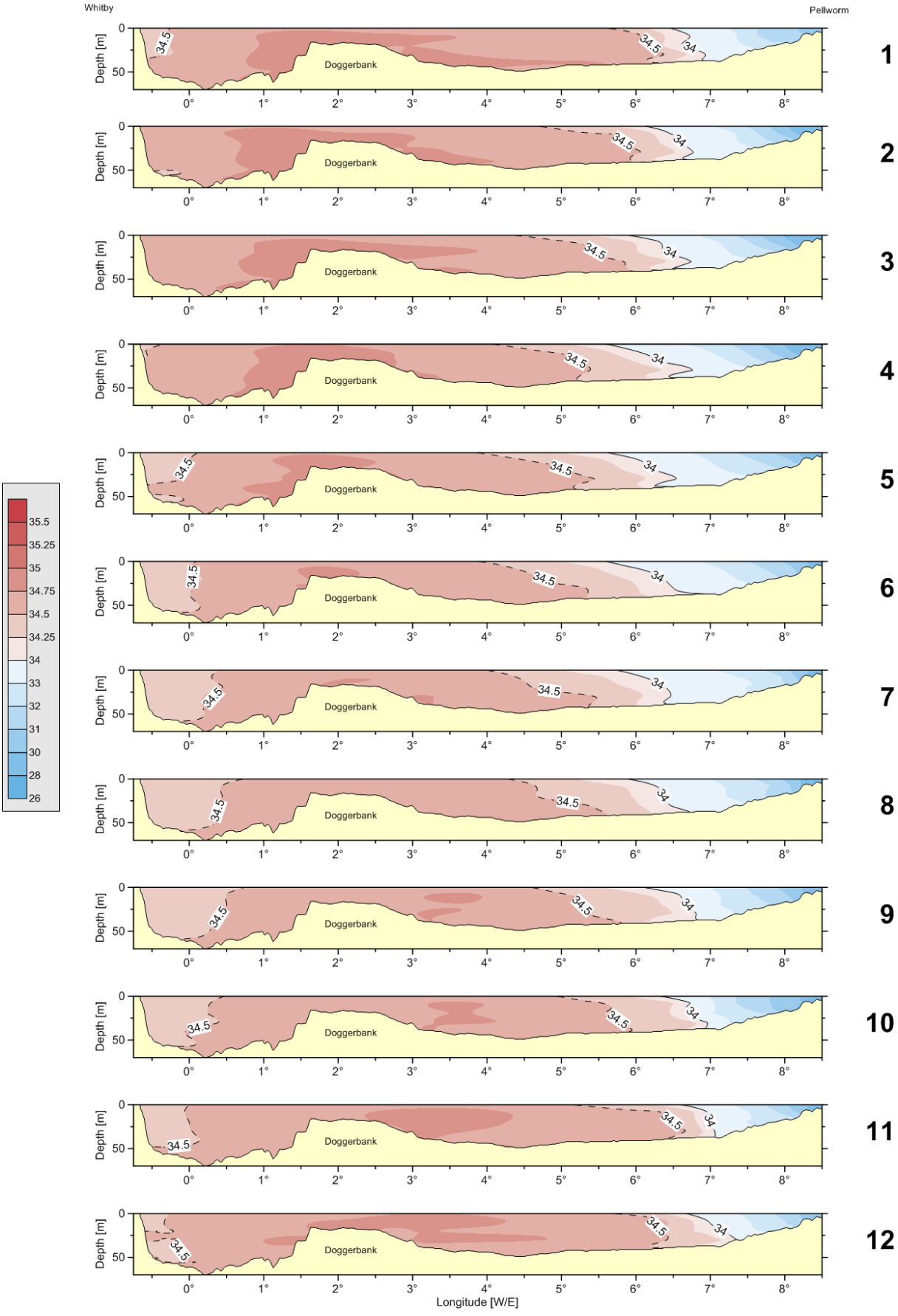
Monthly mean salinity (1902 - 1954) at 53,5°N - January to December (1-12)



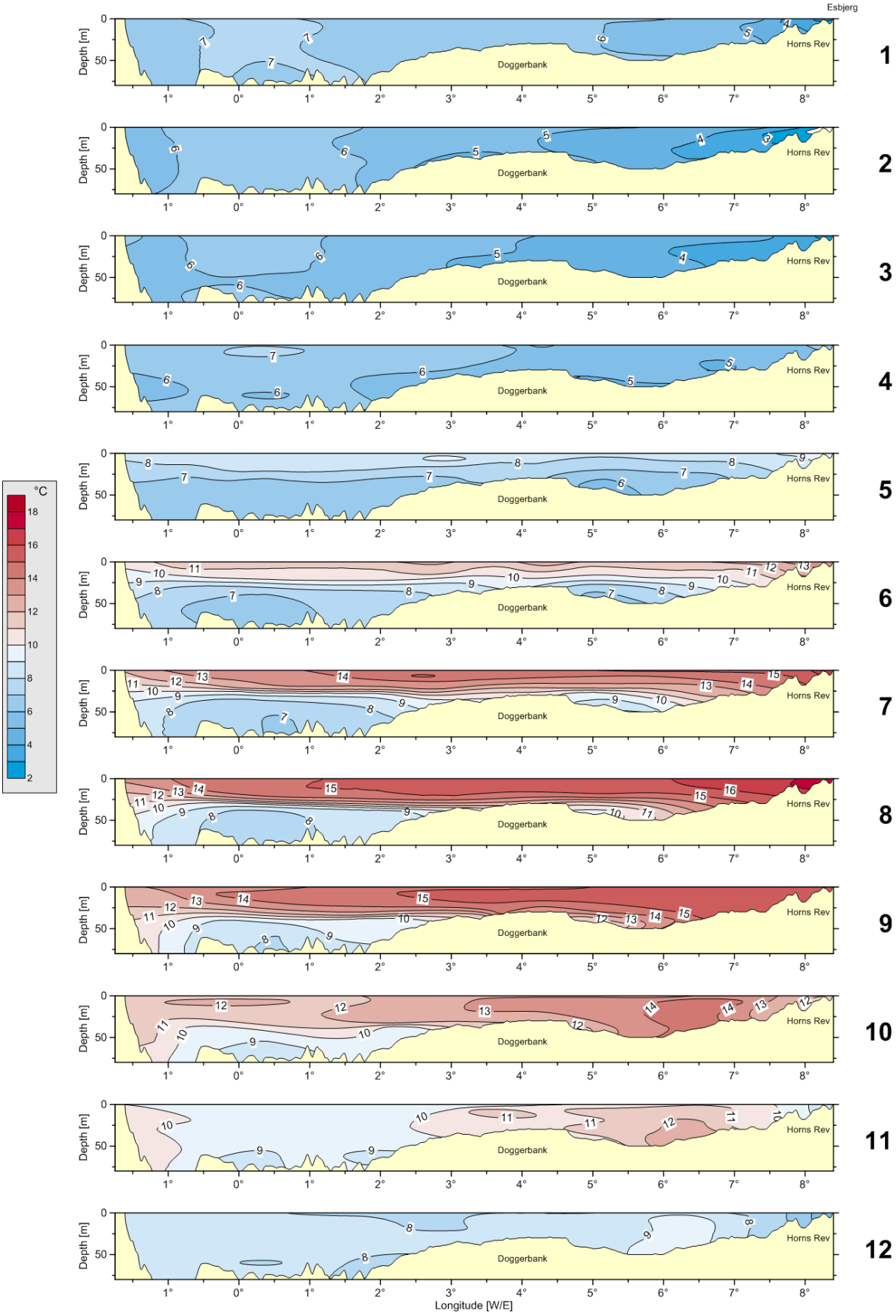
Monthly mean temperature (1902 - 1954) at 54,5°N - January to December (1-12)



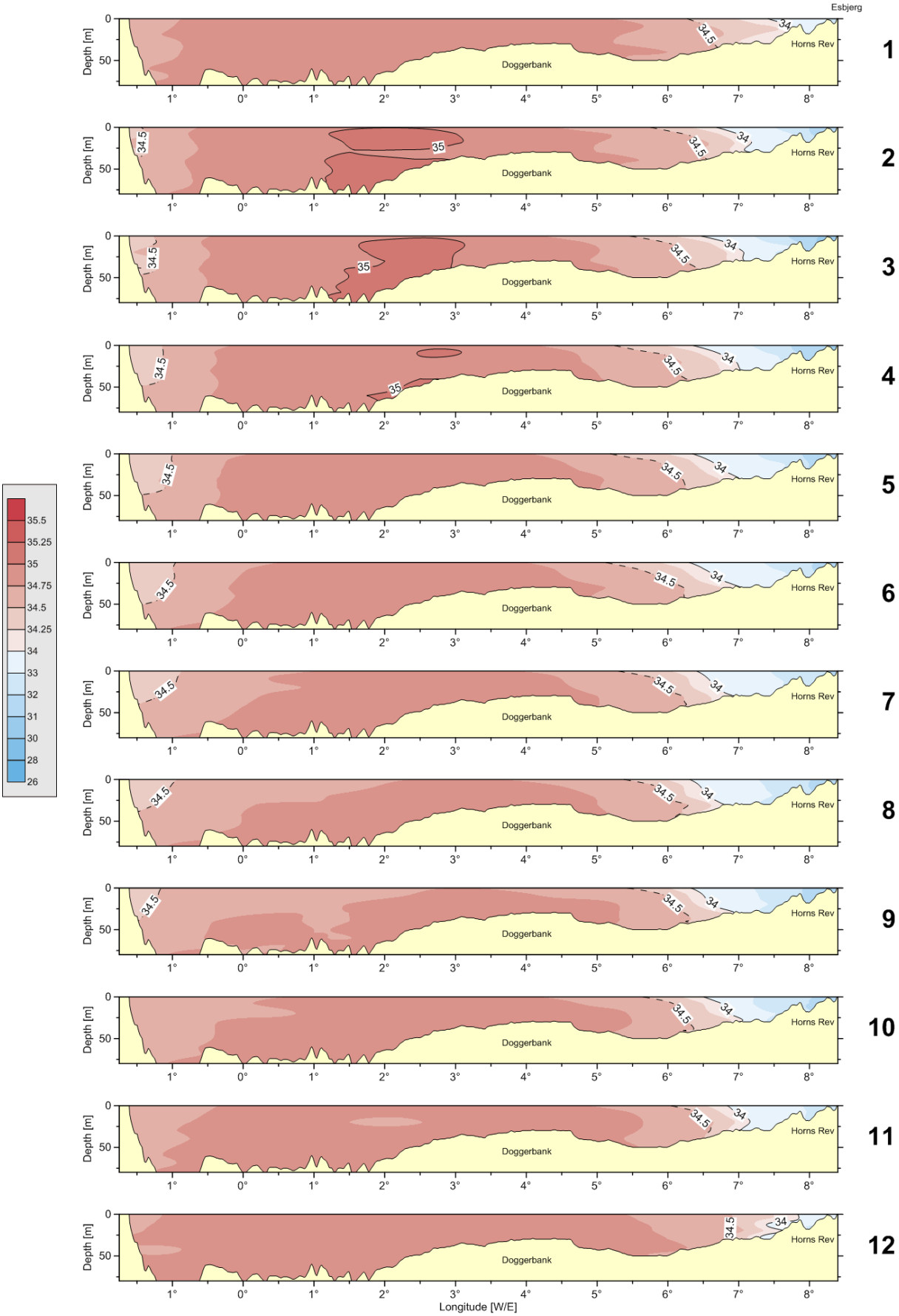
Monthly mean salinity (1902 - 1954) at 54,5°N - January to December (1-12)



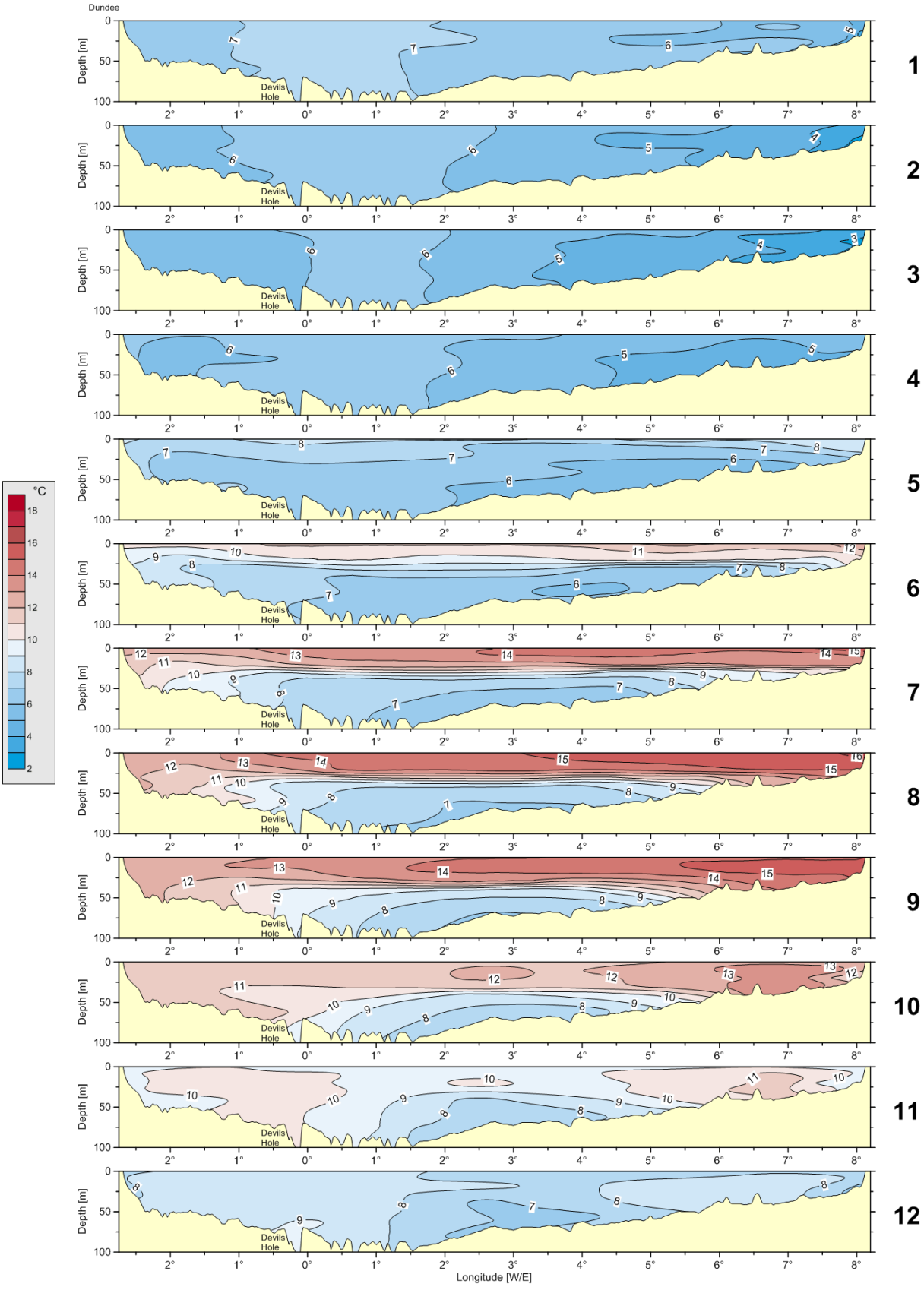
Monthly mean temperature (1902 - 1954) at 55,5°N - January to December (1-12)



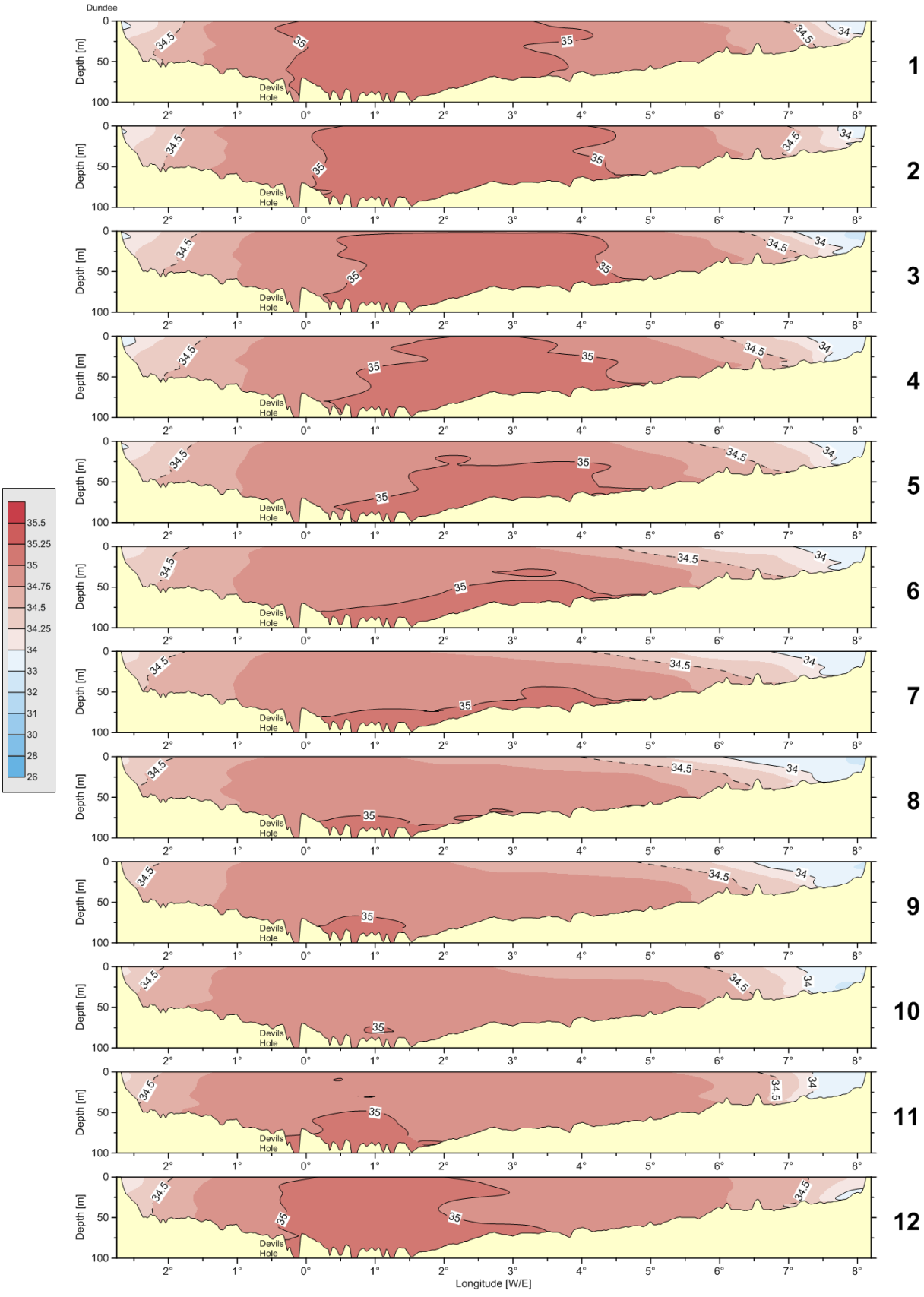
Monthly mean salinity (1902 - 1954) at 55,5°N - January to December (1-12)



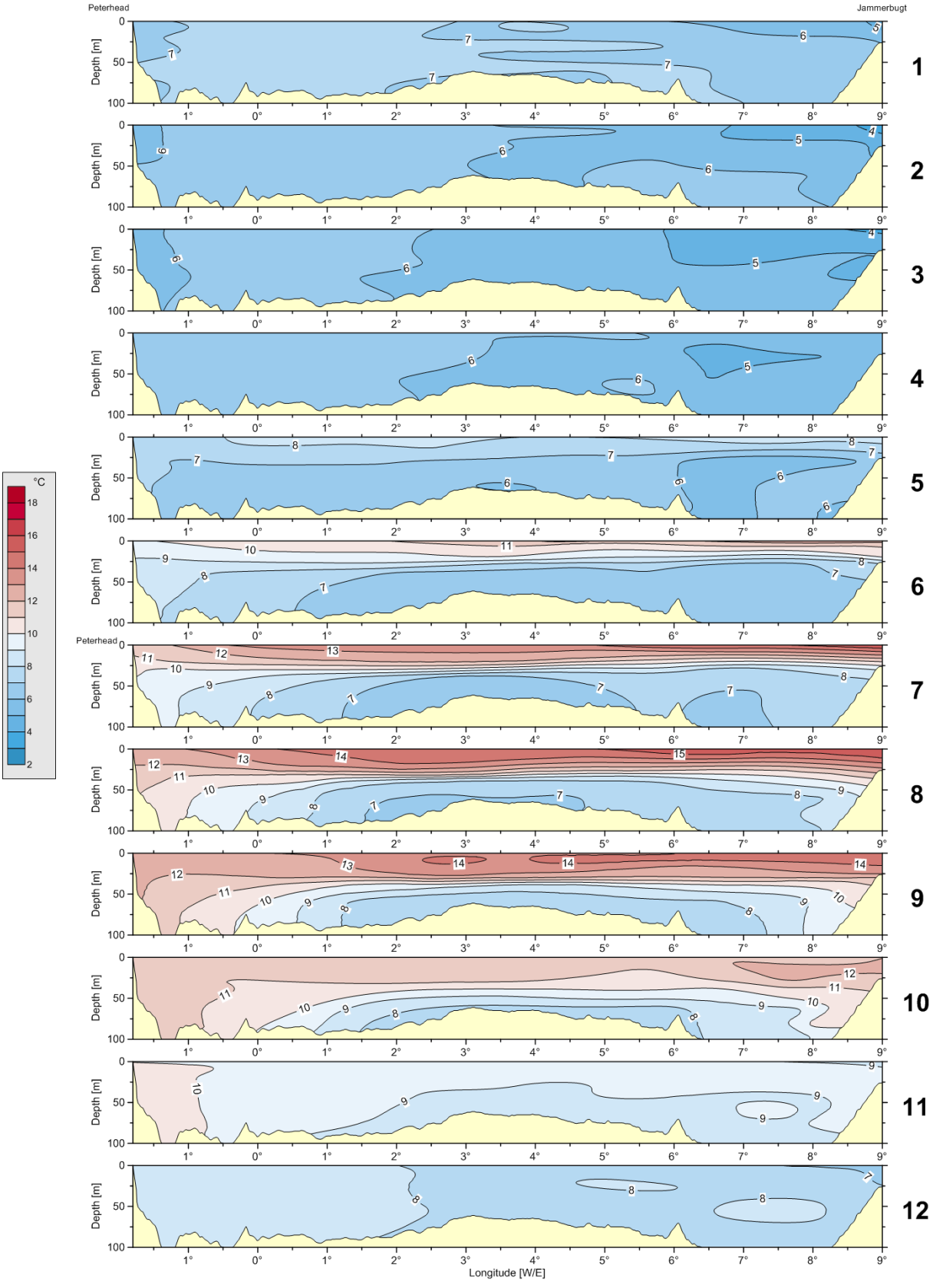
Monthly mean temperature (1902 - 1954) at 56,5°N - January to December (1-12)



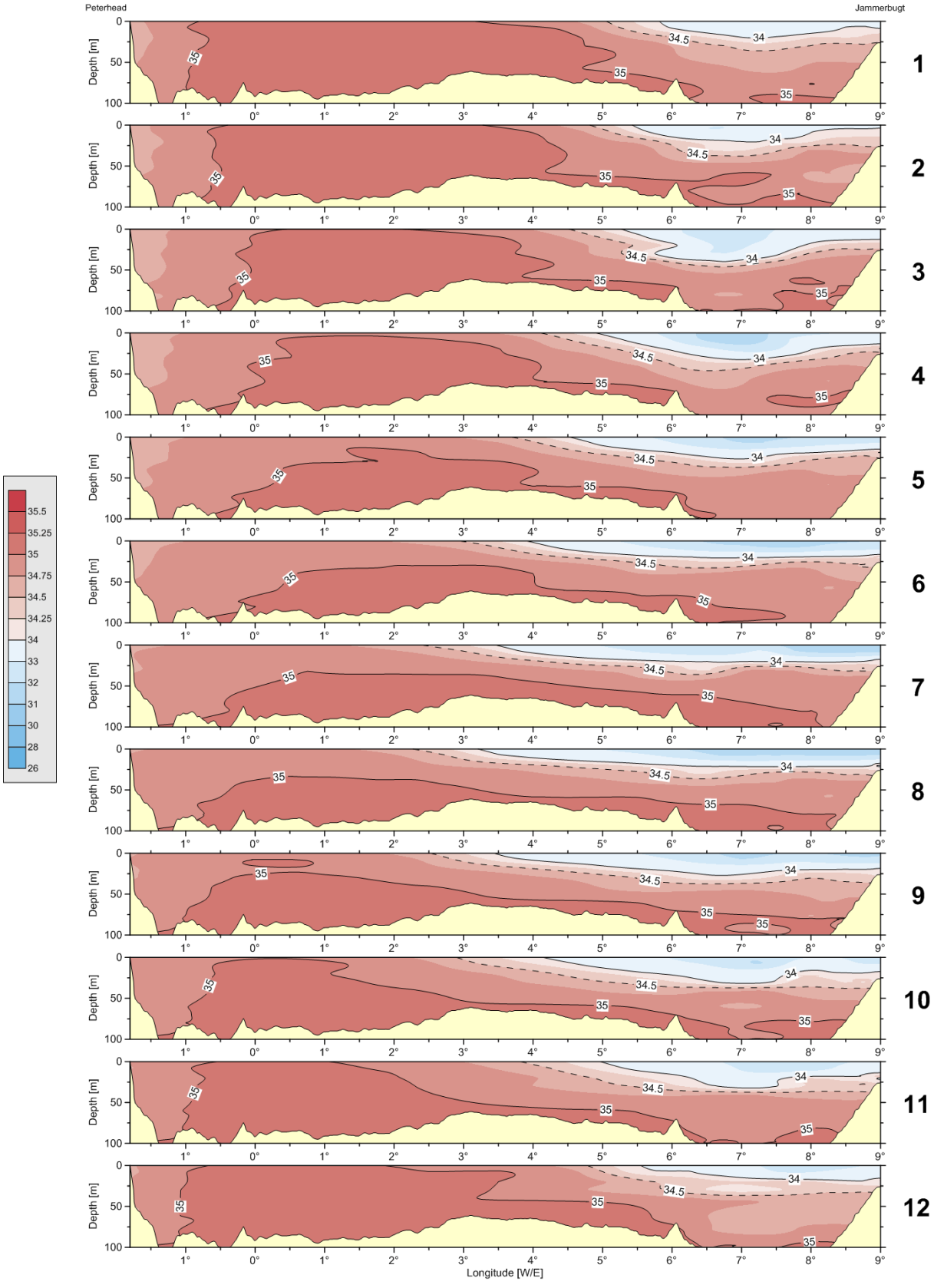
Monthly mean salinity (1902 - 1954) at 56,5°N - January to December (1-12)



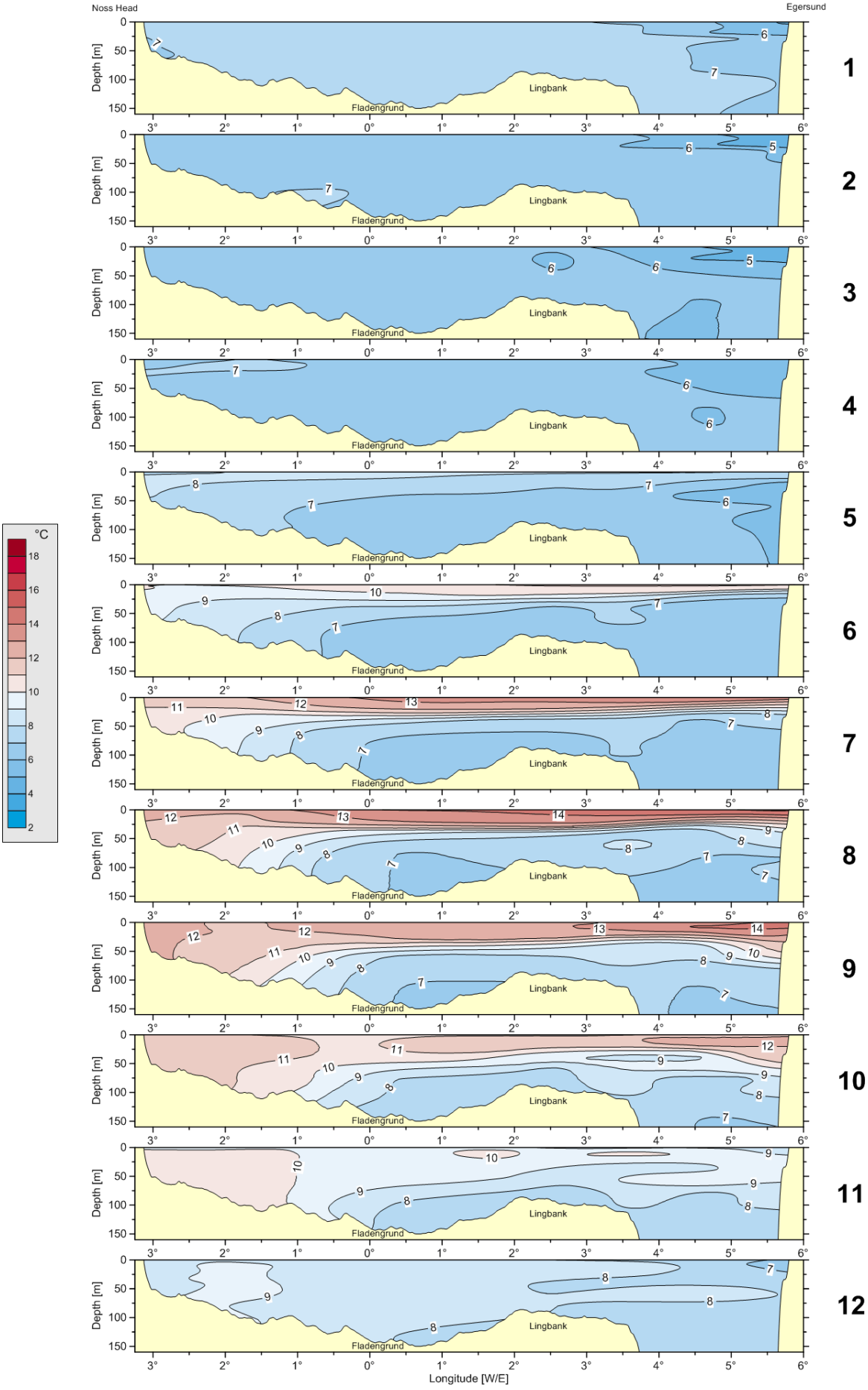
Monthly mean temperature (1902 - 1954) at 57,5°N - January to December (1-12)



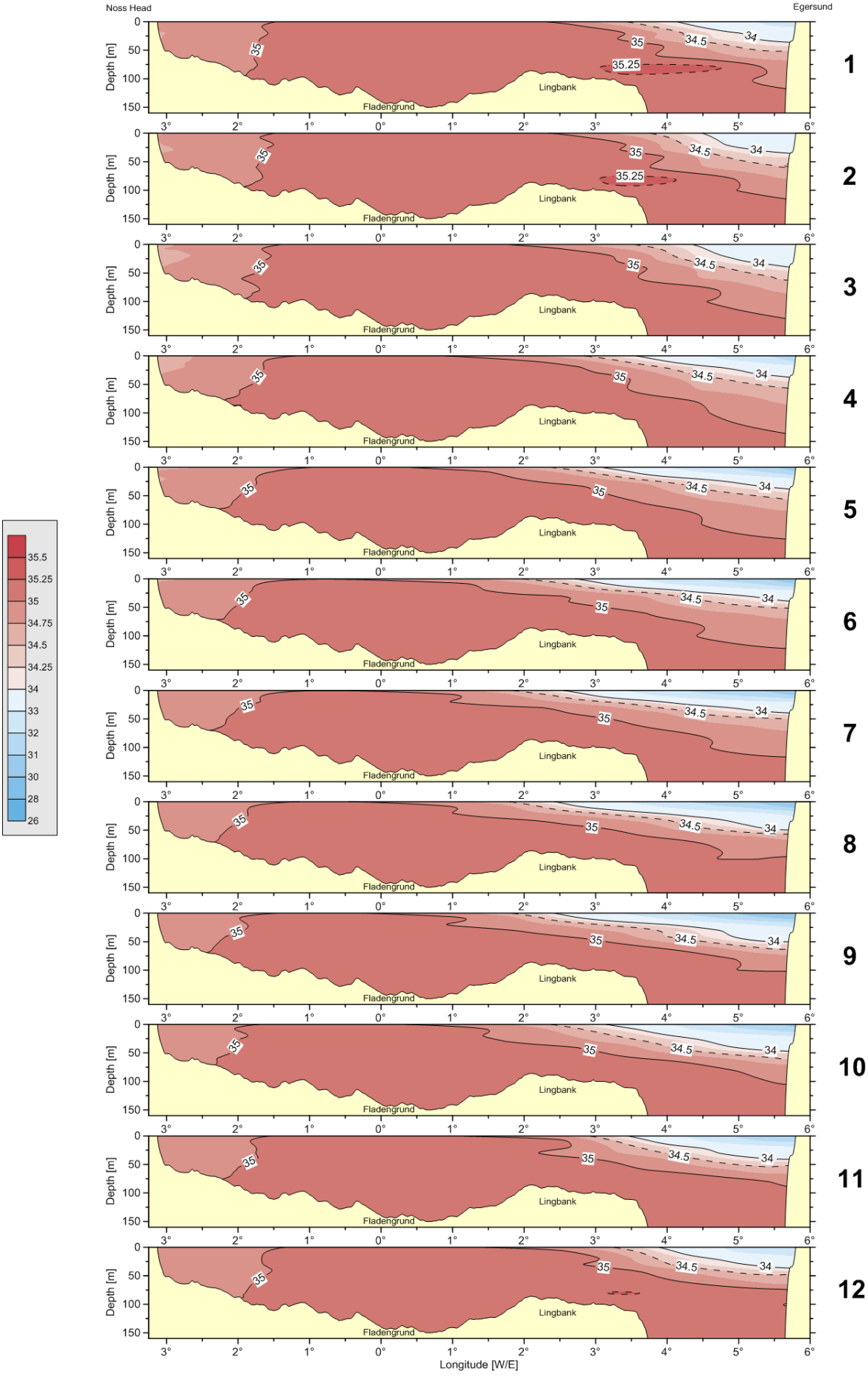
Monthly mean salinity (1902 - 1954) at 57,5°N - January to December (1-12)



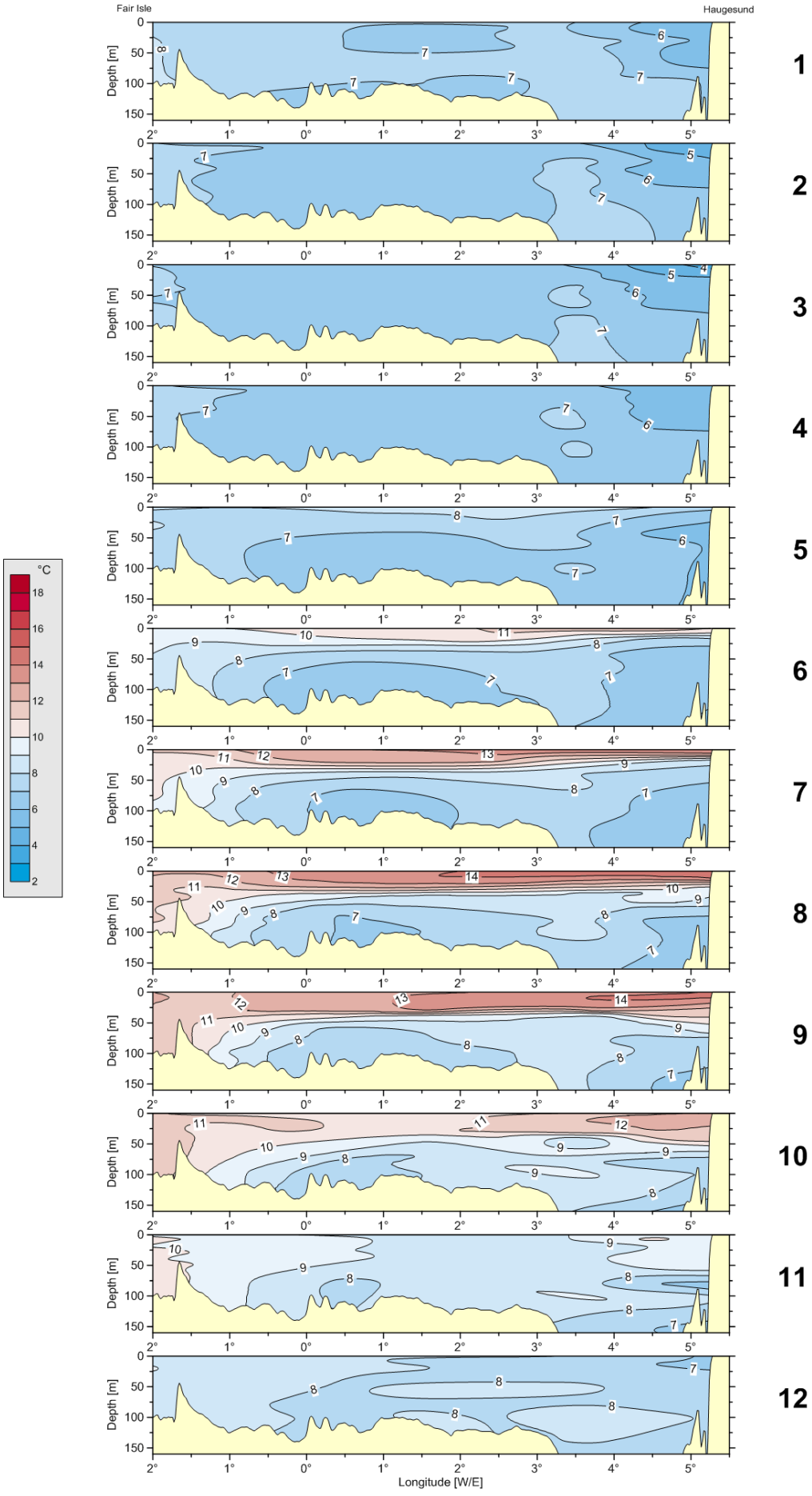
Monthly mean temperature (1902 - 1954) at 58,5°N - January to December (1-12)



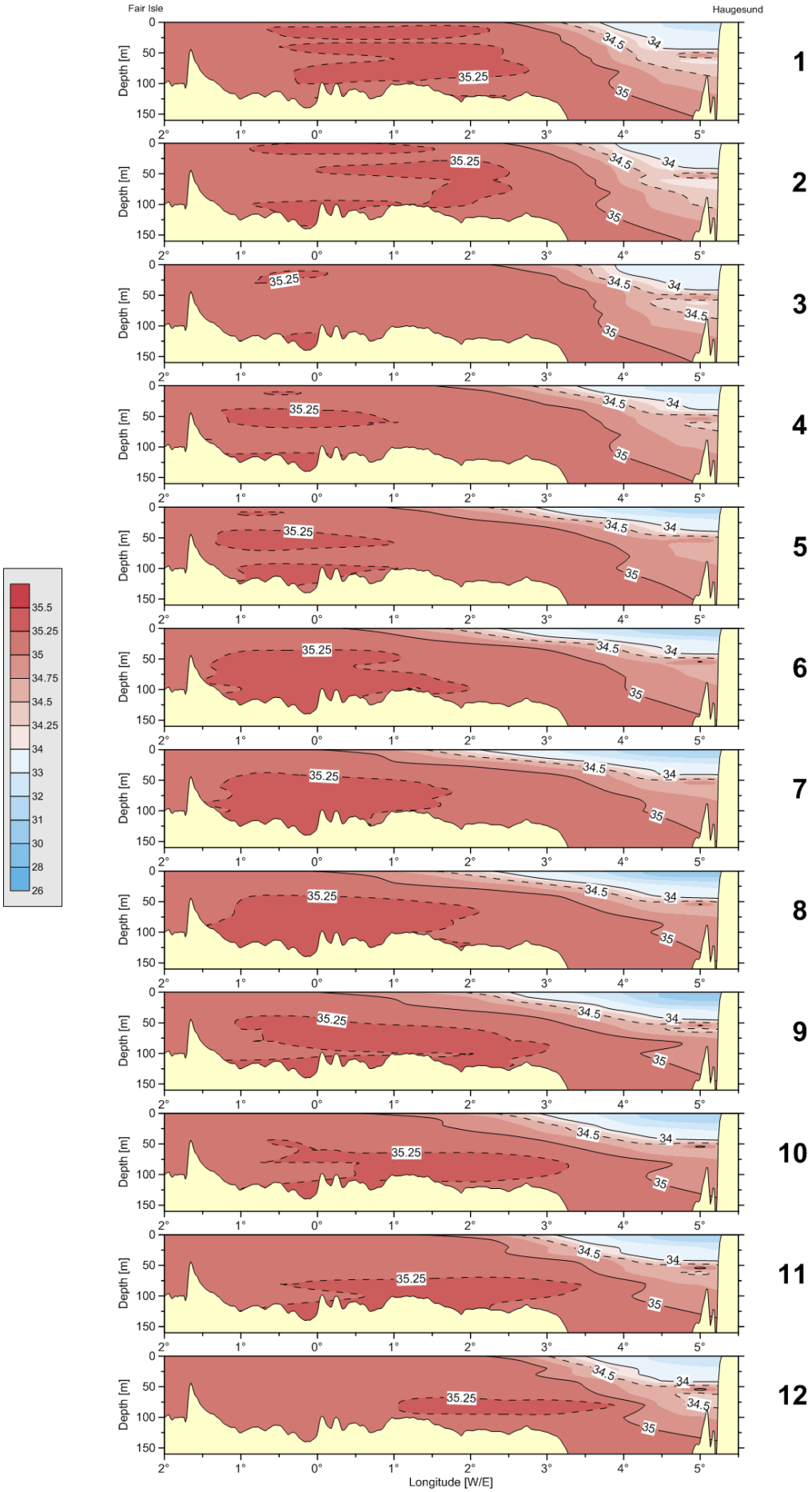
Monthly mean salinity (1902 - 1954) at 58,5°N - January to December (1-12)



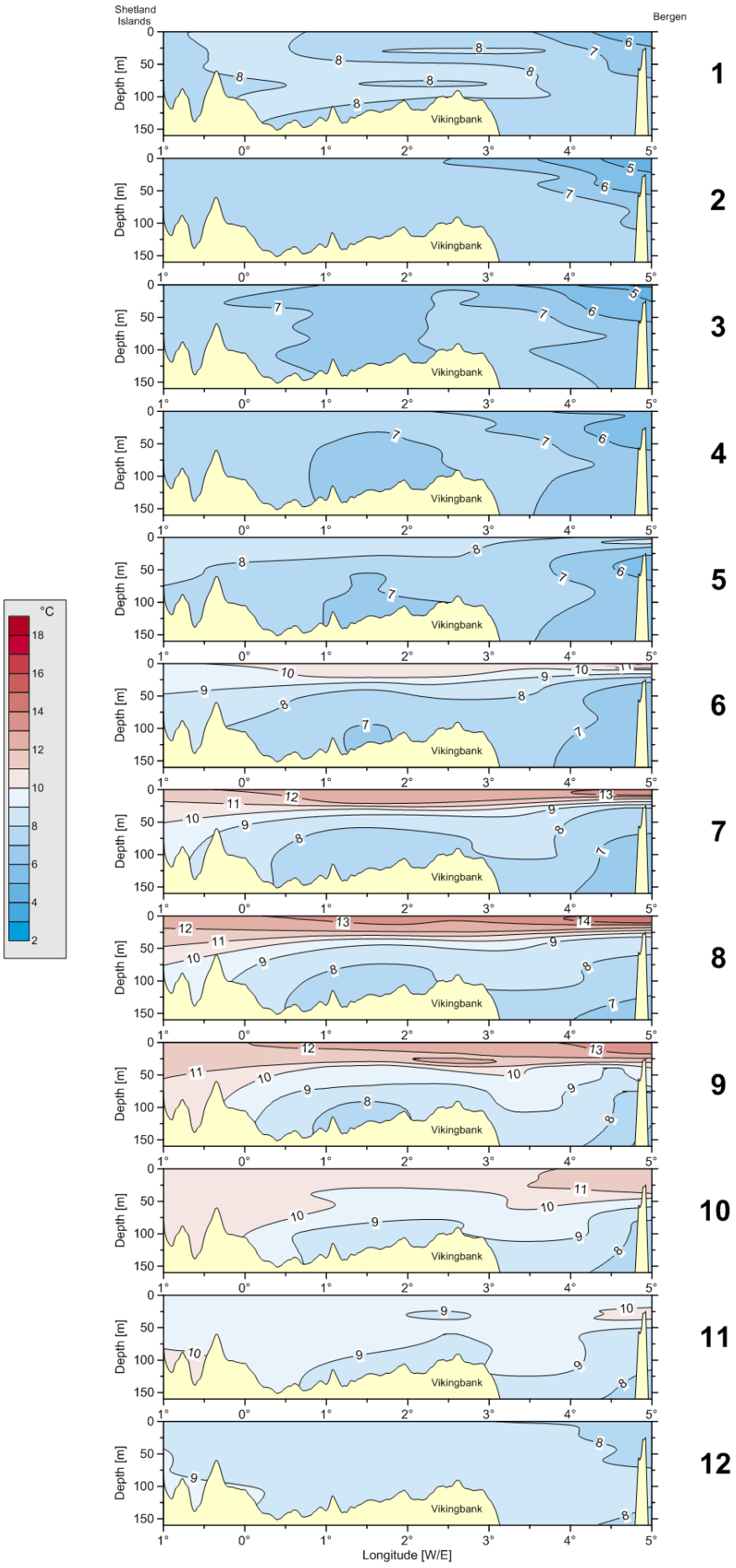
Monthly mean temperature (1902 - 1954) at 59,5°N - January to December (1-12)



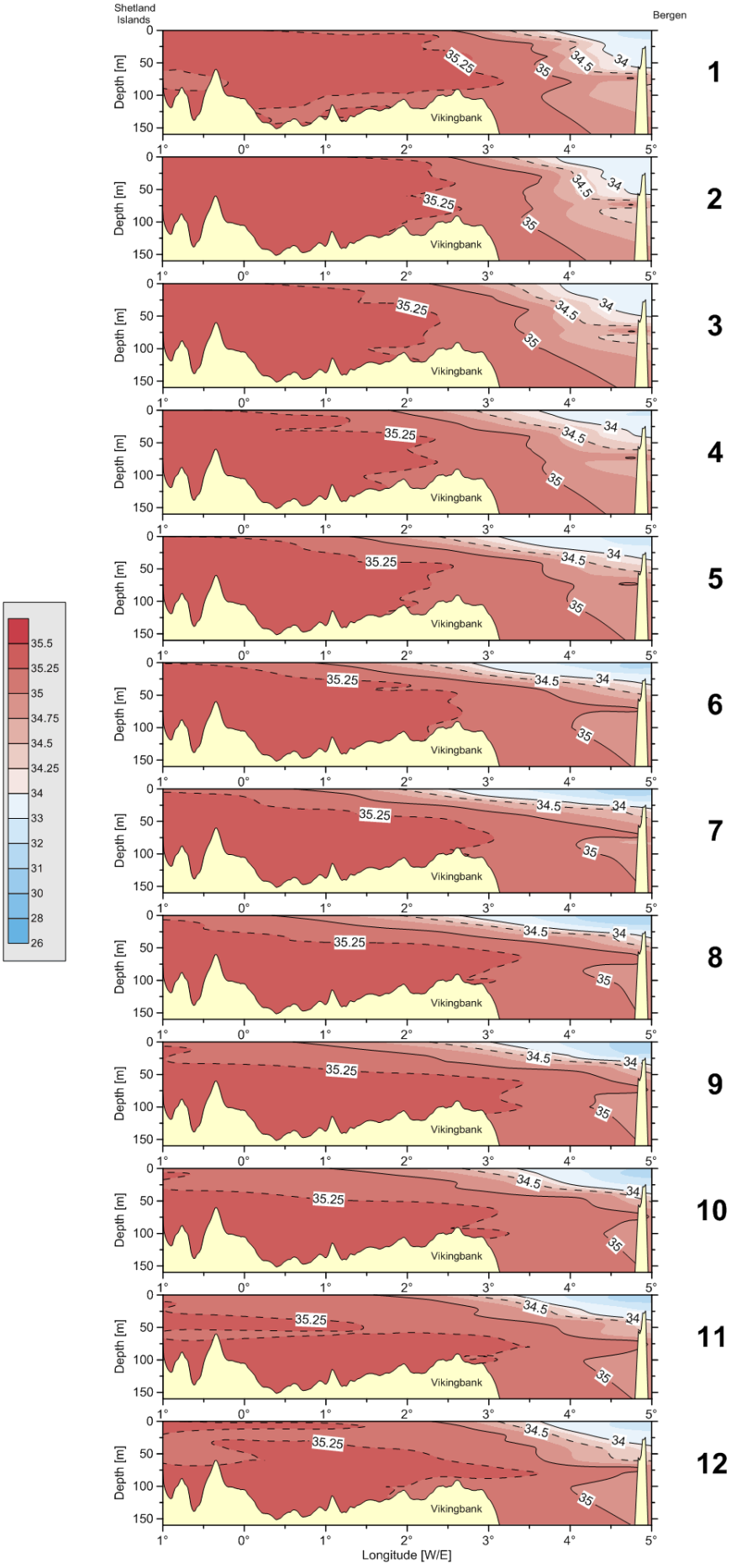
Monthly mean salinity (1902 - 1954) at 59,5°N - January to December (1-12)



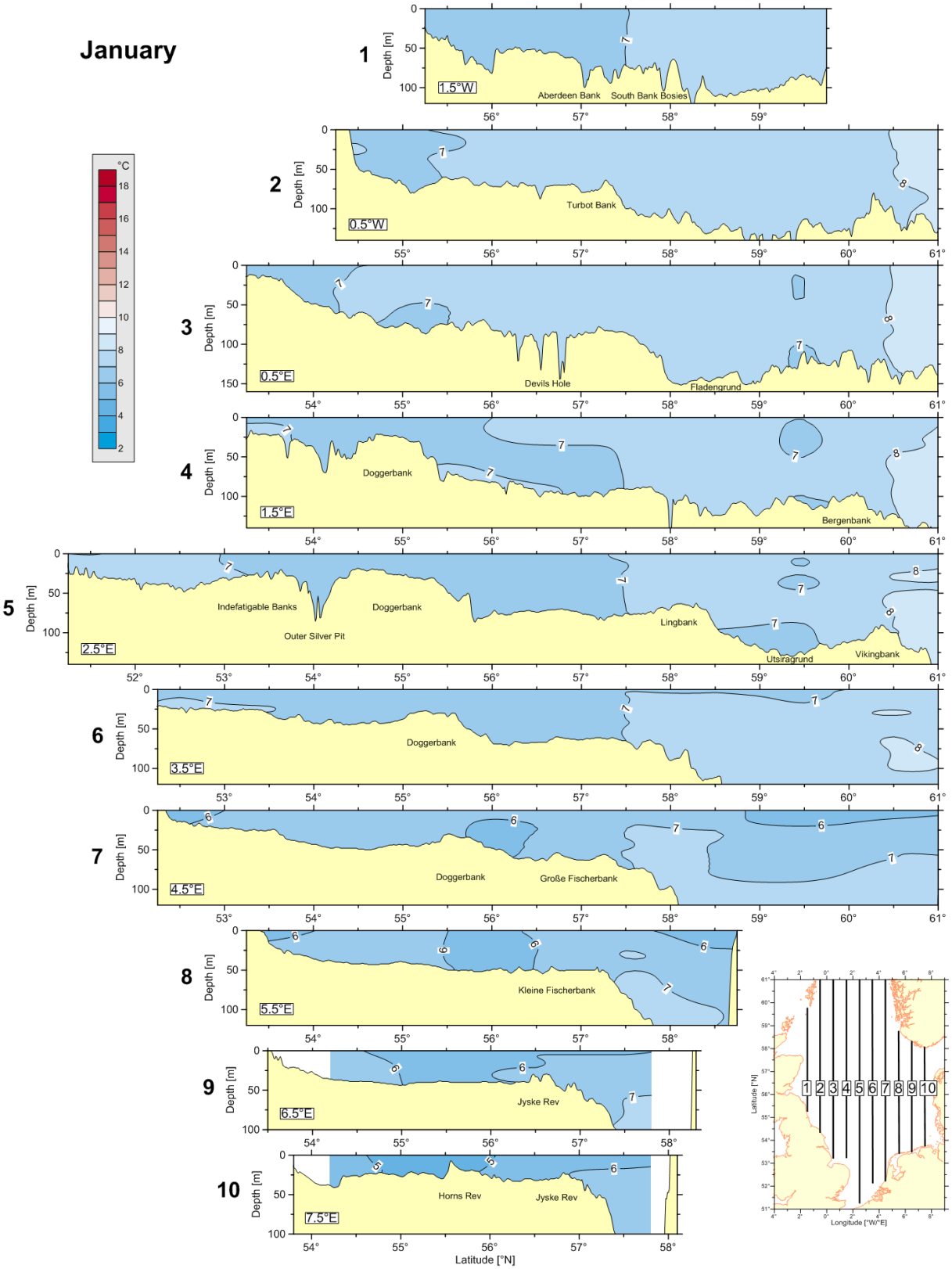
Monthly mean temperature (1902 - 1954) at 60,5°N - January to December (1-12)



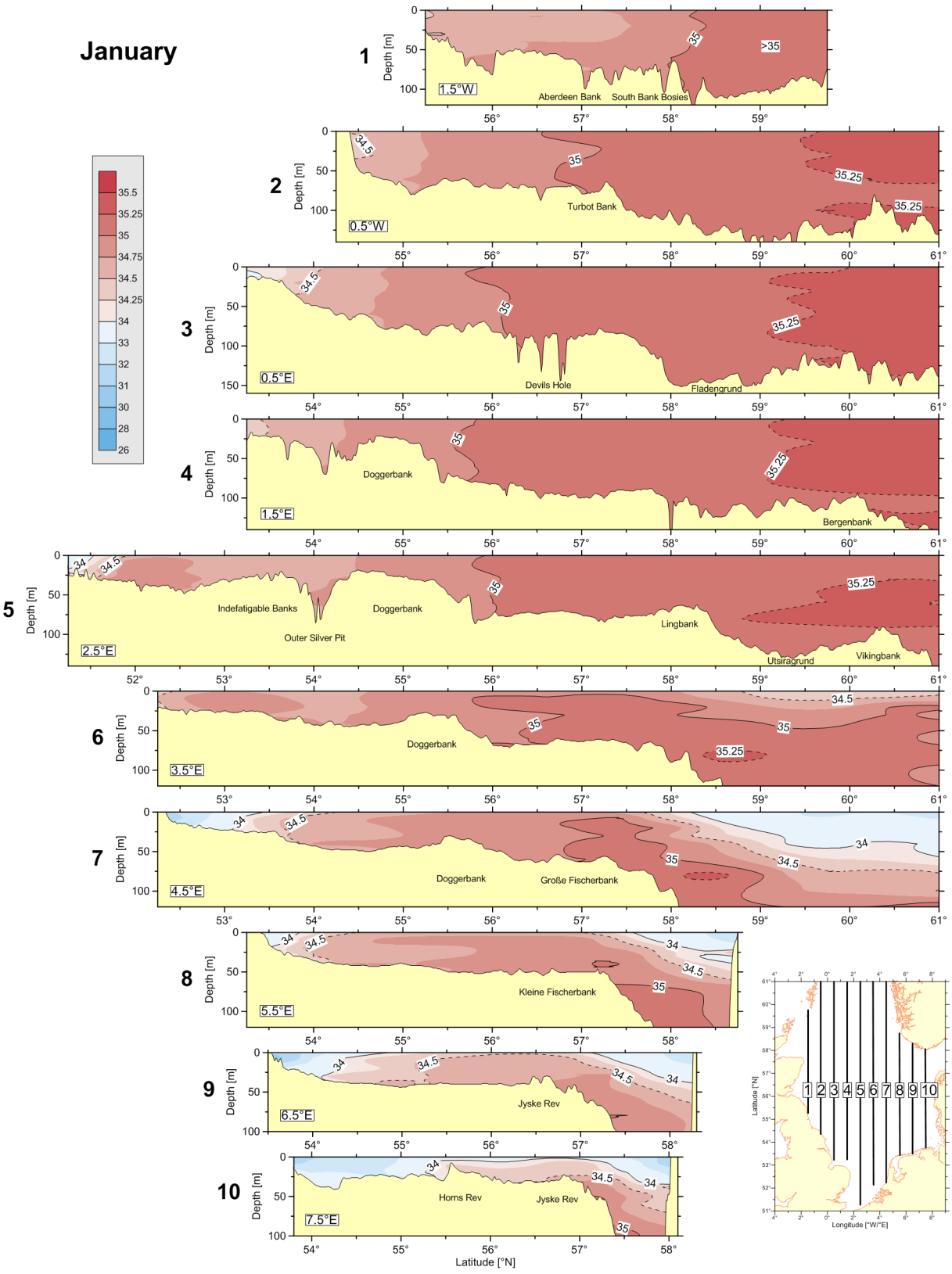
Monthly mean salinity (1902 - 1954) at 60,5°N - January to December (1-12)



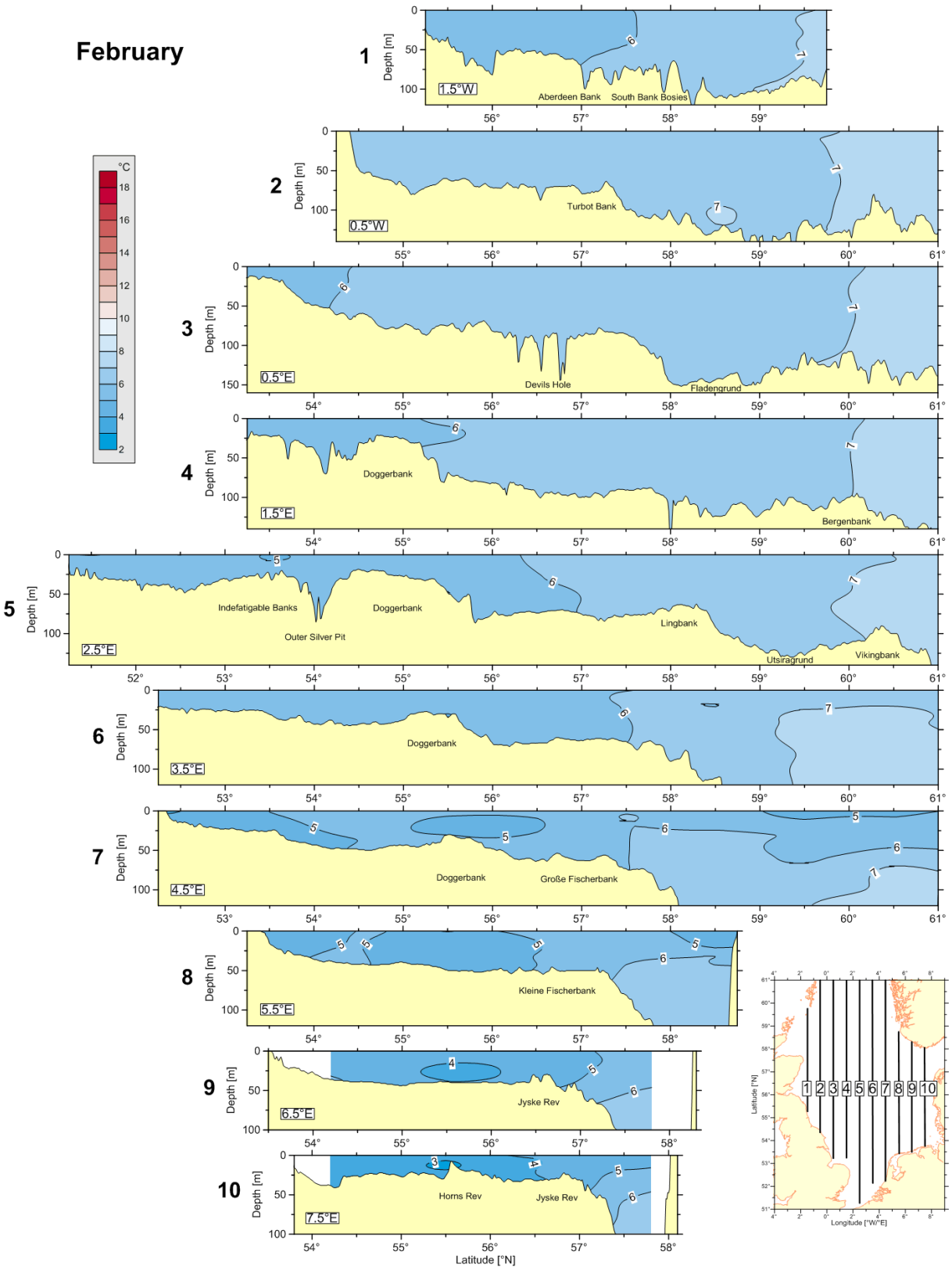
Monthly mean temperature (1902 - 1954) on 10 meridional sections



Monthly mean salinity (1902 - 1954) on 10 meridional sections

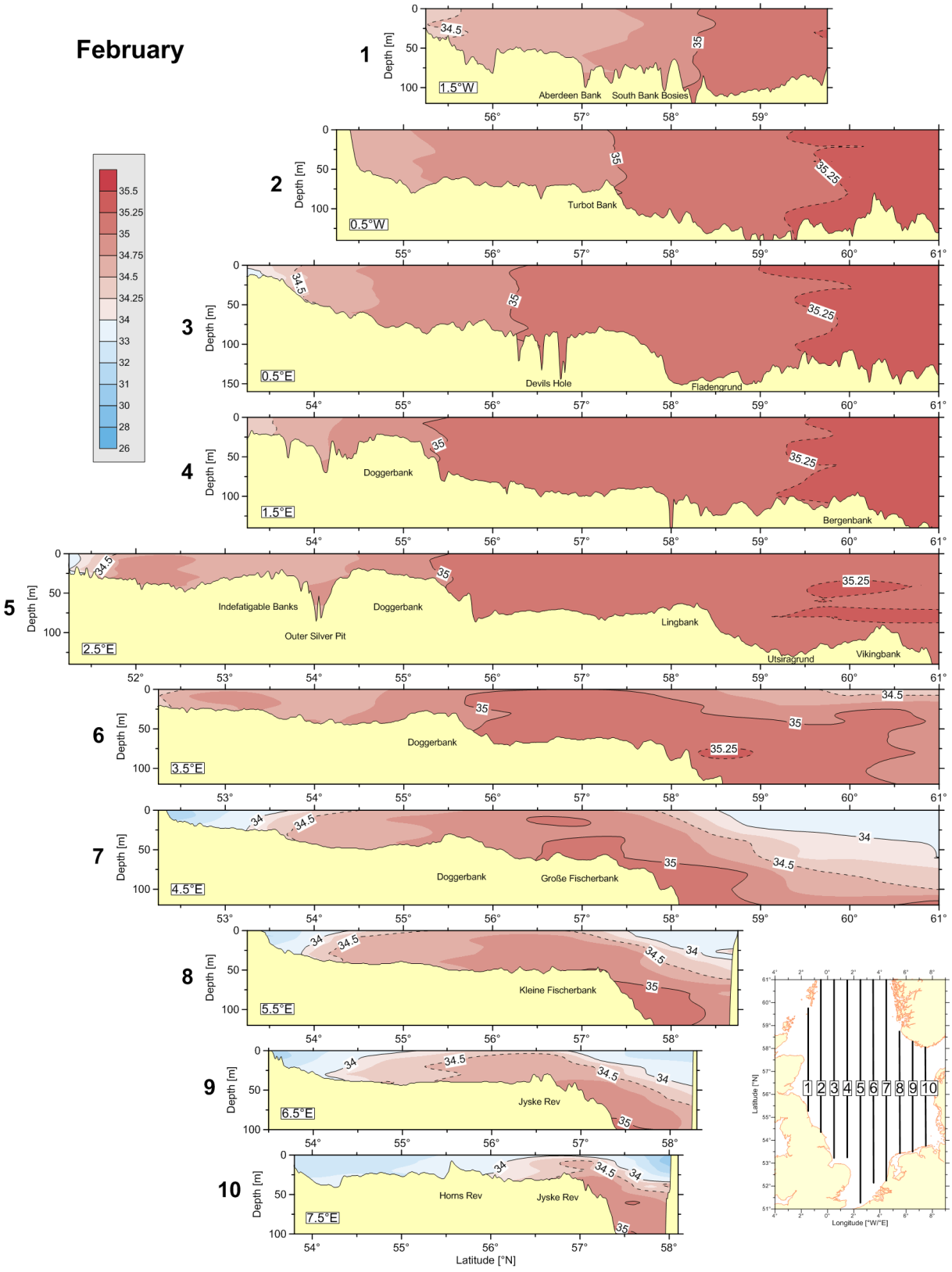


Monthly mean temperature (1902 - 1954) on 10 meridional sections

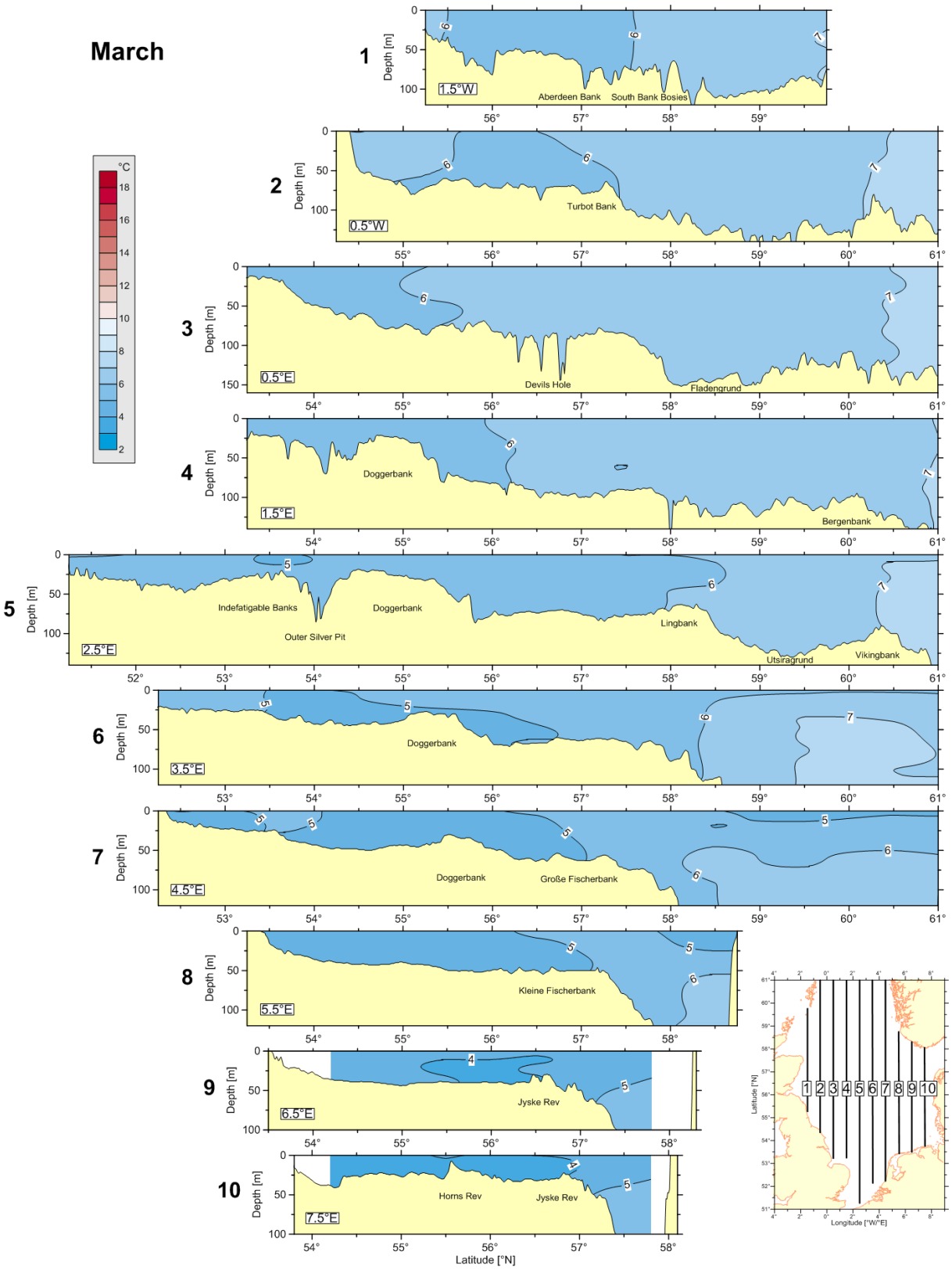


Monthly mean salinity (1902 - 1954) on 10 meridional sections

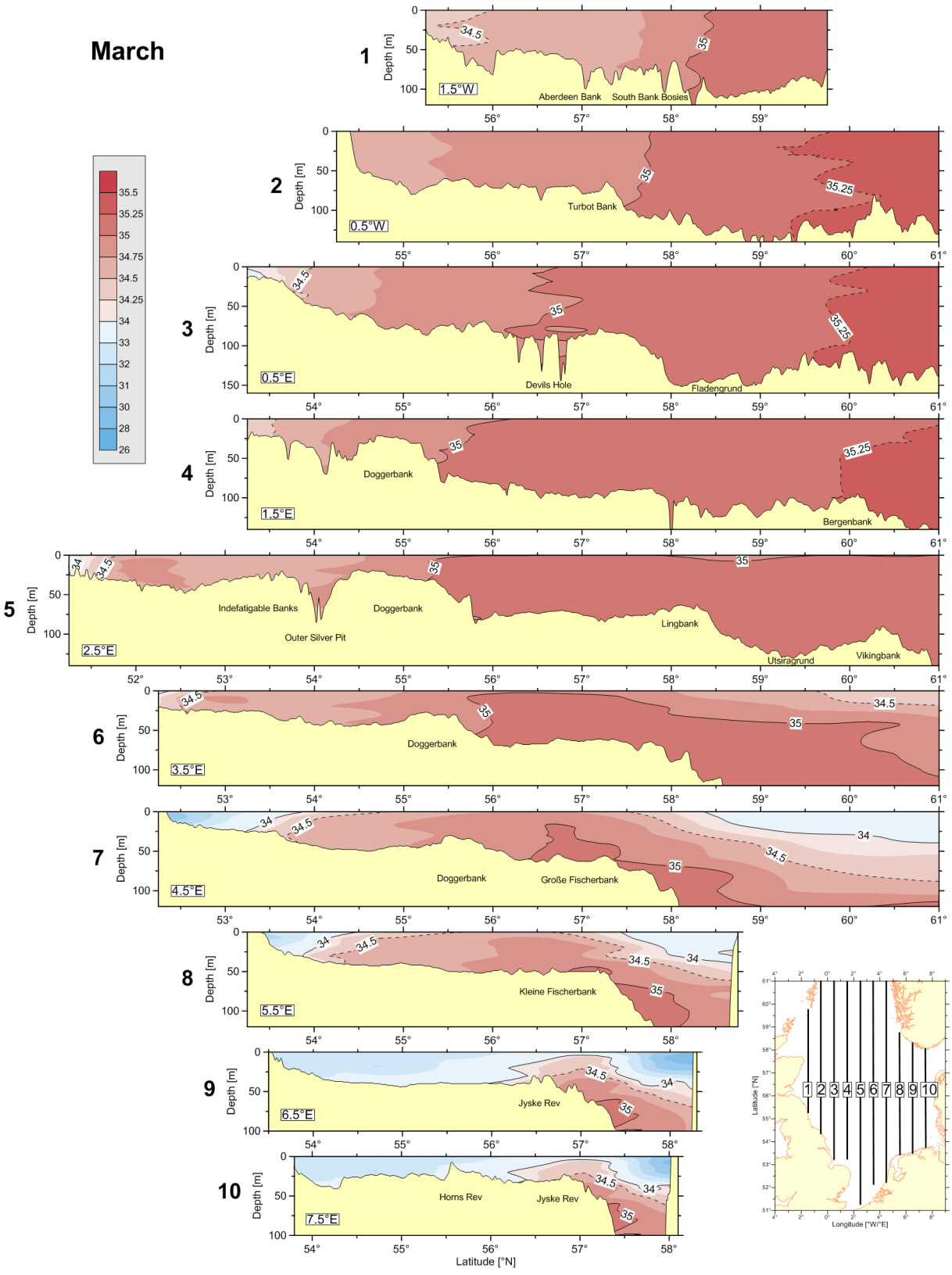
February



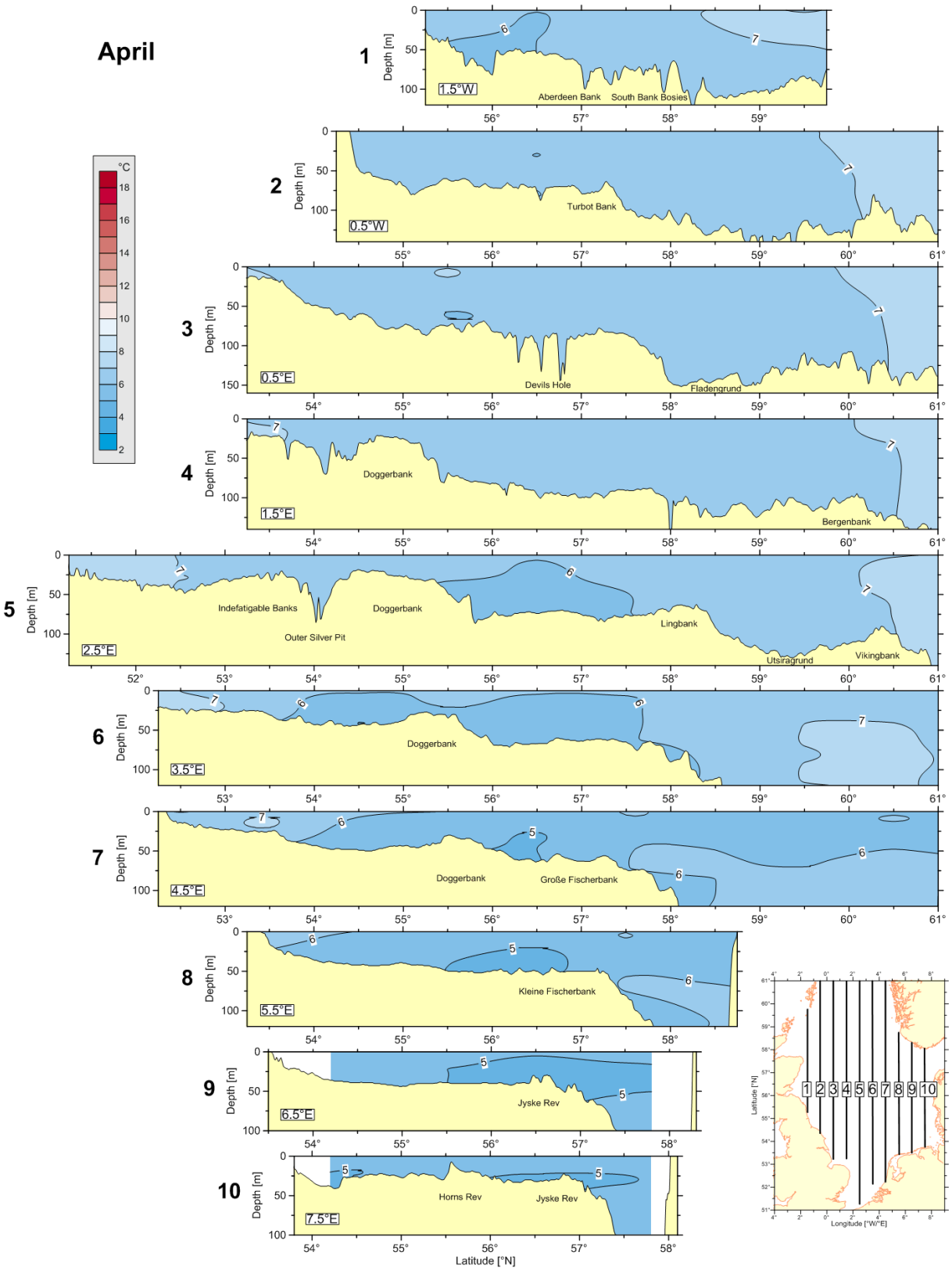
Monthly mean temperature (1902 - 1954) on 10 meridional sections



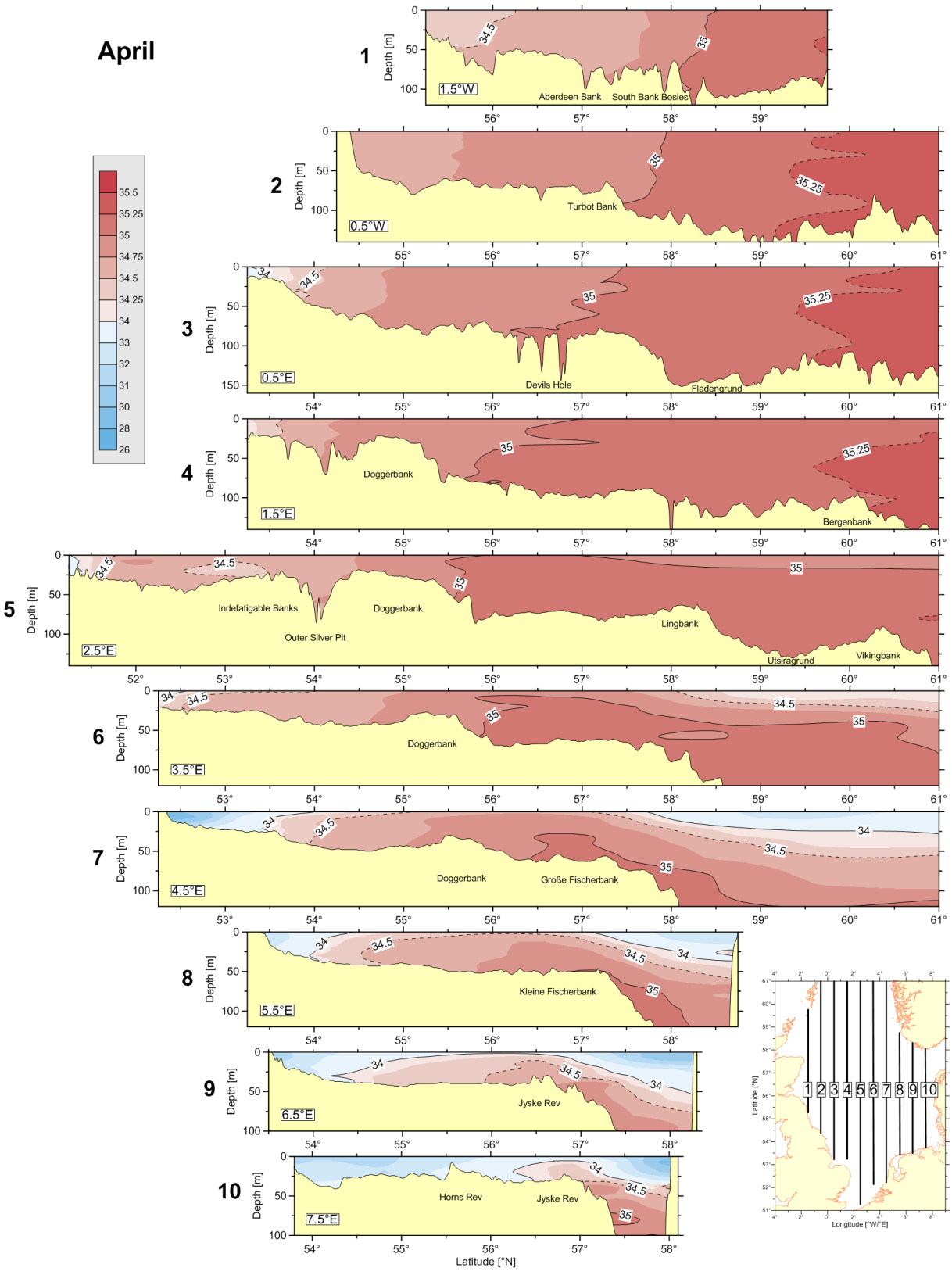
Monthly mean salinity (1902 - 1954) on 10 meridional sections



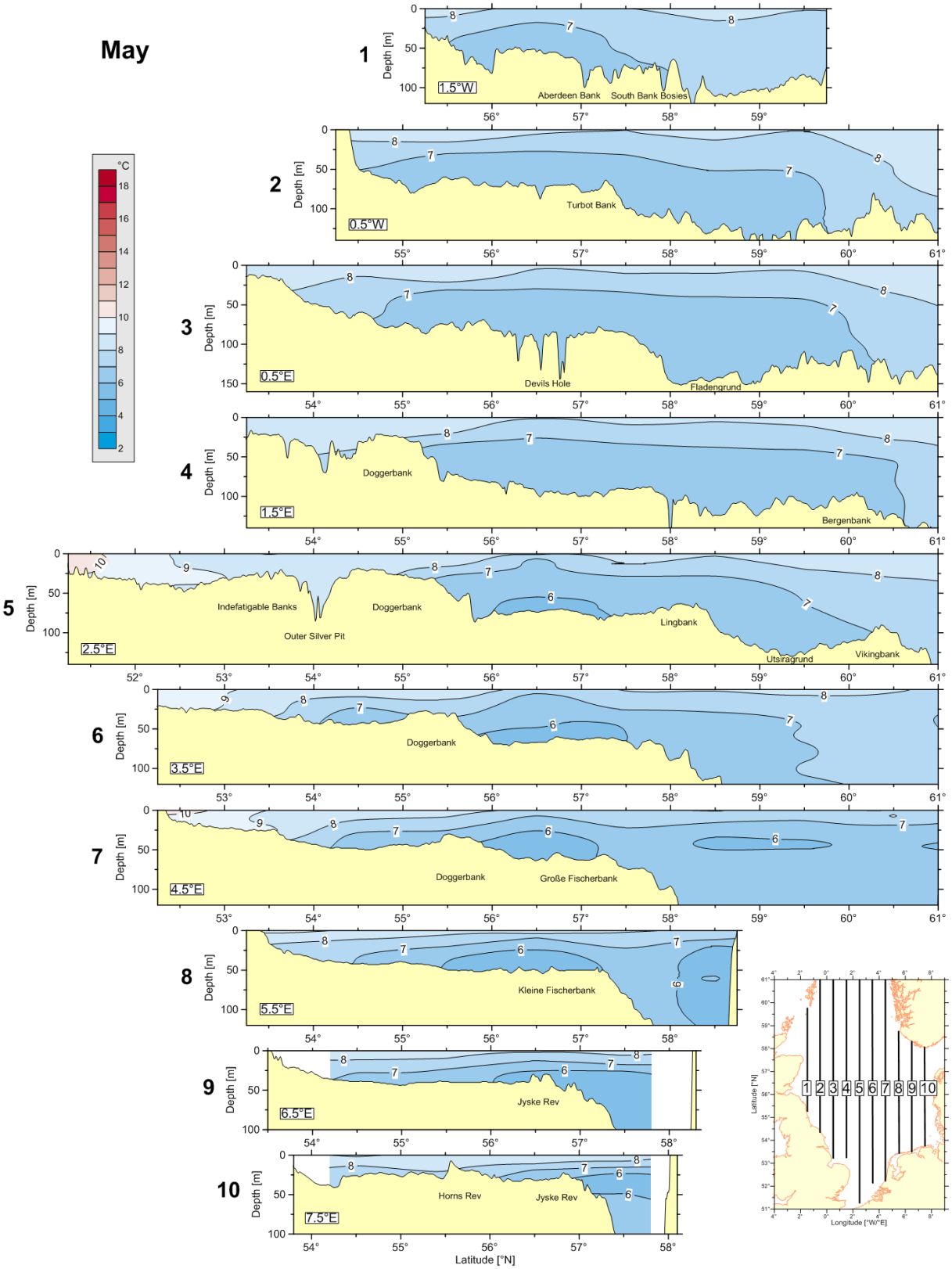
Monthly mean temperature (1902 - 1954) on 10 meridional sections



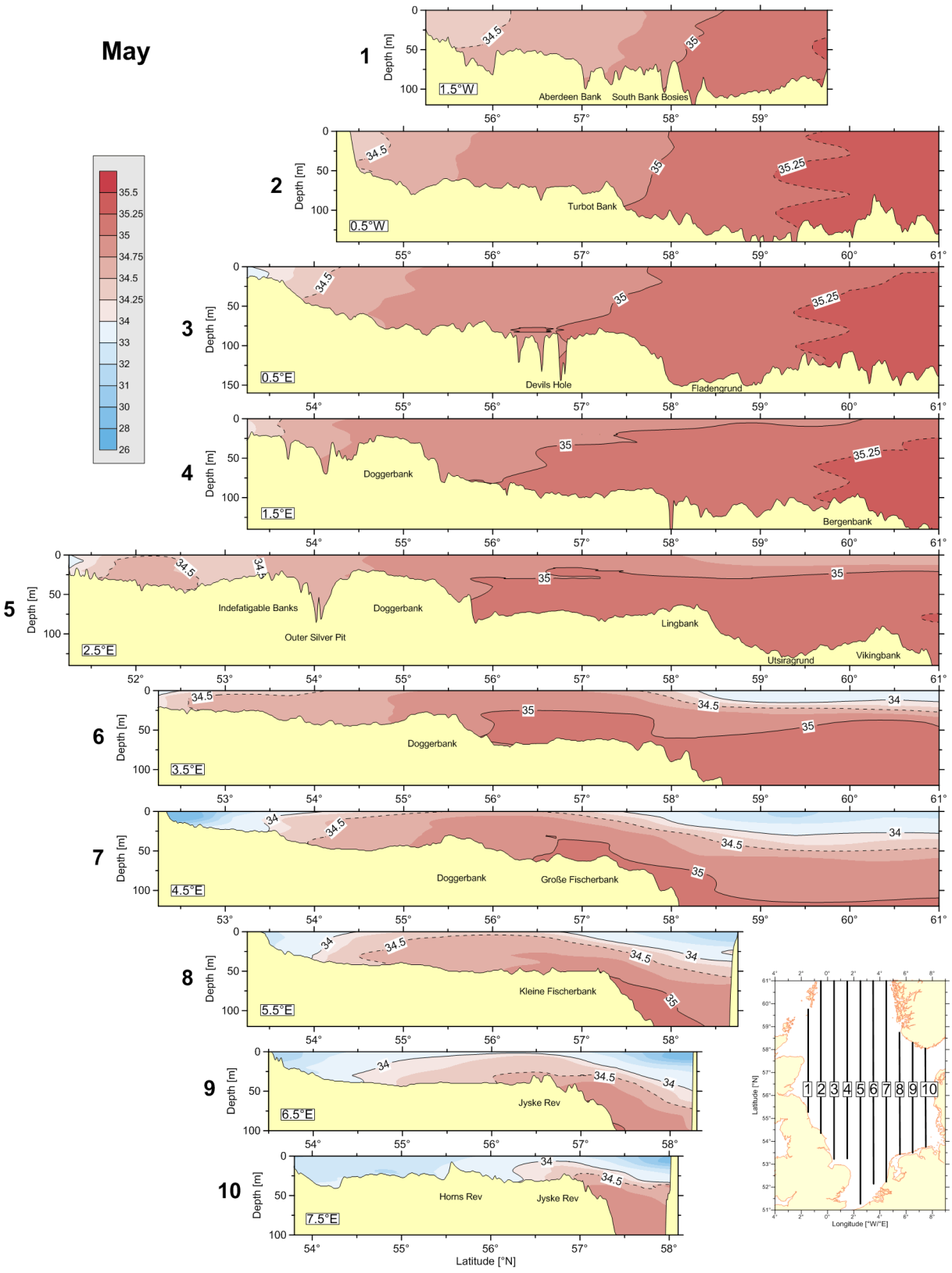
Monthly mean salinity (1902 - 1954) on 10 meridional sections



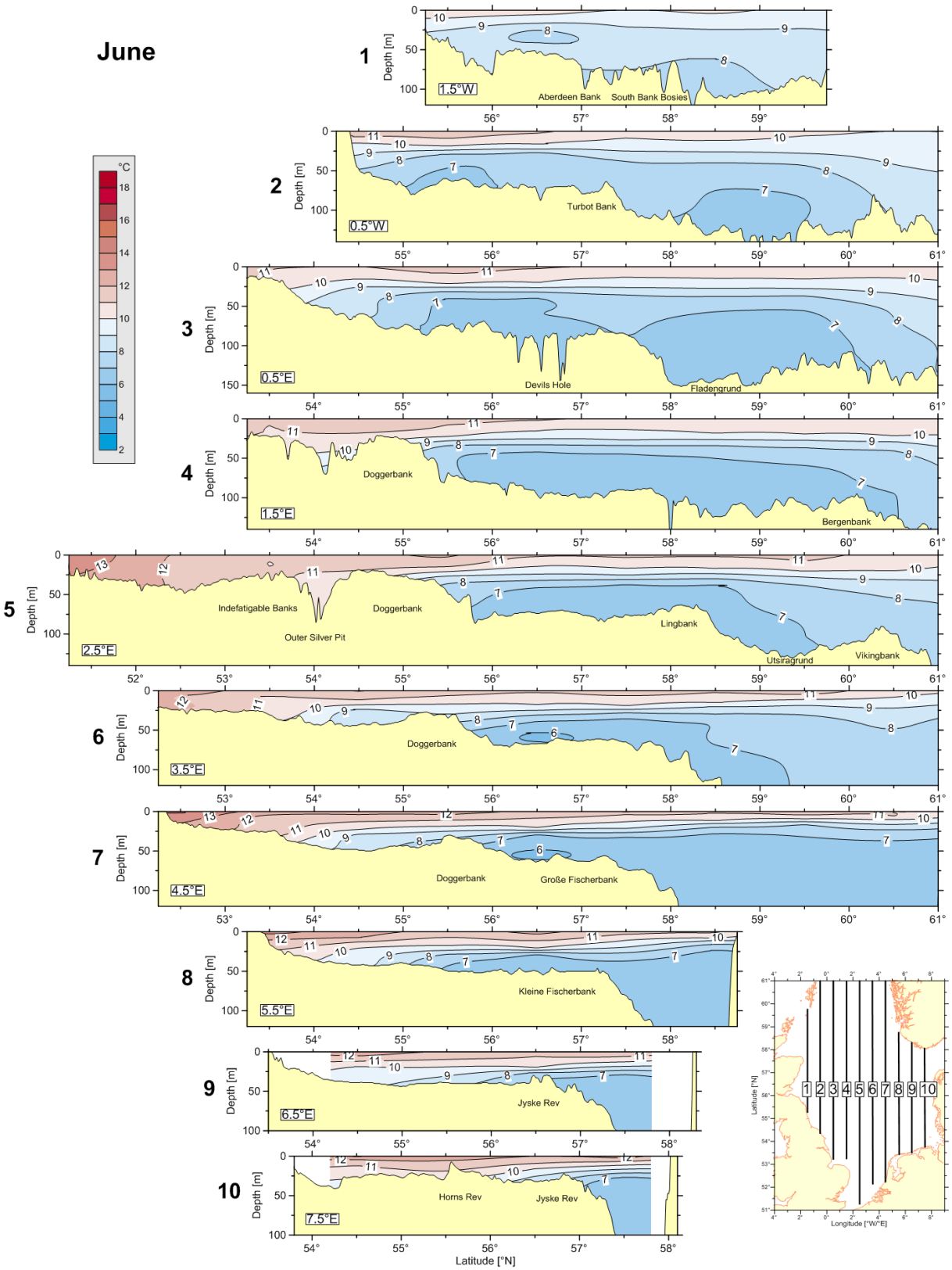
Monthly mean temperature (1902 - 1954) on 10 meridional sections



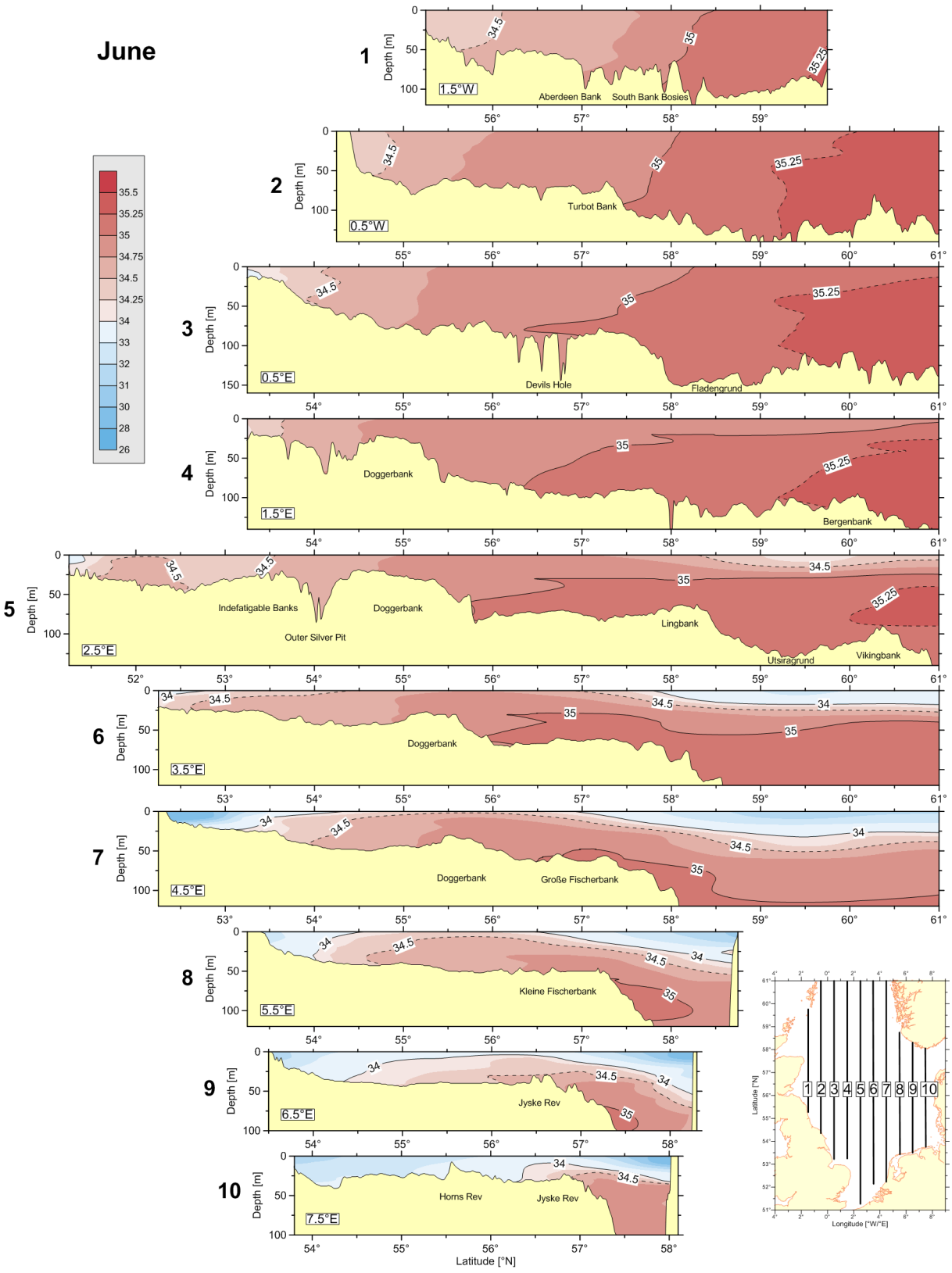
Monthly mean salinity (1902 - 1954) on 10 meridional sections



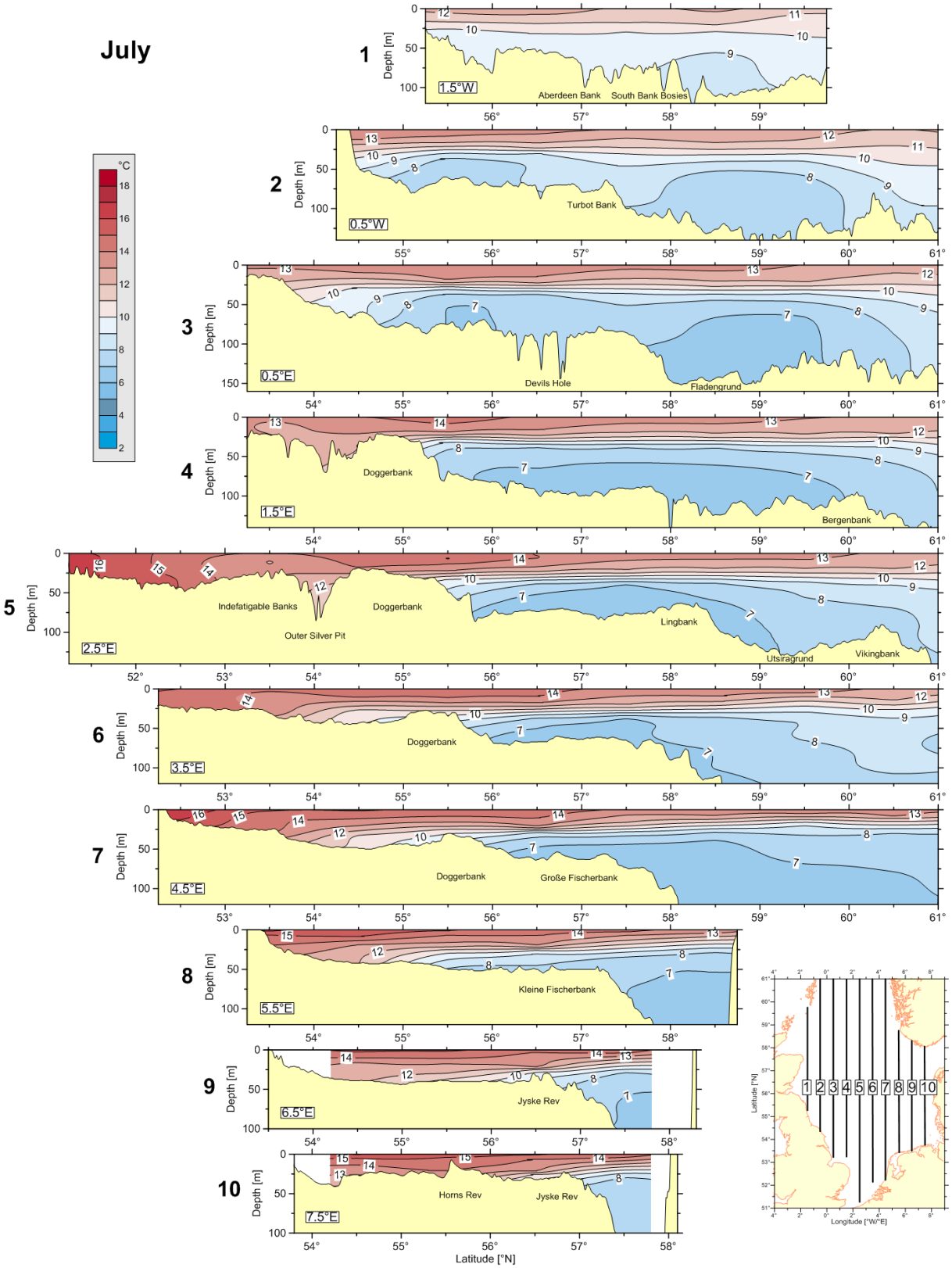
Monthly mean temperature (1902 - 1954) on 10 meridional sections



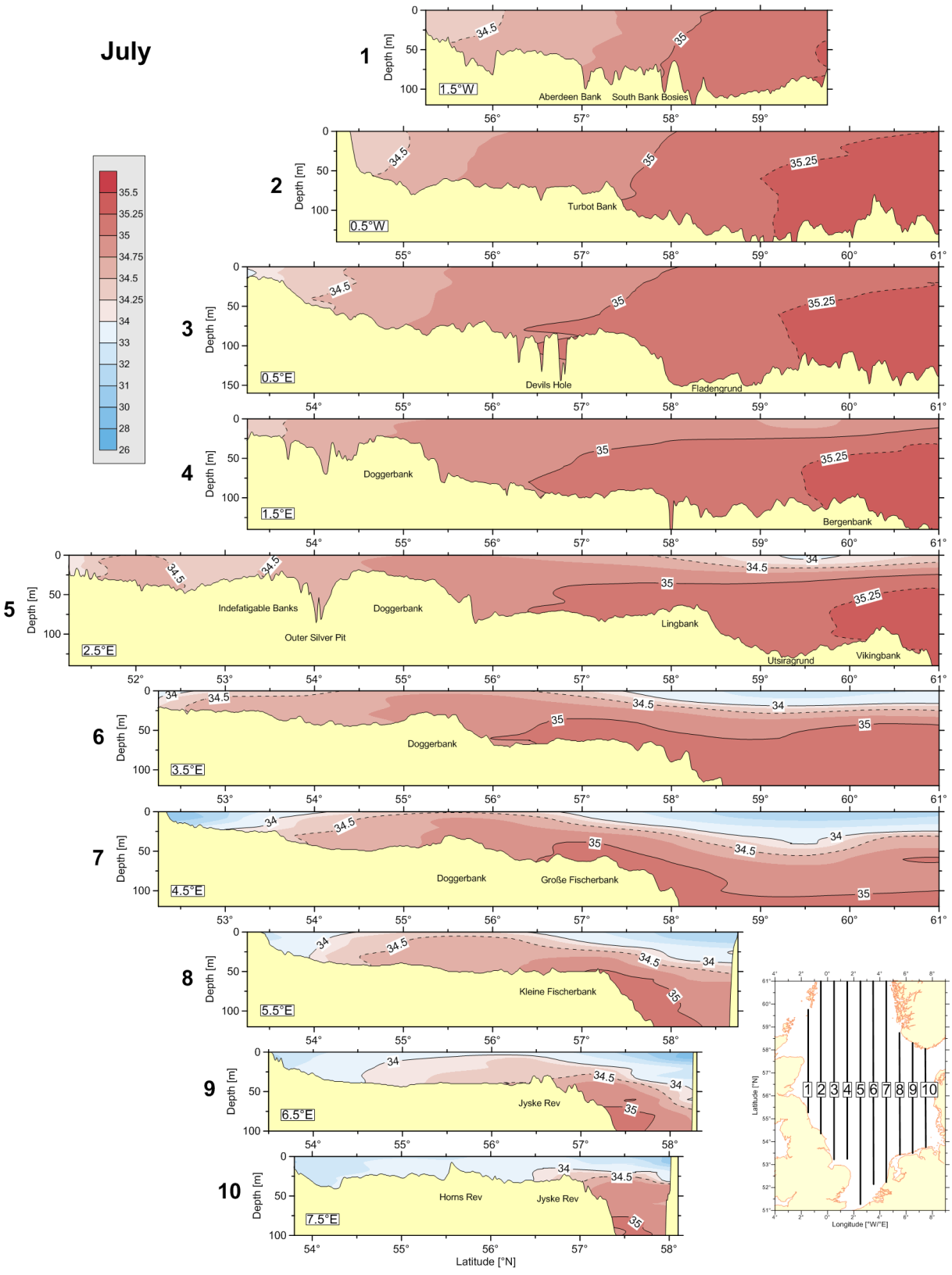
Monthly mean salinity (1902 - 1954) on 10 meridional sections



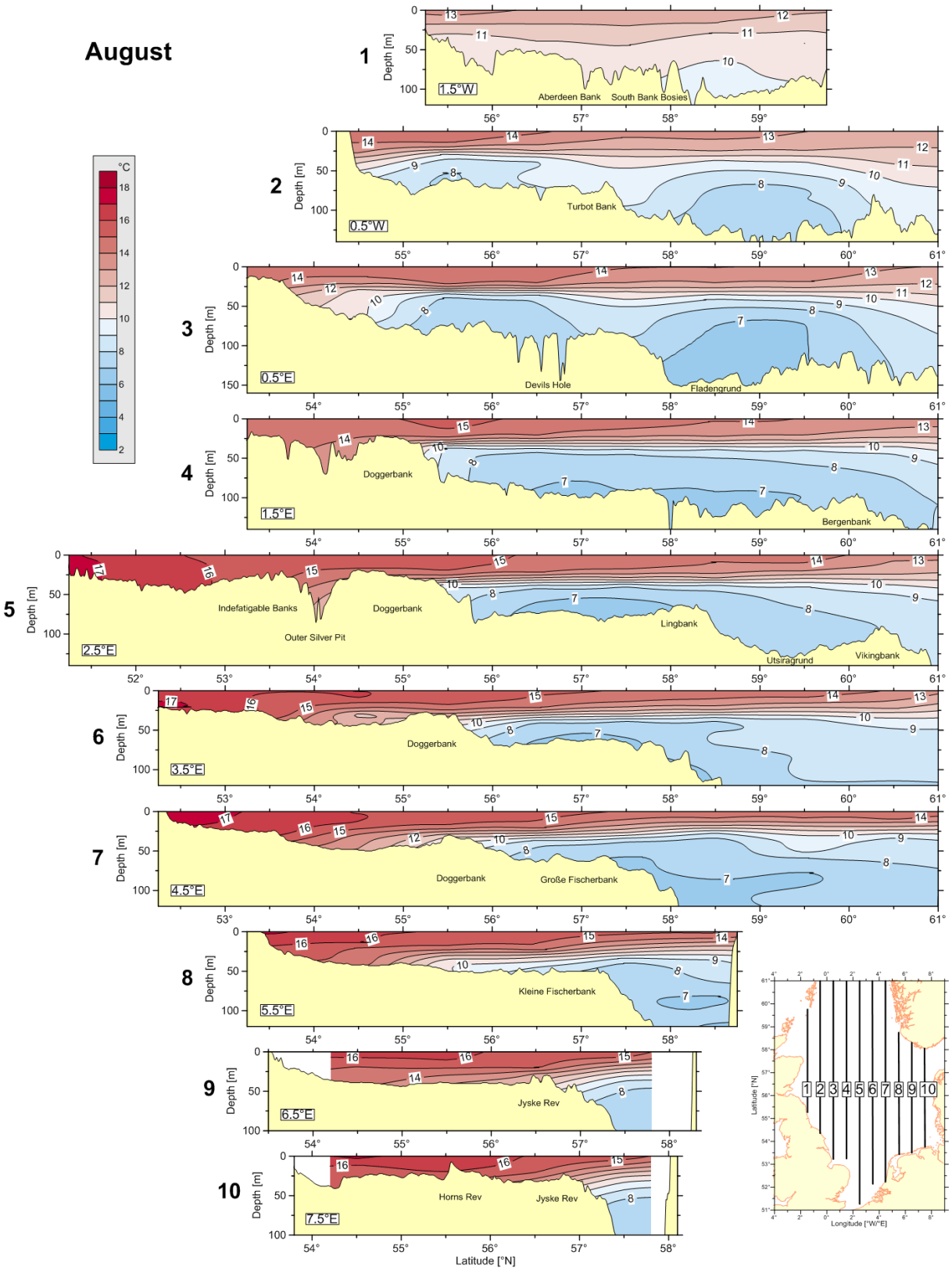
Monthly mean temperature (1902 - 1954) on 10 meridional sections



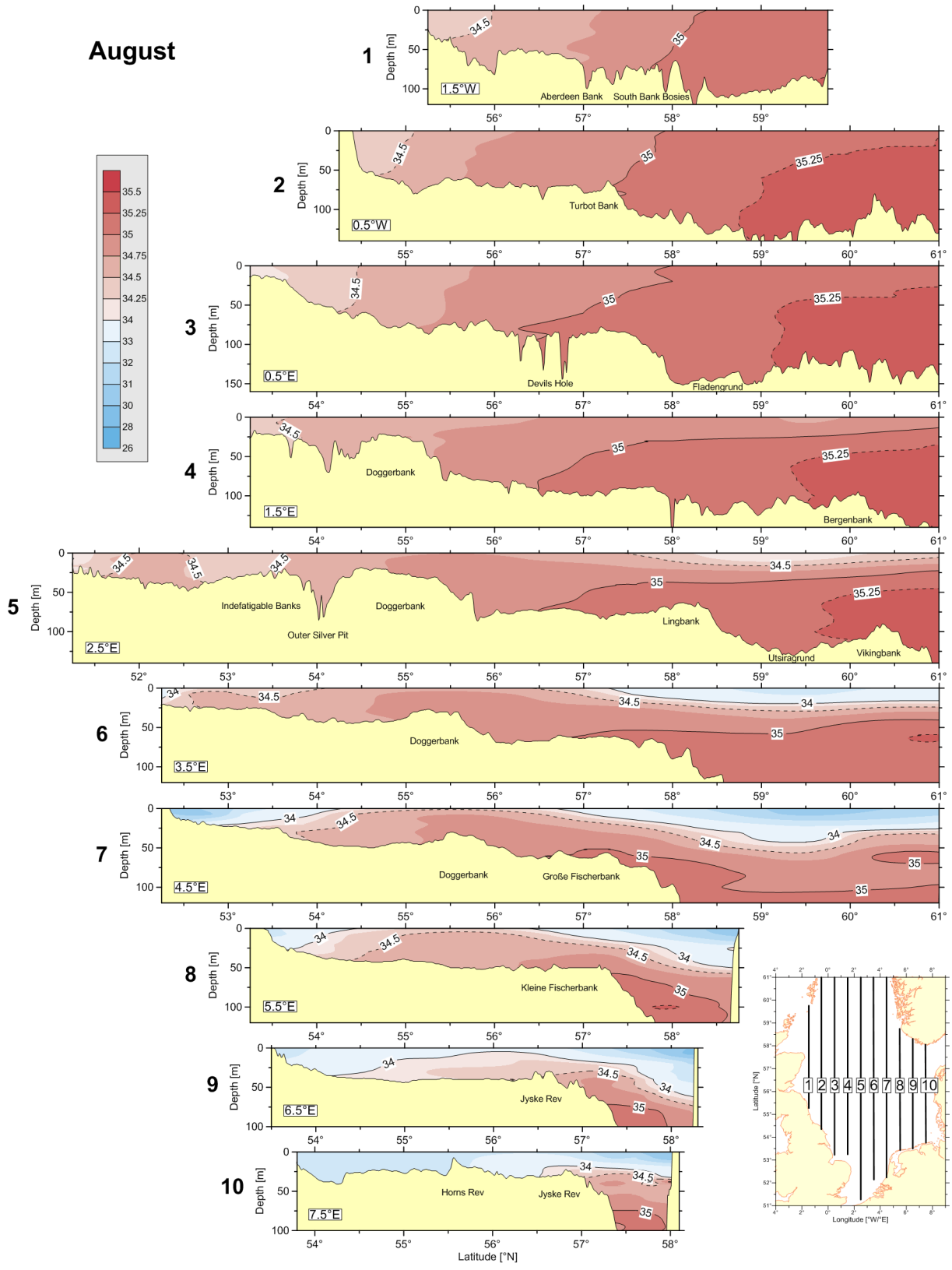
Monthly mean salinity (1902 - 1954) on 10 meridional sections



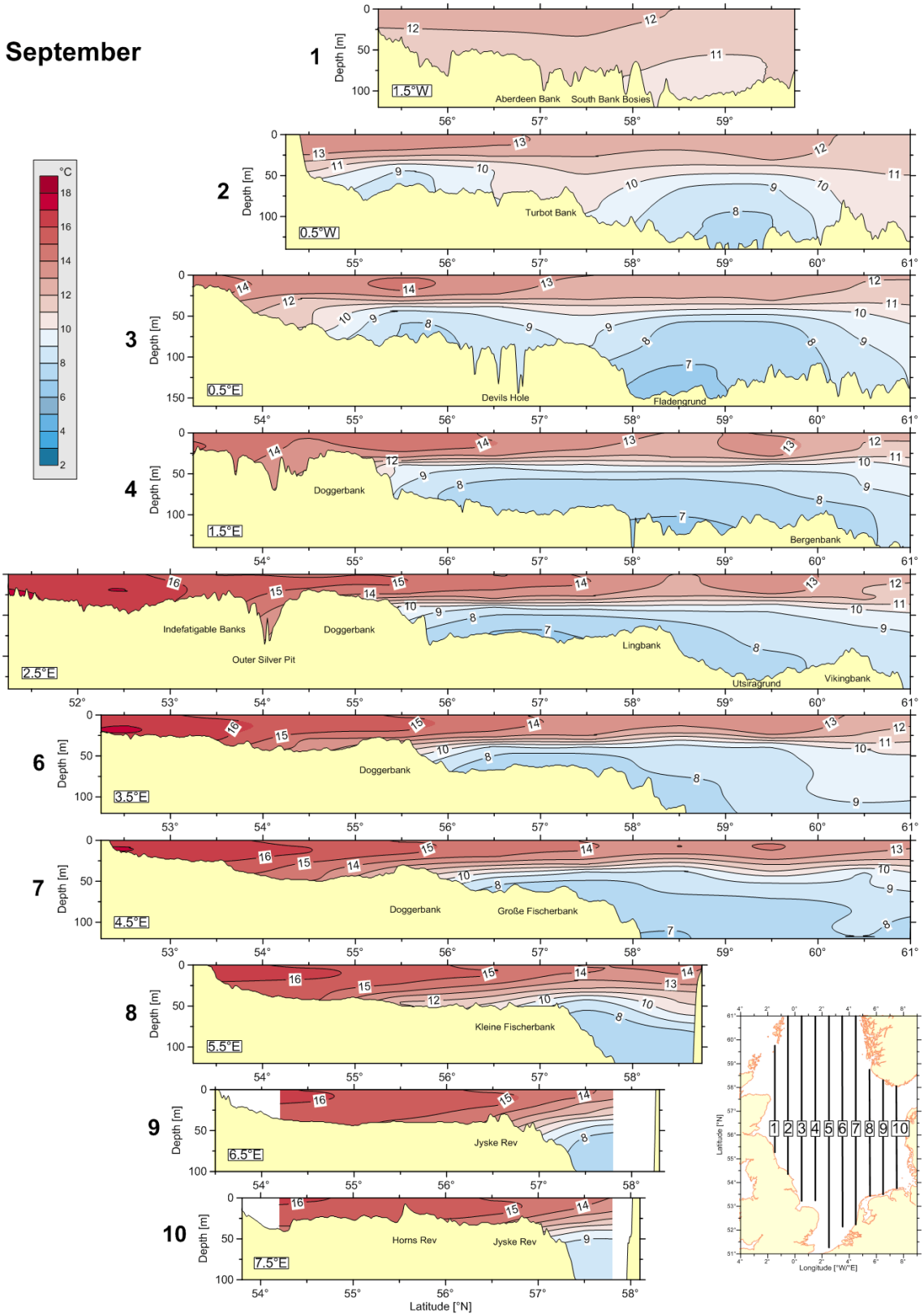
Monthly mean temperature (1902 - 1954) on 10 meridional sections



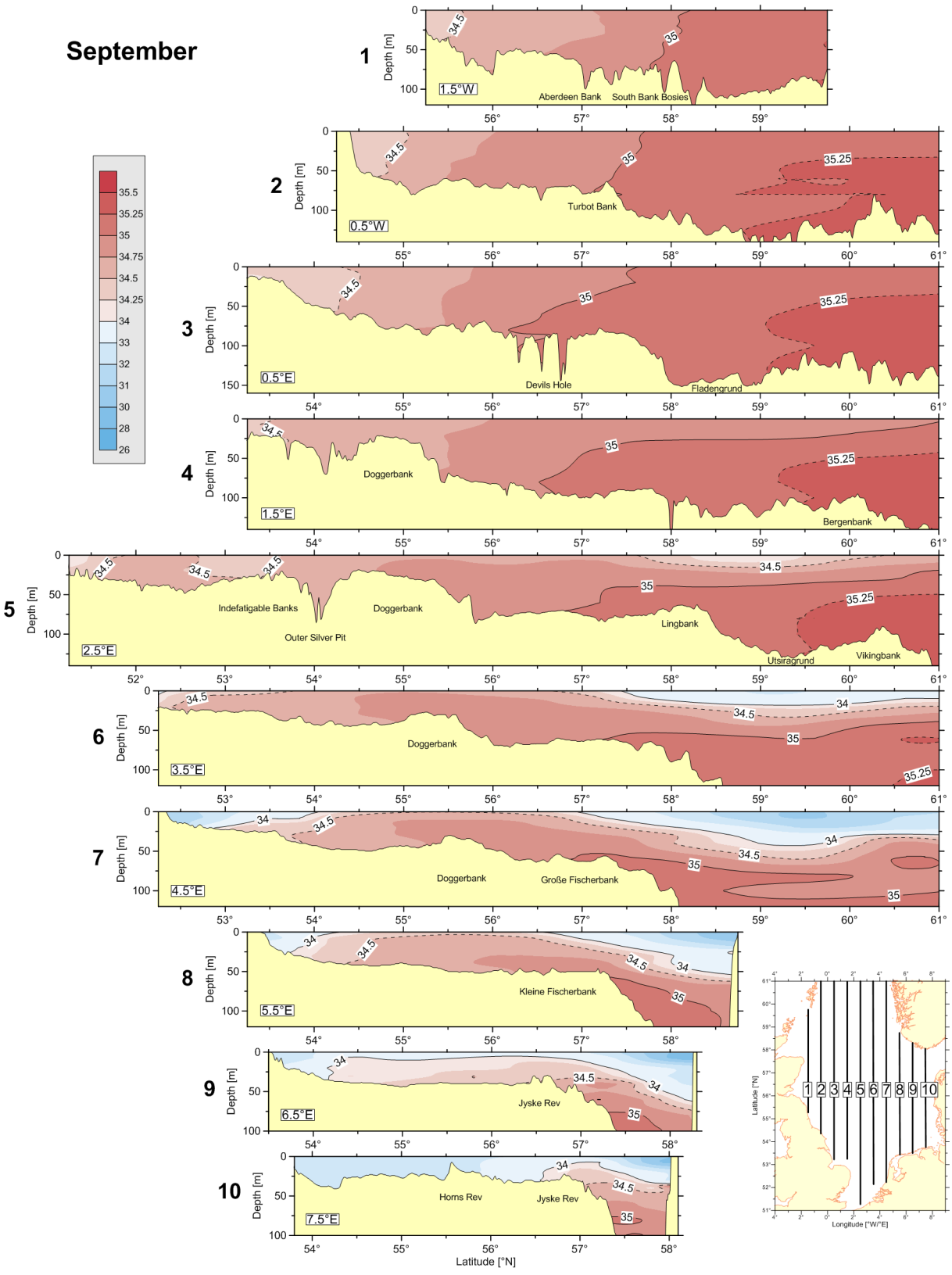
Monthly mean salinity (1902 - 1954) on 10 meridional sections



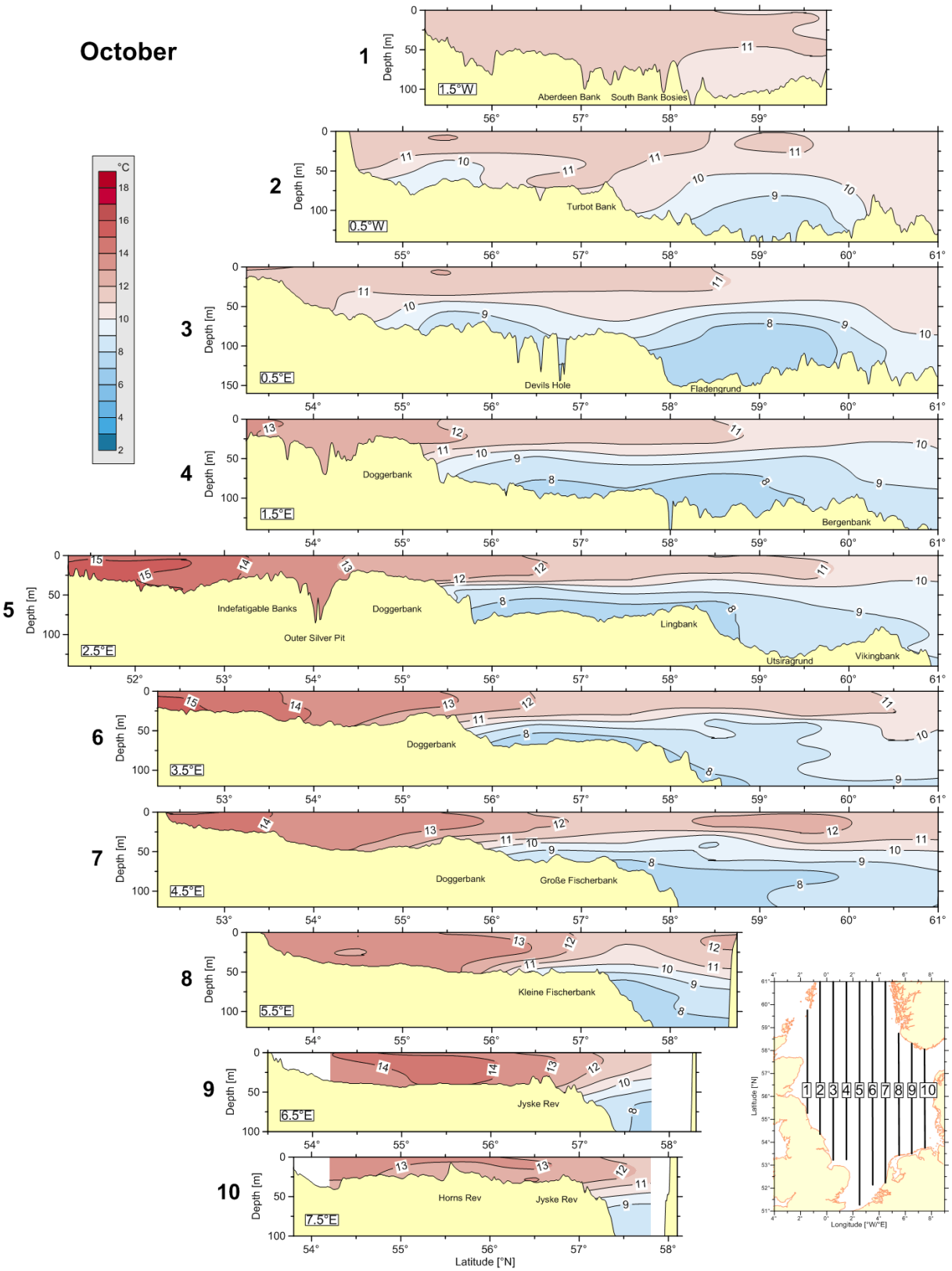
Monthly mean temperature (1902 - 1954) on 10 meridional sections



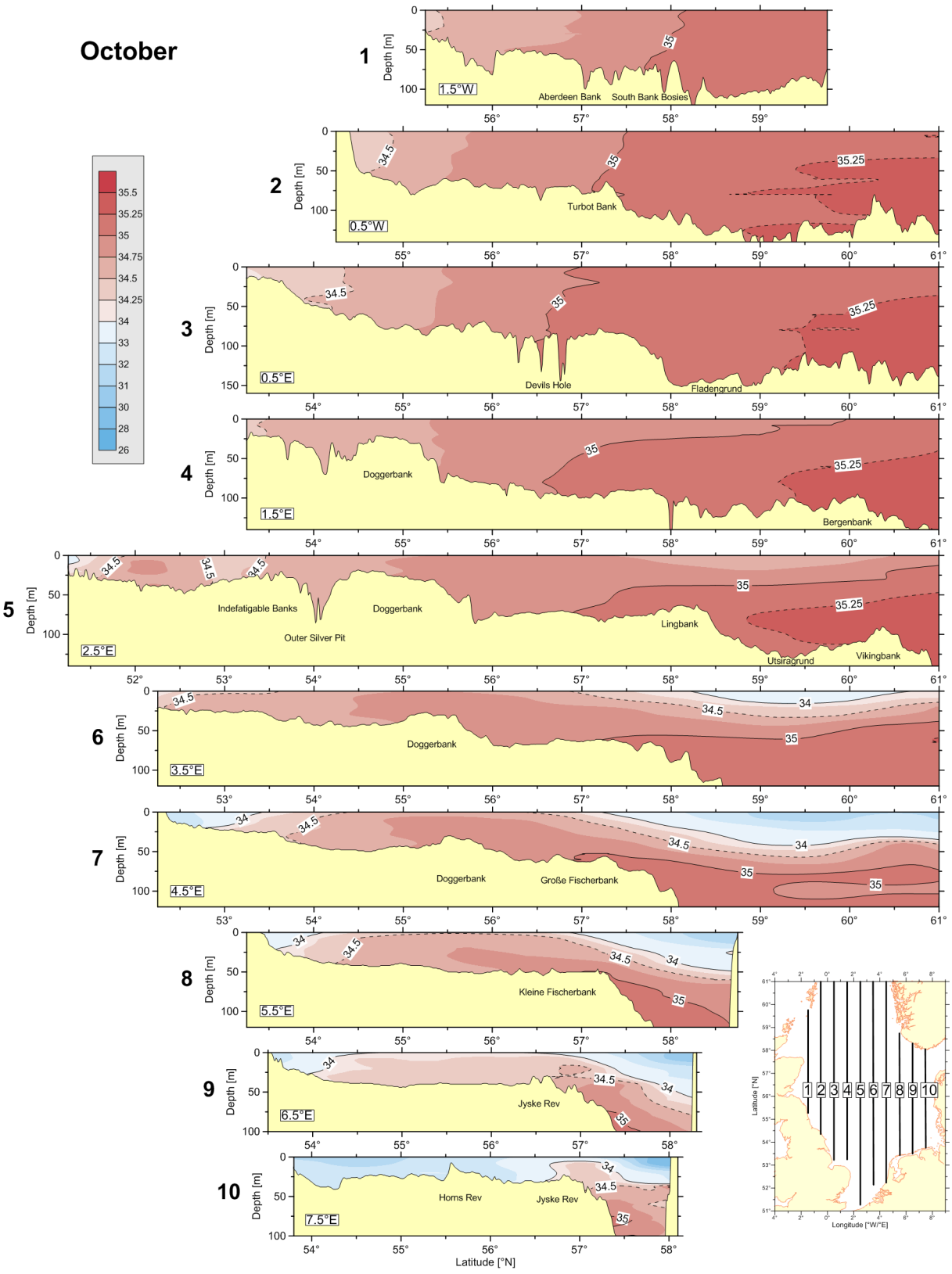
Monthly mean salinity (1902 - 1954) on 10 meridional sections



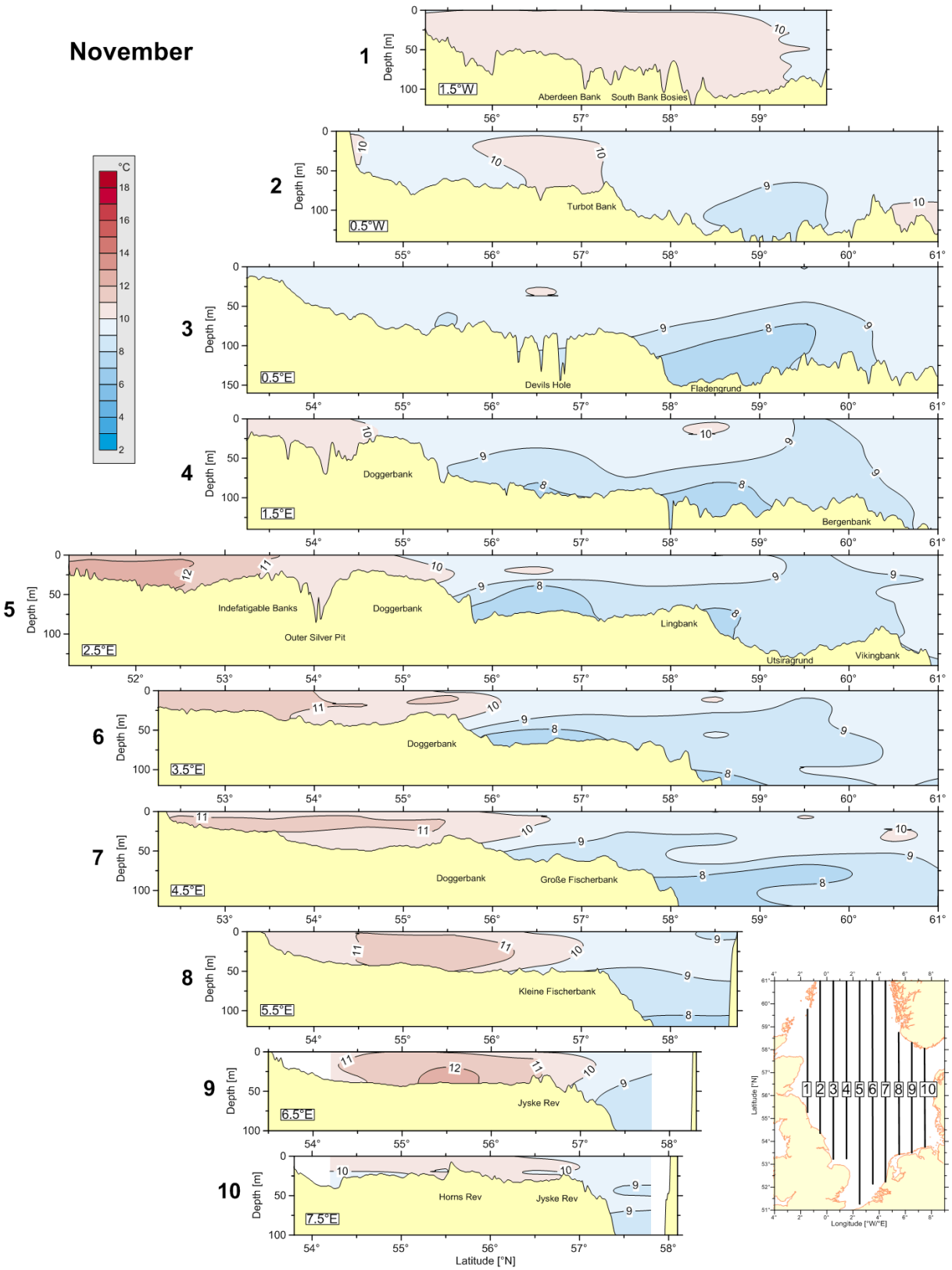
Monthly mean temperature (1902 - 1954) on 10 meridional sections



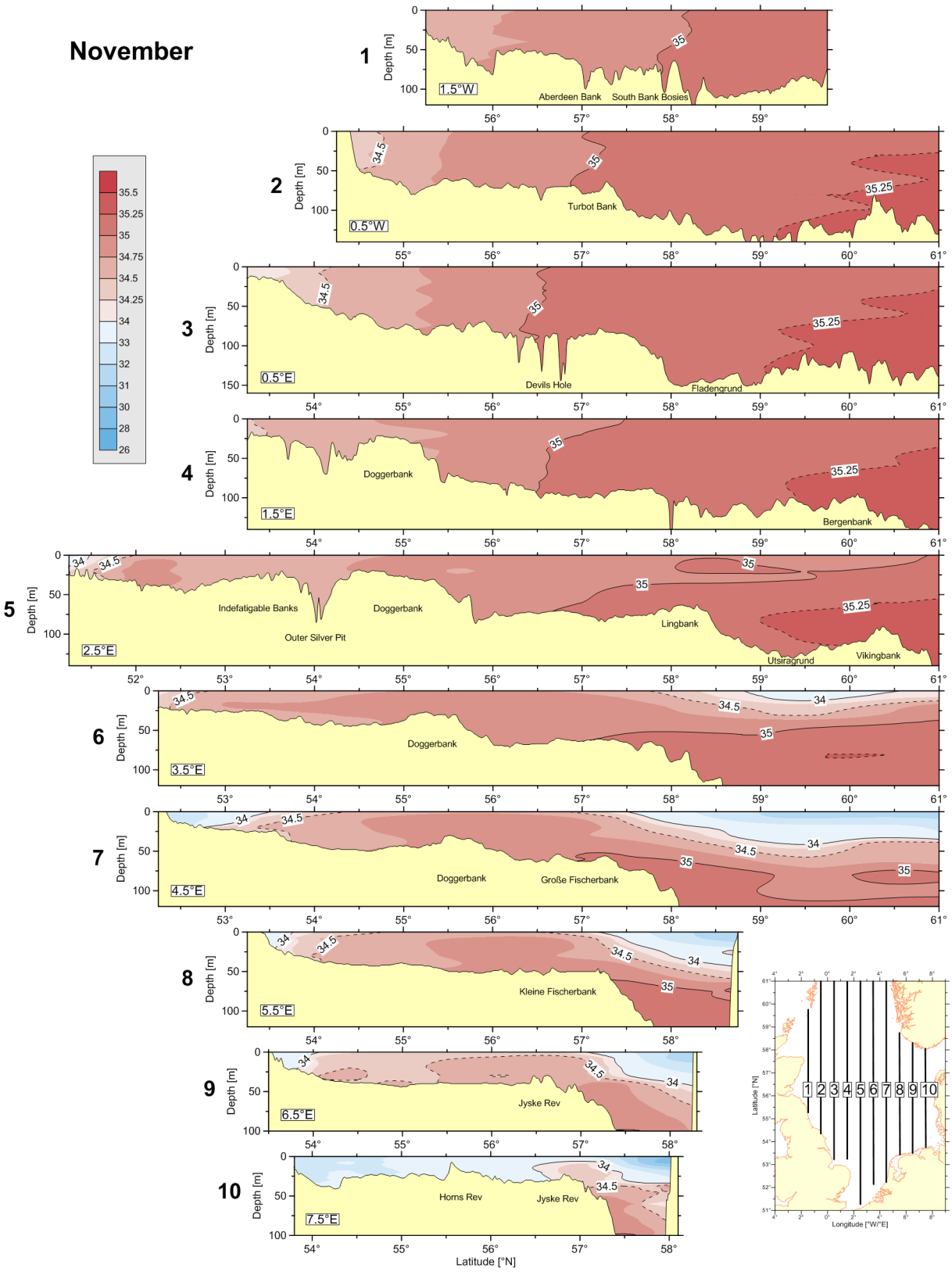
Monthly mean salinity (1902 - 1954) on 10 meridional sections



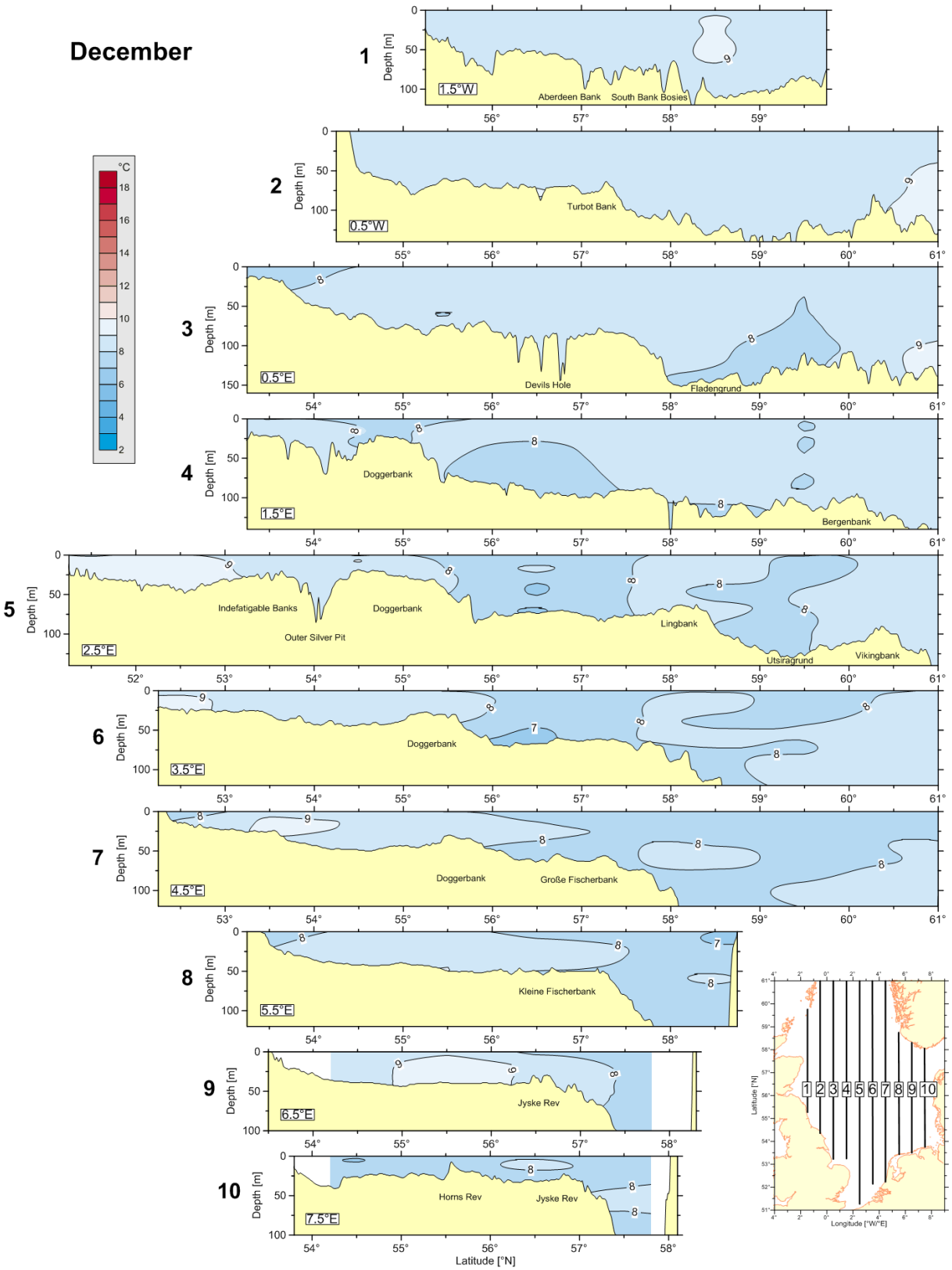
Monthly mean temperature (1902 - 1954) on 10 meridional sections



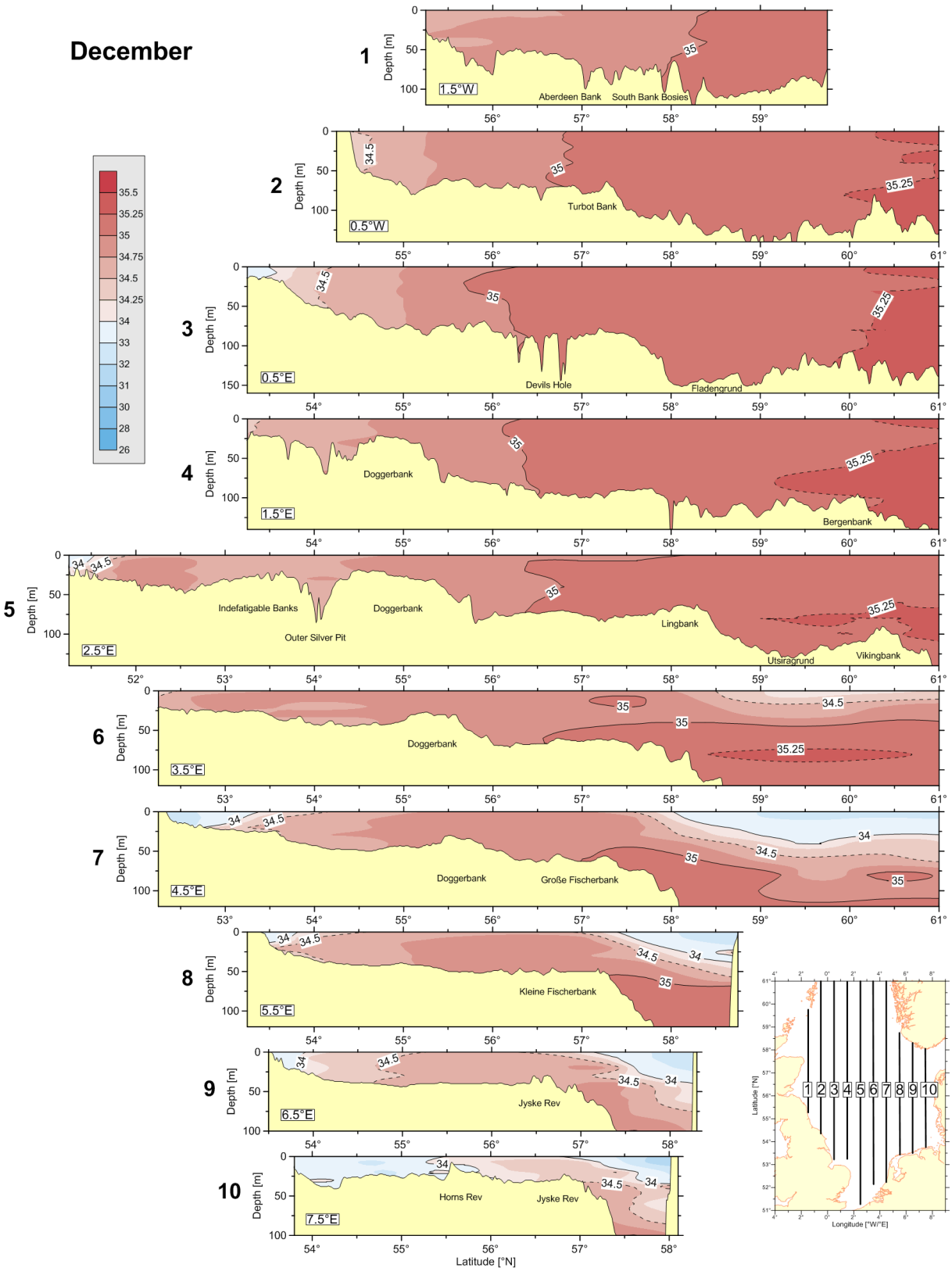
Monthly mean salinity (1902 - 1954) on 10 meridional sections



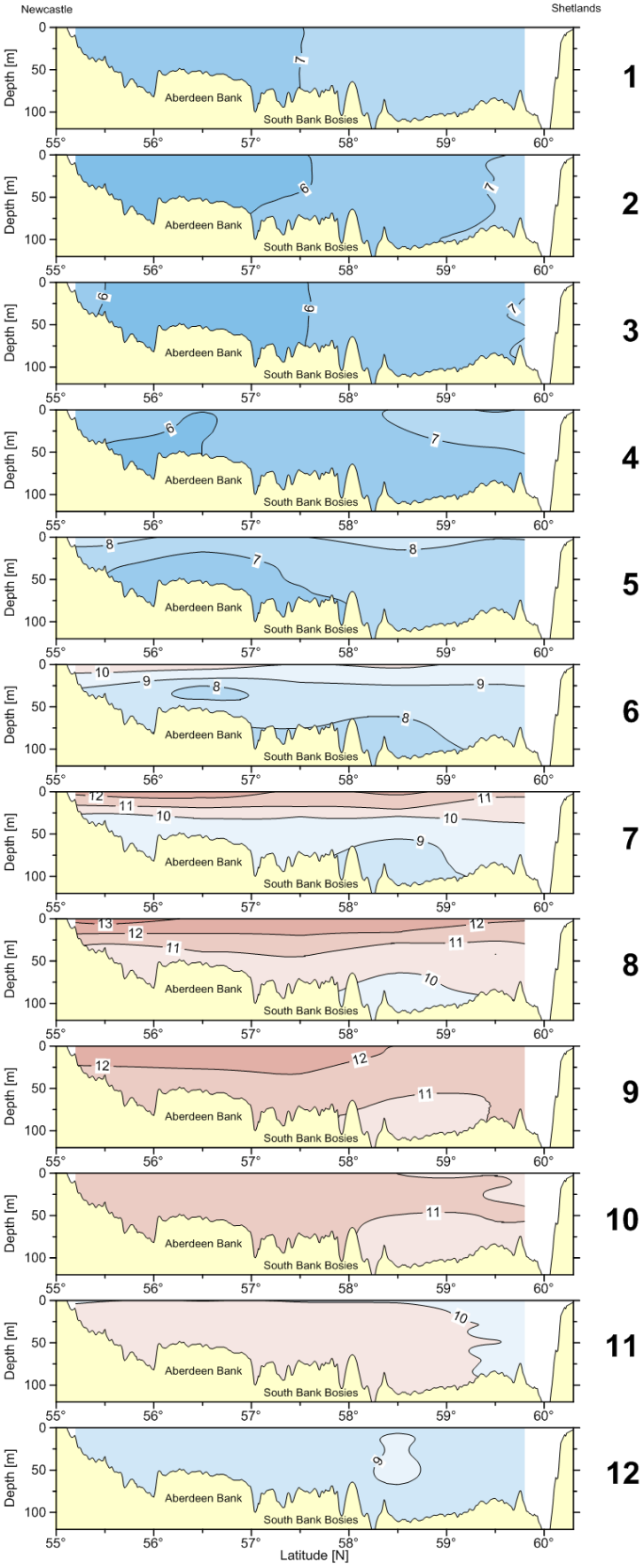
Monthly mean temperature (1902 - 1954) on 10 meridional sections



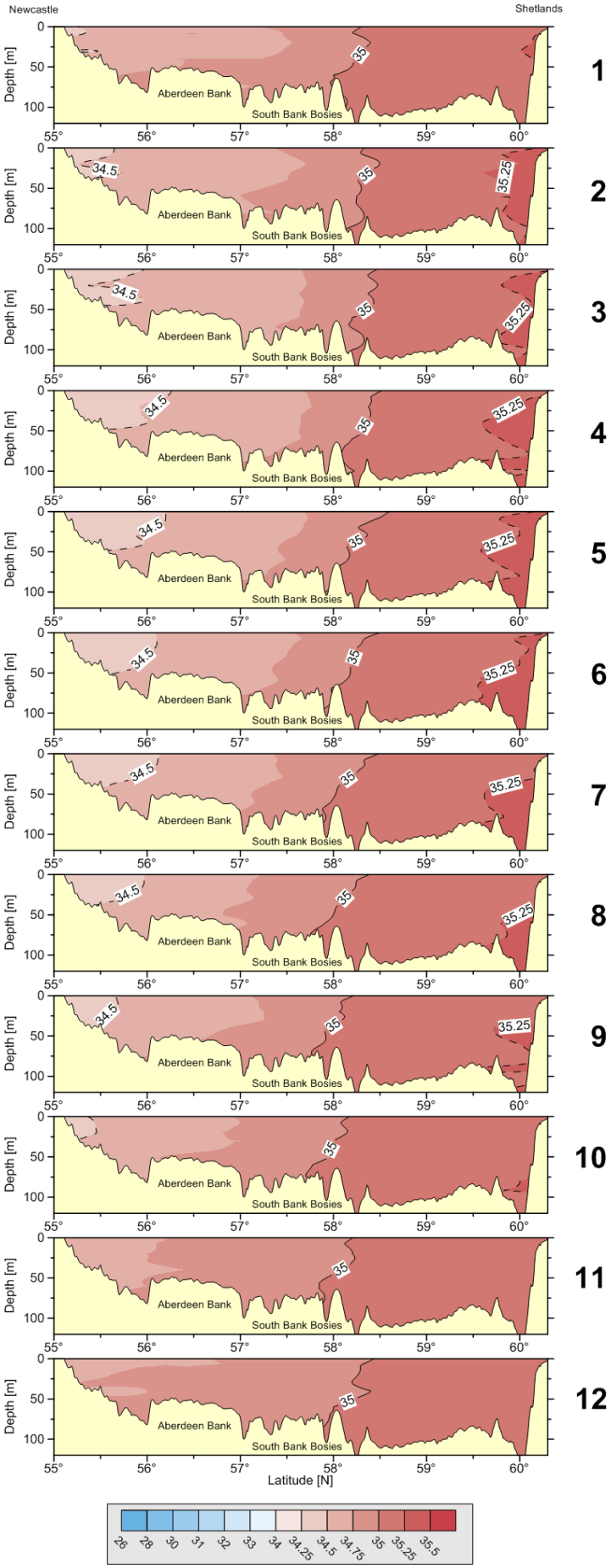
Monthly mean salinity (1902 - 1954) on 10 meridional sections



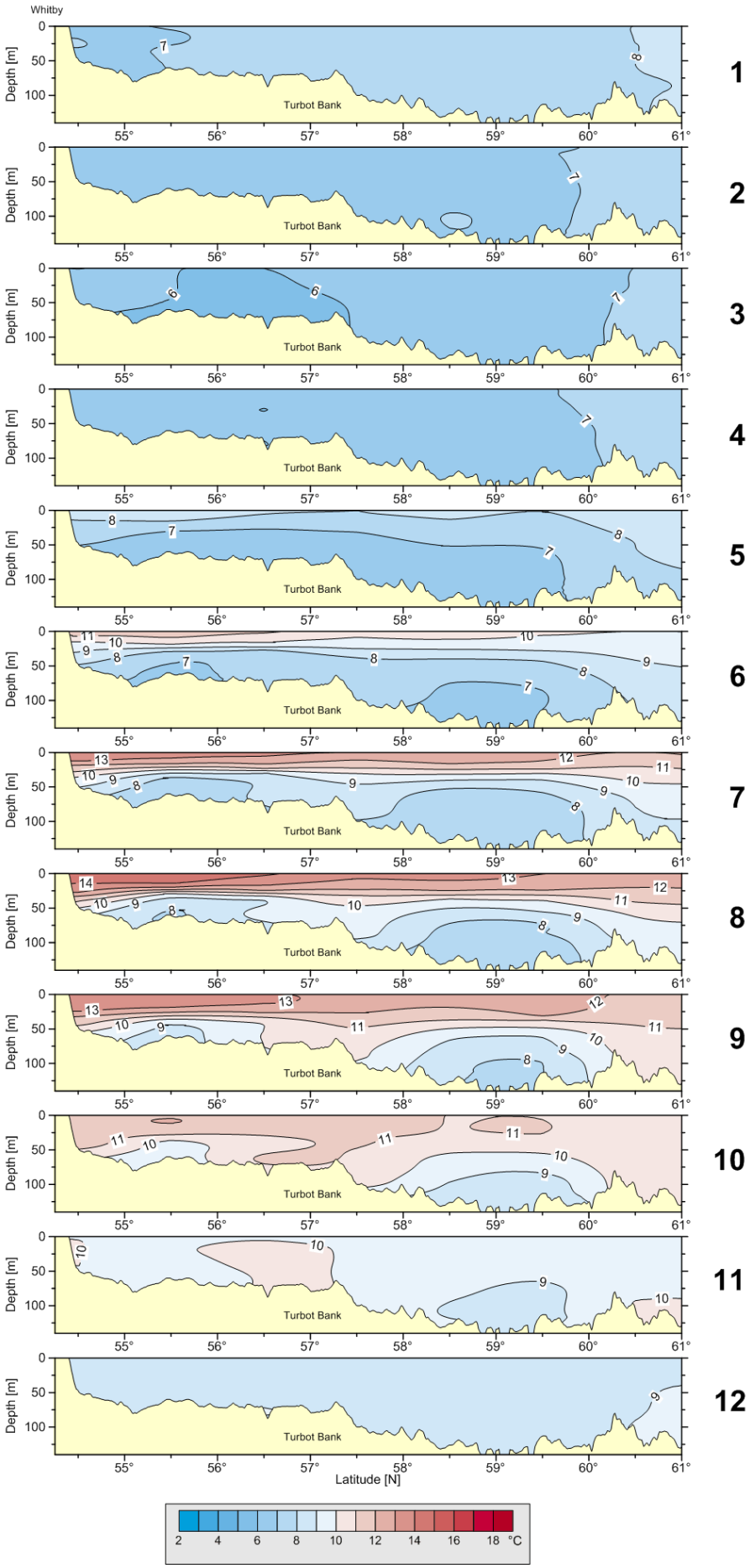
Monthly mean temperature (1902 - 1954) at 1,5°W - January to December (1-12)



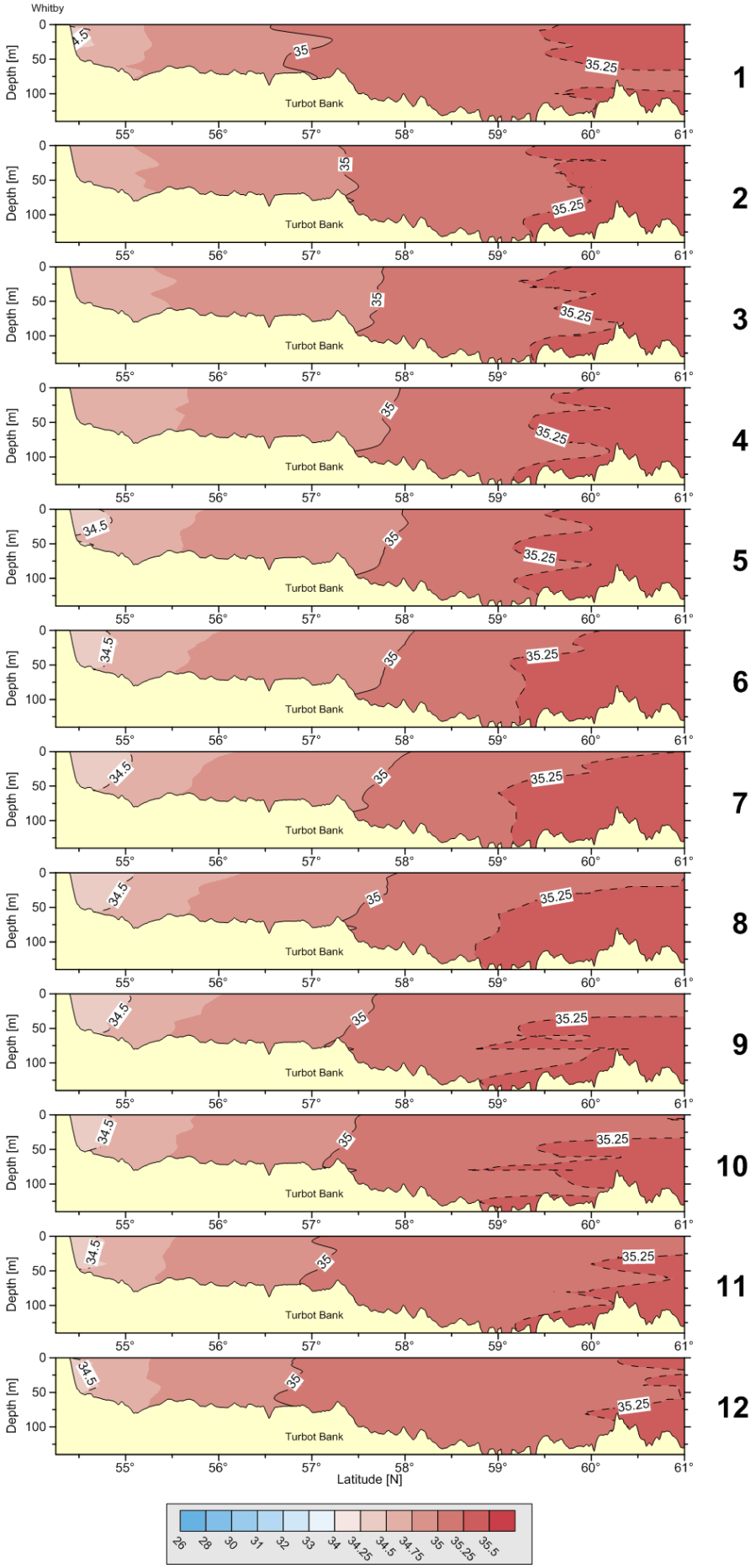
Monthly mean salinity (1902 - 1954) at 1,5°W - January to December (1-12)



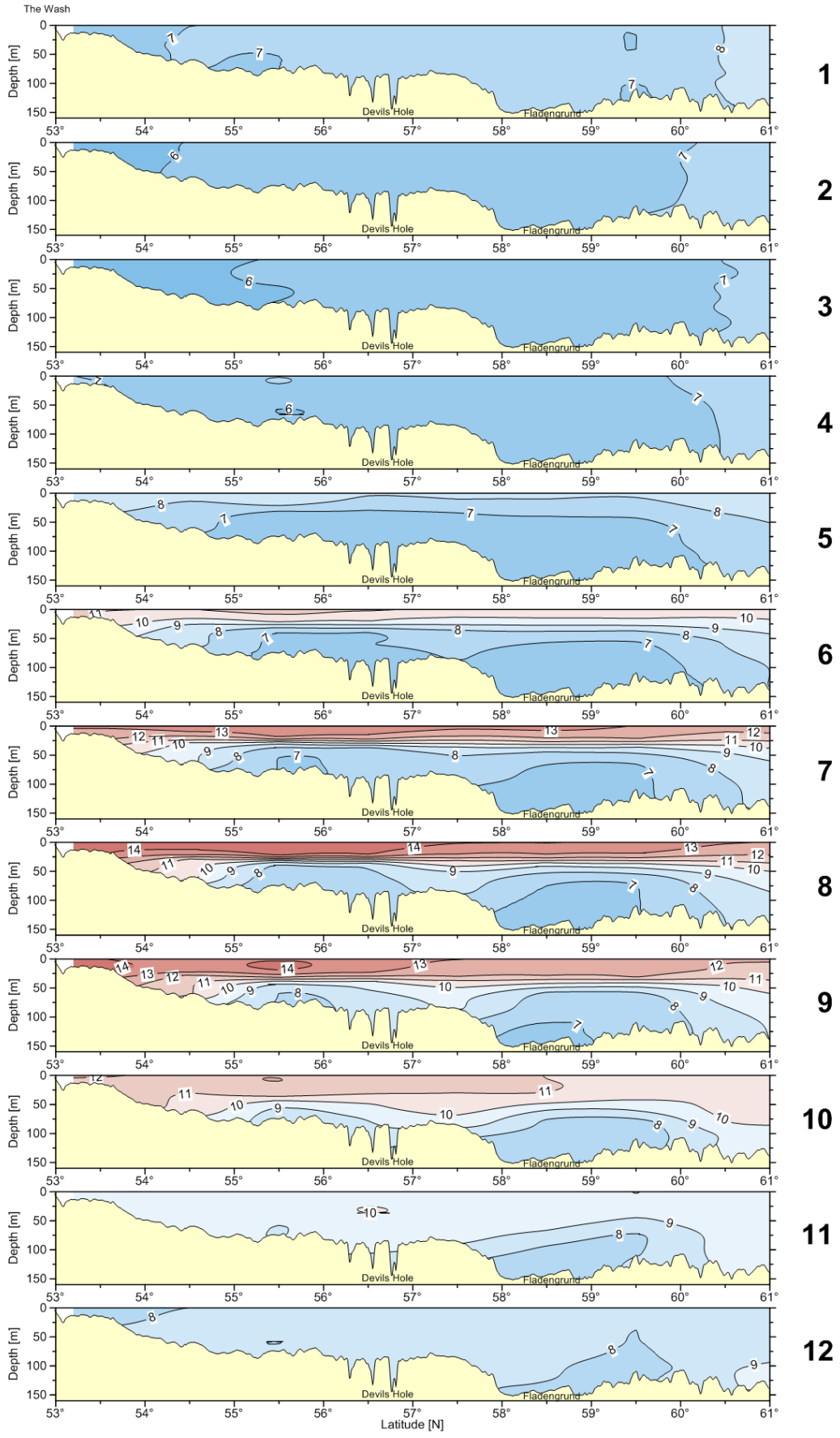
Monthly mean temperature (1902 - 1954) at 0,5°W - January to December (1-12)



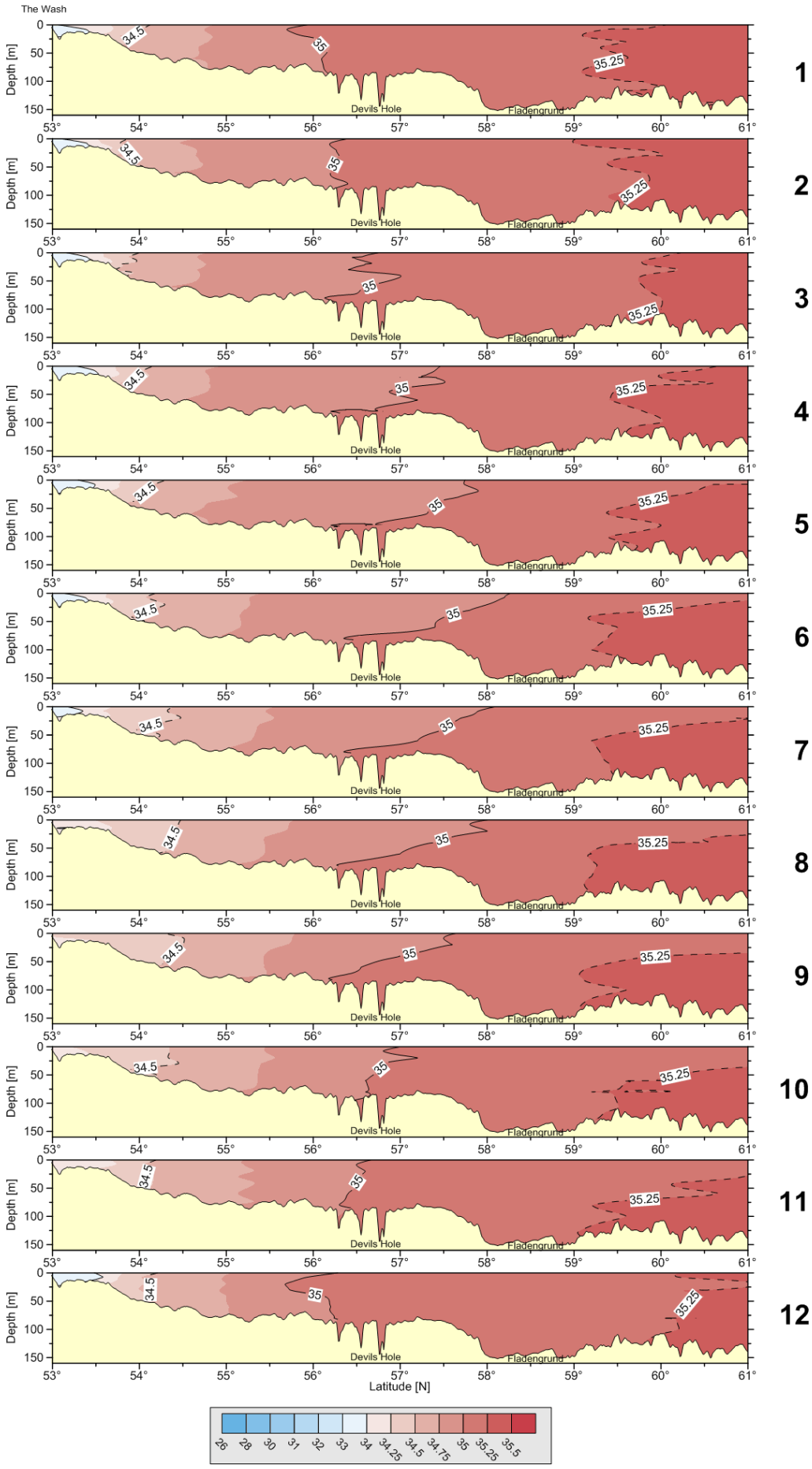
Monthly mean salinity (1902 - 1954) at 0,5°W - January to December (1-12)



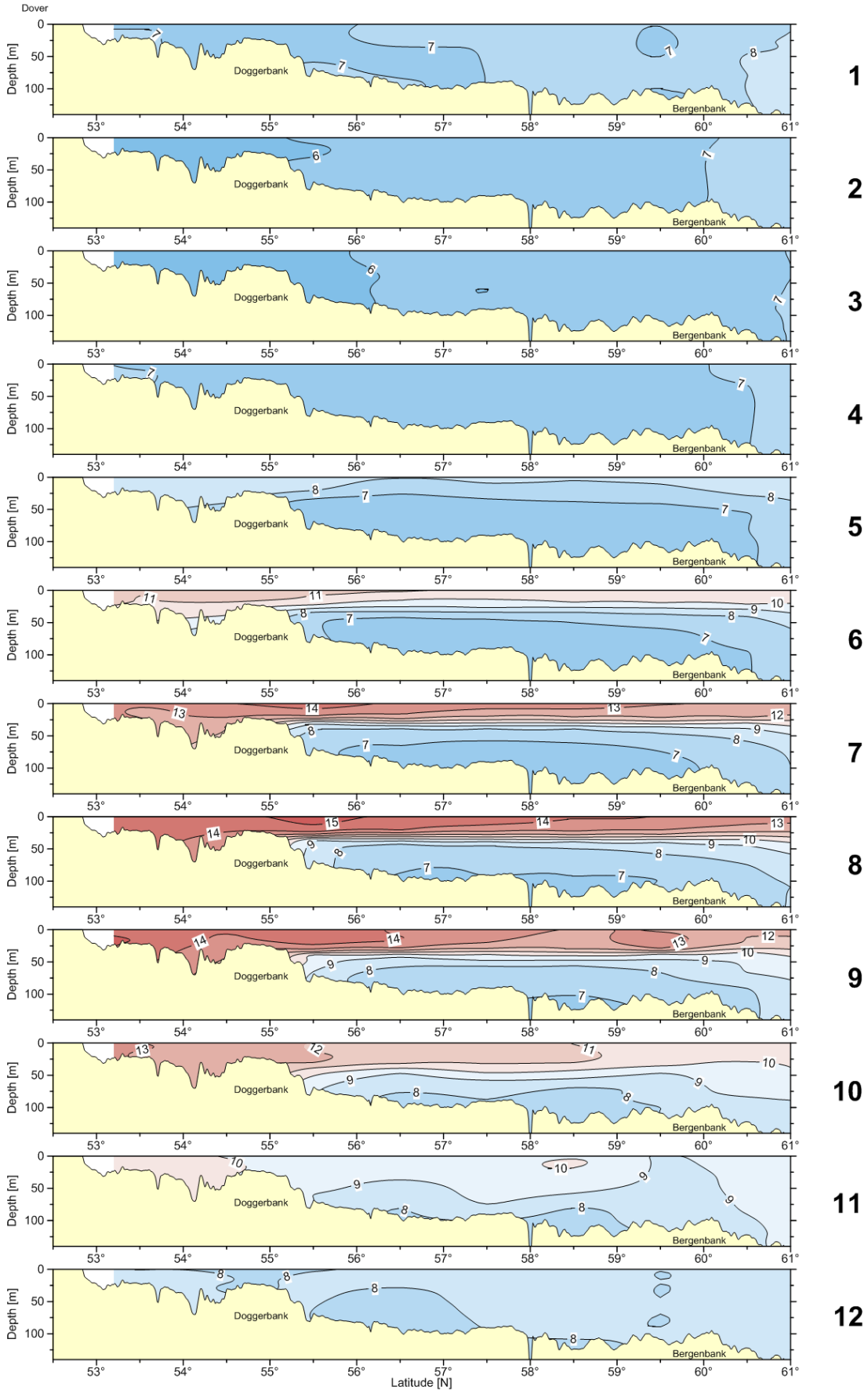
Monthly mean temperature (1902 - 1954) at 0,5°E - January to December (1-12)



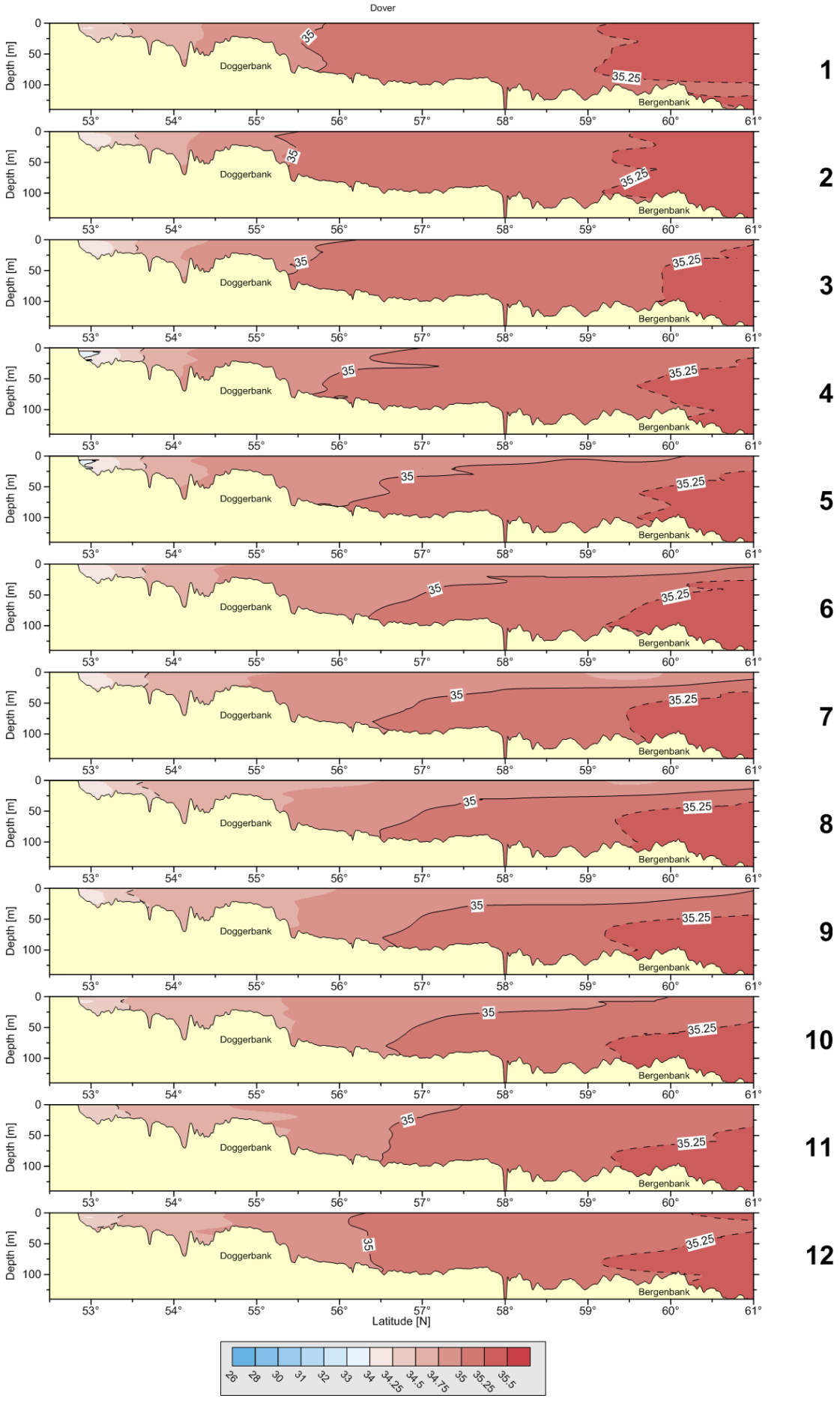
Monthly mean salinity (1902 - 1954) at 0,5°E - January to December (1-12)



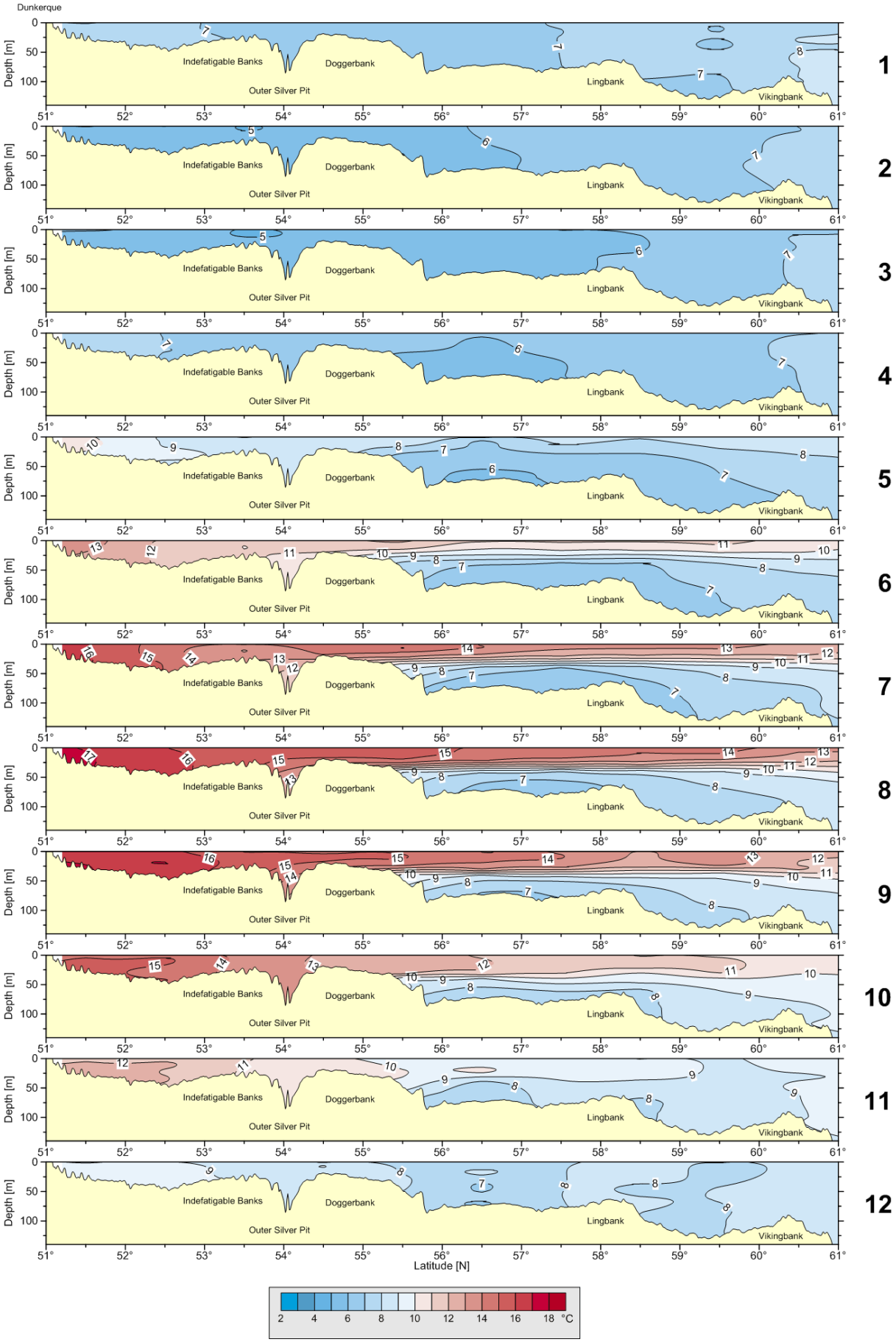
Monthly mean temperature (1902 - 1954) at 1,5°E - January to December (1-12)



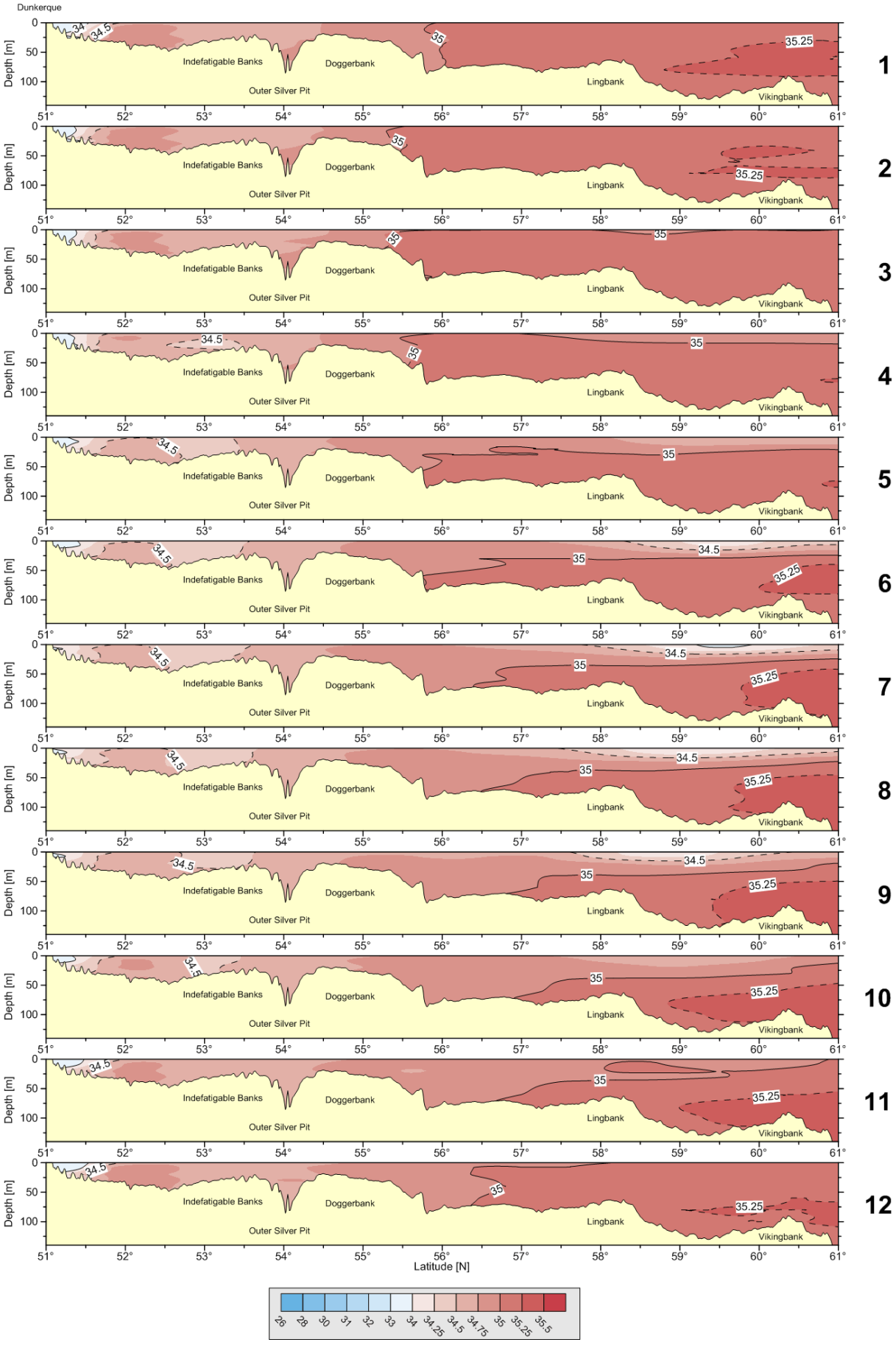
Monthly mean salinity (1902 - 1954) at 1,5°E - January to December (1-12)



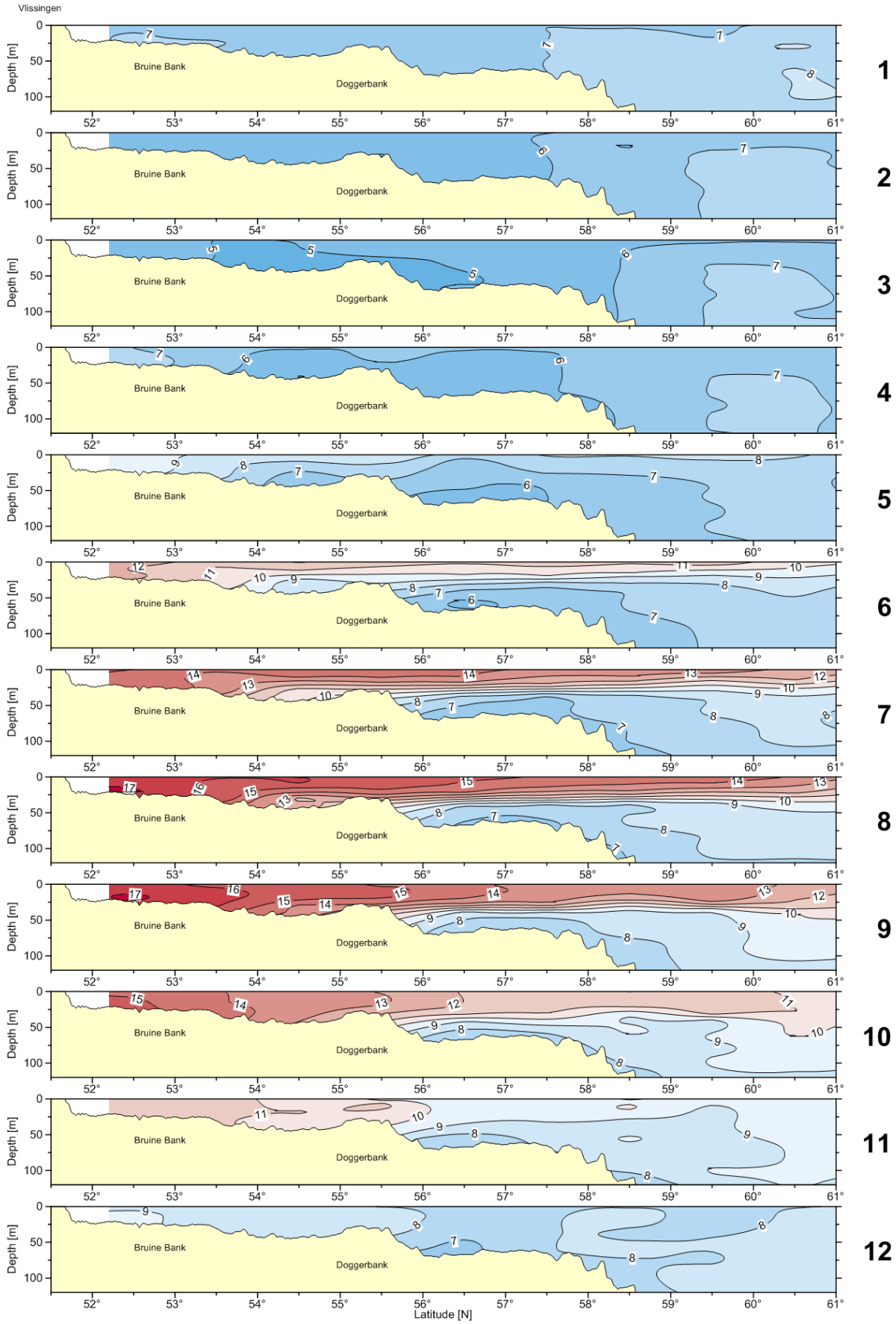
Monthly mean temperature (1902 - 1954) at 2,5°E - January to December (1-12)



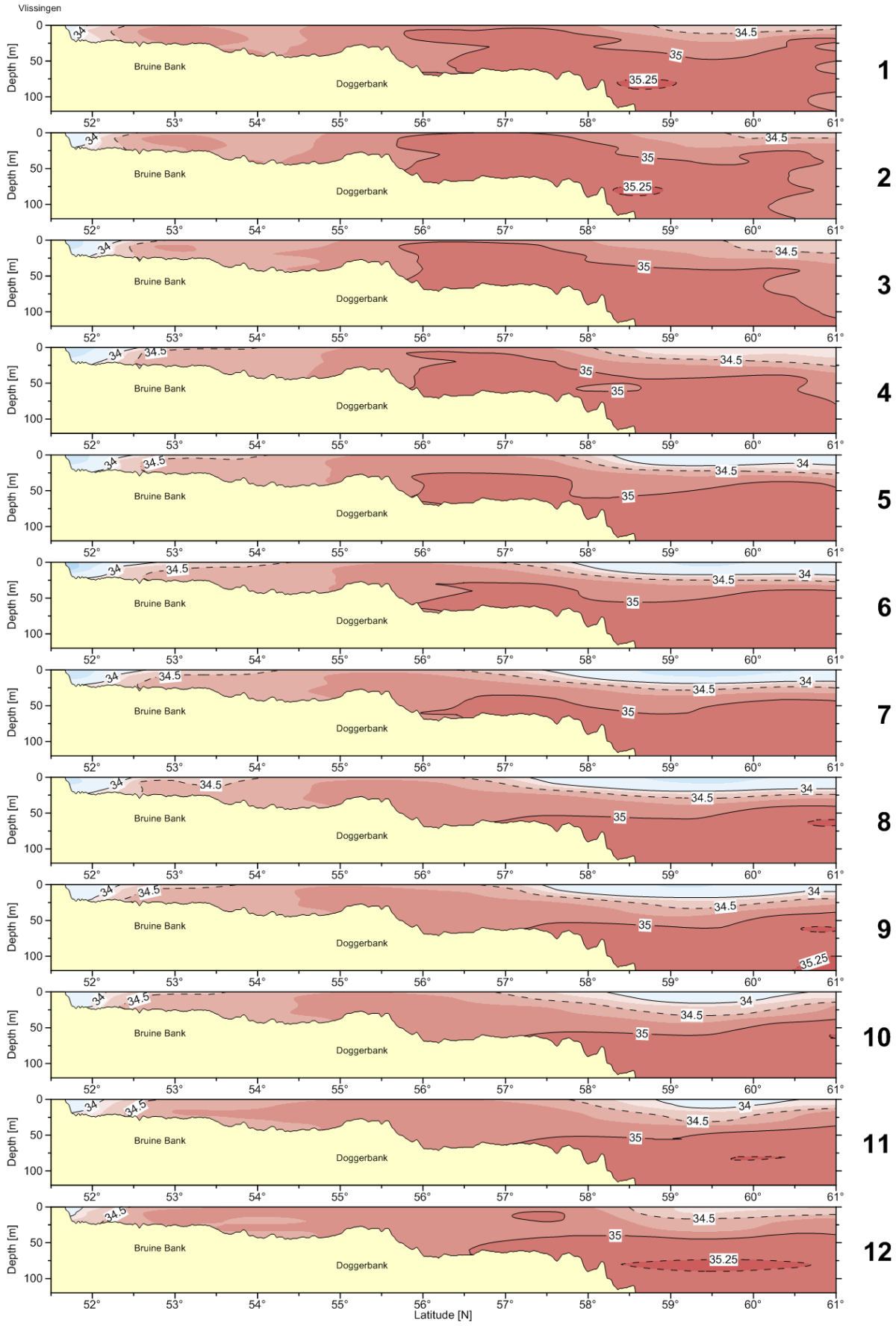
Monthly mean salinity (1902 - 1954) at 2,5°E - January to December (1-12)



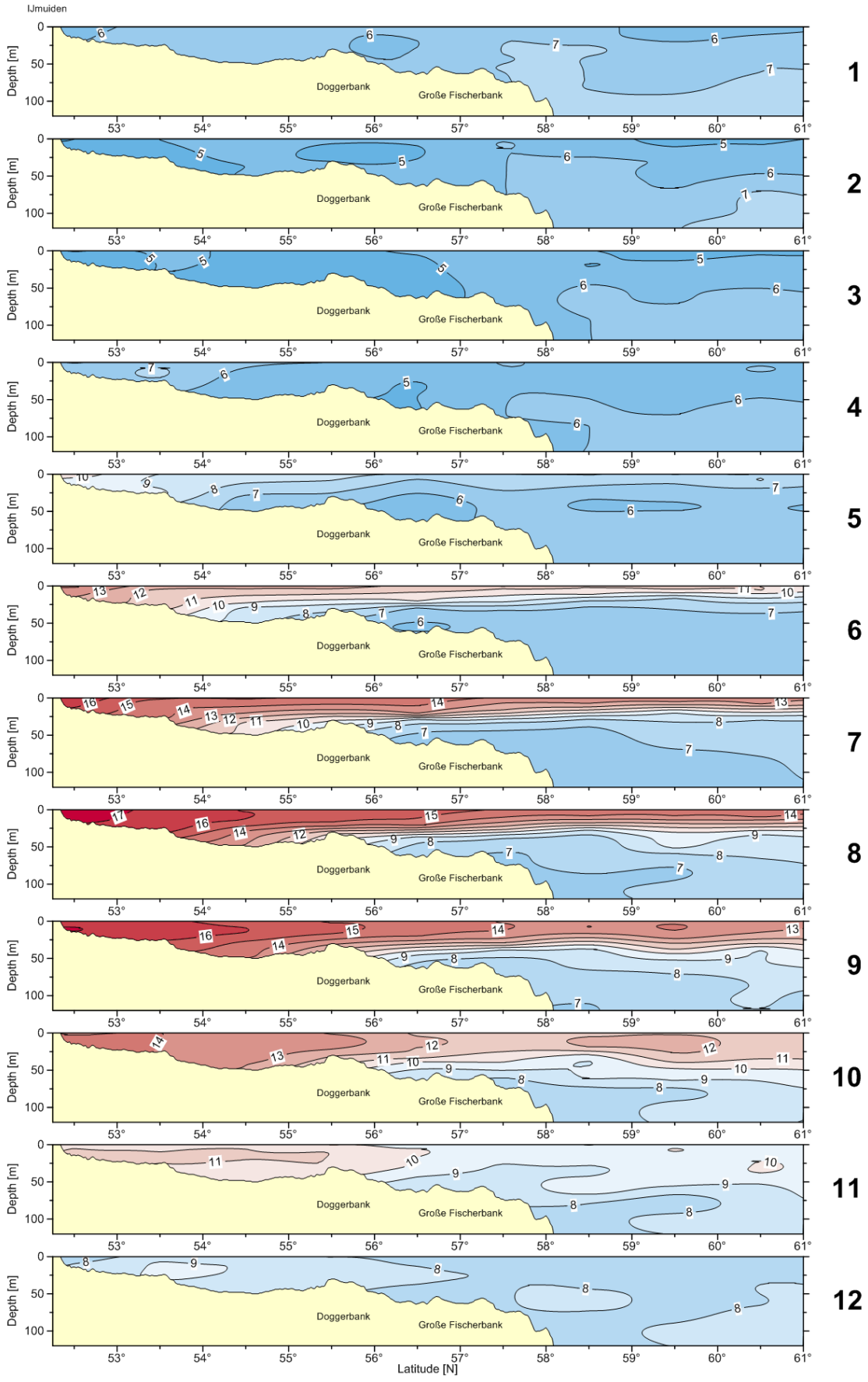
Monthly mean temperature (1902 - 1954) at 3,5°E - January to December (1-12)



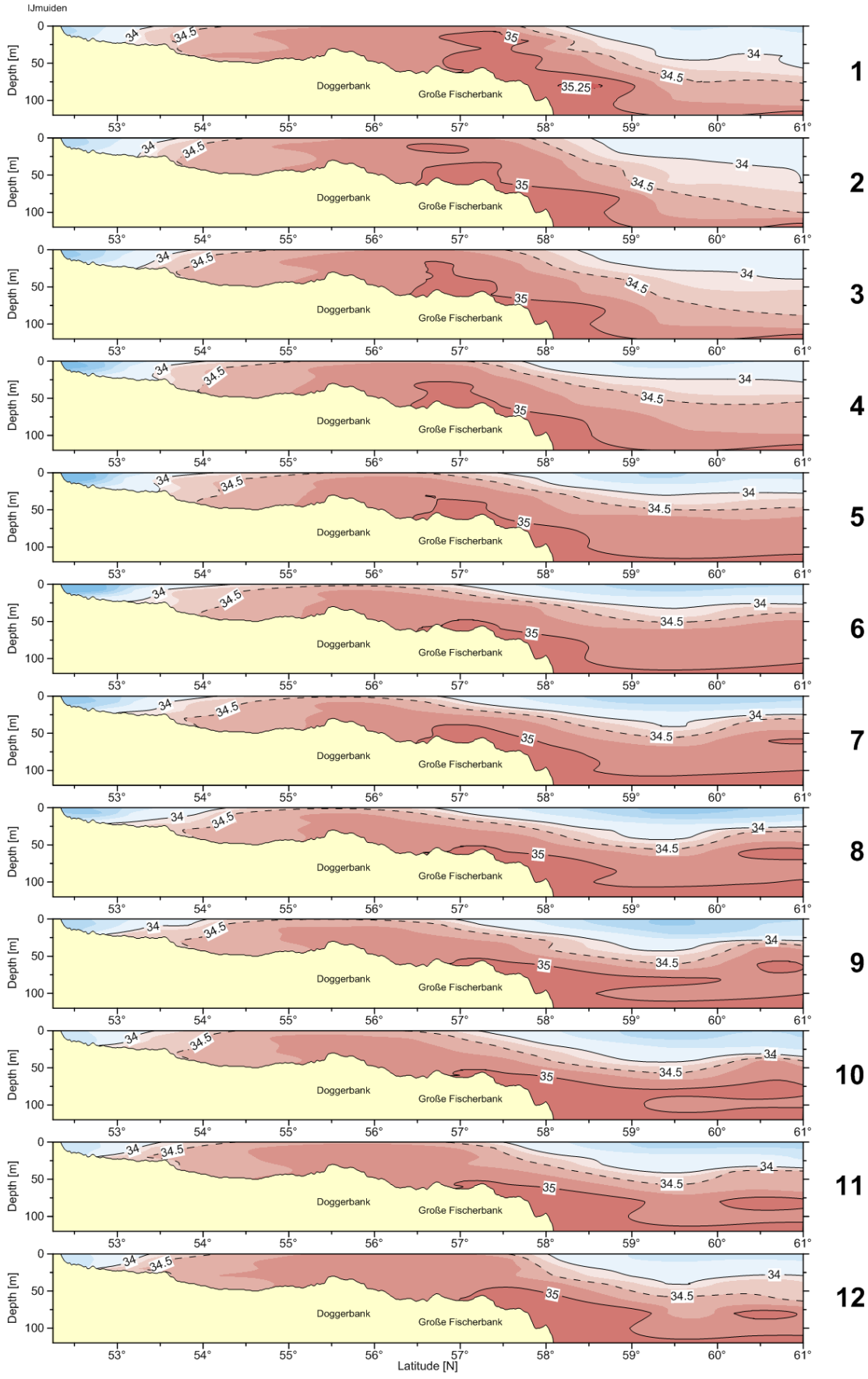
Monthly mean salinity (1902 - 1954) at 3,5°E - January to December (1-12)



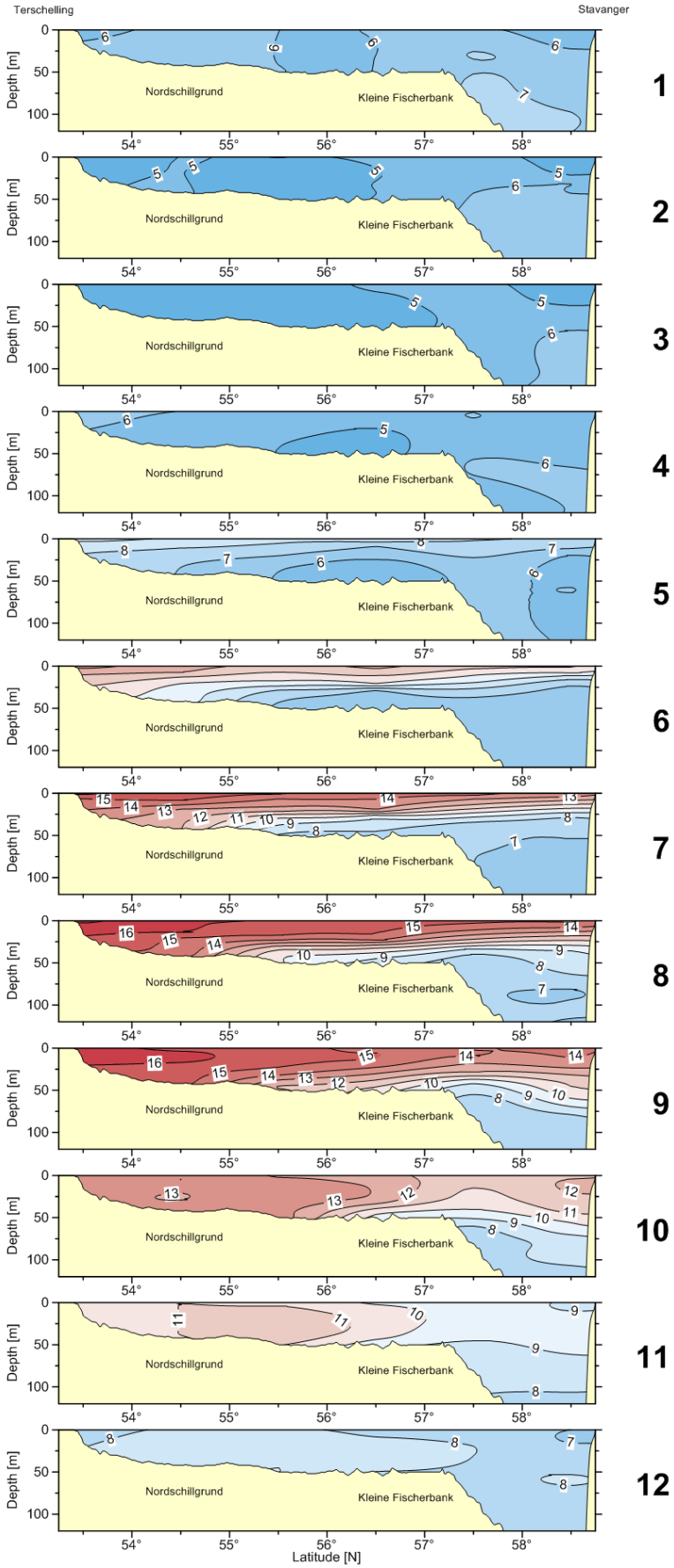
Monthly mean temperature (1902 - 1954) at 4,5°E - January to December (1-12)



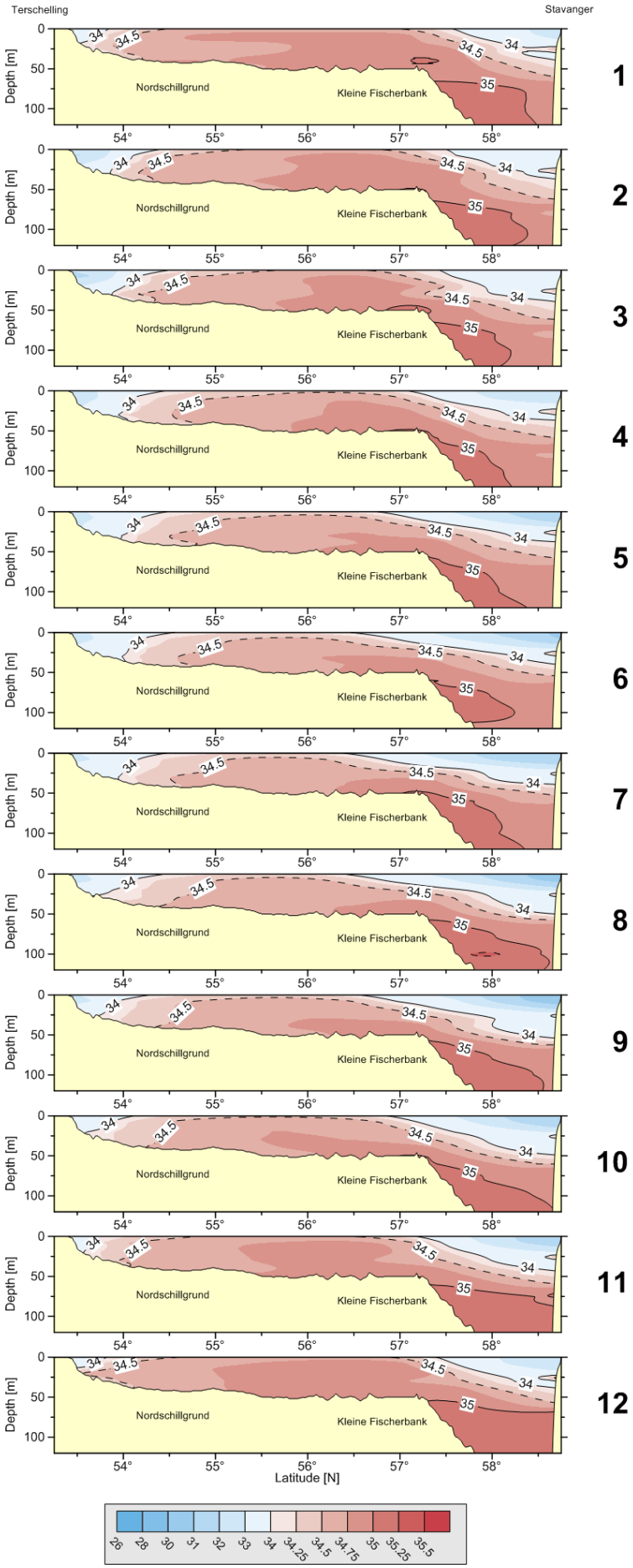
Monthly mean salinity (1902 - 1954) at 4,5°E - January to December (1-12)



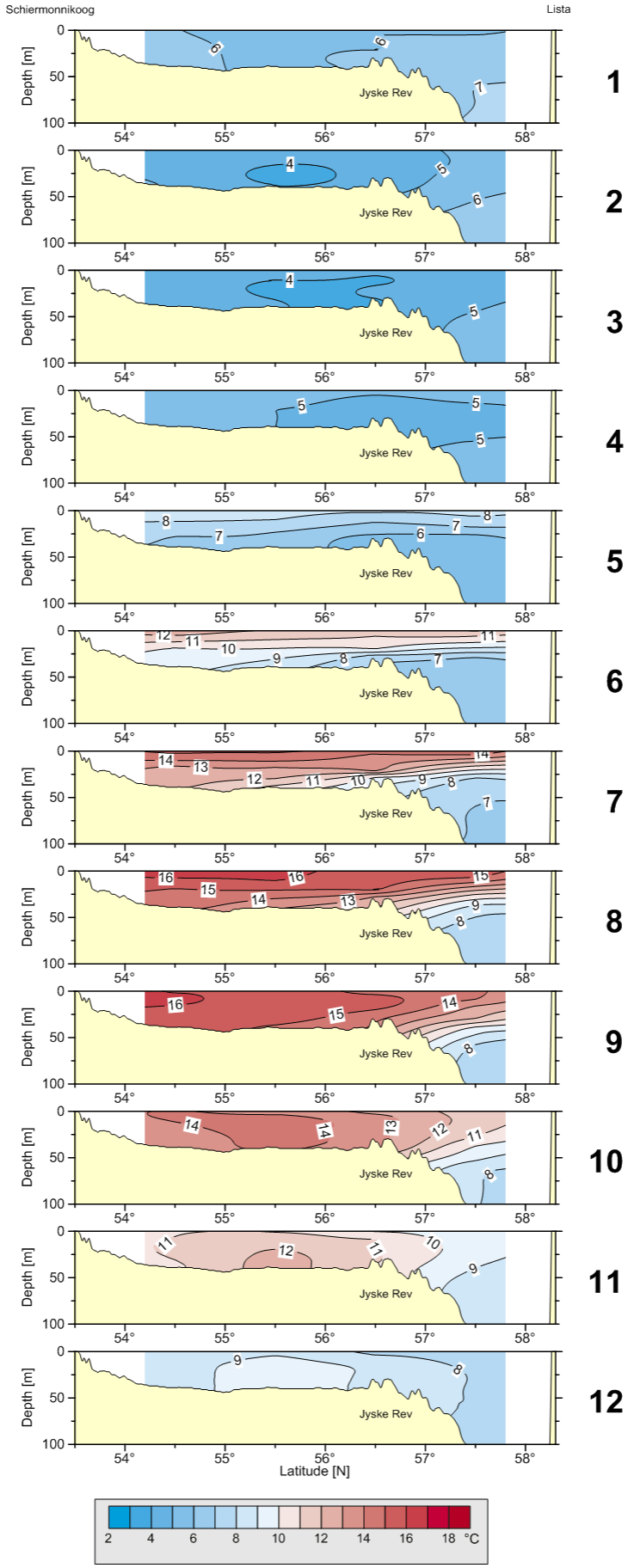
Monthly mean temperature (1902 - 1954) at 5,5°E - January to December (1-12)



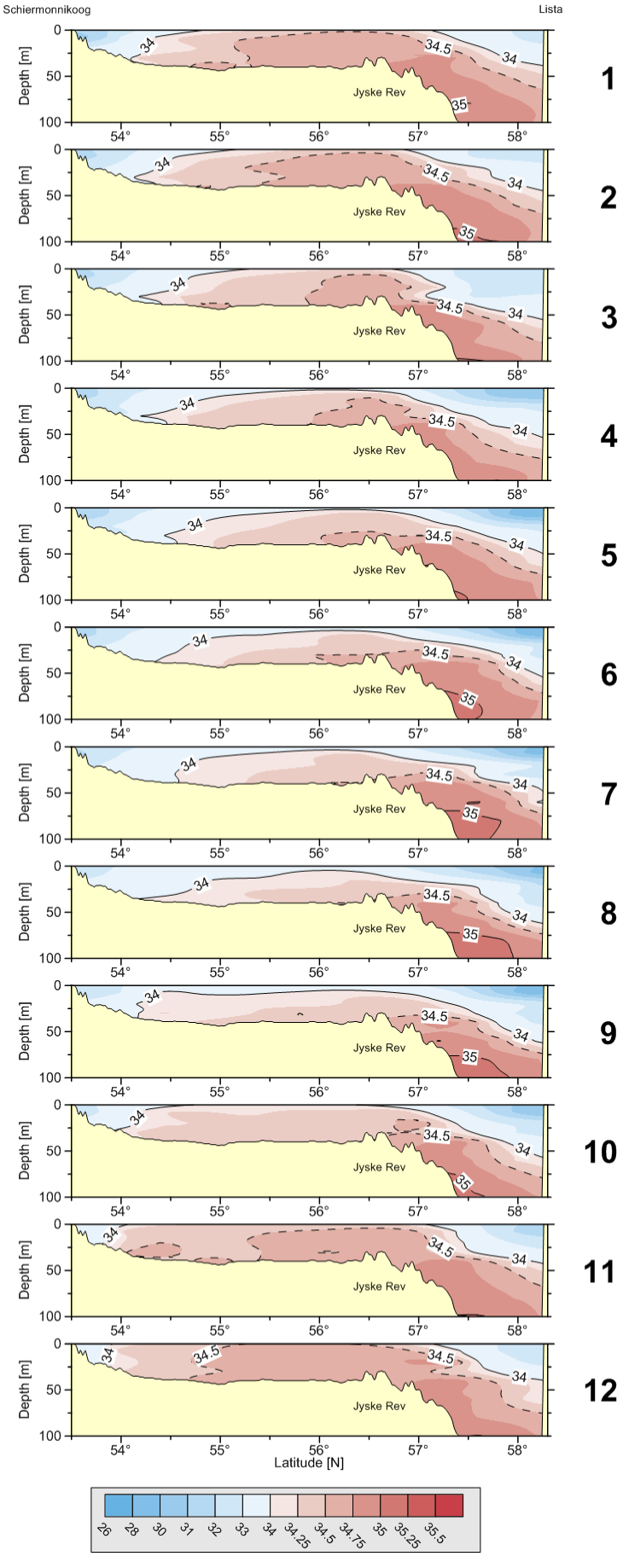
Monthly mean salinity (1902 - 1954) at 5,5°E - January to December (1-12)



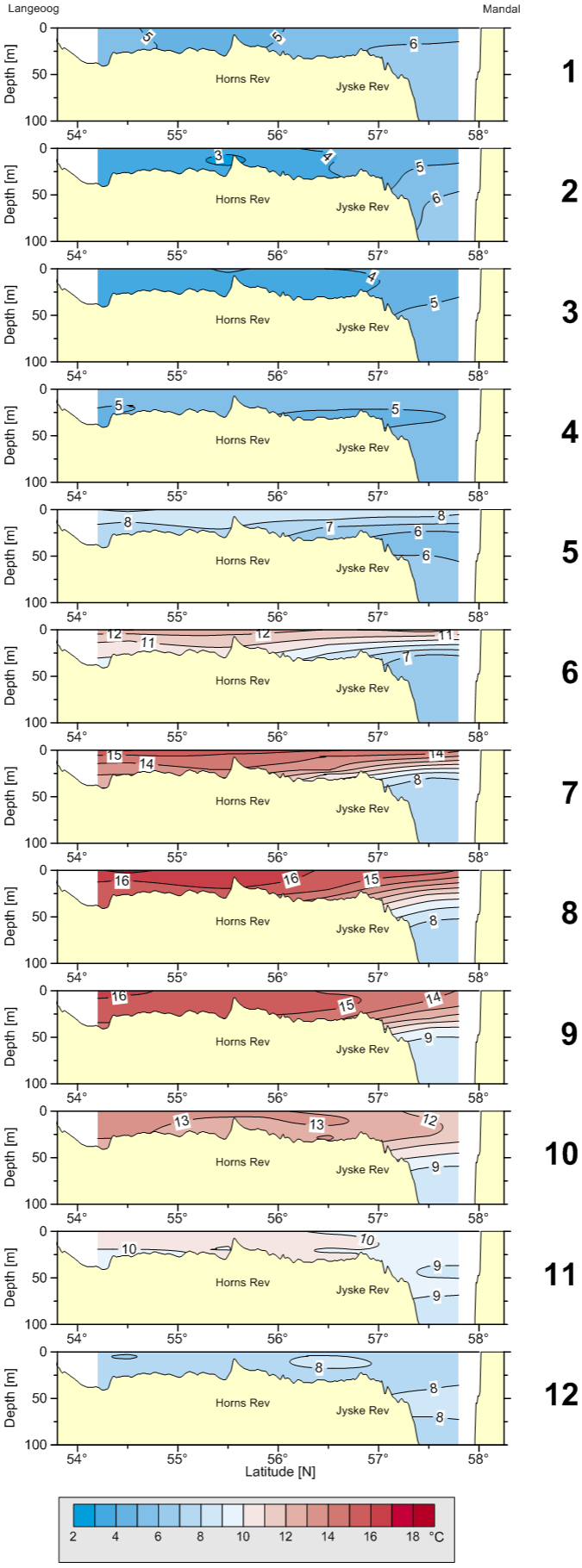
Monthly mean temperature (1902 - 1954) at 6,5°E - January to December (1-12)



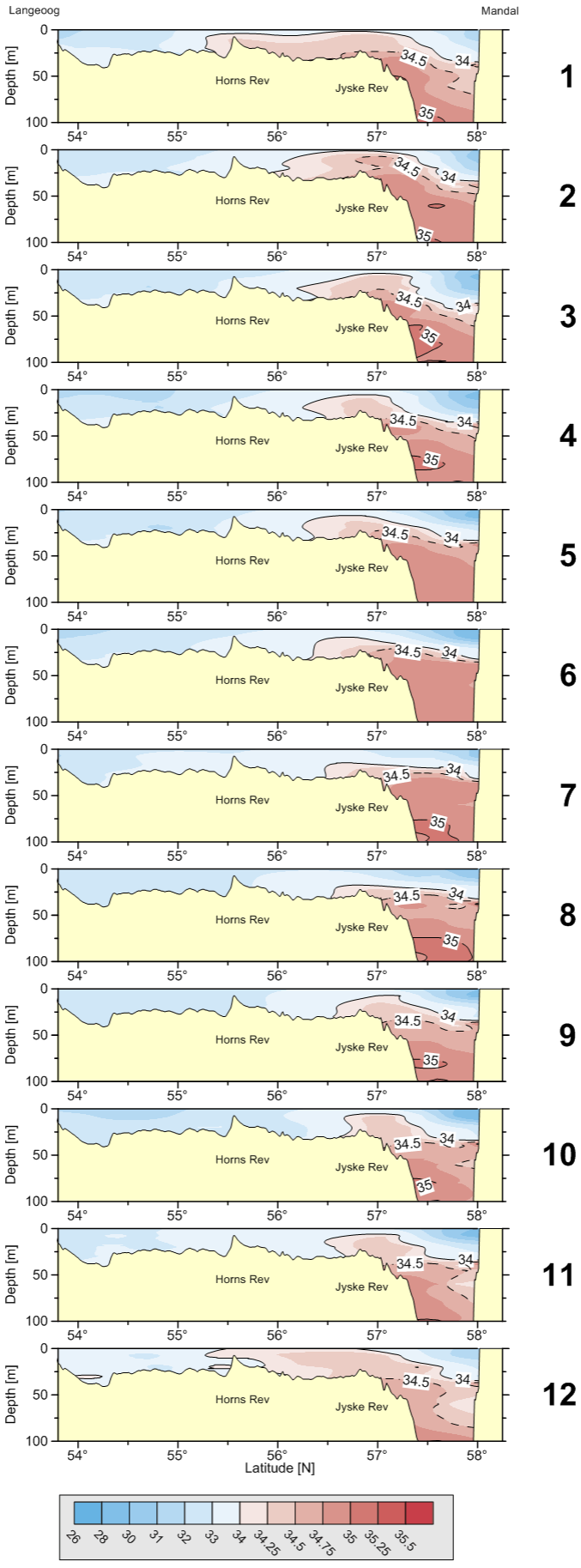
Monthly mean salinity (1902 - 1954) at 6,5°E - January to December (1-12)



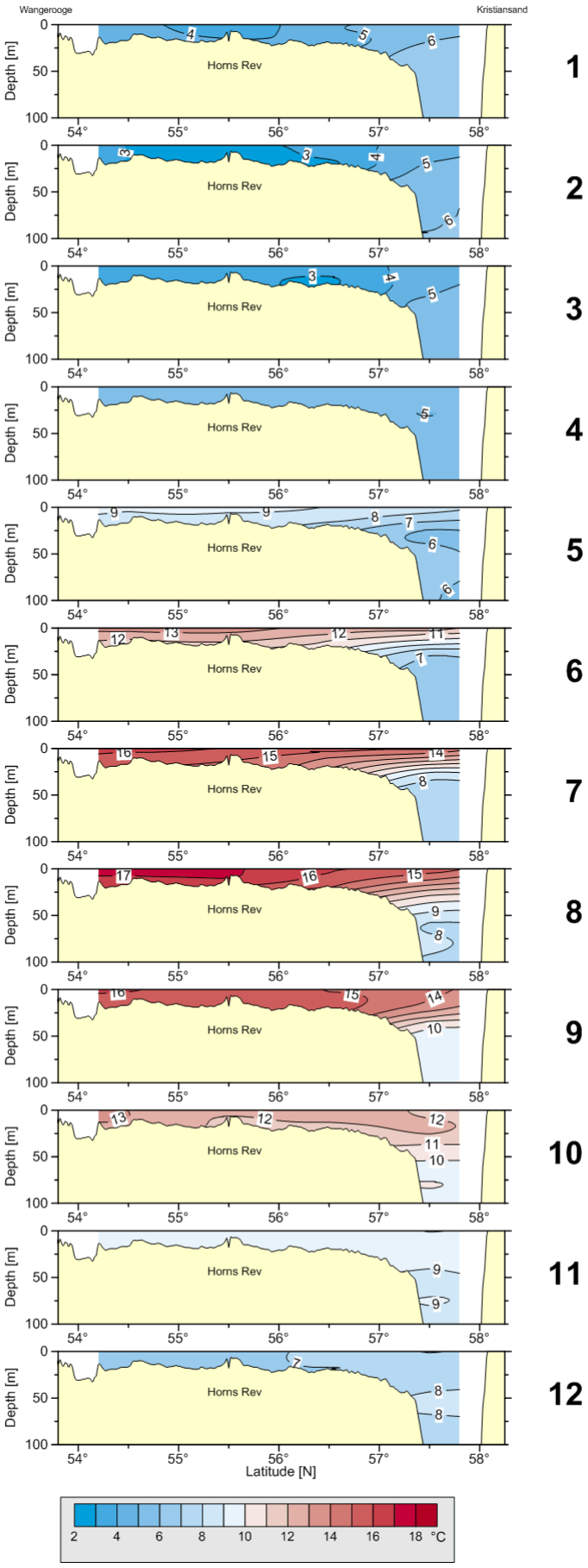
Monthly mean temperature (1902 - 1954) at 7,5°E - January to December (1-12)



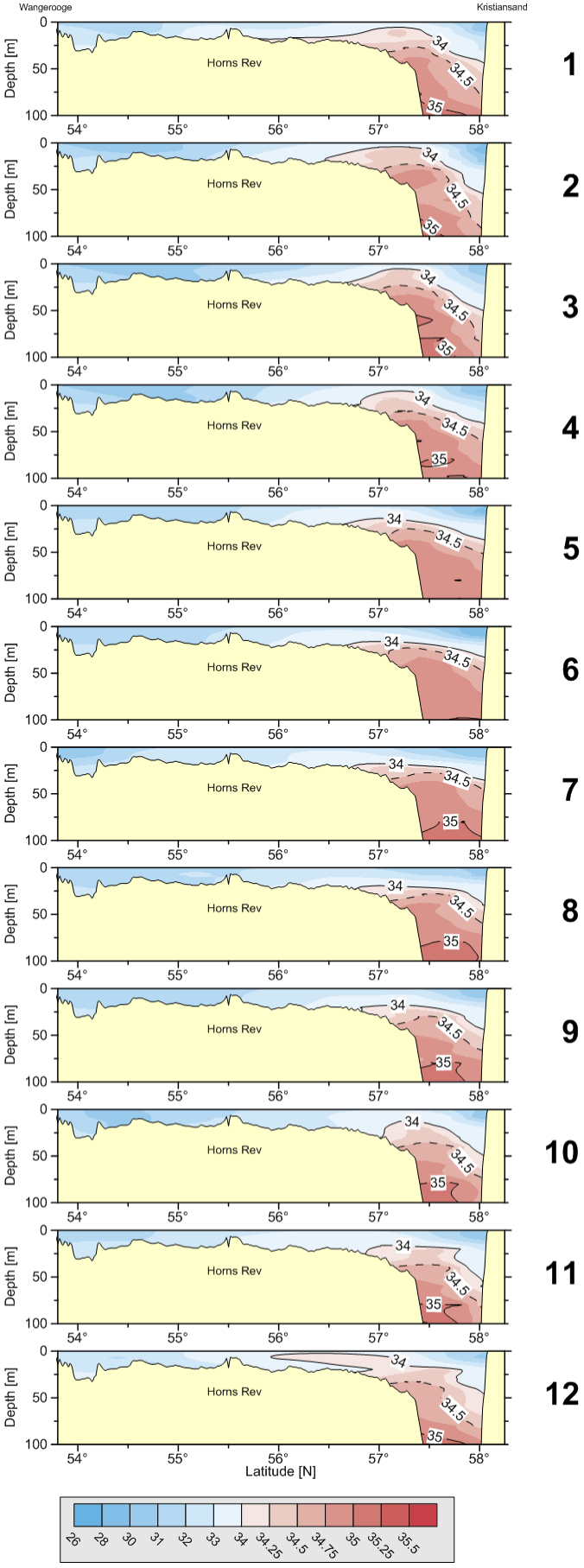
Monthly mean salinity (1902 - 1954) at 7,5°E- January to December (1-12)



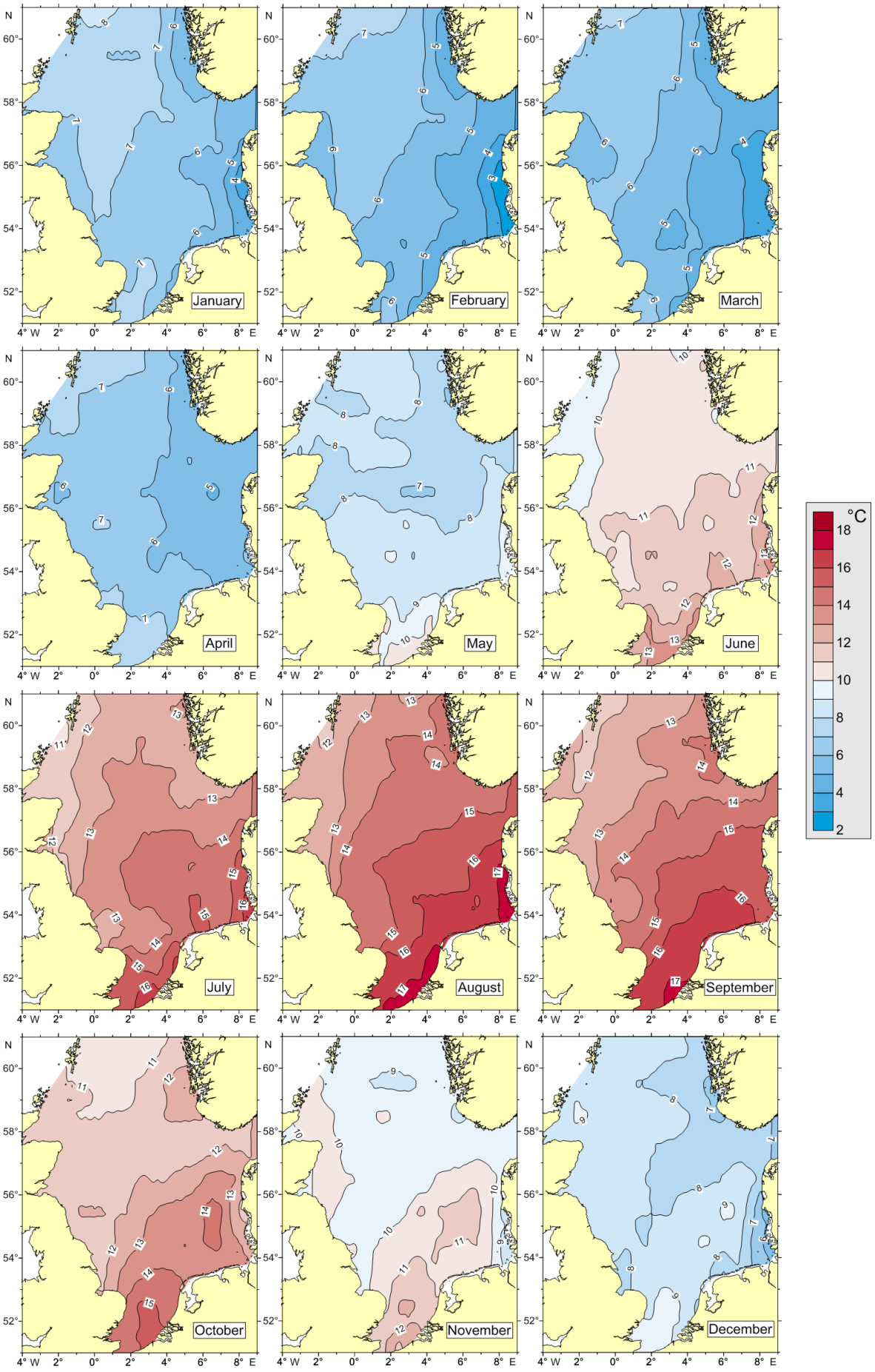
Monthly mean temperature (1902 - 1954) at 8,0°E - January to December (1-12)



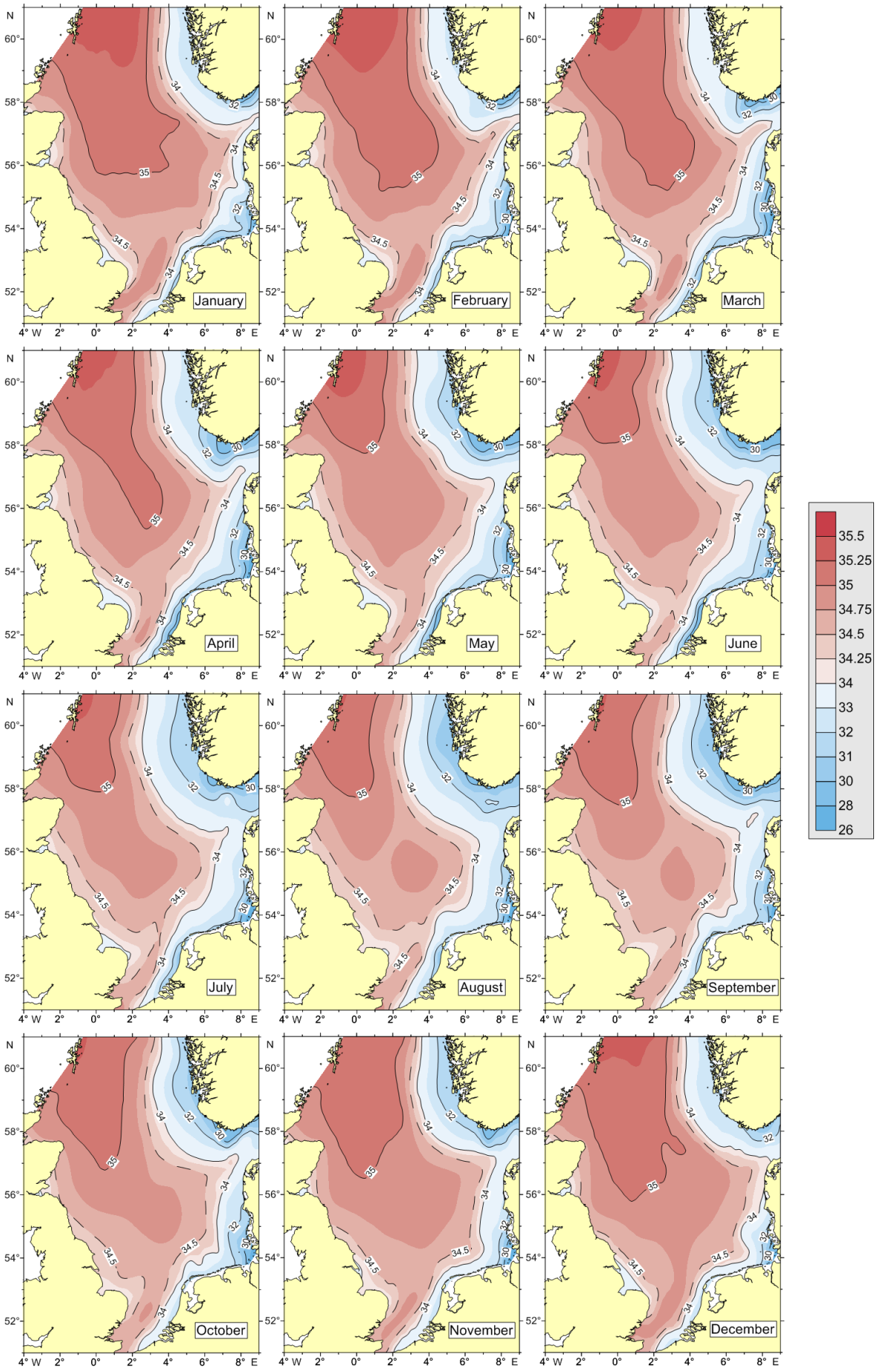
Monthly mean salinity (1902 - 1954) at 8,0°E - January to December (1-12)



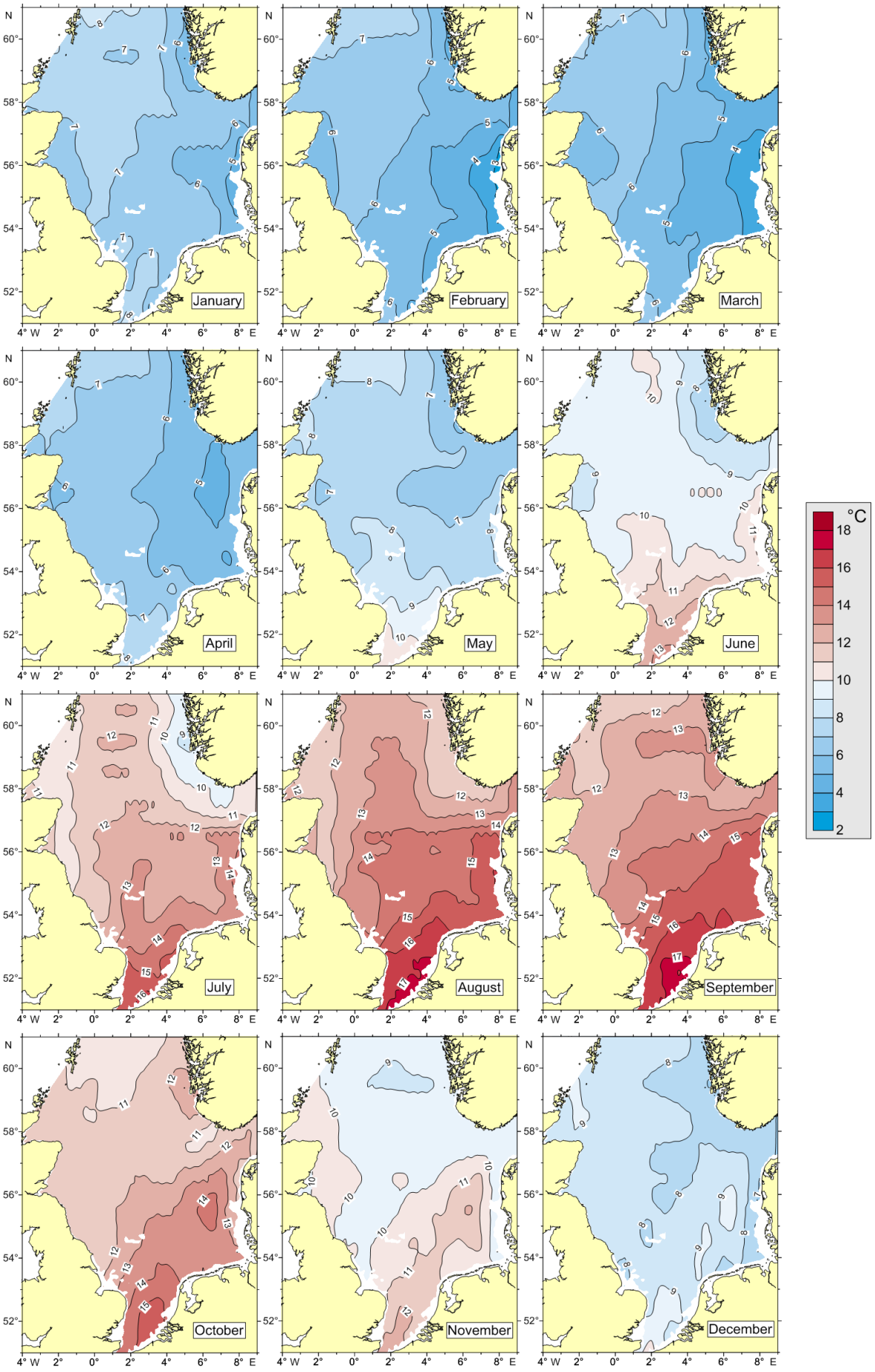
Monthly mean temperature - 7m (1902-1954)



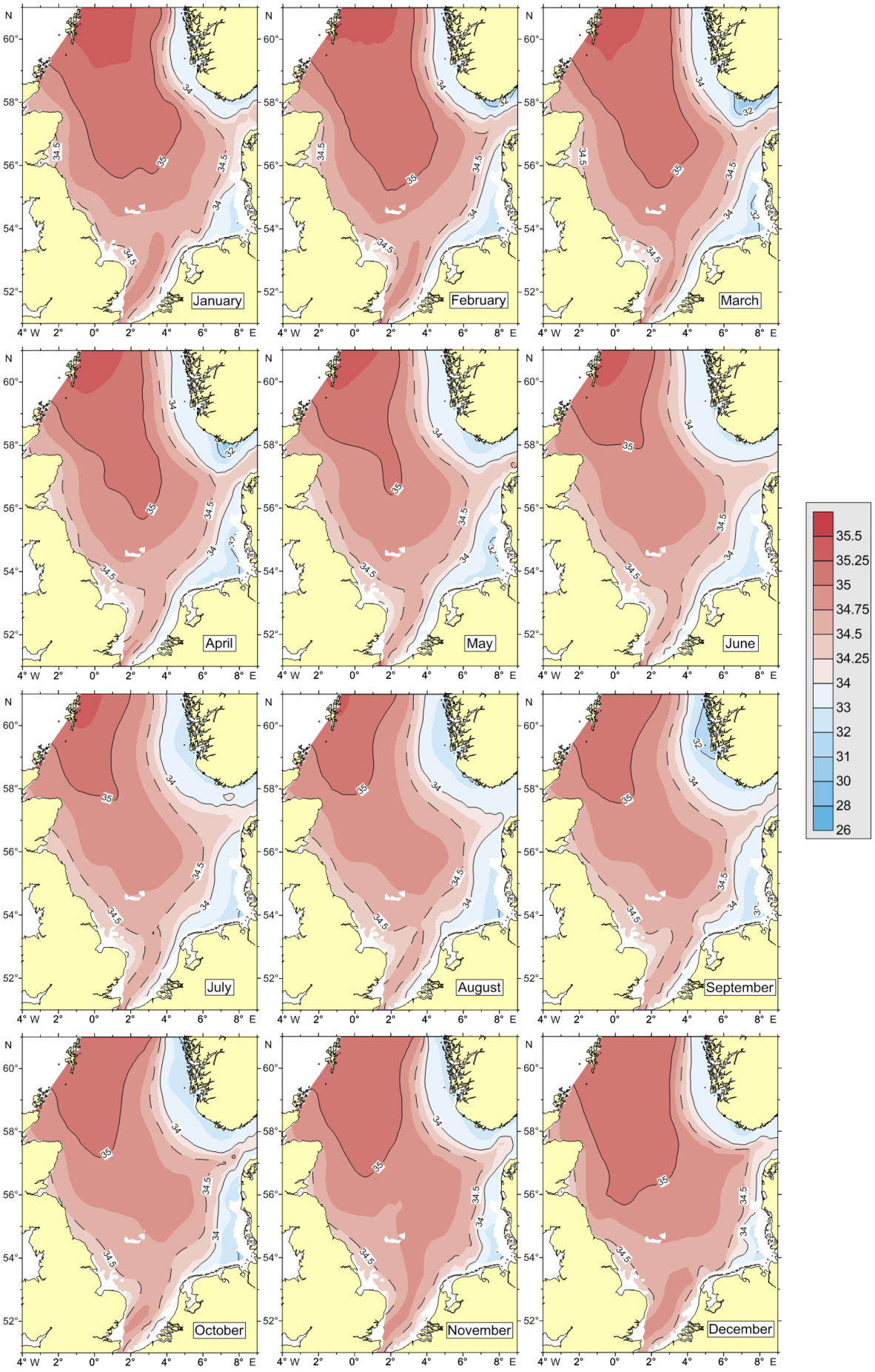
Monthly mean salinity - 7,5m (1902-1954)



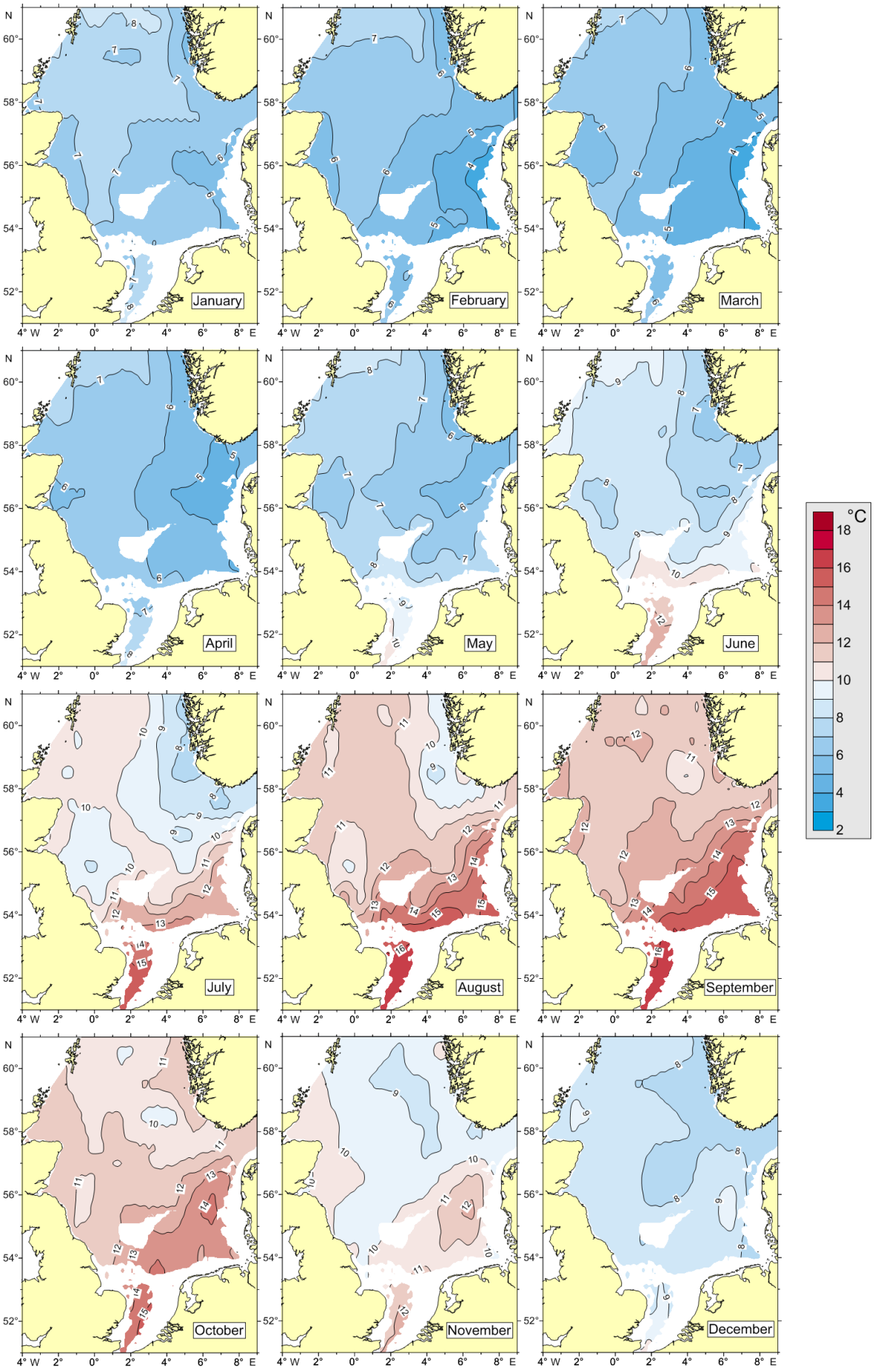
Monthly mean temperature - 20m (1902-1954)



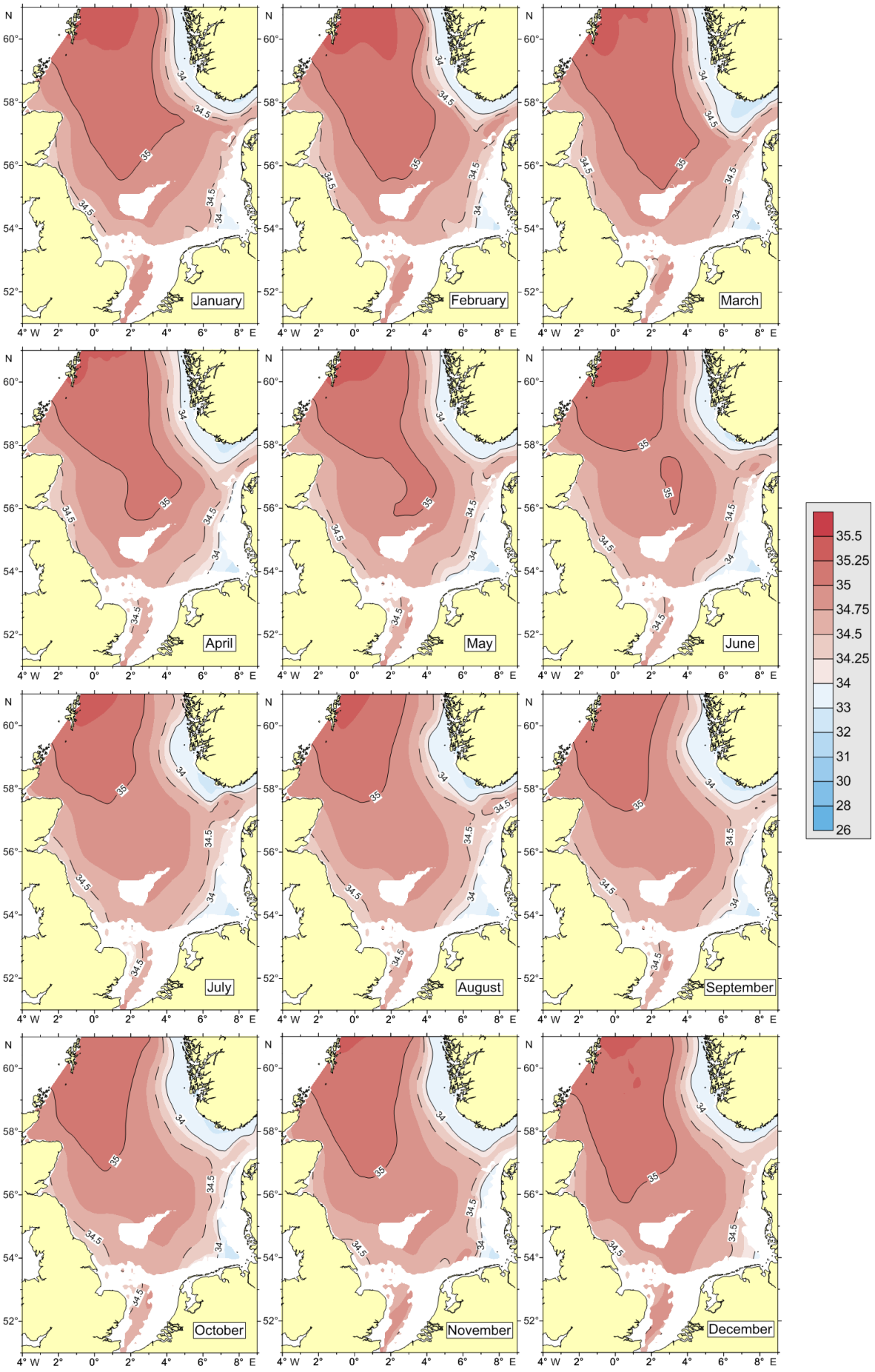
Monthly mean salinity - 20m (1902-1954)



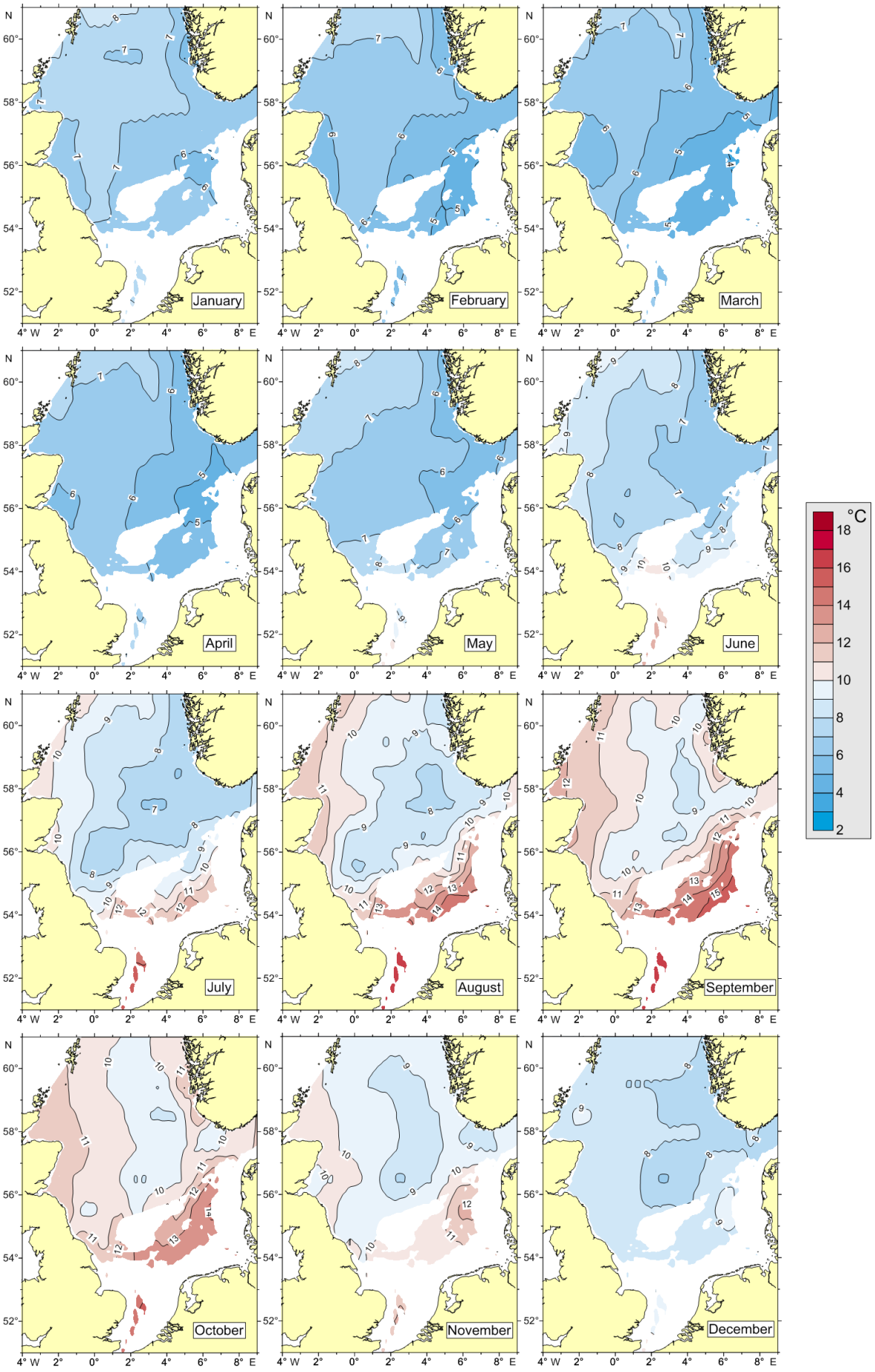
Monthly mean temperature - 30m (1902-1954)



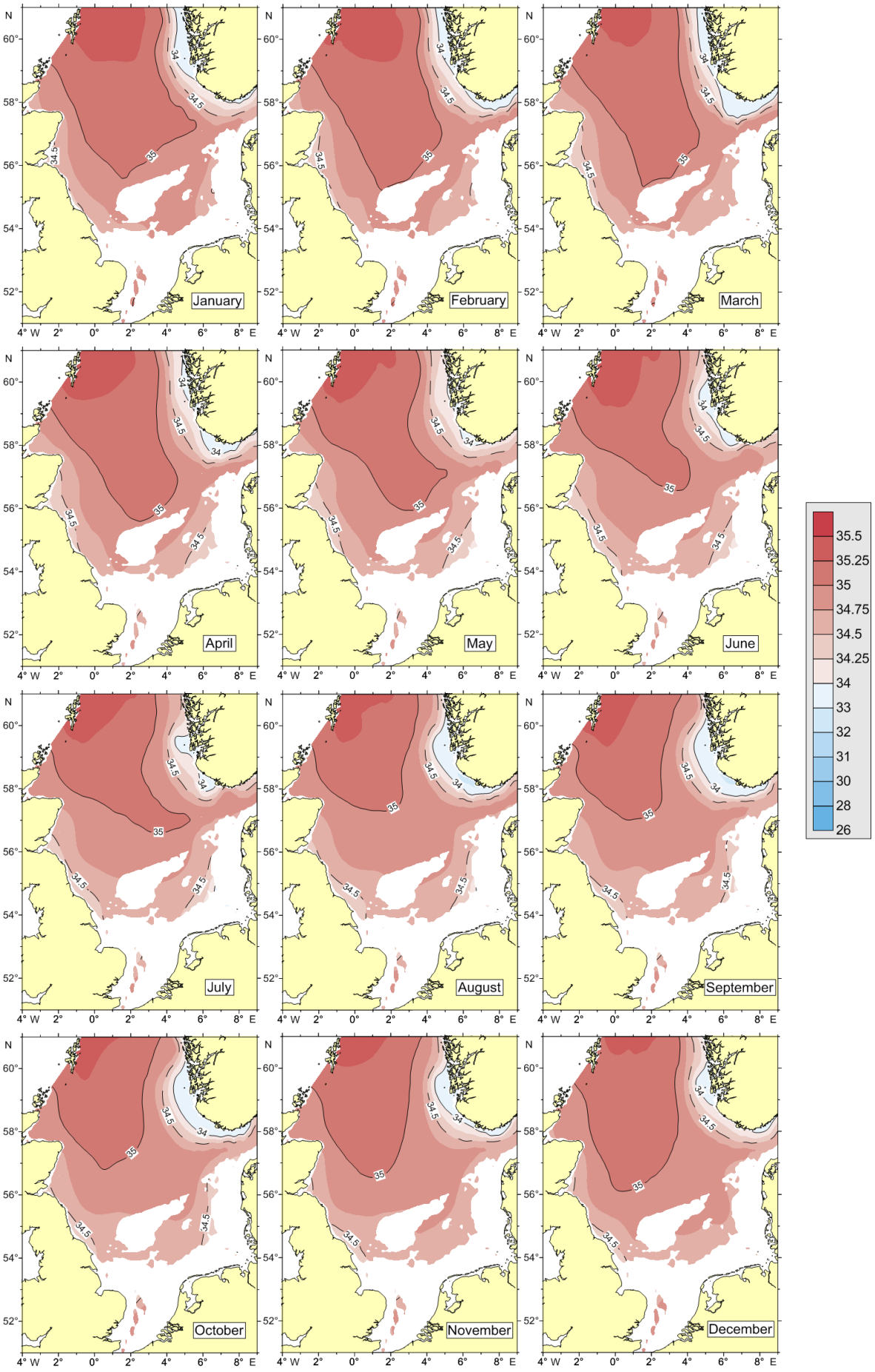
Monthly mean salinity - 30m (1902-1954)



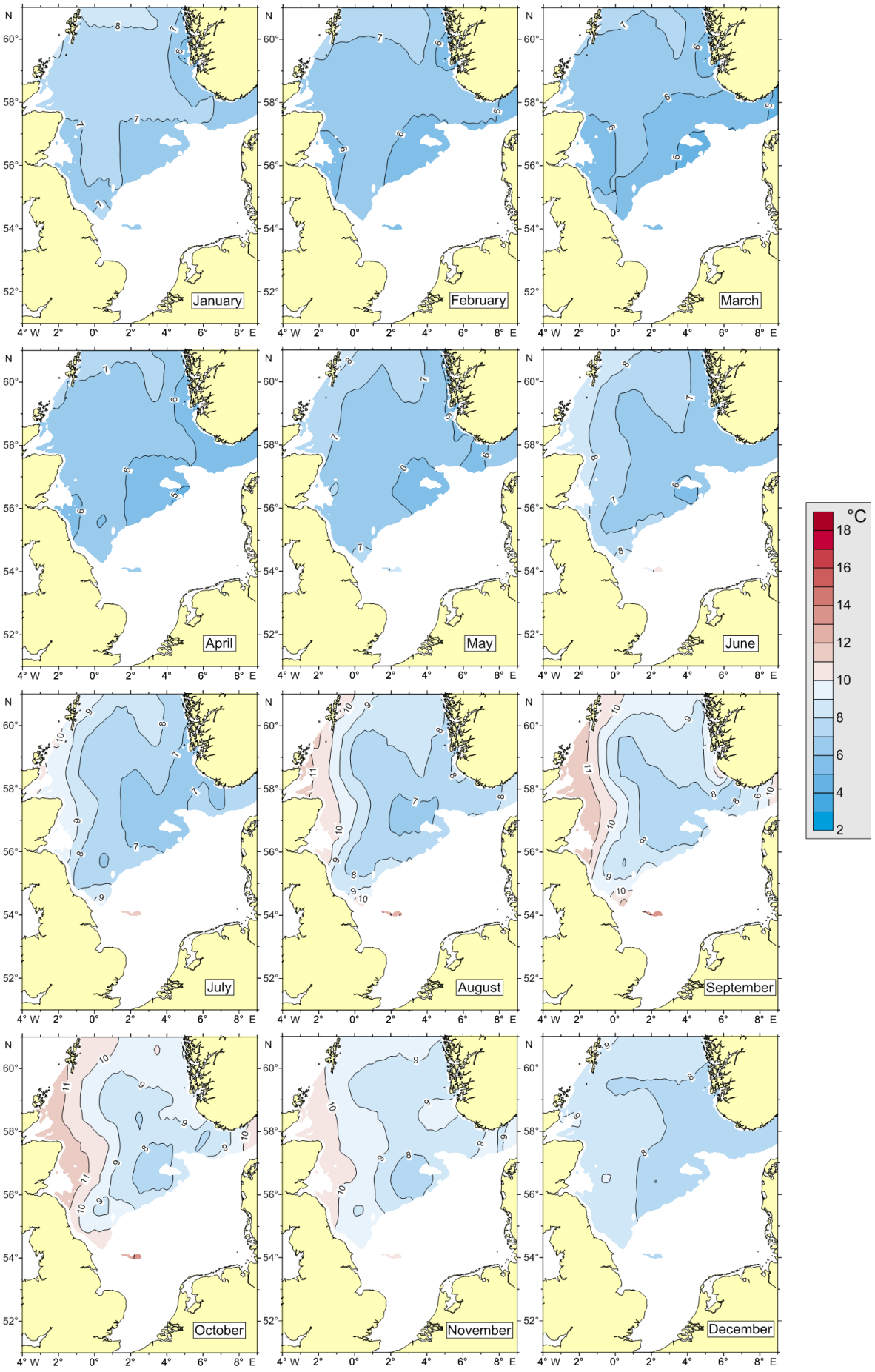
Monthly mean temperature - 40m (1902-1954)



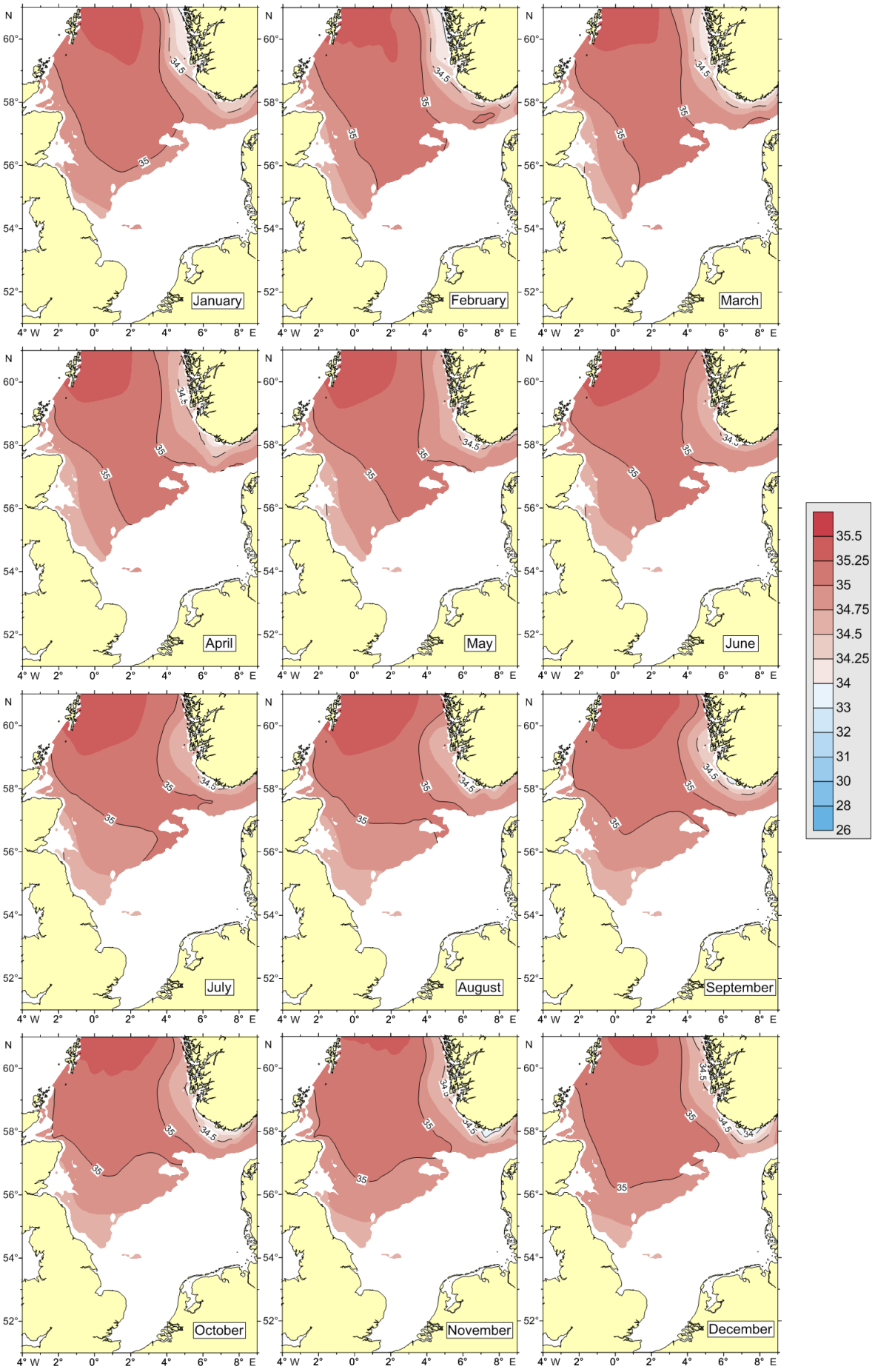
Monthly mean salinity - 40m (1902-1954)



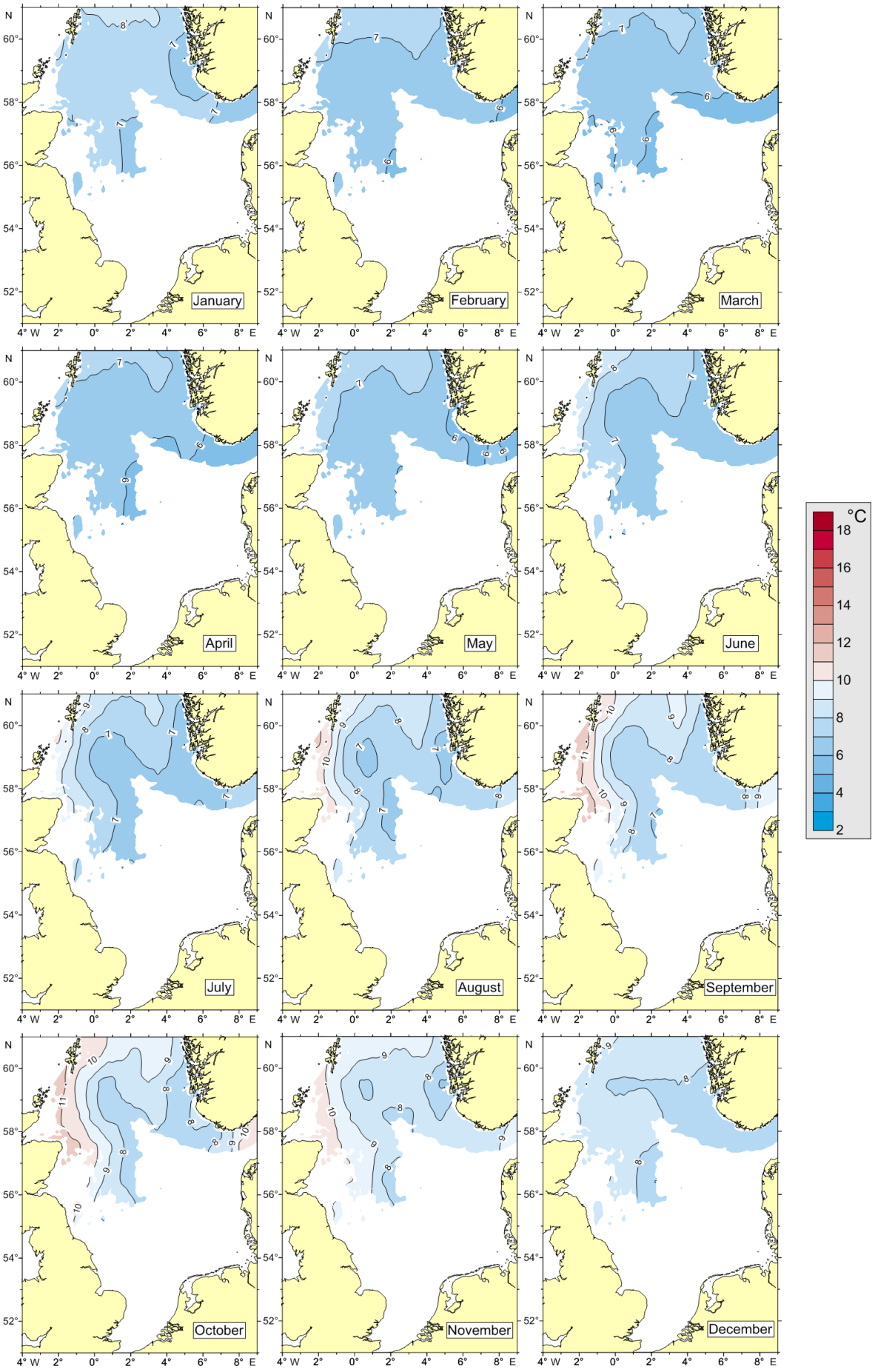
Monthly mean temperature - 60m (1902-1954)



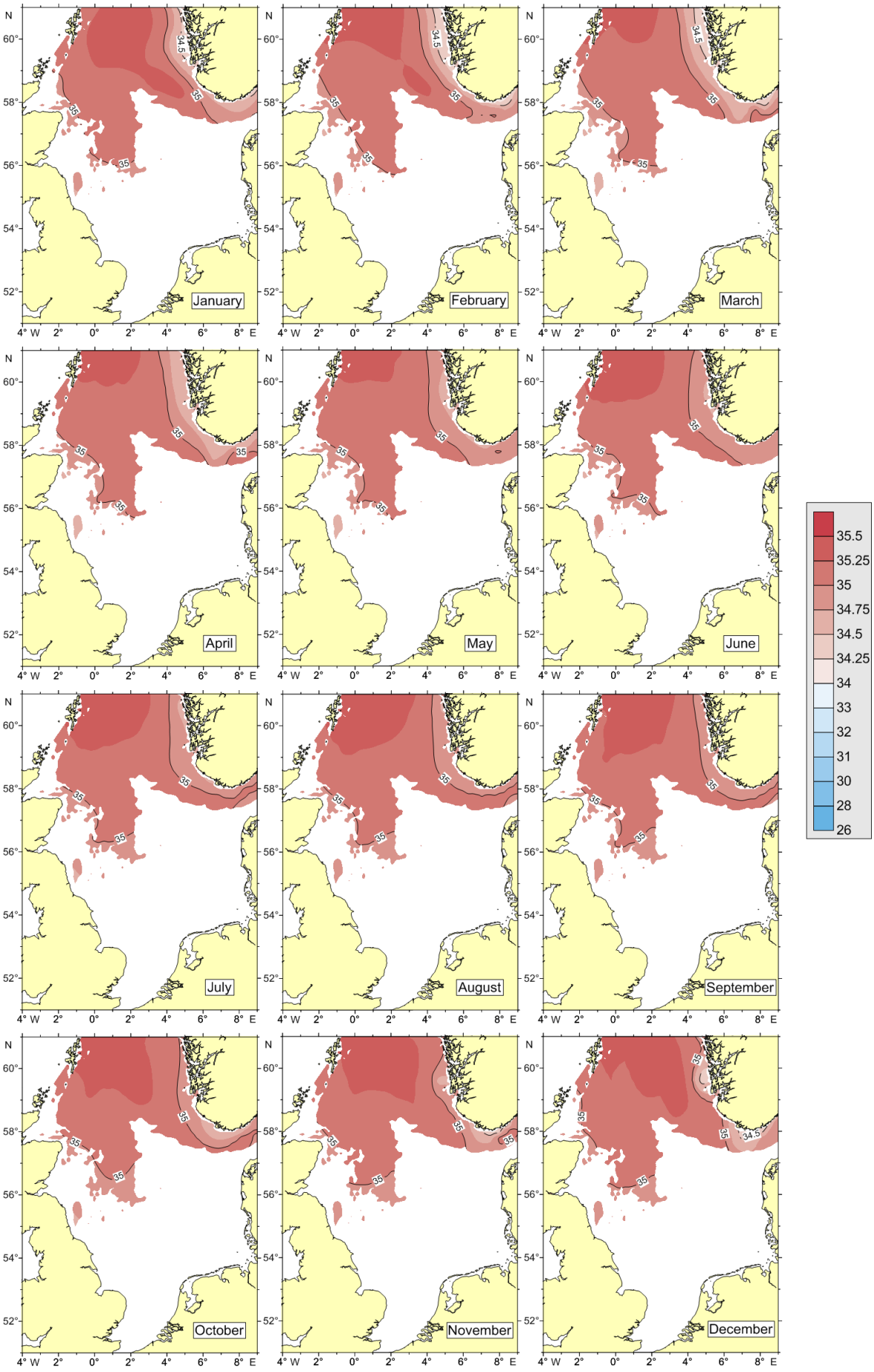
Monthly mean salinity - 60m (1902-1954)



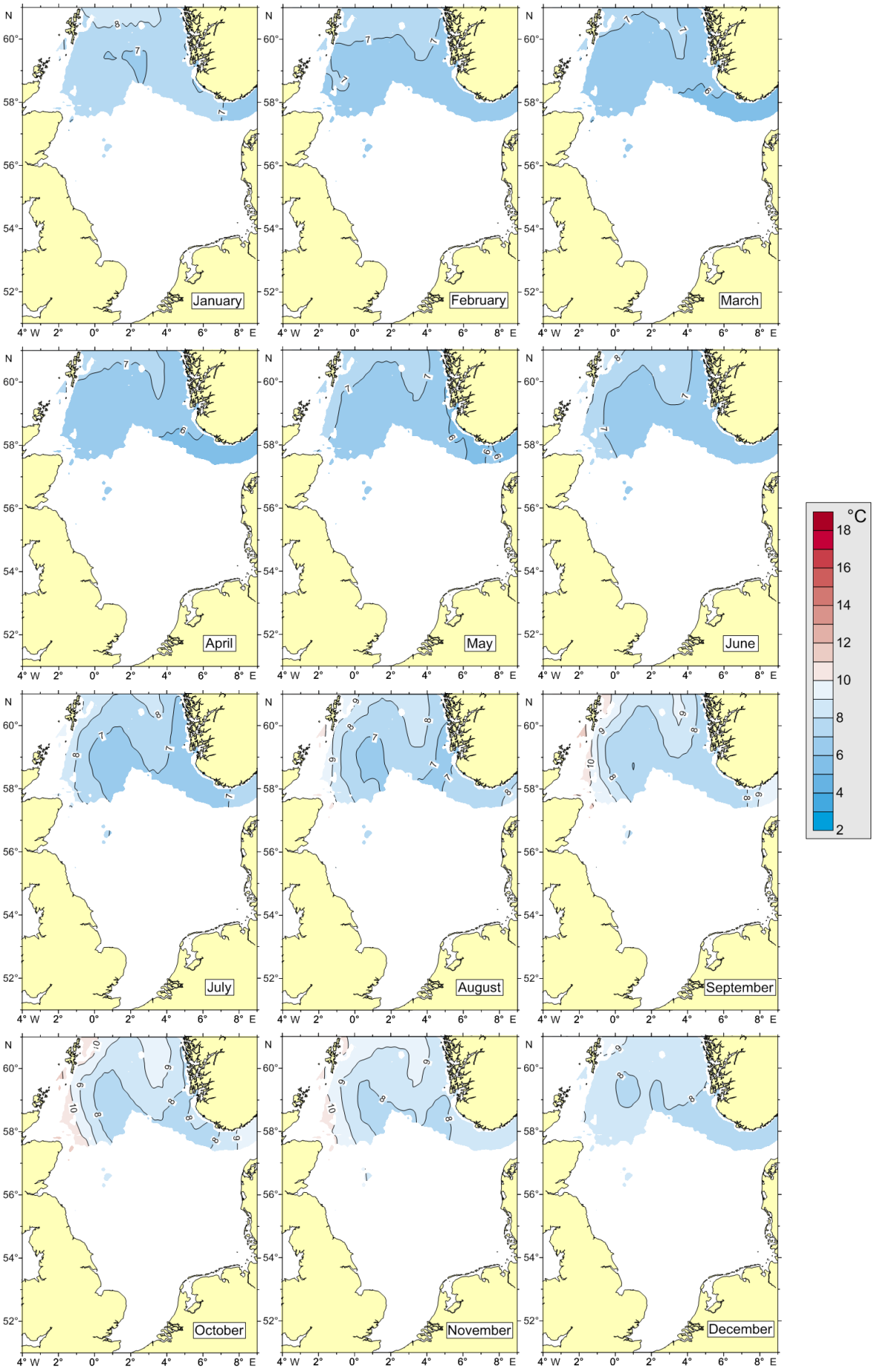
Monthly mean temperature - 80m (1902-1954)



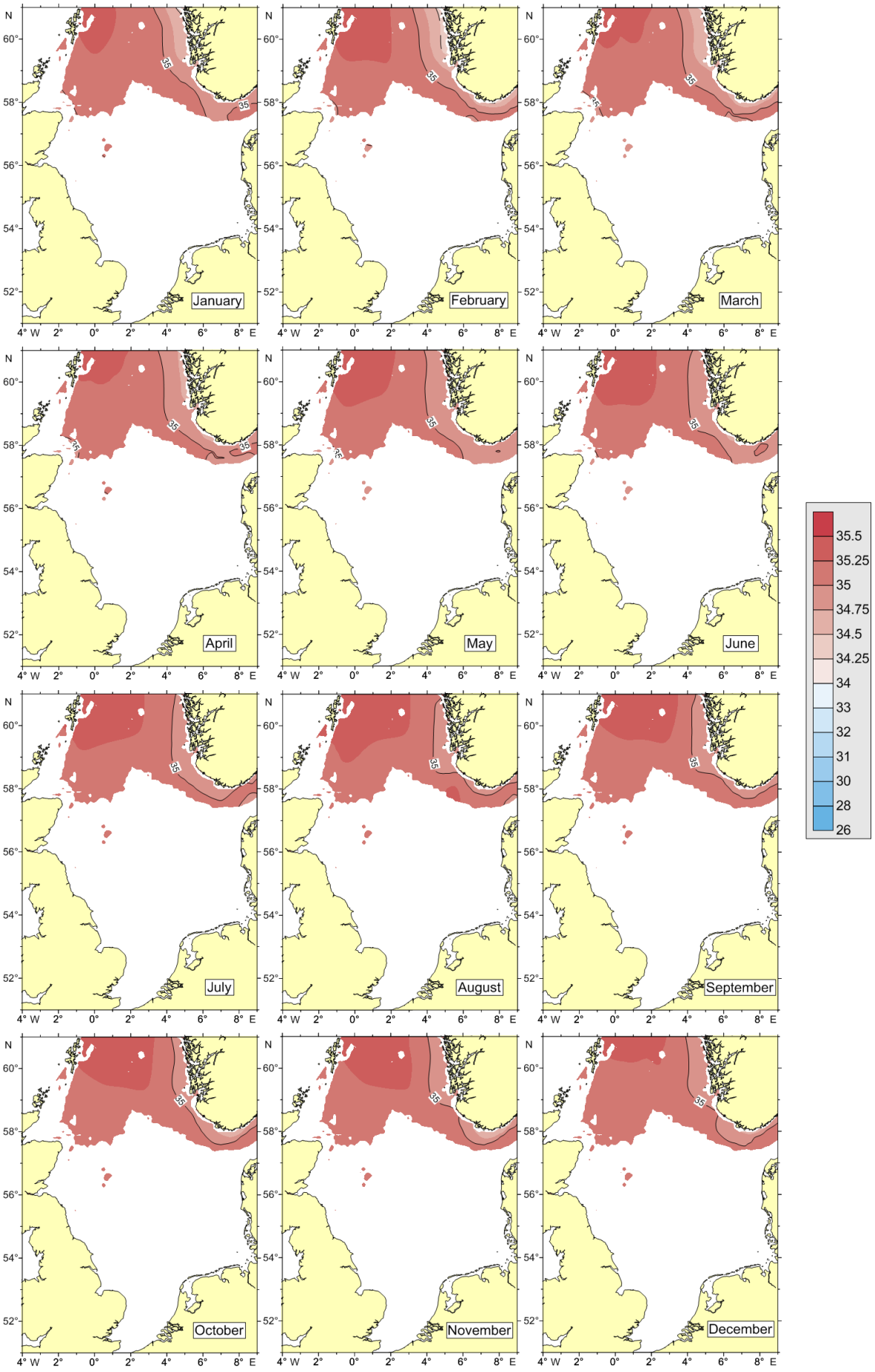
Monthly mean salinity - 80m (1902-1954)



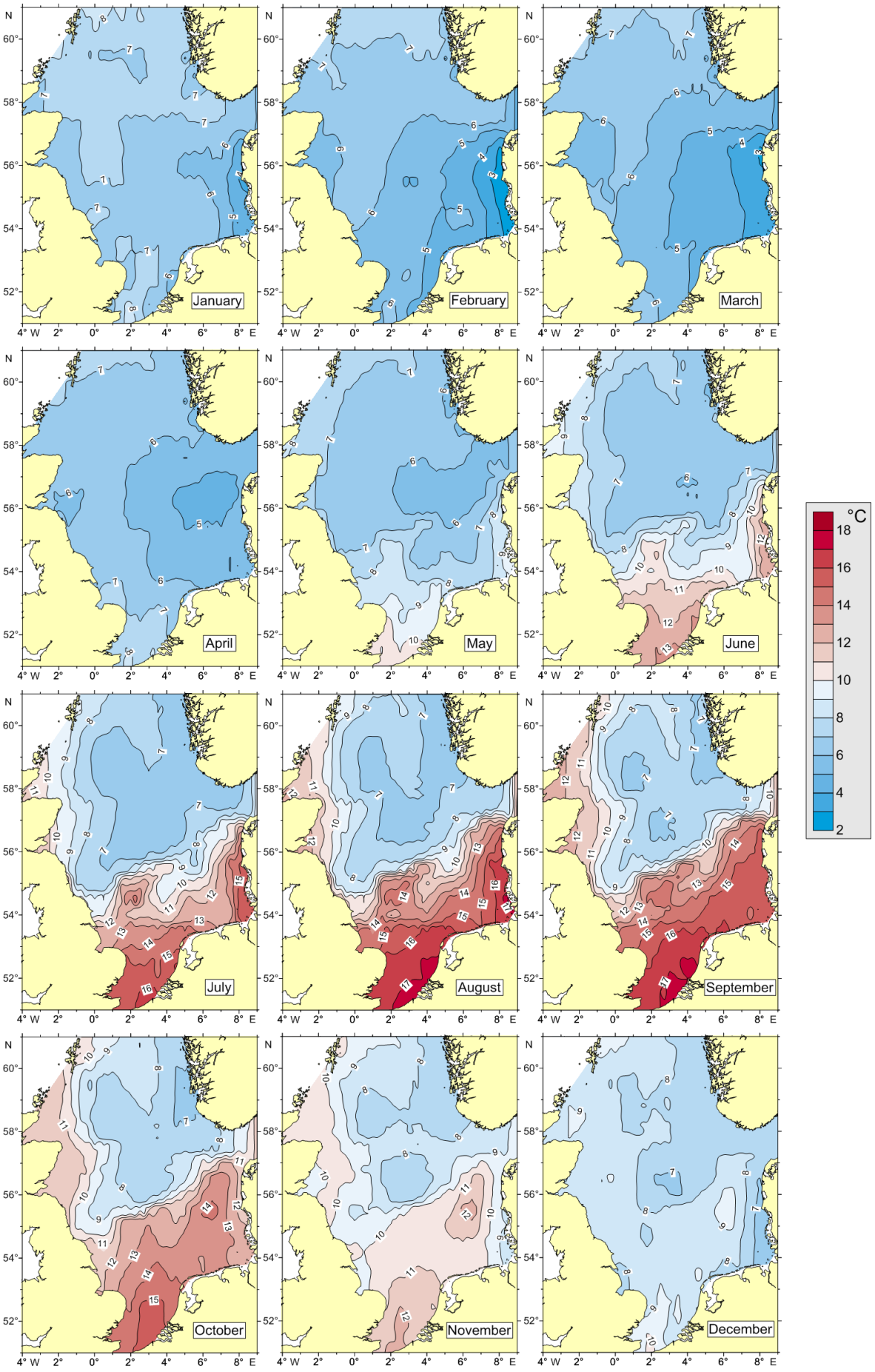
Monthly mean temperature - 100m (1902-1954)



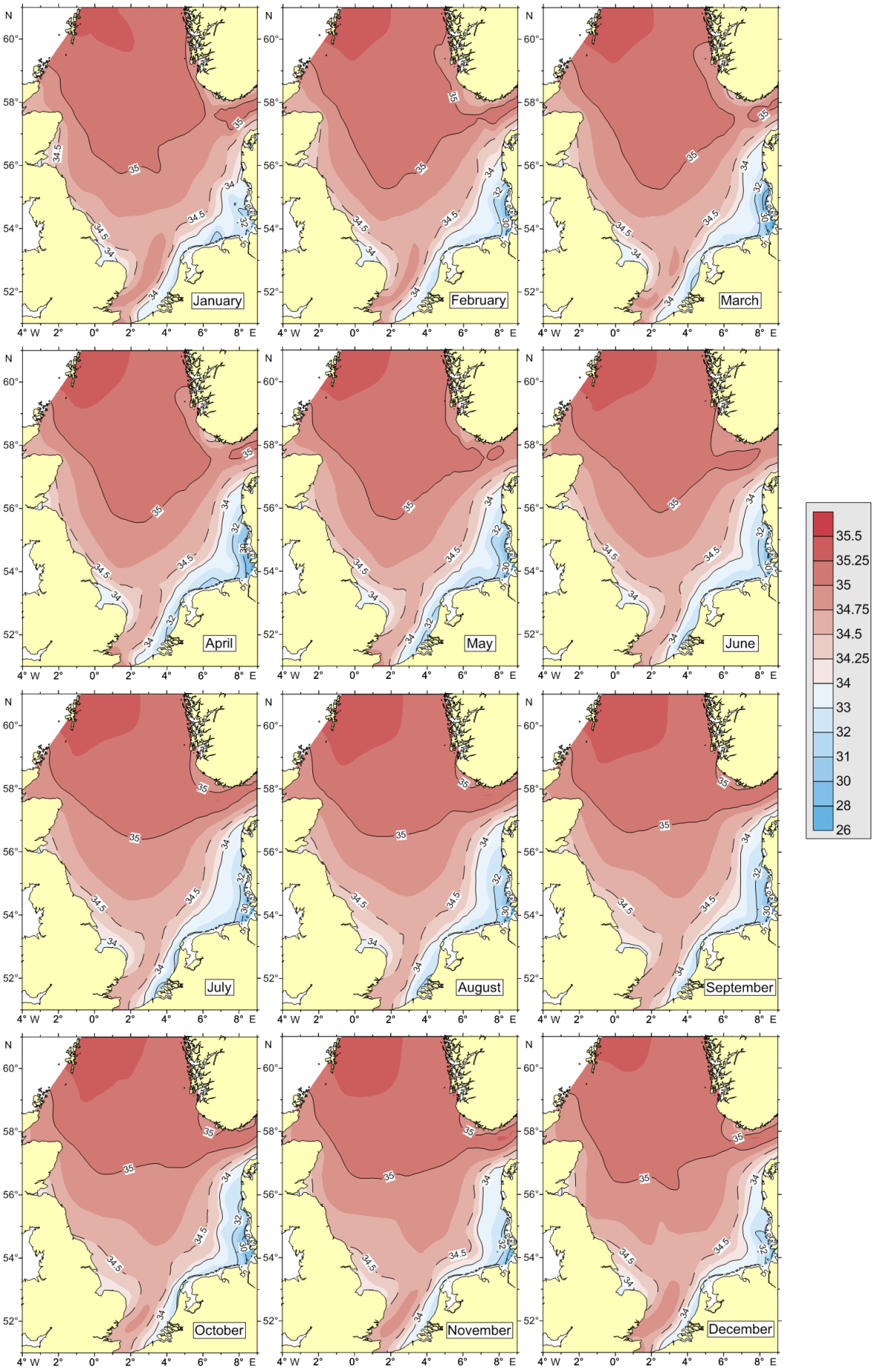
Monthly mean salinity - 100m (1902-1954)



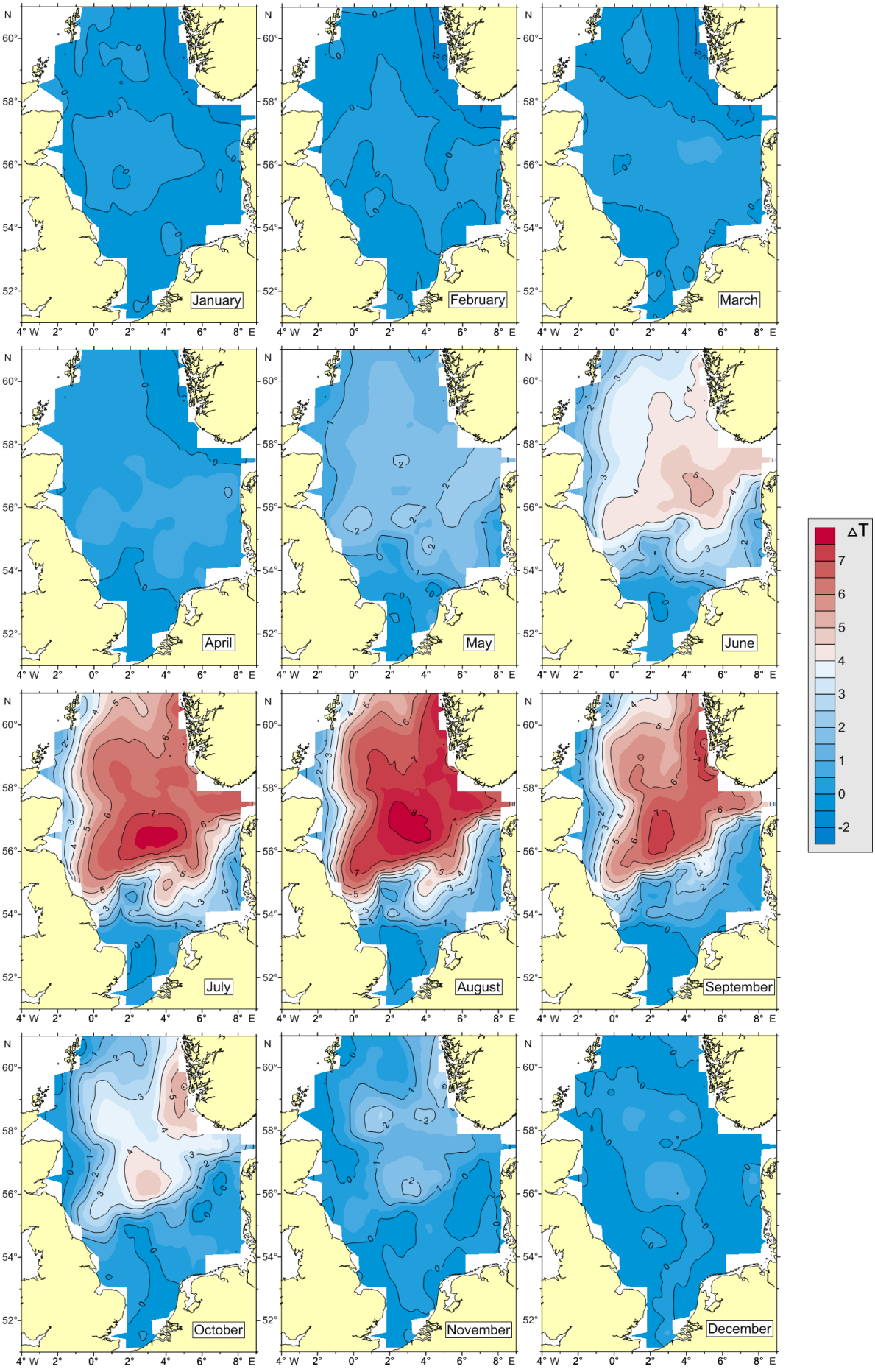
Monthly mean temperature - bottom (1902-1954)



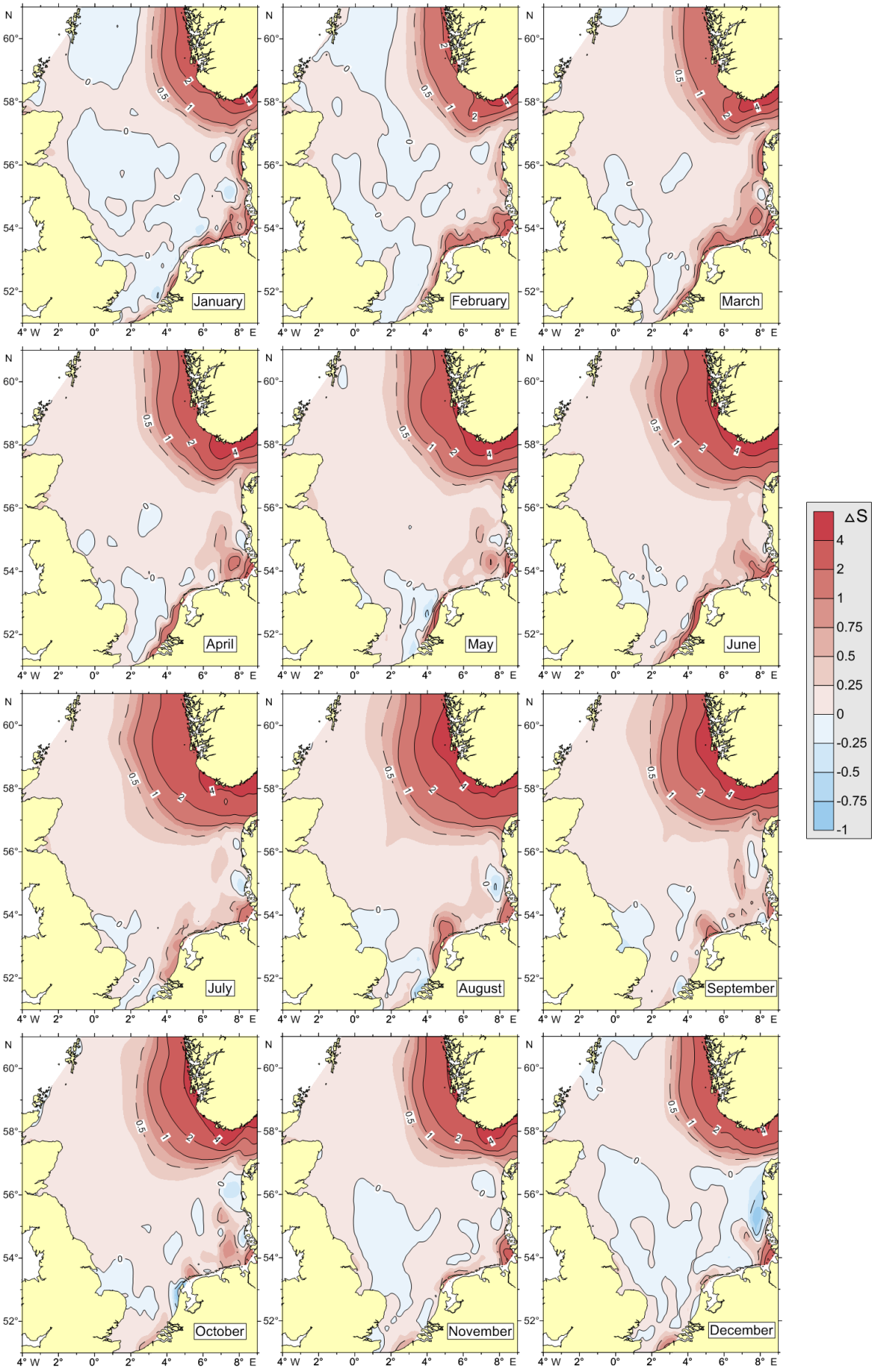
Monthly mean salinity - bottom (1902-1954)



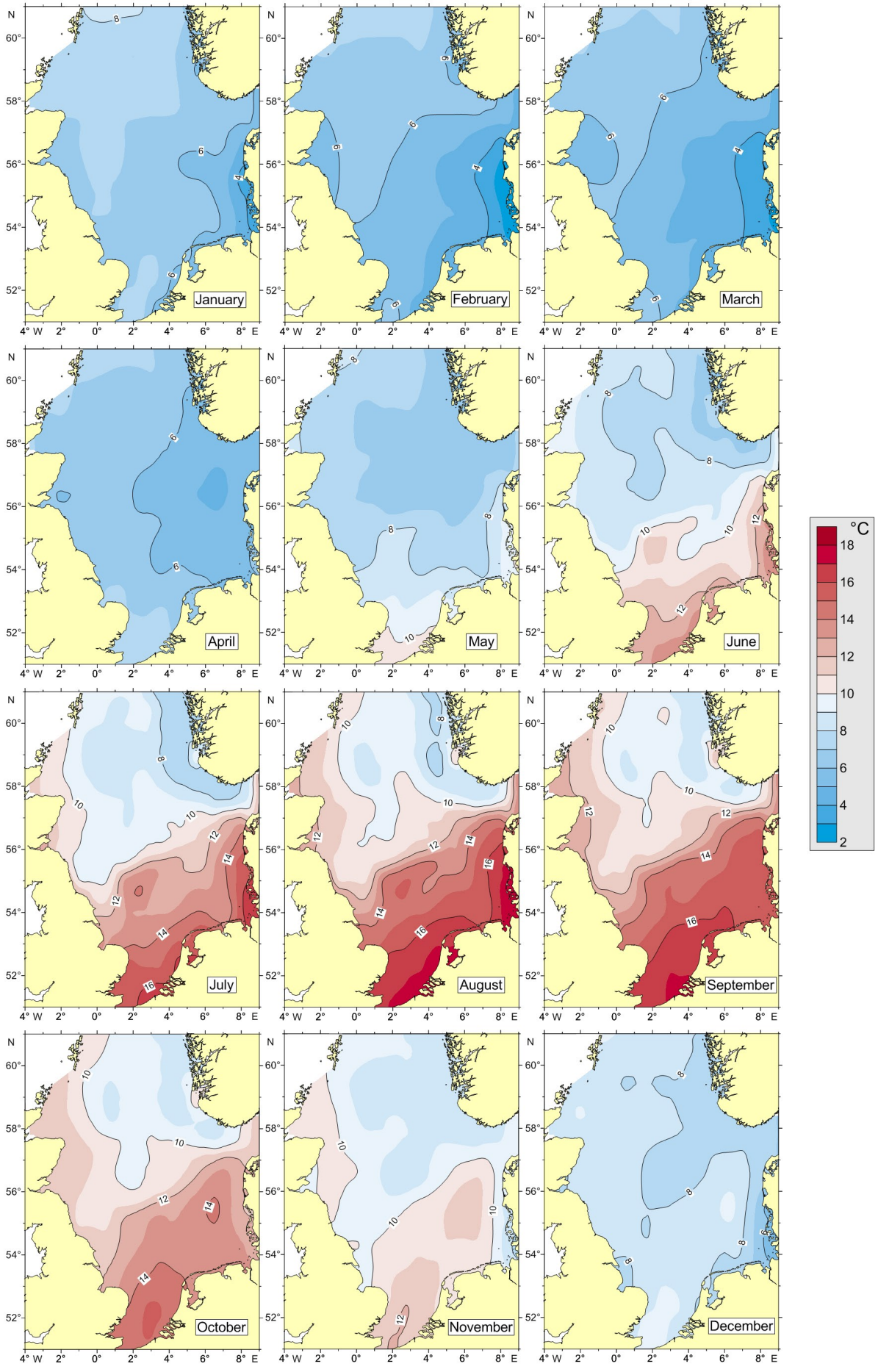
Temperature difference surface to bottom (1902-1954)



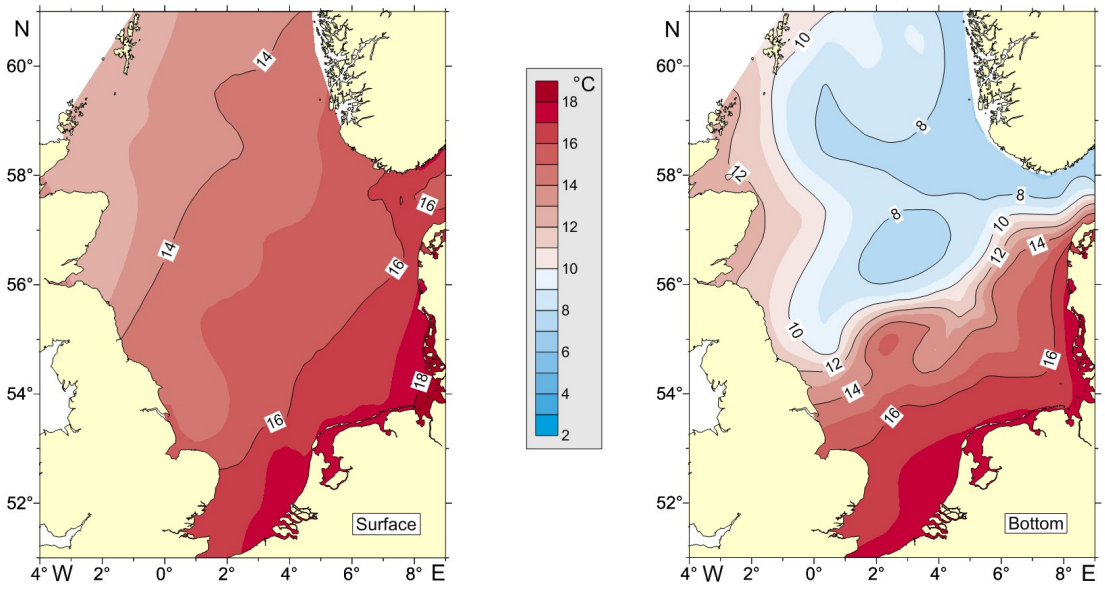
Monthly mean salinity difference bottom to surface (1902-1954)



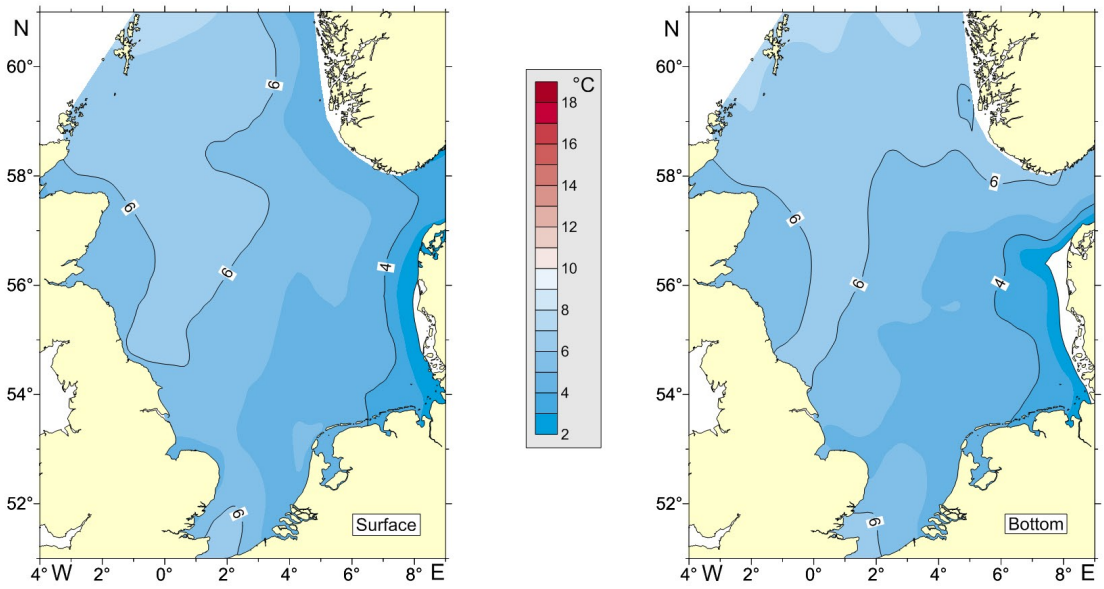
Monthly vertical mean temperature (1902-1954)



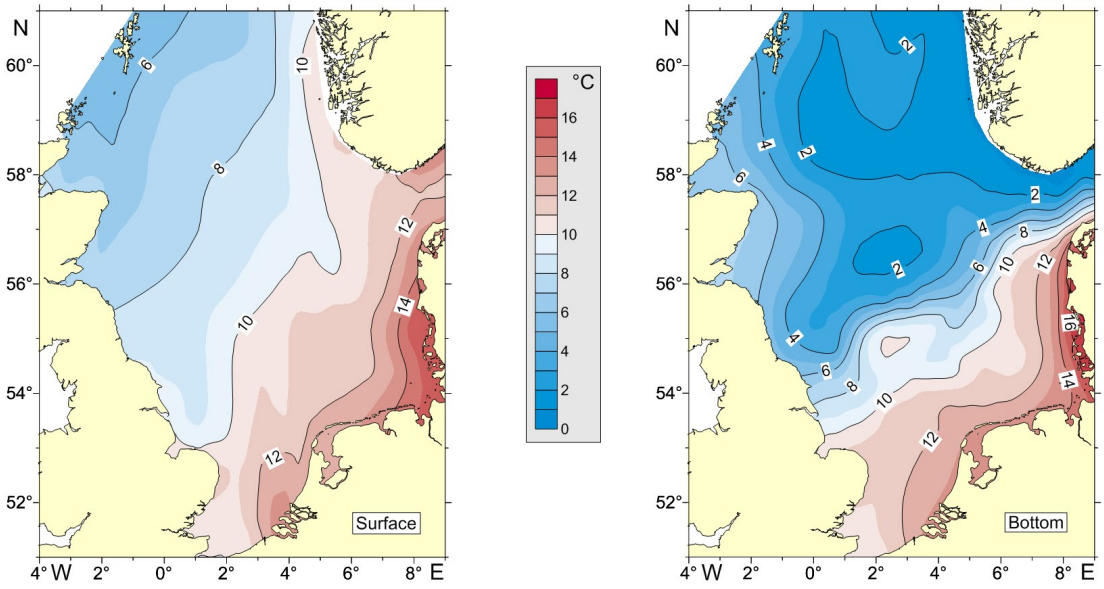
Maximum of monthly mean temperature (1902-1954)



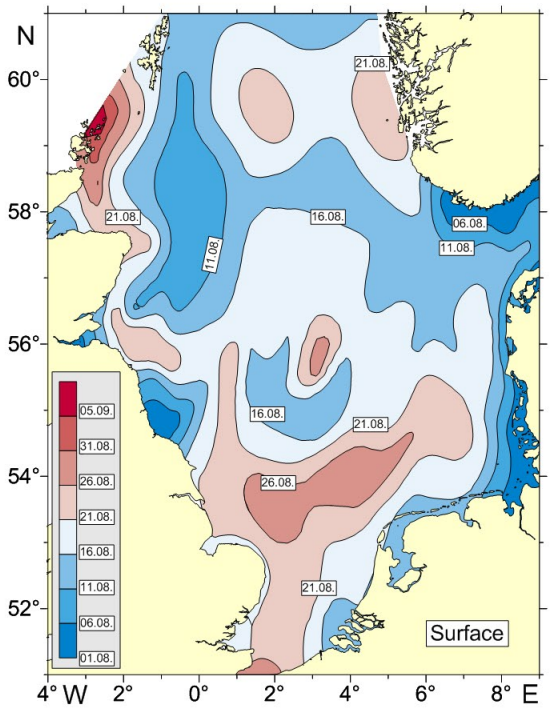
Minimum of monthly mean temperature (1902-1954)

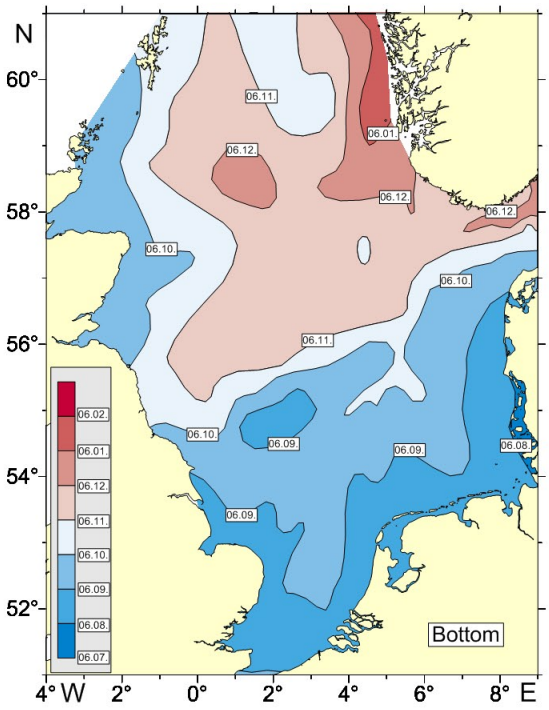


Amplitude distribution of the mean anual wave of monthly mean temperature (1902-1954)

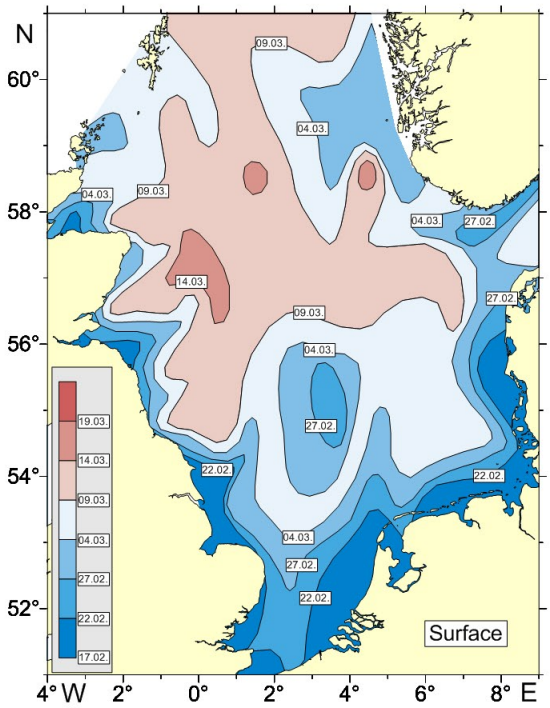


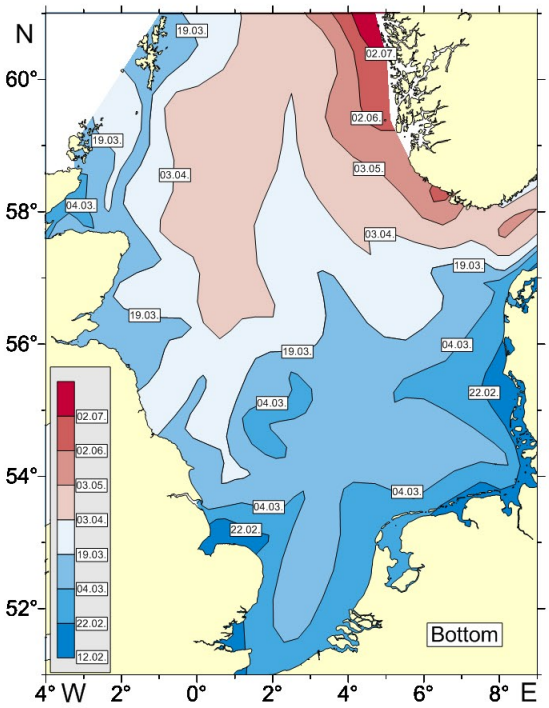
Date of maximum of monthly mean temperature (1902-1954)



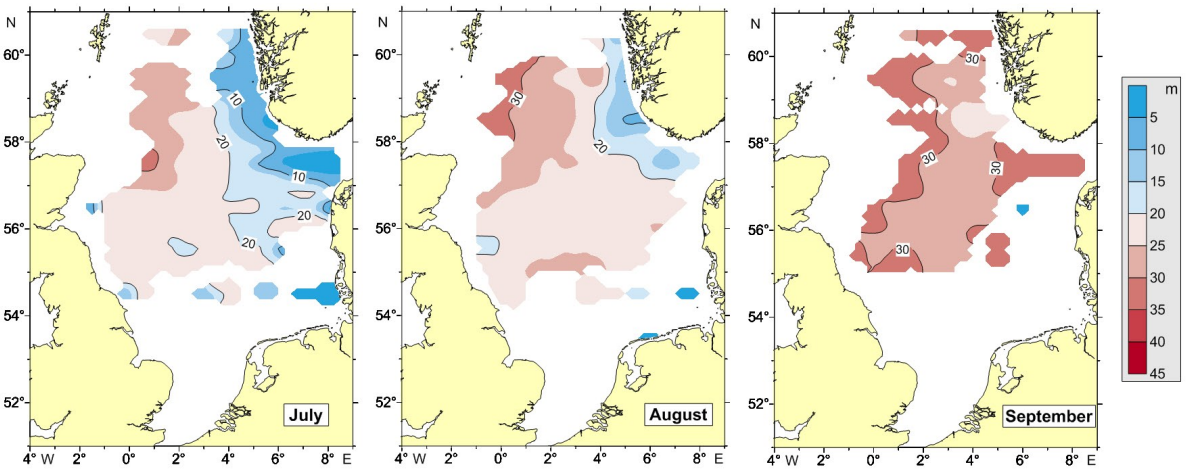


Date of minimum of monthly mean temperature (1902-1954)

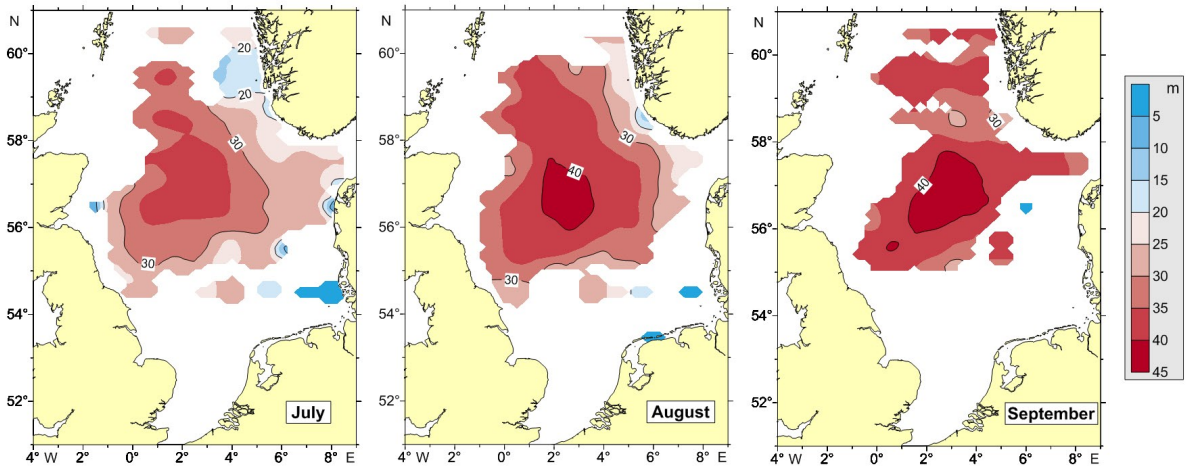




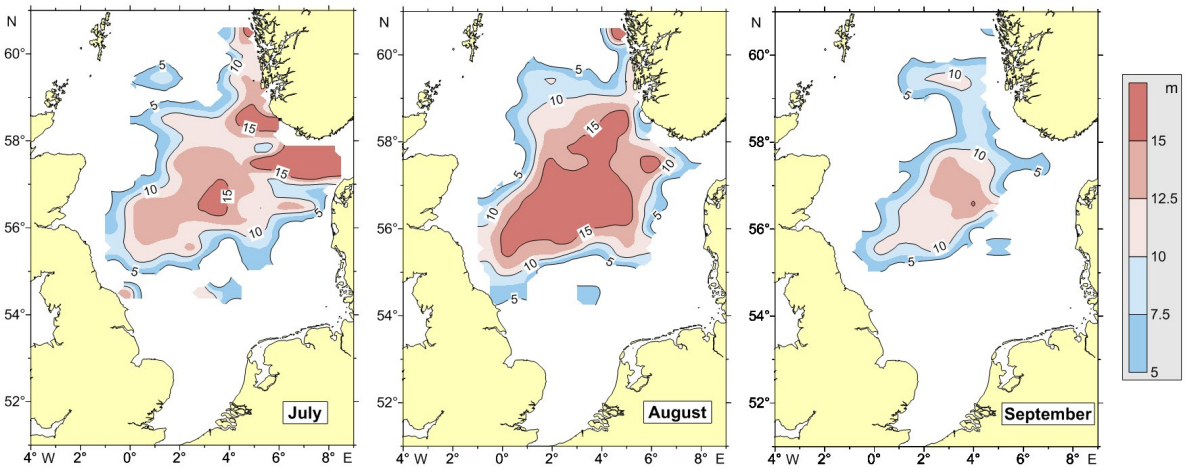
Mean depth of upper level of the thermocline in summer (1902-1954)



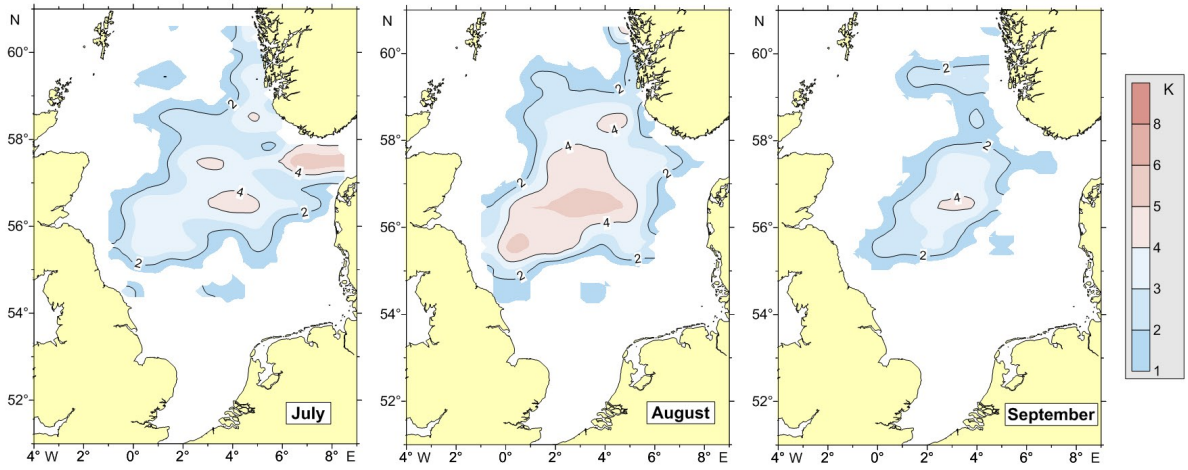
Mean depth of lower level of the thermocline in summer (1902-1954)



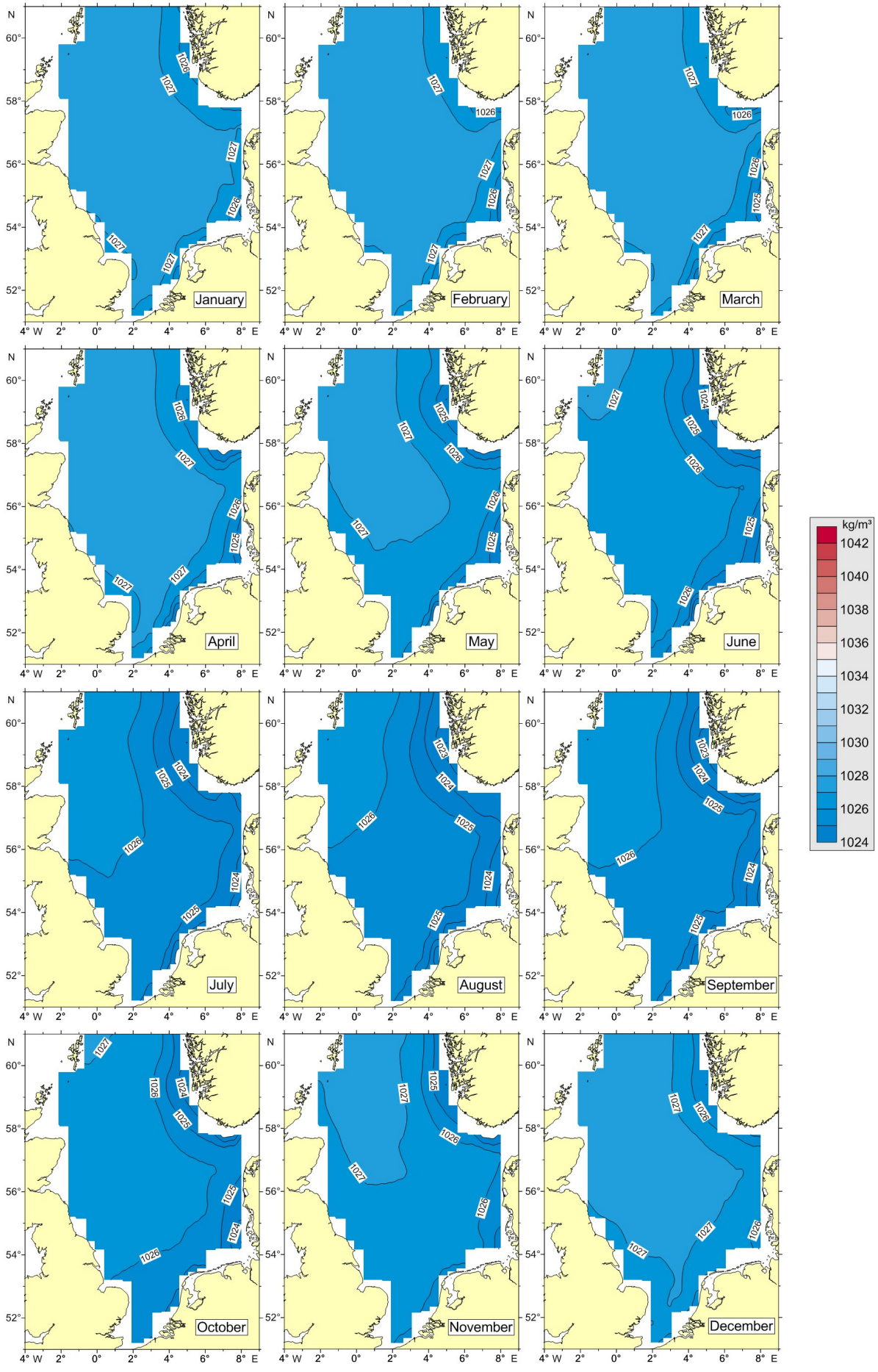
Mean strength (lower minus upper level) of the thermocline in summer (1902-1954)



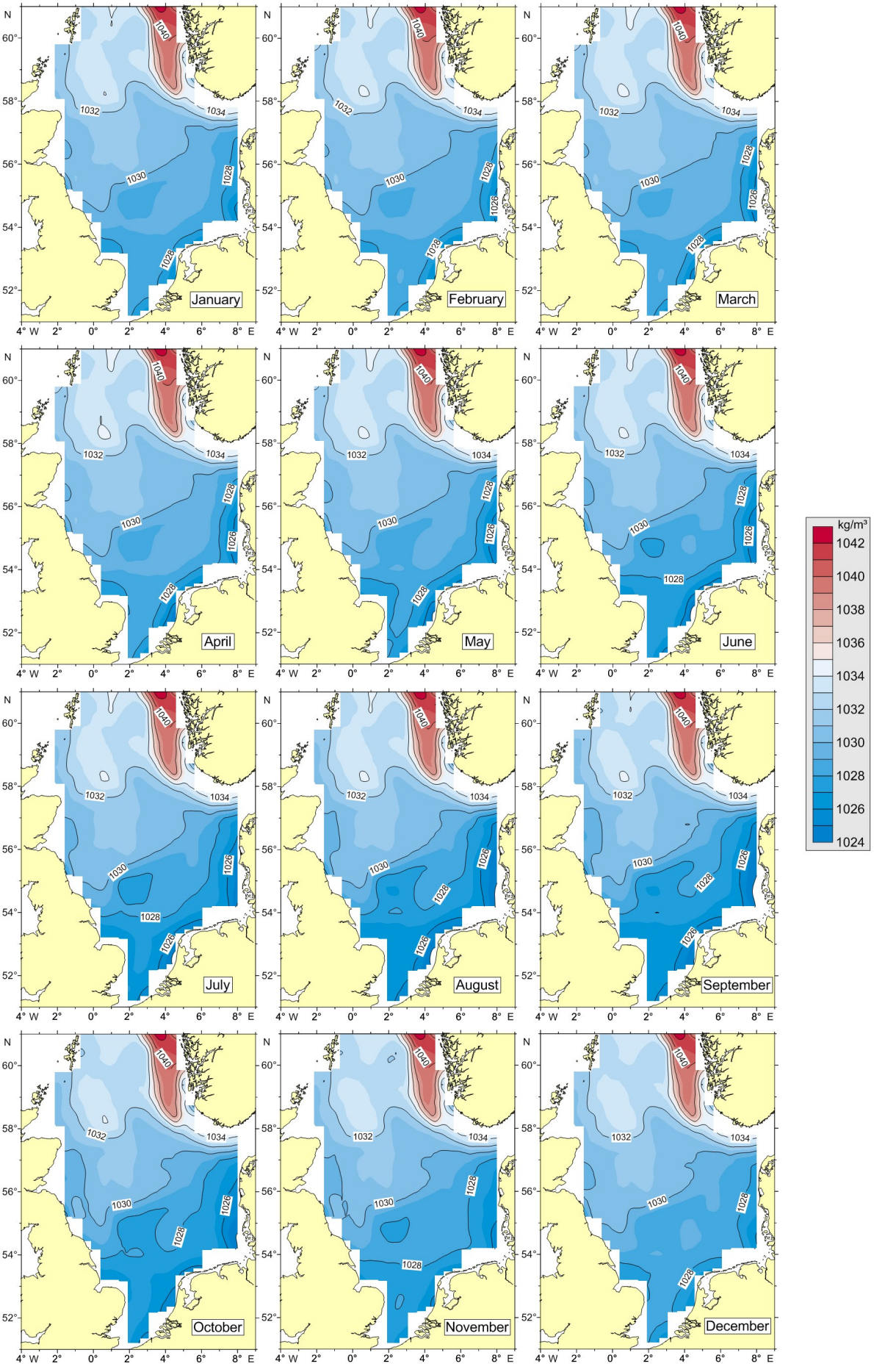
Mean intensity (upper minus lower level) of the thermocline in summer (1902-1954)



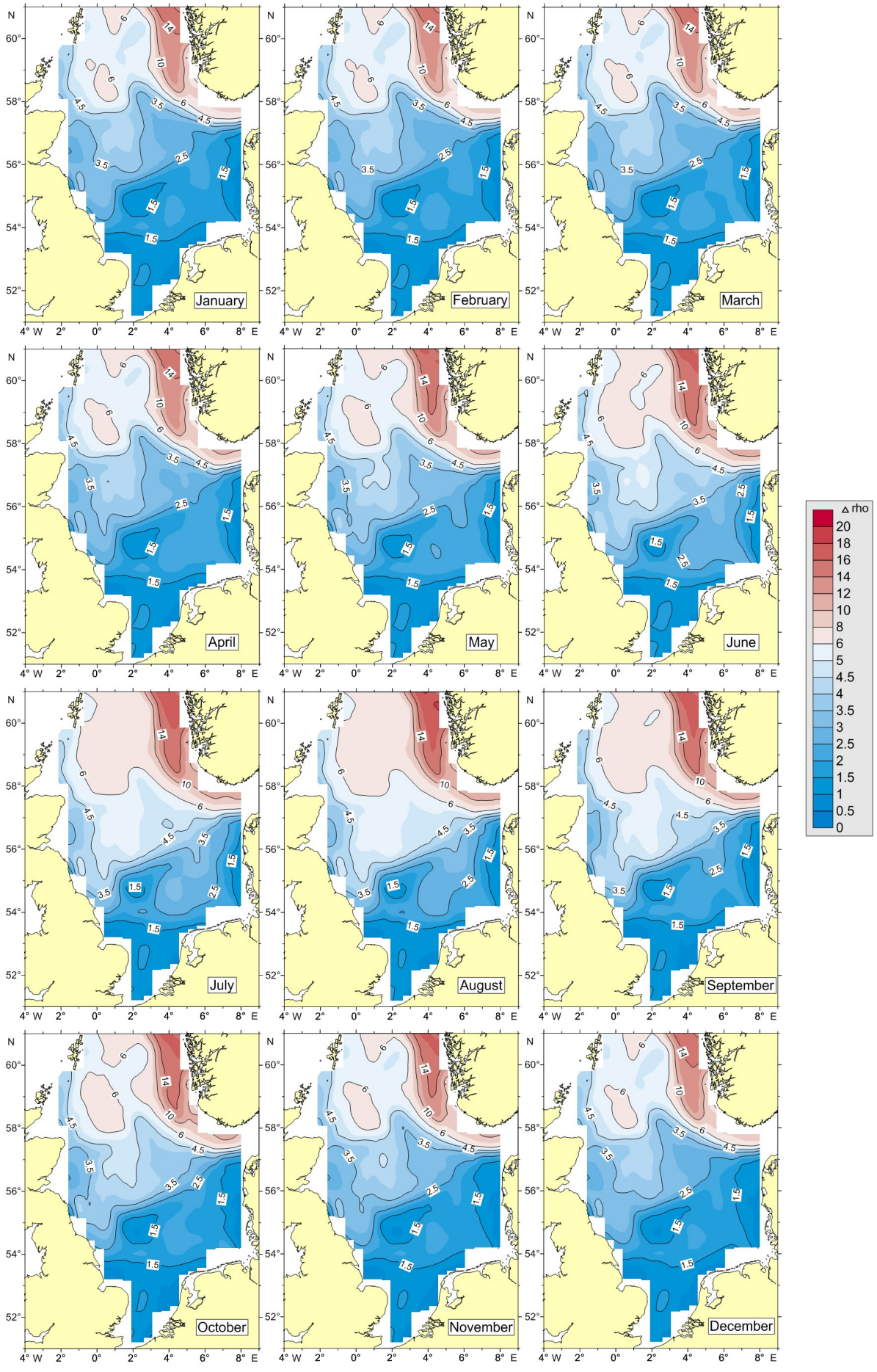
Monthly mean surface density (1902-1954)



Monthly mean bottom density (1902-1954)

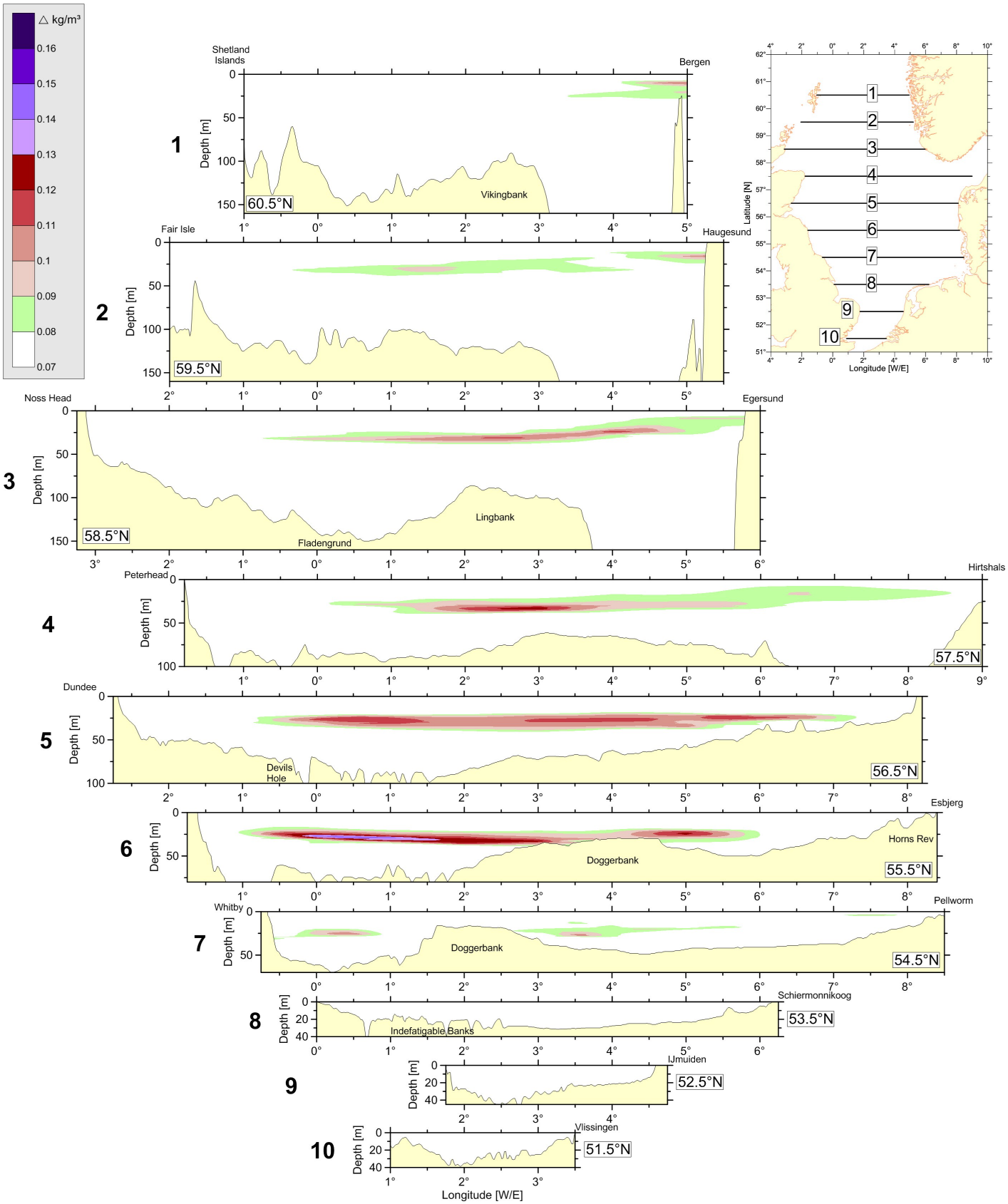


Monthly mean density difference bottom to surface (1902-1954)

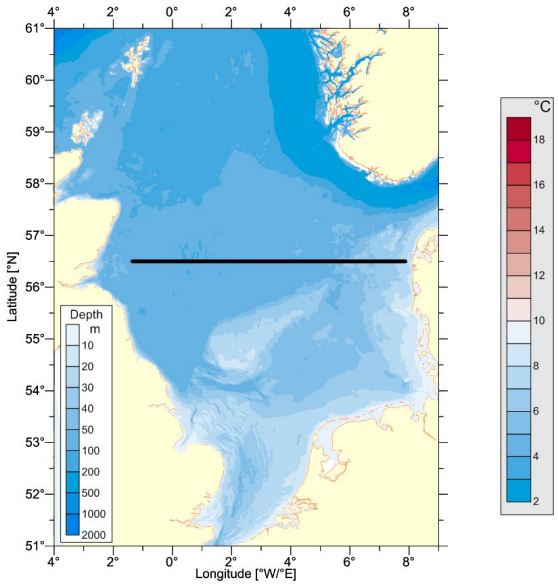


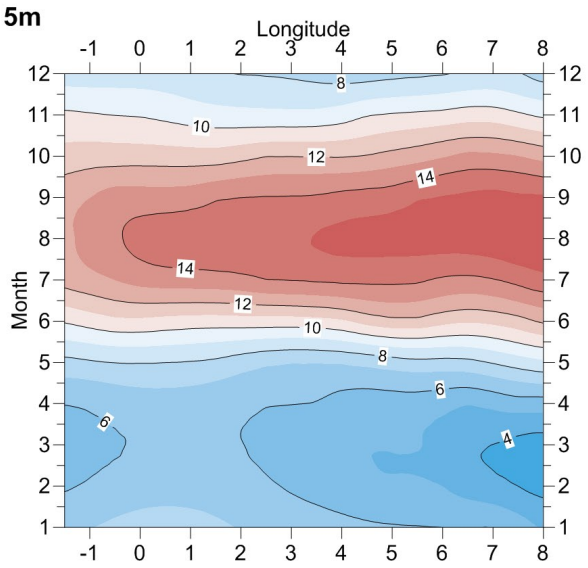
Monthly mean density difference within 1 dBar (kg/m³) on 10 zonal sections

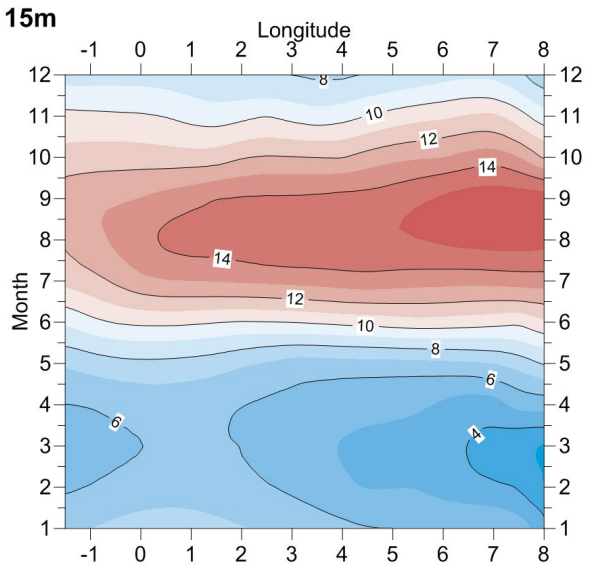
August (1902 - 1954)

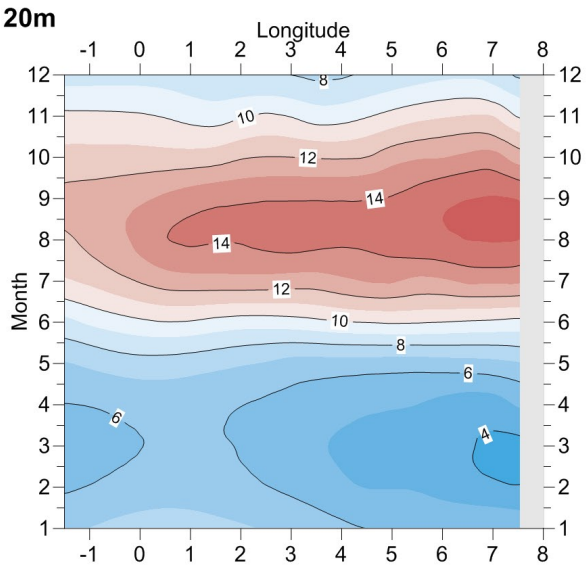


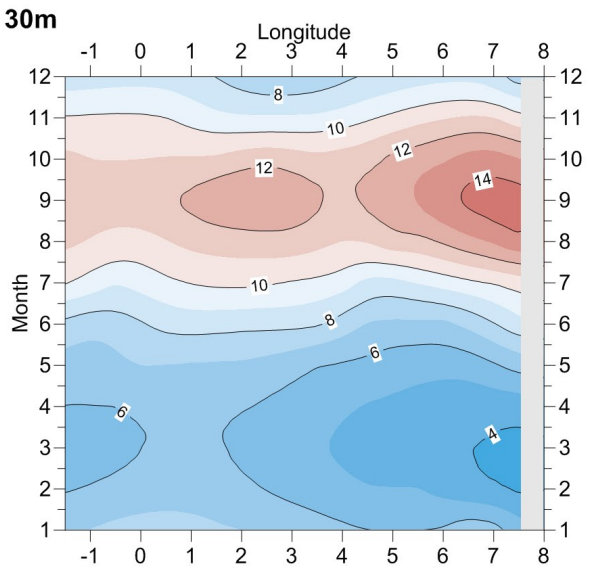
Isopleths of monthly mean temperature (1902-1954) at 5 depths along 56.5 °N

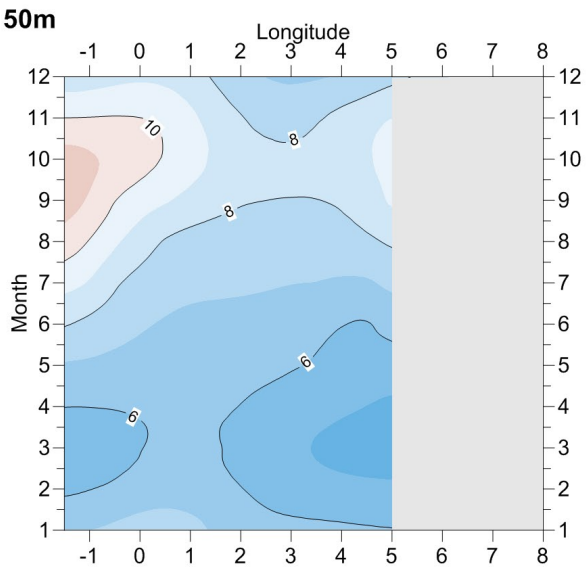




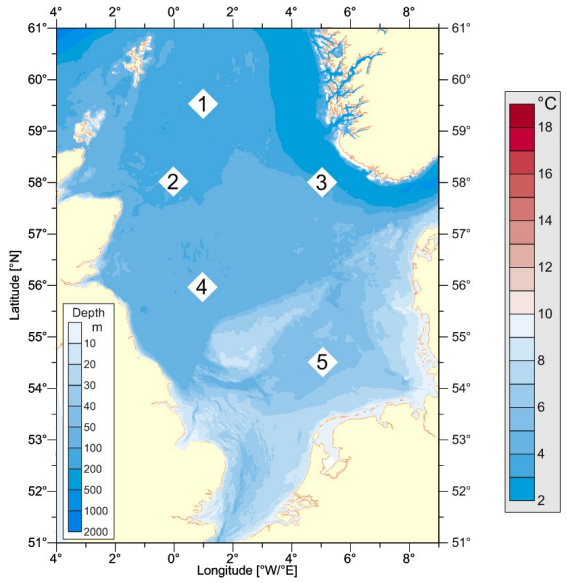


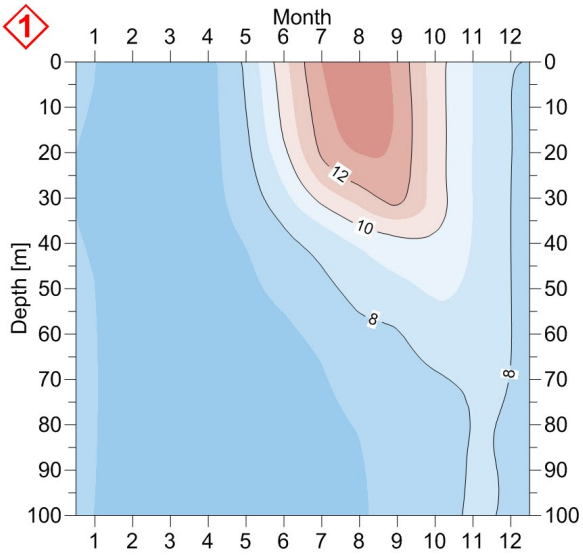


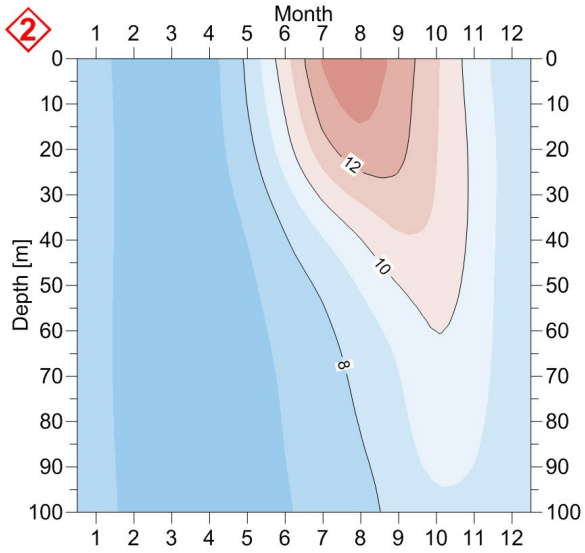


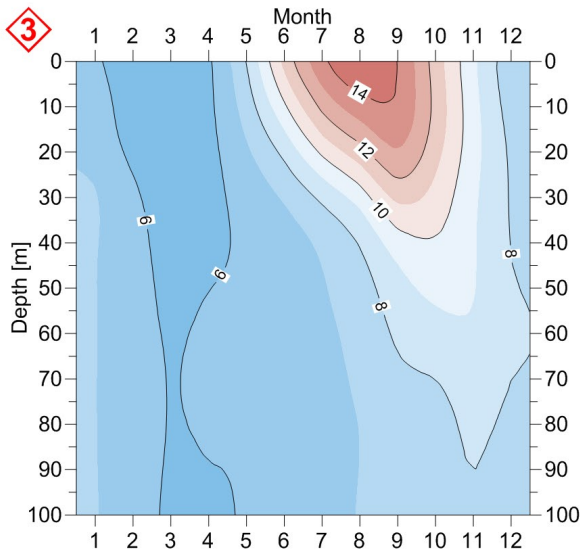


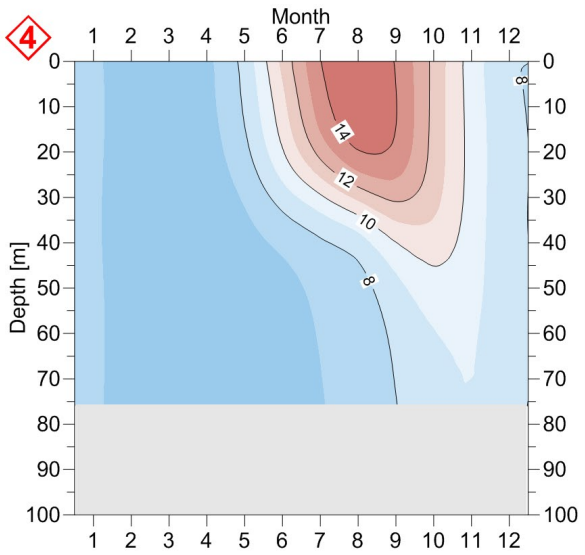
Isopleths of monthly mean temperature (1902-1954) at 5 positions

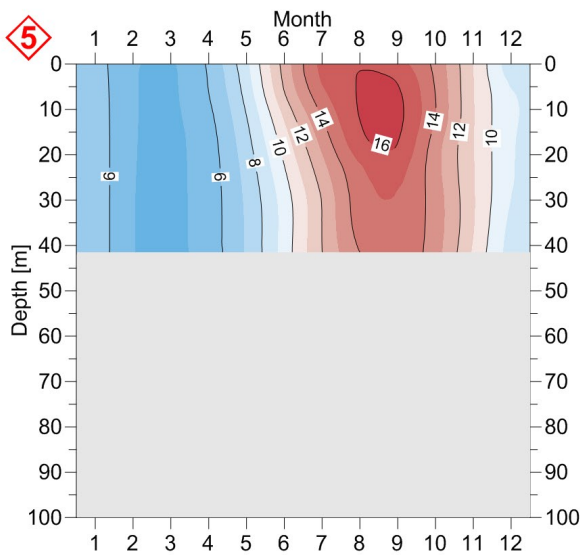




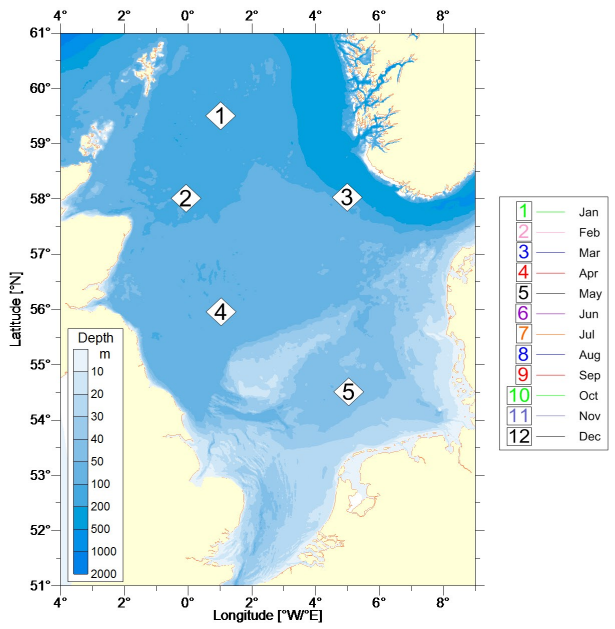


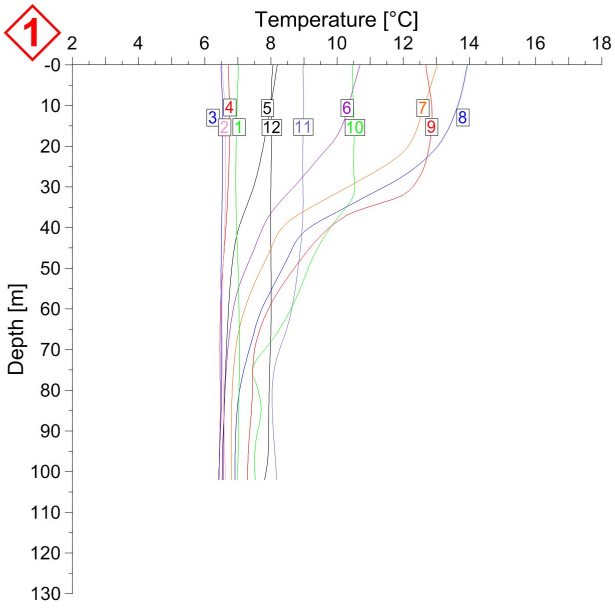


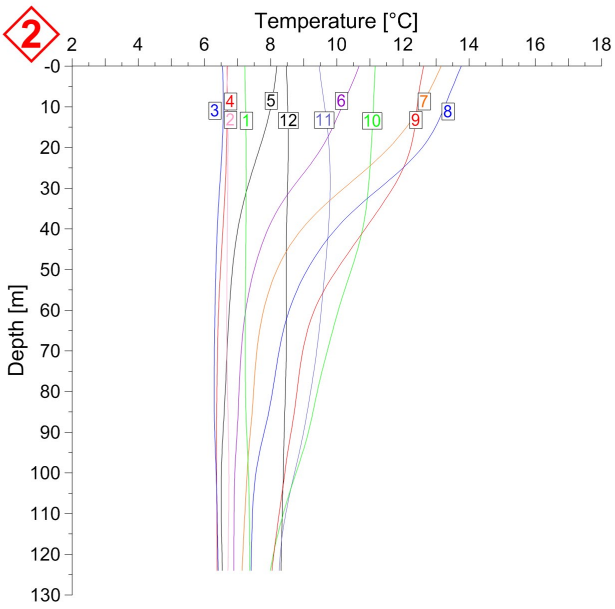


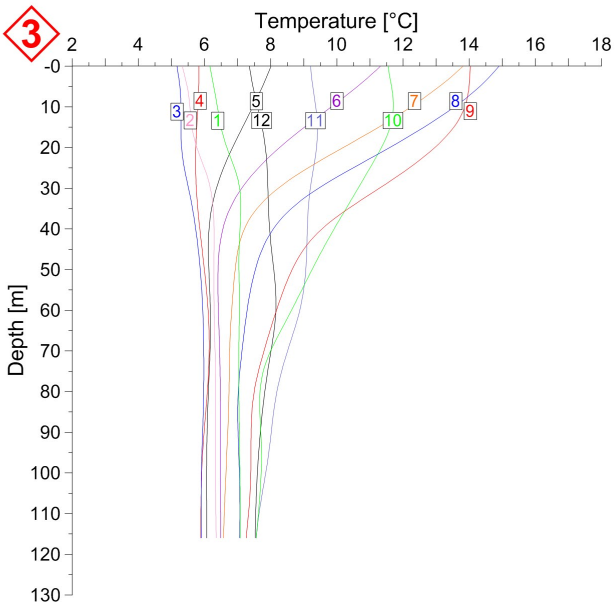


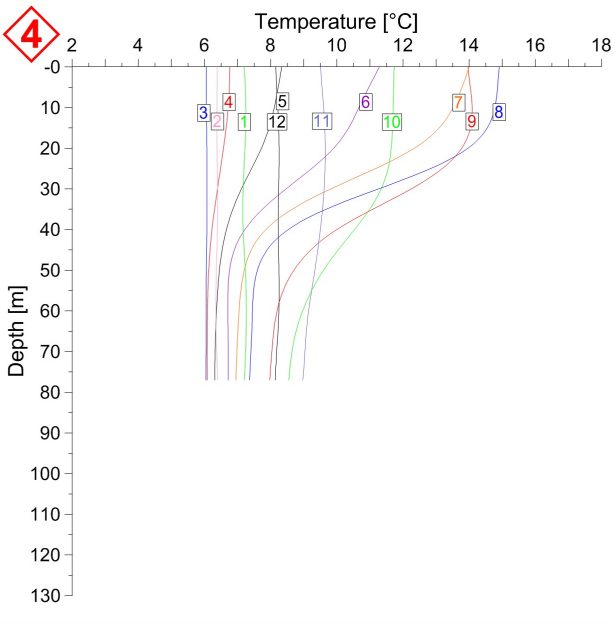
Profiles of monthly mean temperature (1902-1954) at 5 positions

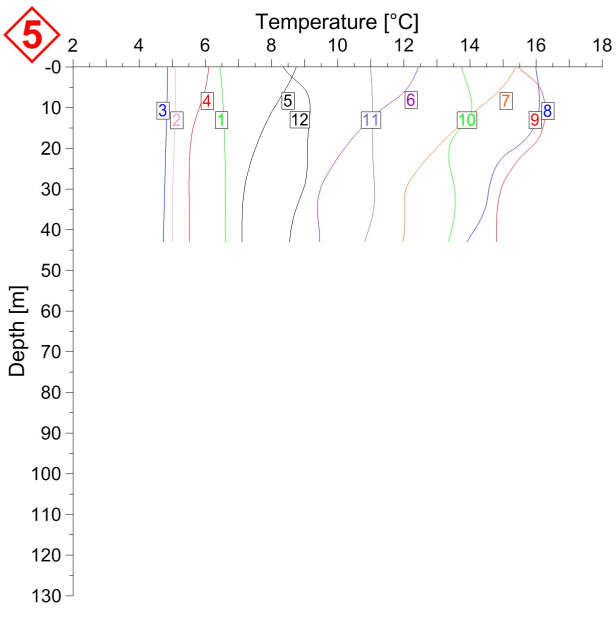




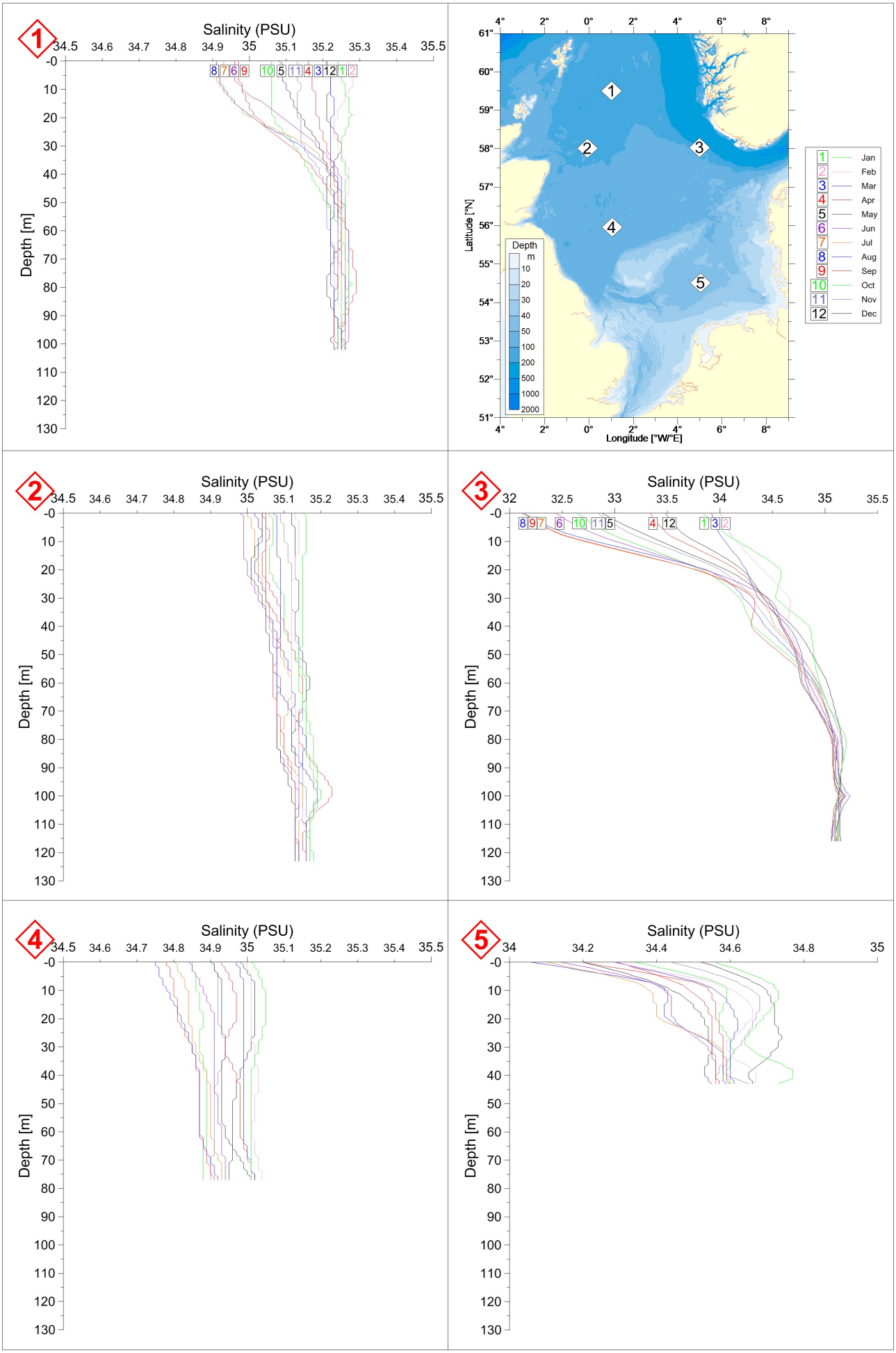




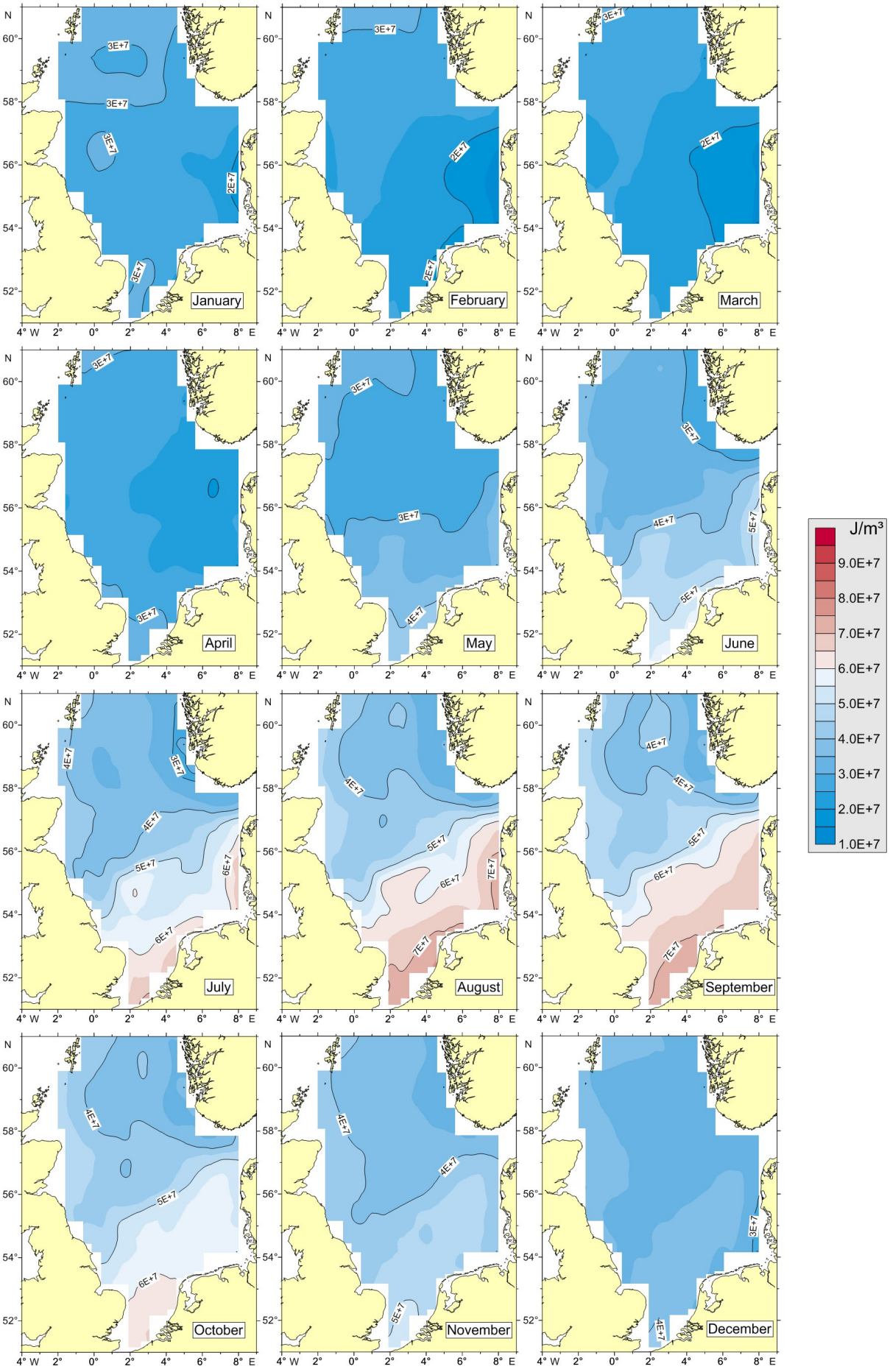




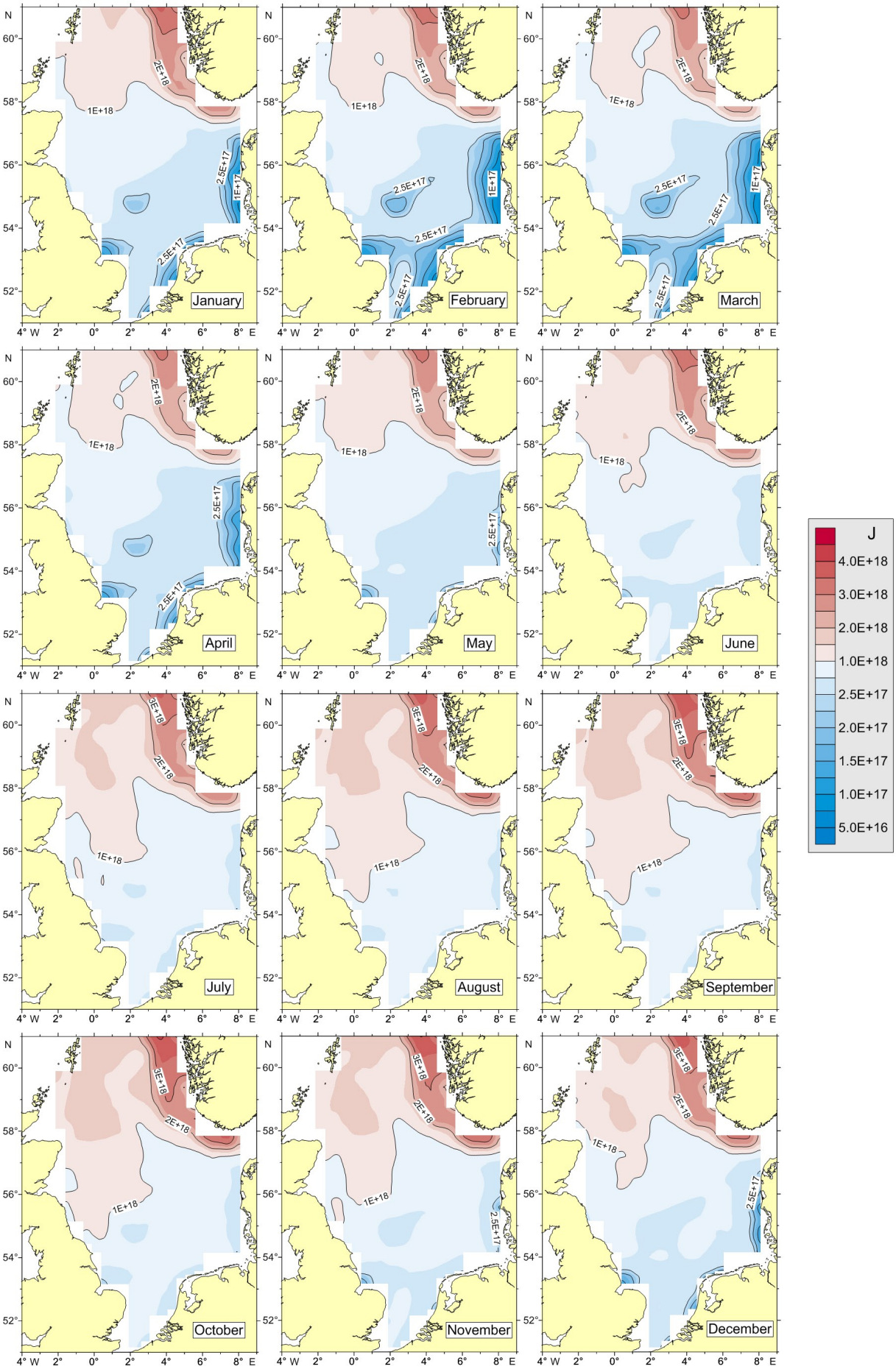
Profiles of monthly mean salinity (1902-1954) at 5 positions

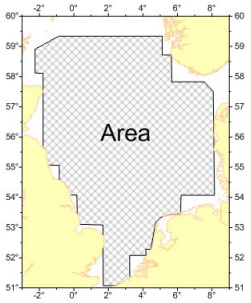


Monthly mean heat content per unit volume (1902-1954)



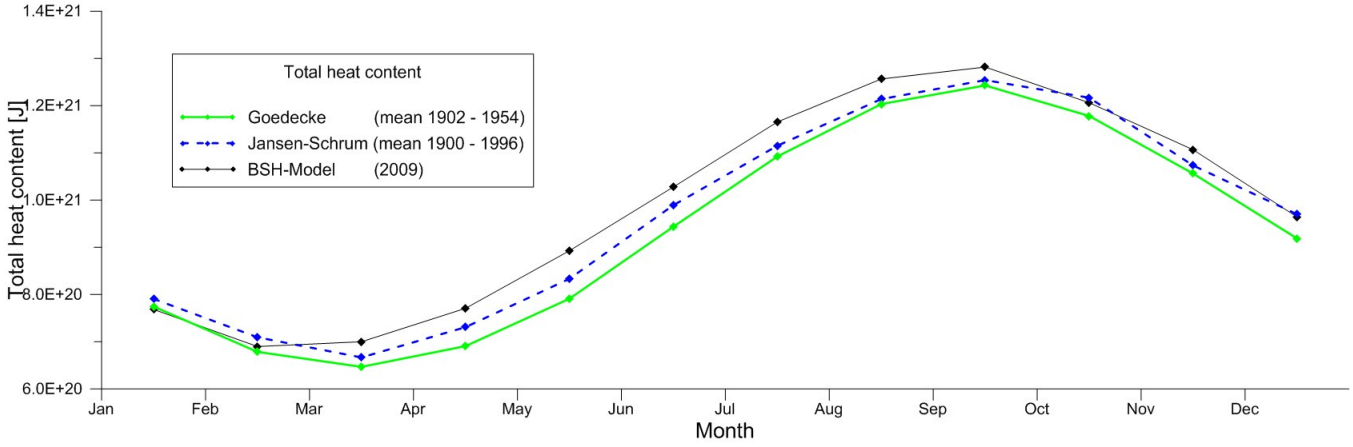
Monthly mean total heat content in the watercolumn (1902-1954)

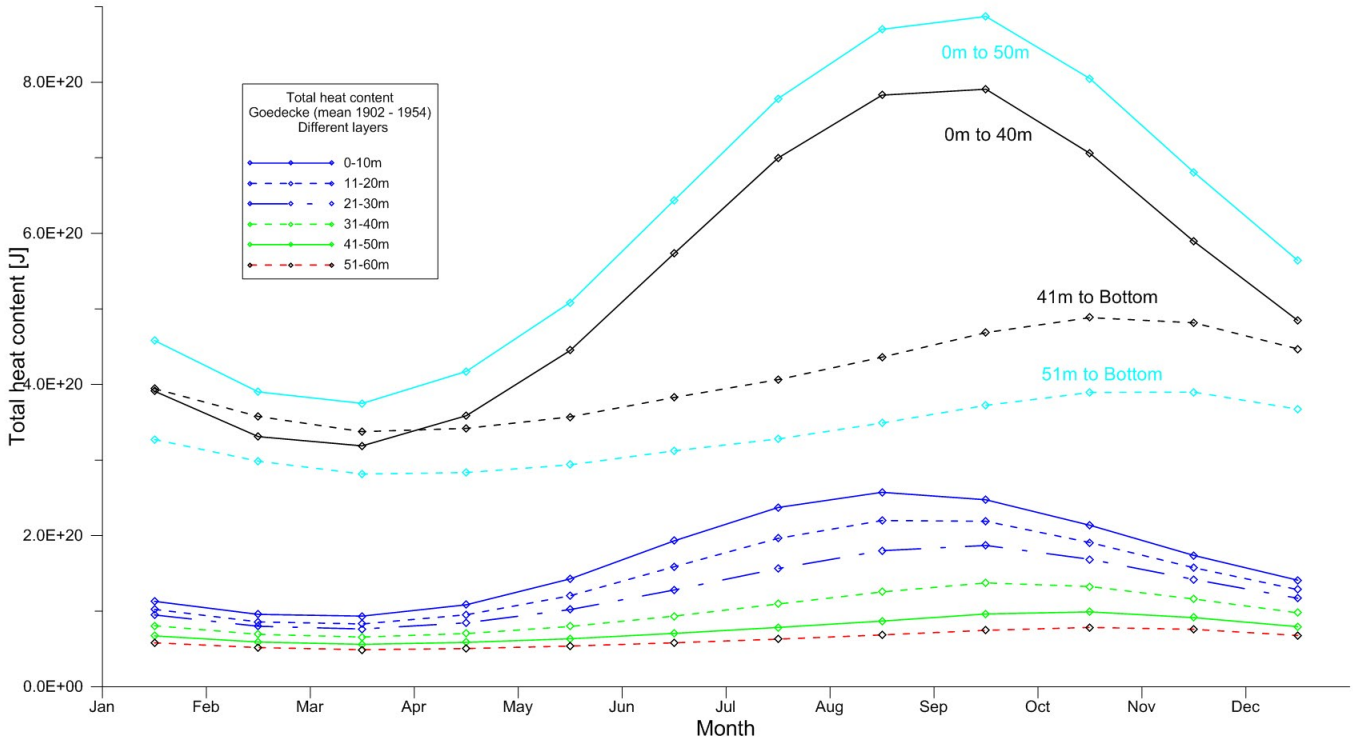




Total heat content in the North Sea

(area: 51,2 to 59,25 ° N, see chart on left side;
volume: 27500 km³)





Data distributions