FIGURES

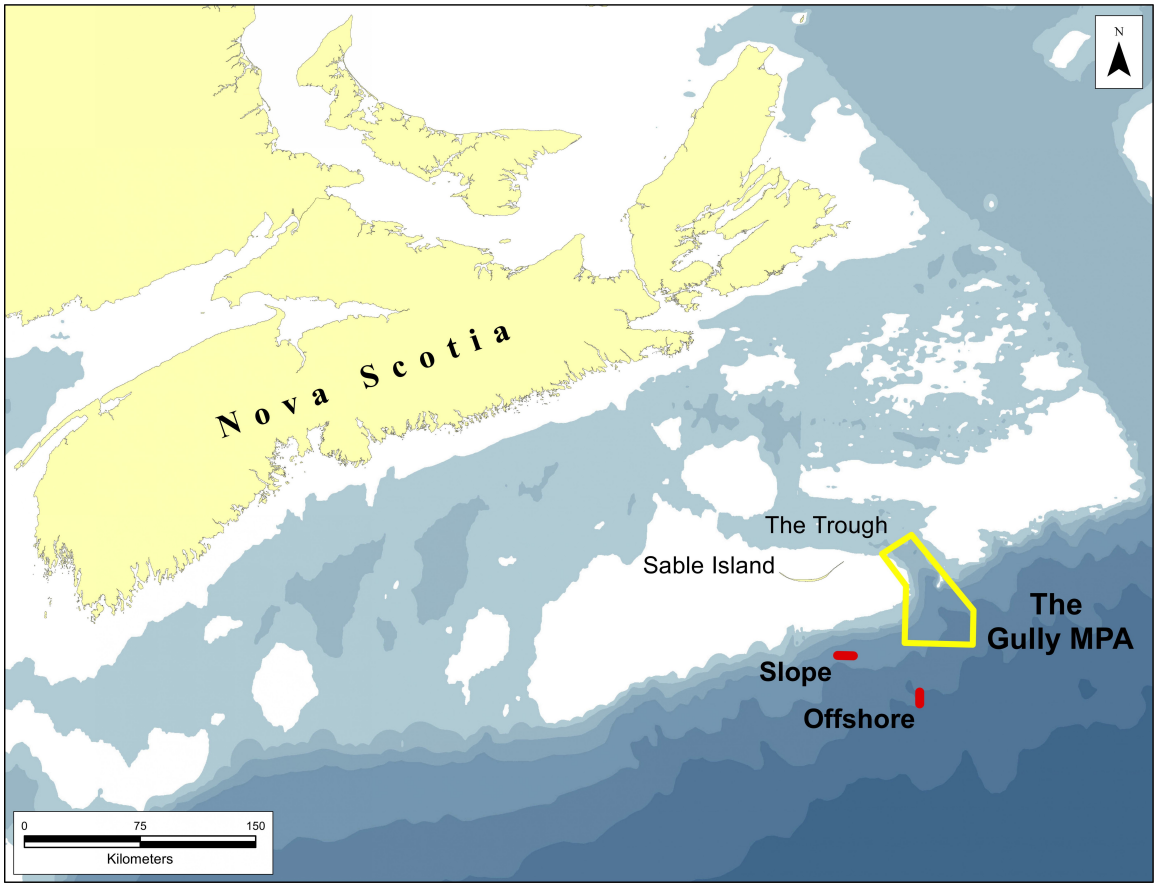


Figure 1 : Location of The Gully, showing also the Offshore and Slope stations of the trawl surveys and the bathymetric feature here named "The Trough"
White areas are shallower than 100 m, while those shaded in the lightest blue are 100 to 200 m deep

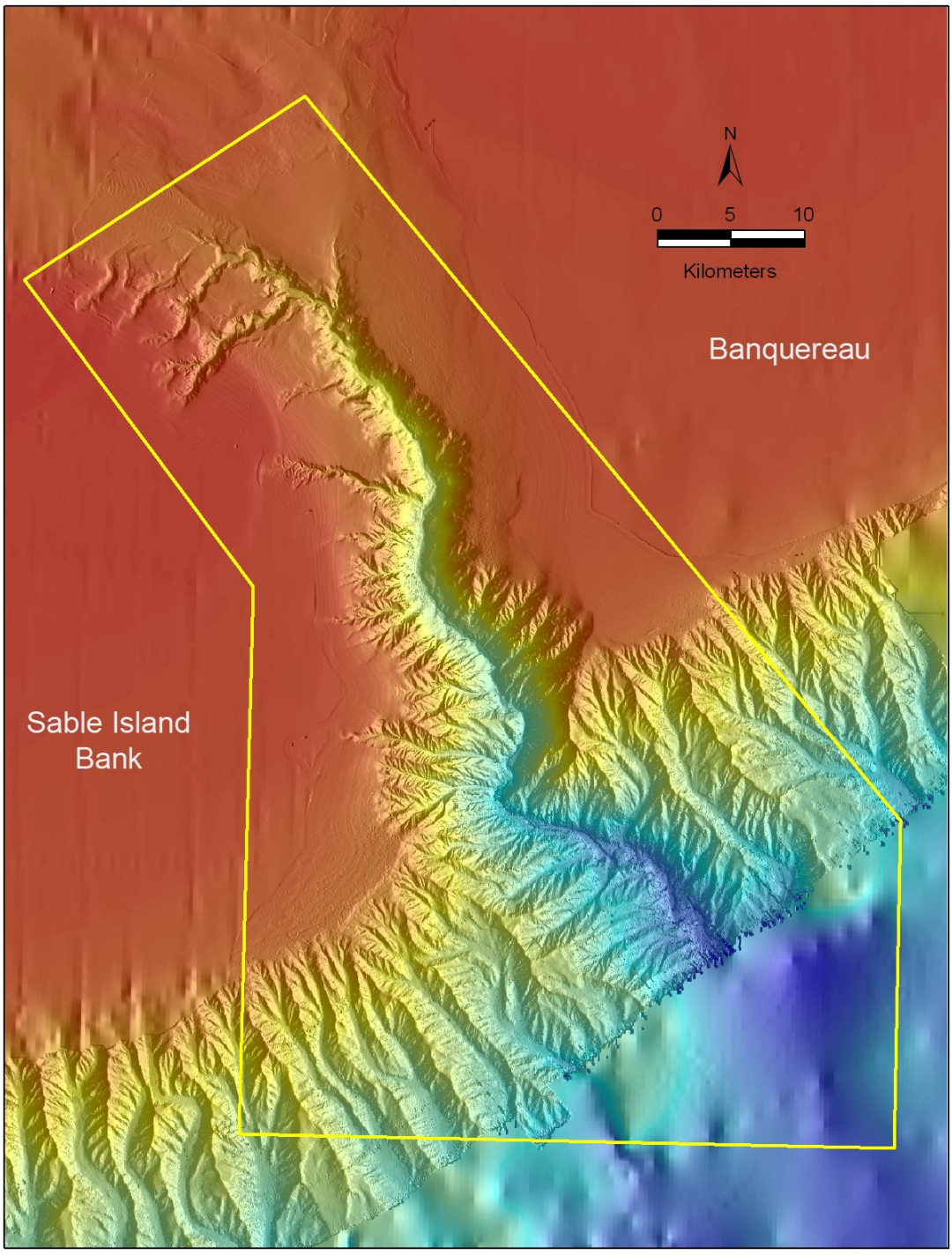


Figure 2 : Bathymetry of The Gully Marine Protected Area
Boundaries of the MPA are shown. The bathymetry of the deeper waters to the southeast has not been surveyed to the same accuracy as the rest.

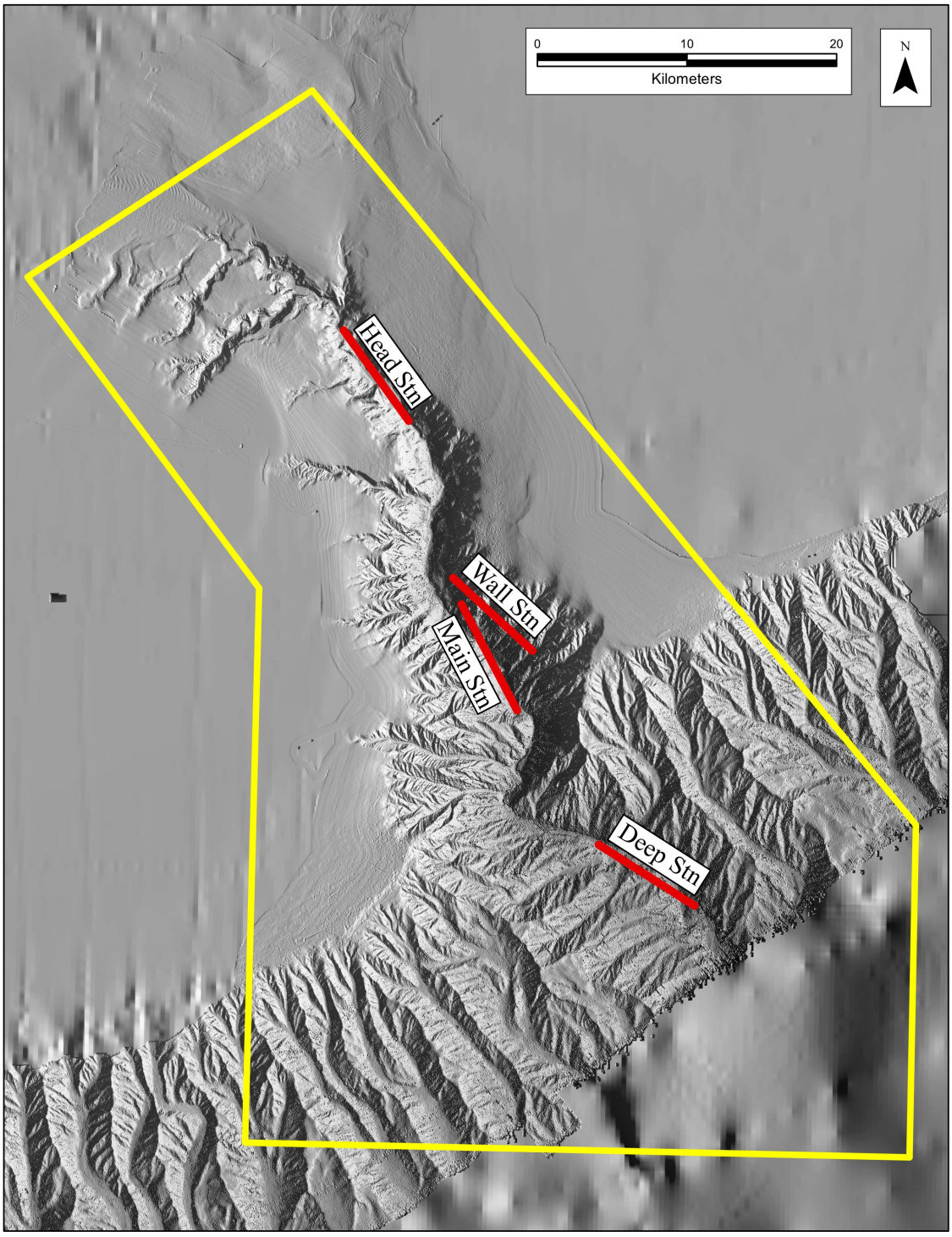


Figure 3 : Locations of the four principal named trawling stations of the 2007 to 2010 surveys within the Marine Protected Area

Figure 4 : Bathymetry of The Gully and identification of its major features

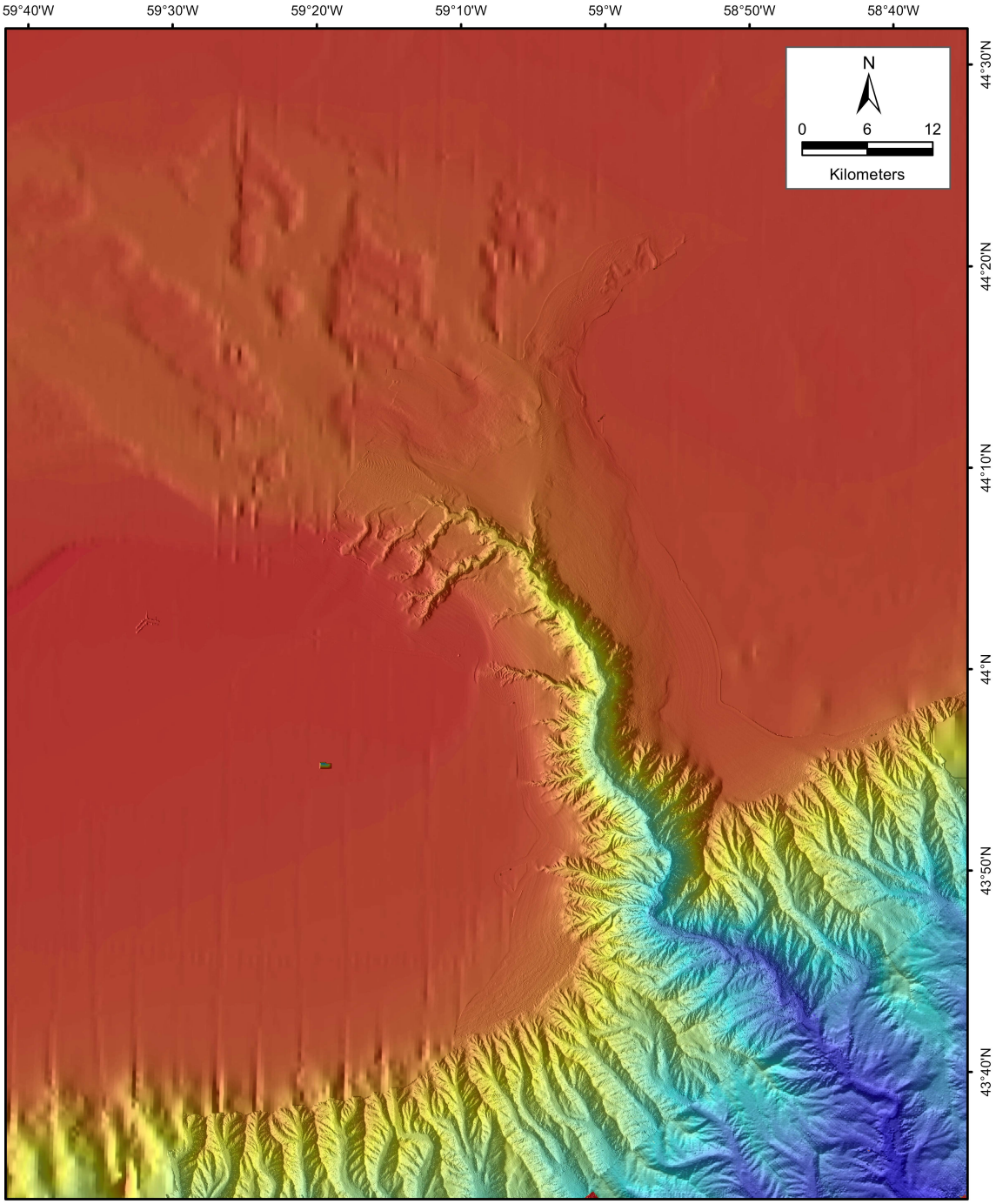


Figure 4A : The Gully to 3,100 m depth, including the Head Valleys Area
Extensive portions of Banquereau and Sable Island Bank, outside The Gully, plus some of the Scotian Slope are also shown. The canyon, and hence the feature here recognized as The Gully, extends further to the south and east, across the continental rise.

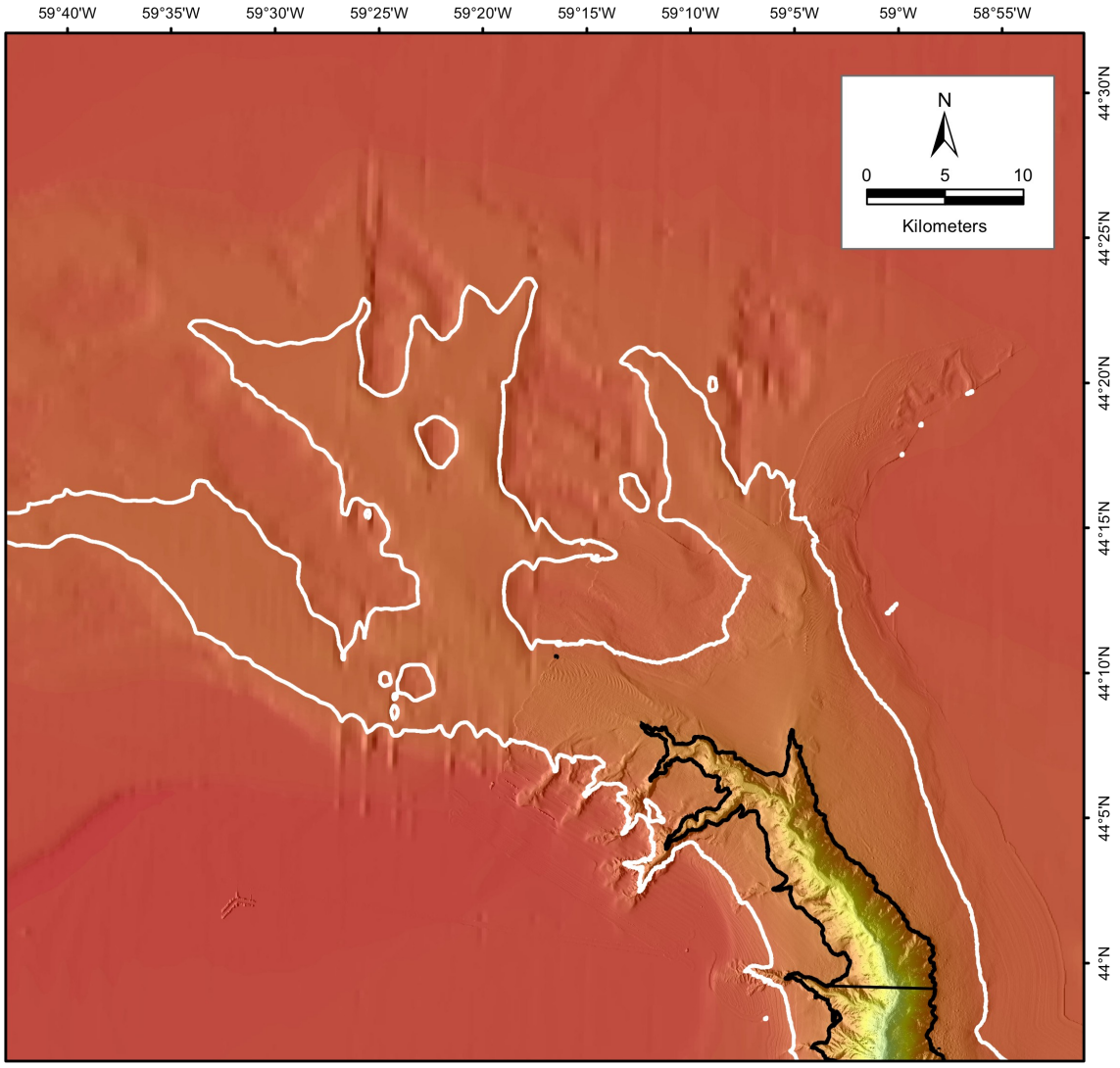


Figure 4B : The Head Valleys Area and the upper canyon
The 400 m contour, in black, closely approximates to the limits of the canyon. The 200 m contour, in white, emphasizes the shelf valleys that extend north and west from the canyon head. The Head Valleys Area, however, is here considered to be more extensive than the valleys themselves. It includes the entire depression between Banquereau and Sable Island Bank, north of the canyon head and east of The Trough.

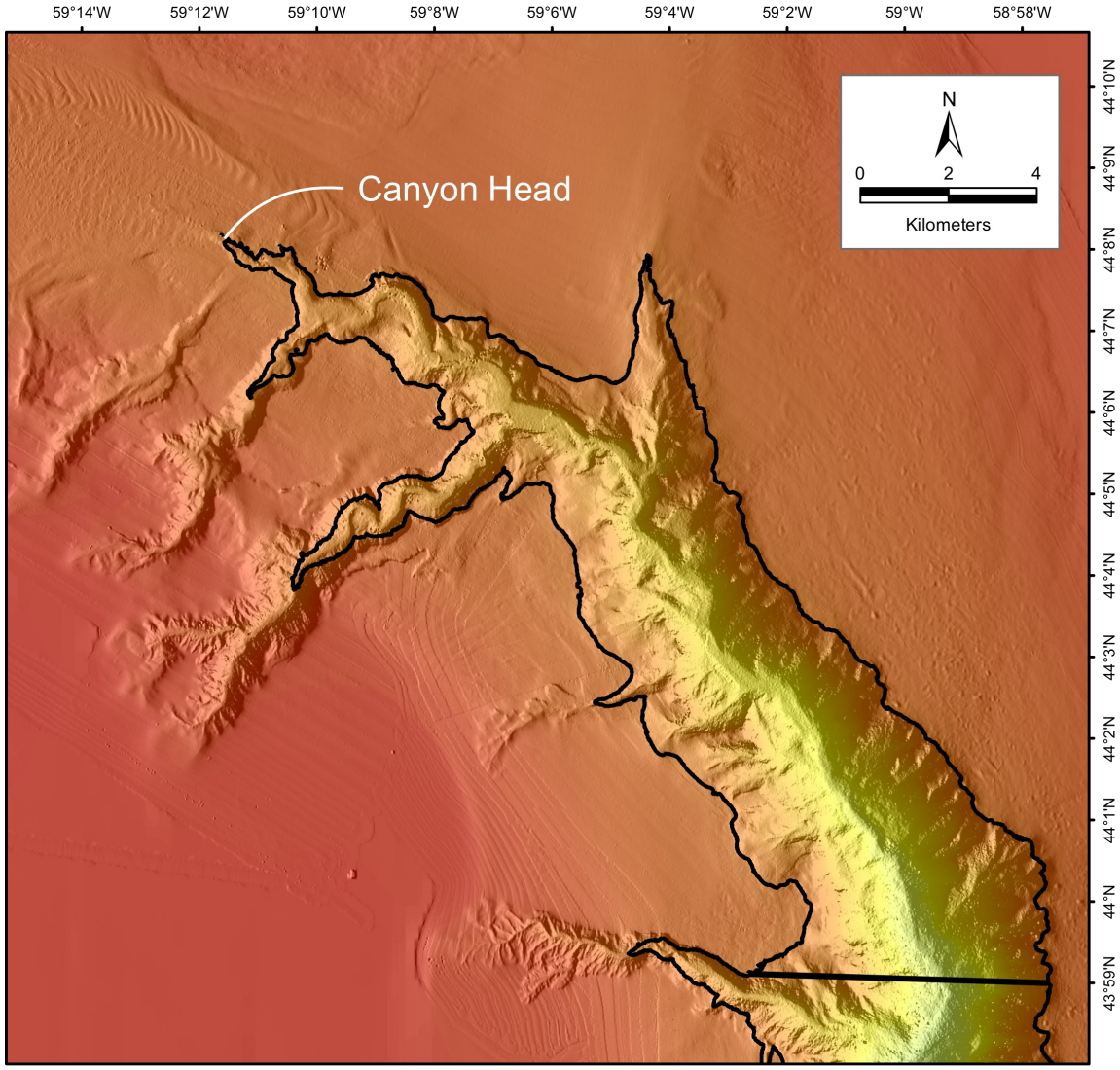


Figure 4C : The upper canyon and canyon head
The line at 43° 59'N delimits the upper canyon, as defined for the purposes of this report. The 400 m contour is highlighted. It closely approximates to the top of the steep canyon walls around much of the upper canyon, though not in the feeder canyons on the Sable Island Bank side.

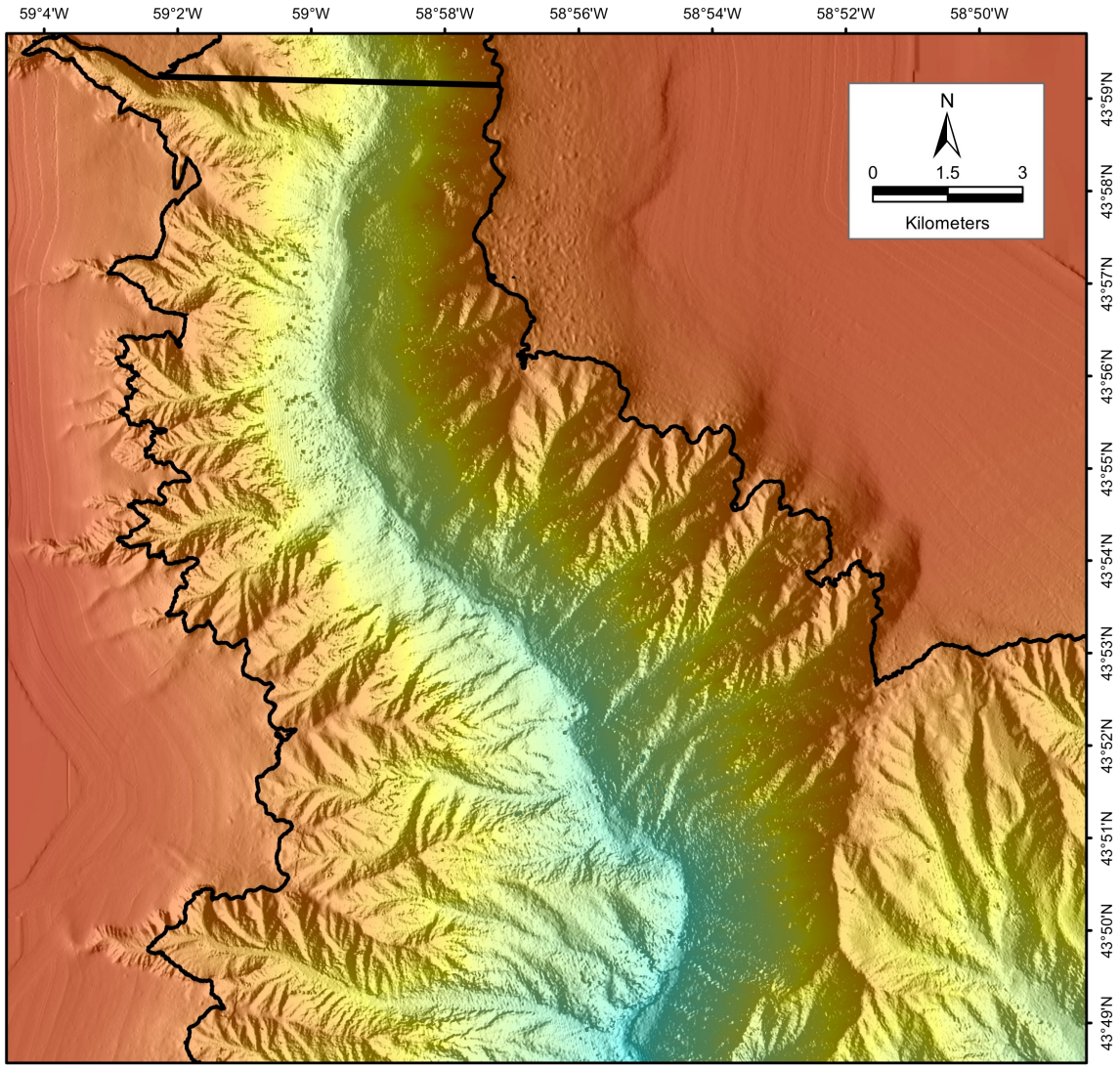


Figure 4D : The central canyon
The line at 43° 59'N delimits the central canyon, as defined for the purposes of this report, at its northern end. Its southern limit (corresponding to the canyon mouth) is not so readily defined but generally follows the spine of the Banquereau Spur. The 400 m contour is highlighted. It closely approximates to the top of the steep canyon walls around much, but not all, of the central canyon.

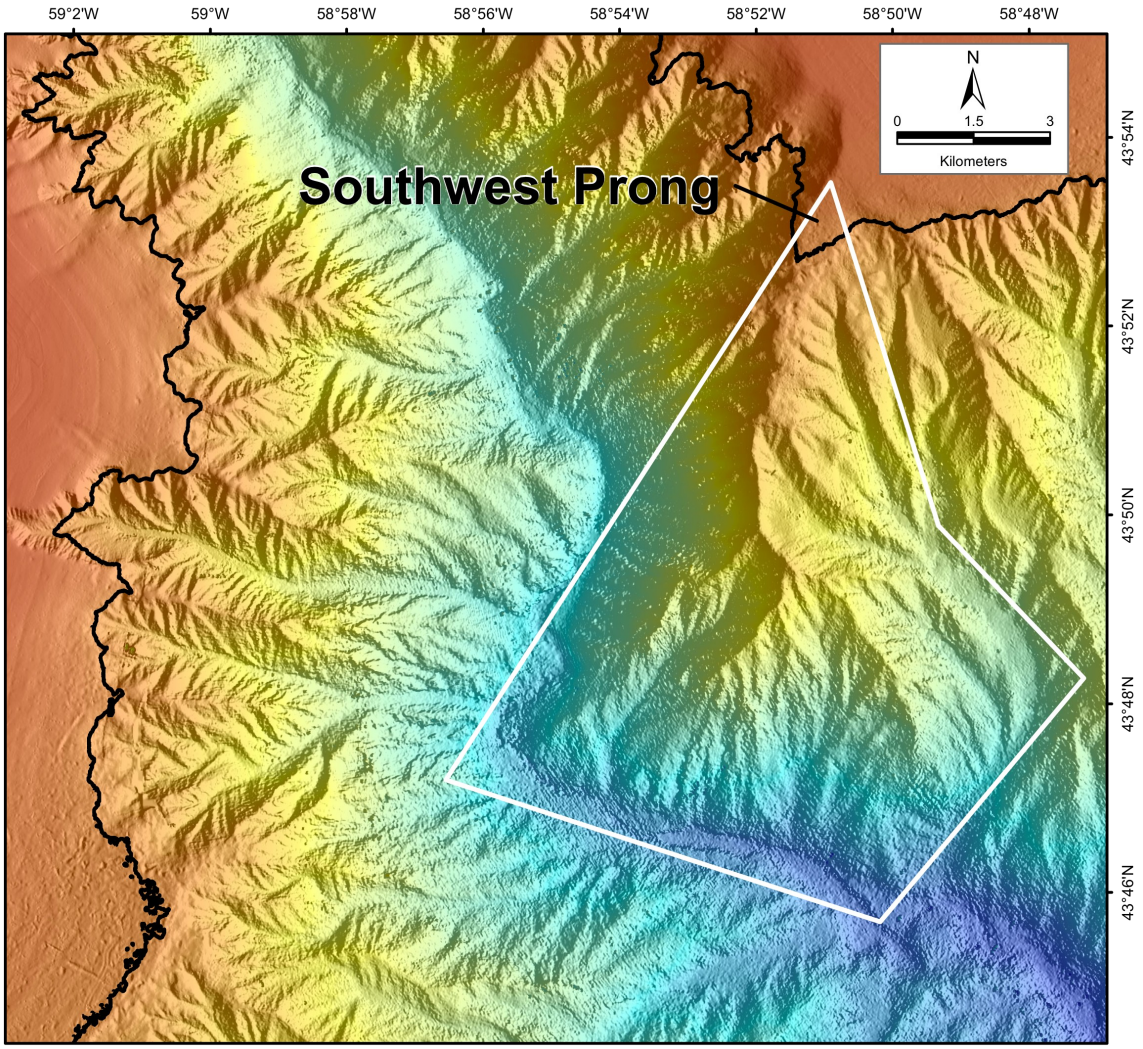


Figure 4E : The canyon mouth and the Banquereau Spur
The 400 m contour is highlighted. It closely approximates to the top of the steep canyon walls around much, but not all, of the canyon mouth.

On a map, the mouth of The Gully (where the canyon cuts through the shelf break) is an area rather than a line, shaped by the curve in the thalweg, passing around the Banquereau Spur. As understood here, that Spur is the ridge (delimited by a white polygon) sloping downwards from the Southwest Prong of Banquereau. In so far as the mouth can be better defined, it would follow the crest of the Spur from the Prong, reaching the thalweg at the Spur's south-western tip, and would thence climb the western wall of the canyon to meet the 400 m contour on Sable Island Bank, where the latter turns south-westerly.

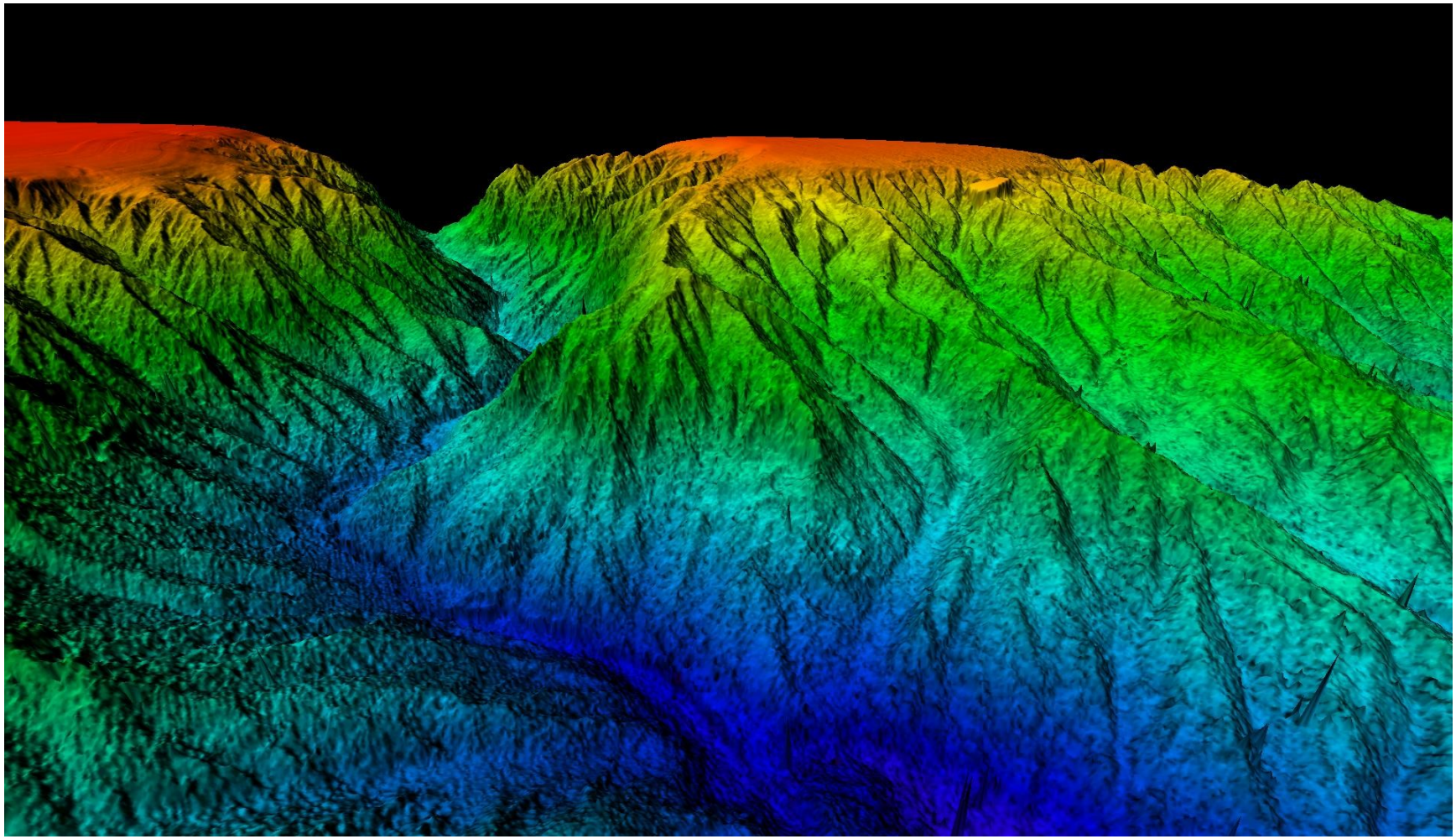


Figure 4F : The Banquereau Spur and the canyon mouth, seen from the south in perspective view
The vertical dimension is here exaggerated 2.23 times, relative to the horizontal dimensions, making slopes appear steeper than they are. The available bathymetric data are unedited and occasional errors appear as “steeple-like” spikes.

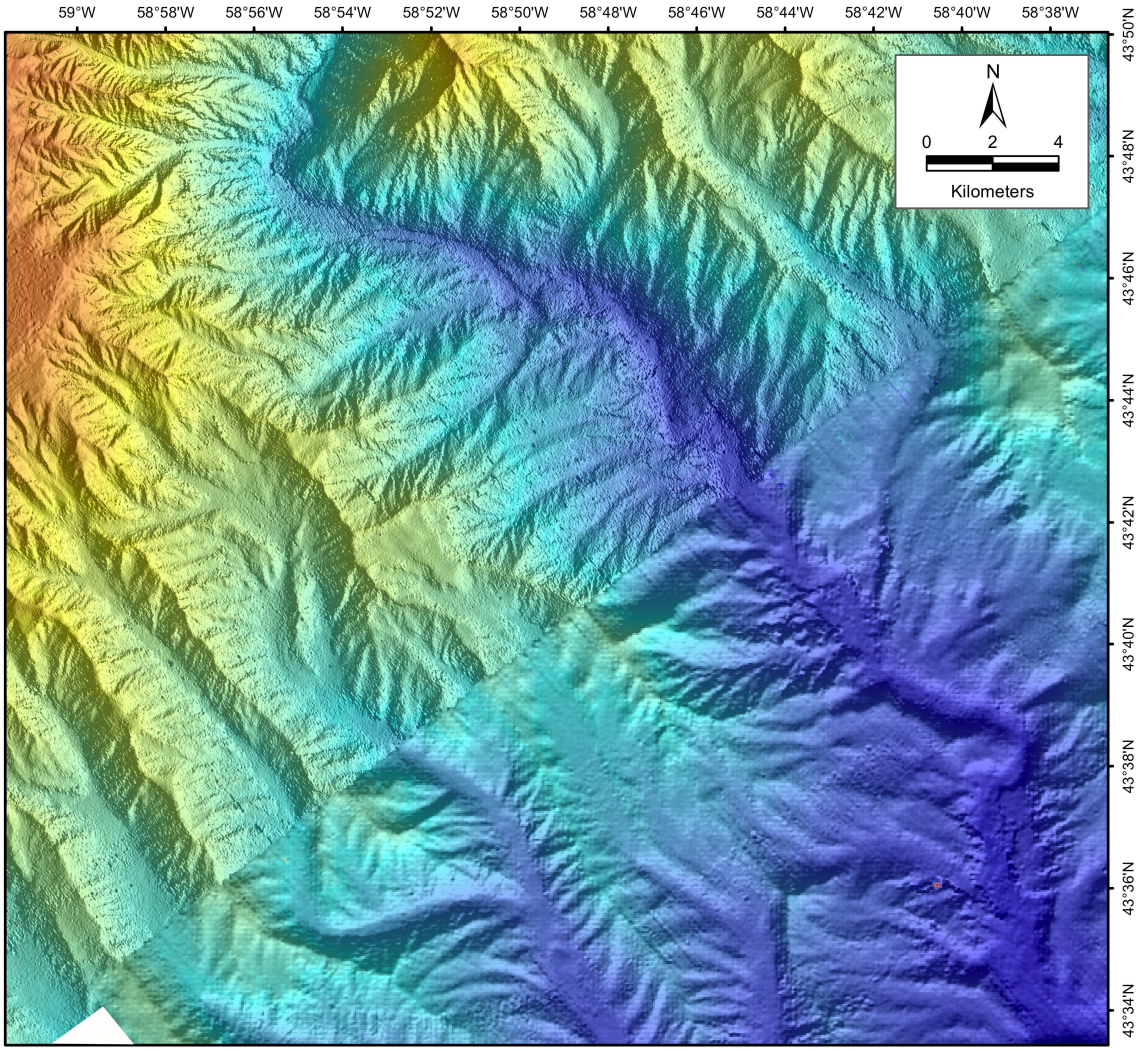


Figure 4G : The portion of the outer canyon within the MPA, including some of the minor continental-slope canyons that have thalwegs which join that of the main canyon

This map is drawn to the limit of the available multibeam bathymetric data, which reaches slightly further south and east than the MPA's boundary. The maximum mapped depth of the thalweg within the area shown is 3,138 m. (The maximum mapped depth within the MPA is 3,110 m.) The south-eastern portion of the mapped area has been surveyed using multibeam equipment but not to the same spatial precision applied further to the north and west. The white triangular area in the lower left of the map lacks adequate data.

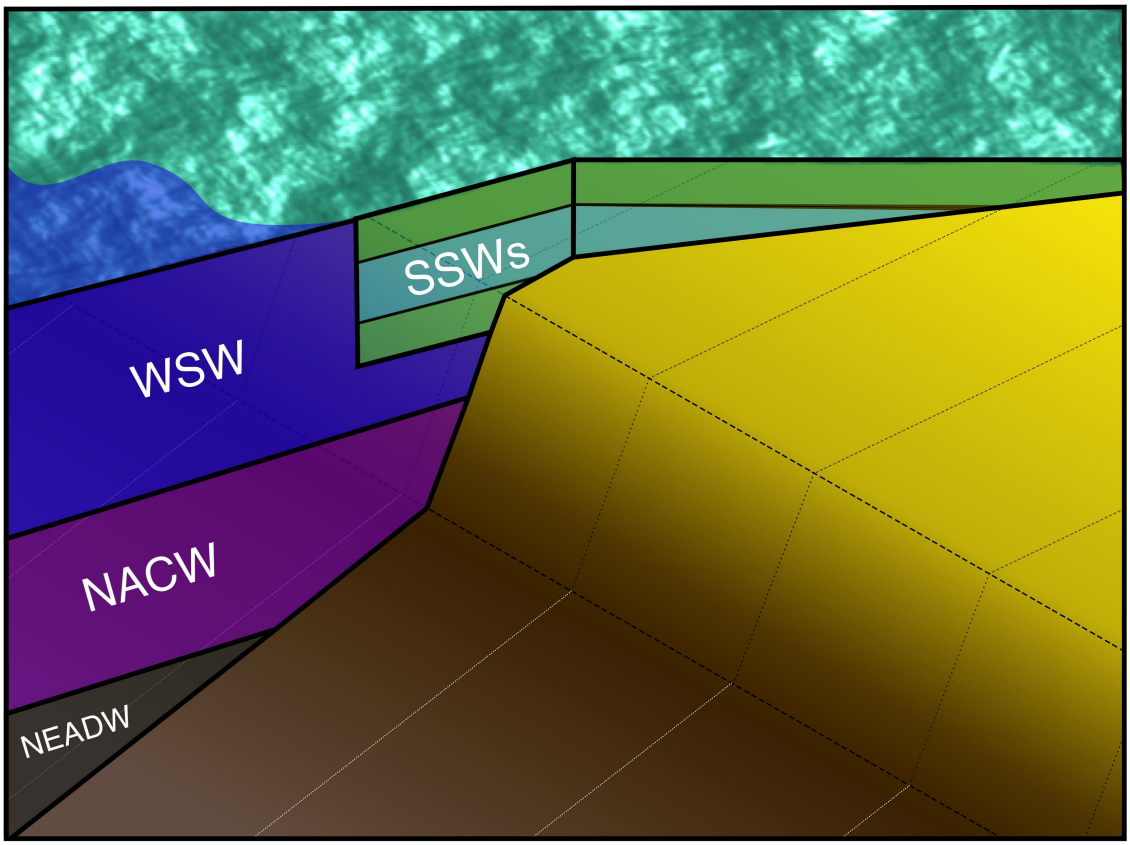
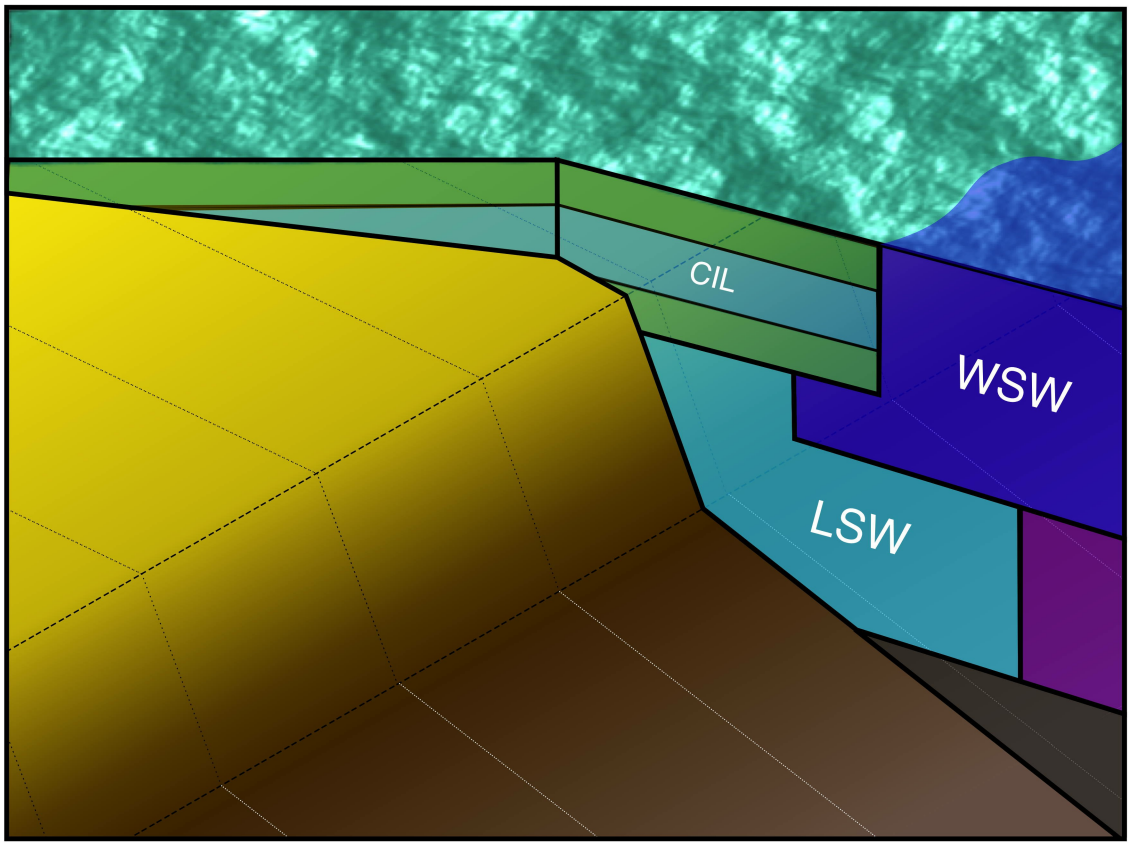


Figure 5 : Diagrammatic sections through water column, showing the major water masses found along the Scotian Slope
Right: Coupled slope water system at upper-slope depths in its minimum modal state; Deep Western Boundary Current carrying LSW along mid- and lower slope. Left: Coupled system in its maximum modal state; Mid- and lower slope washed by NACW, as suggested by data from The Gully.



The vertical scale is distorted to better display the thin, near-surface layers. In reality, the underside of the SSWs is at about 300 m depth, whereas the top of the NEADW is below 2,000 m. The diagram shows the seabed of the outer shelf, slope and continental rise, as well as the overlying waters, which are cut by vertical sections. The water masses are indicated by the abbreviations presented in Table 2. (Note that the SSWs are three-layered, the central layer being the CIL.) In reality, the boundaries between water masses are neither sharp nor regular, while the individual water masses are not internally homogeneous.

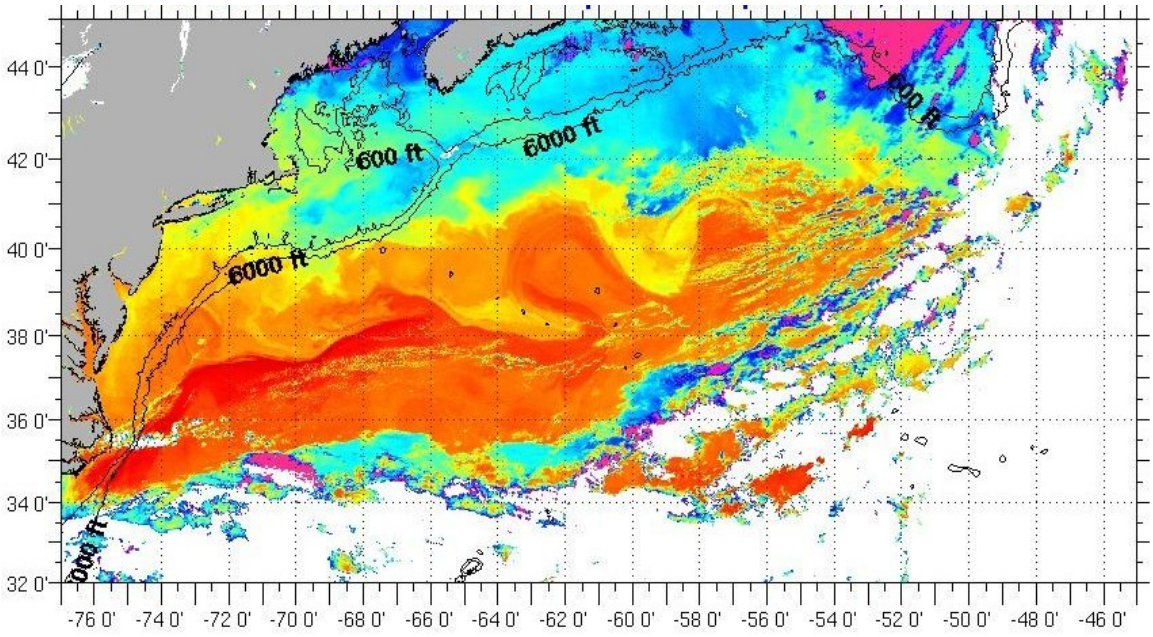


Figure 6 : Sea Surface Temperature from Cape Hatteras to Grand Bank on 5 September 2008. The Gully lies at 44°N 59°W.
The turquoise shading along much of the Scotian Slope represents ≈17°C, while the red of the Gulf Stream near Cape Hatteras represents ≈28°C.
[Image courtesy of Rutgers University's Coastal Ocean Observation Laboratory]

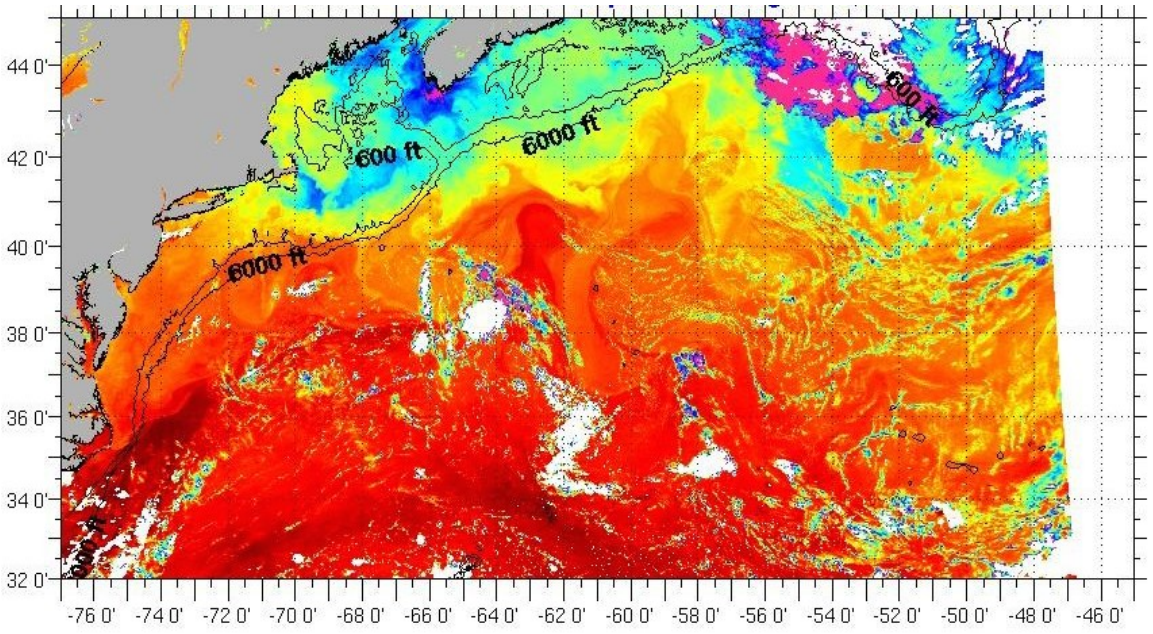


Figure 7 : Sea Surface Temperature from Cape Hatteras to Grand Bank on 18 August 2009. The Gully lies at 44°N 59°W.
Note the tongue of Slope Water reaching to the mouth of The Gully. The yellow shading represents ≈23°C.
[Image courtesy of Rutgers University's Coastal Ocean Observation Laboratory]

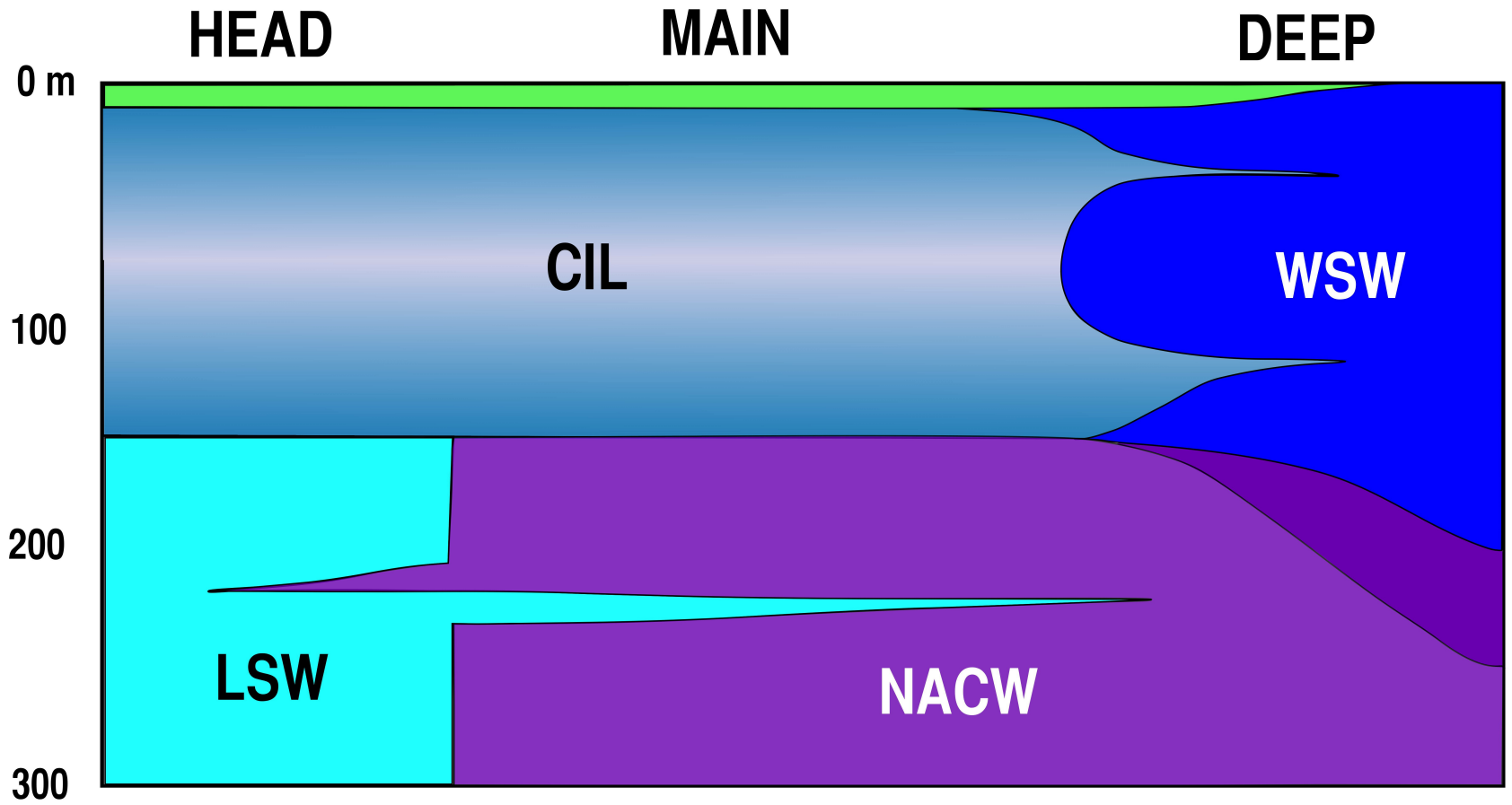

HEAD
MAIN
DEEP
0 m
100
200
300
CIL
WSW
LSW
NACW

Figure 8 : Diagrammatic section of the upper 300 m of the water column along the canyon thalweg, from the Head Station to the Deep Station, illustrating the distribution of water masses seen in August 2009

The approximate locations of the three stations are indicated. Most water masses are indicated by the abbreviations presented in Table 2 but the surface layer of SSW is shown in green. The body of warm NACW-like water seen on the Deep Station is indicated by deeper shading. The core of the CIL and the thermohaloclines above and below are indicated as a single layer.

This diagram does not attempt to show the fine-scale spatial and temporal variation that was evident in the CTD data. With the exception of the CIL, the interfaces between the water masses have been represented as sharp, when they were usually gradual, while each water mass is shown as homogeneous, when they were not. The uncertainties in water-mass identification presented in the text are not repeated here.

Figure 9 : Depth Profiles of Temperature, Salinity, Density and Oxygen Concentration in August 2009

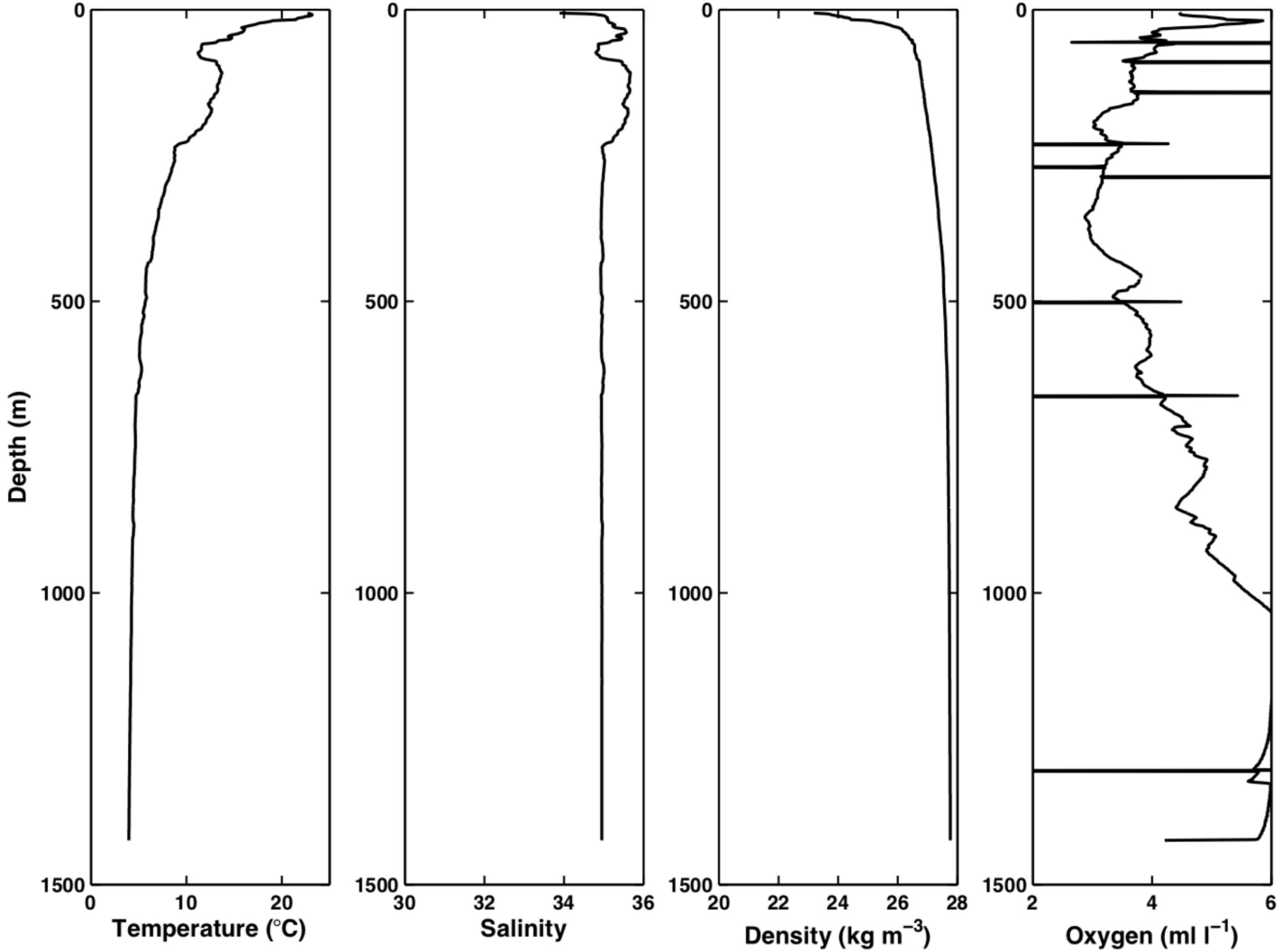
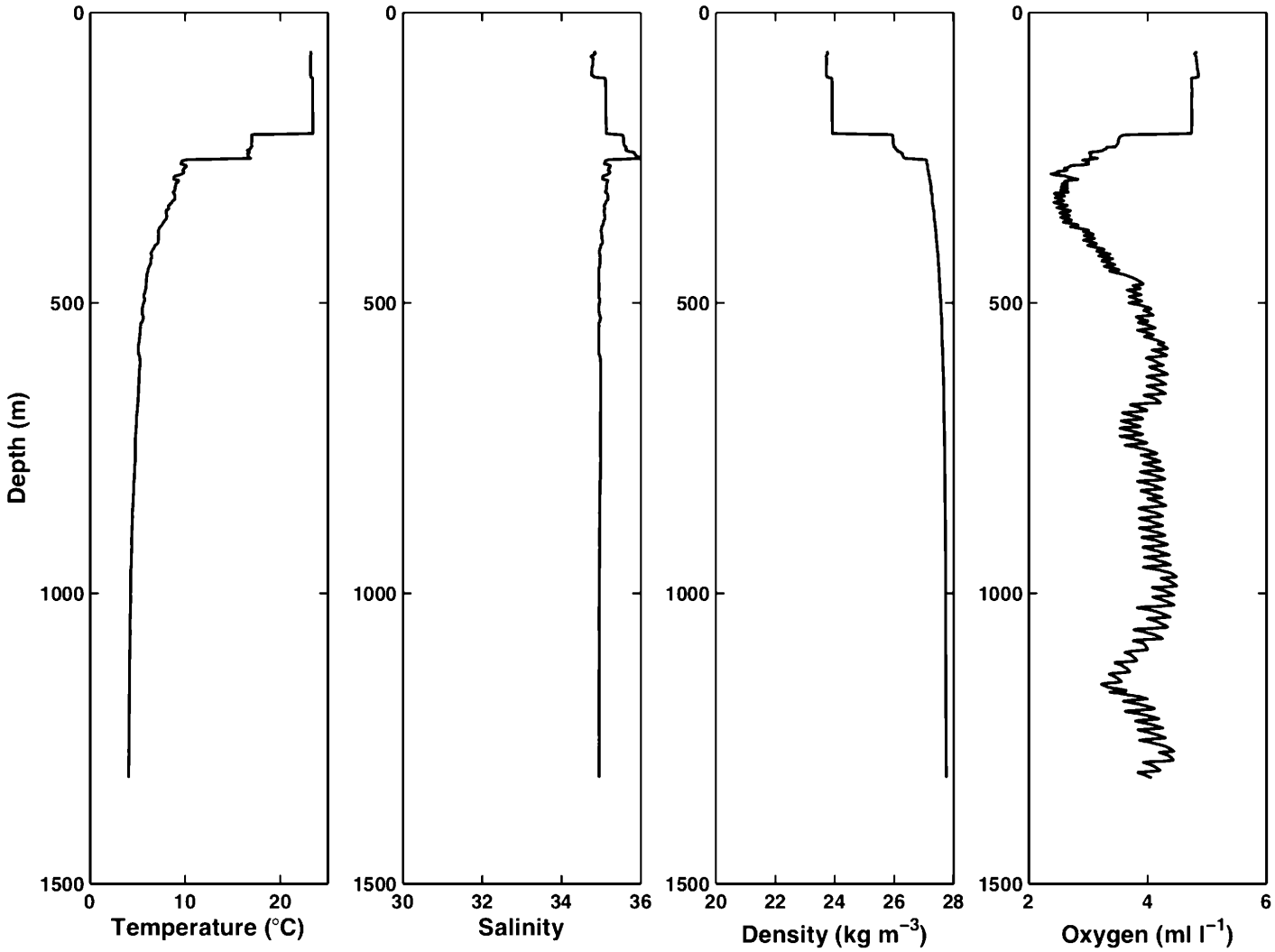


Figure 9a : Set 2 up cast (Slope Station)


Depth (m)
0
500
1000
1500
0
10
20
Temperature (°C)
30
32
34
36
Salinity
20
22
24
26
28
Density (kg m^{-3})
2
4
6
Oxygen (ml l^{-1})

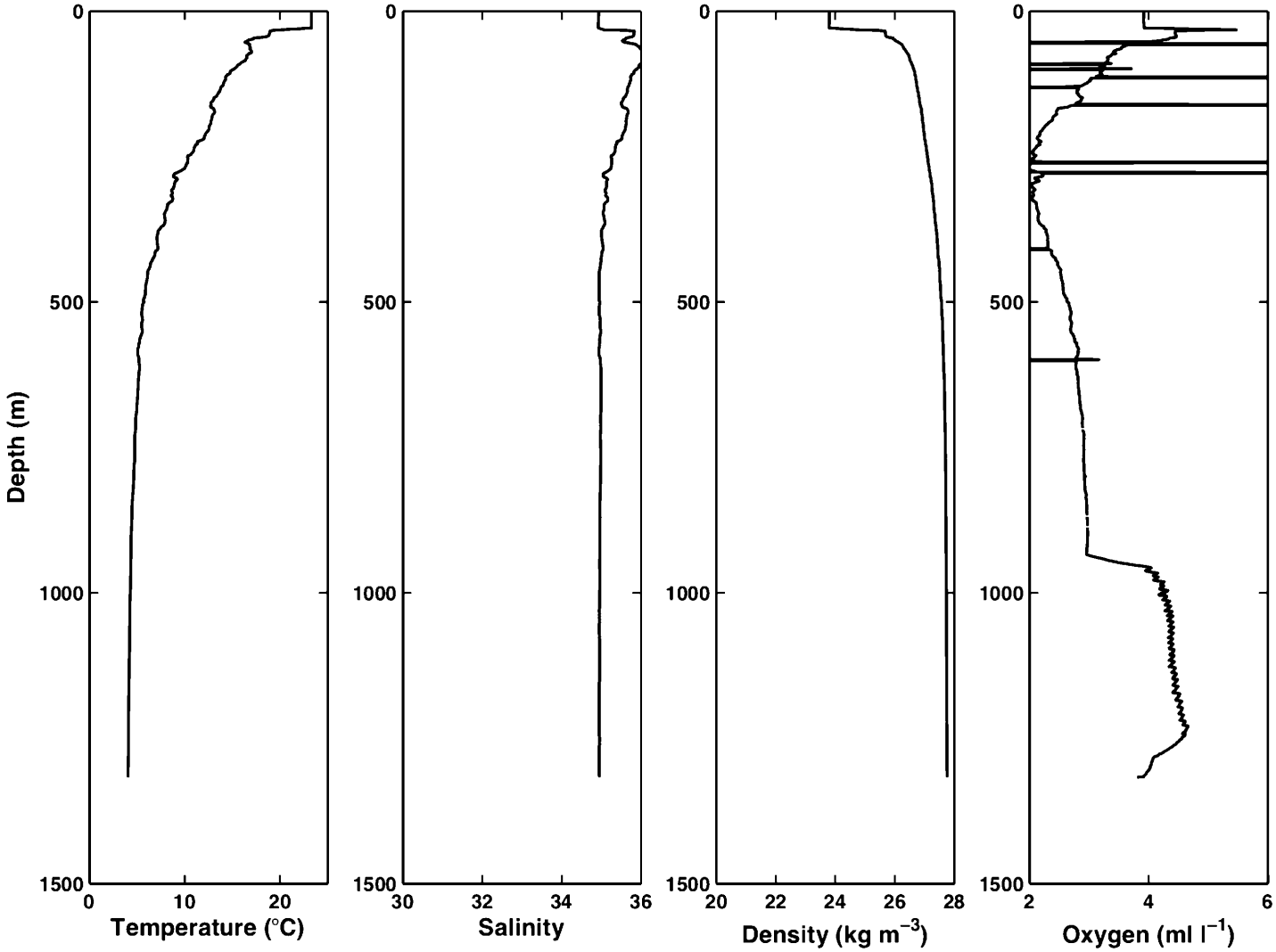
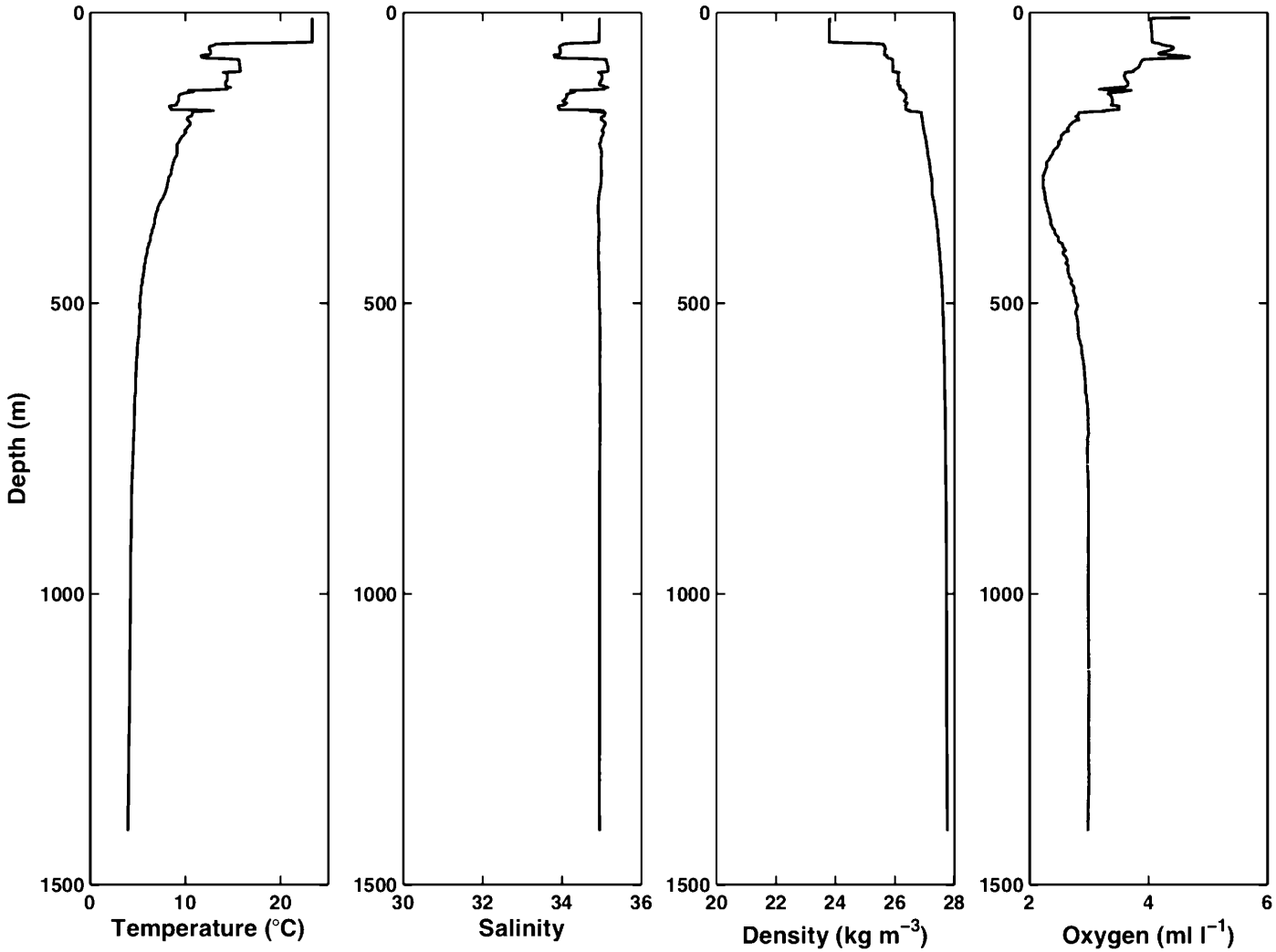


Figure 9b : Set 7 down (facing page) and up casts (Deep Station)


Depth (m)
0
500
1000
1500
0
10
20
Temperature (°C)
30
32
34
36
Salinity
20
22
24
26
28
Density (kg m^{-3})
2
4
6
Oxygen (ml l^{-1})

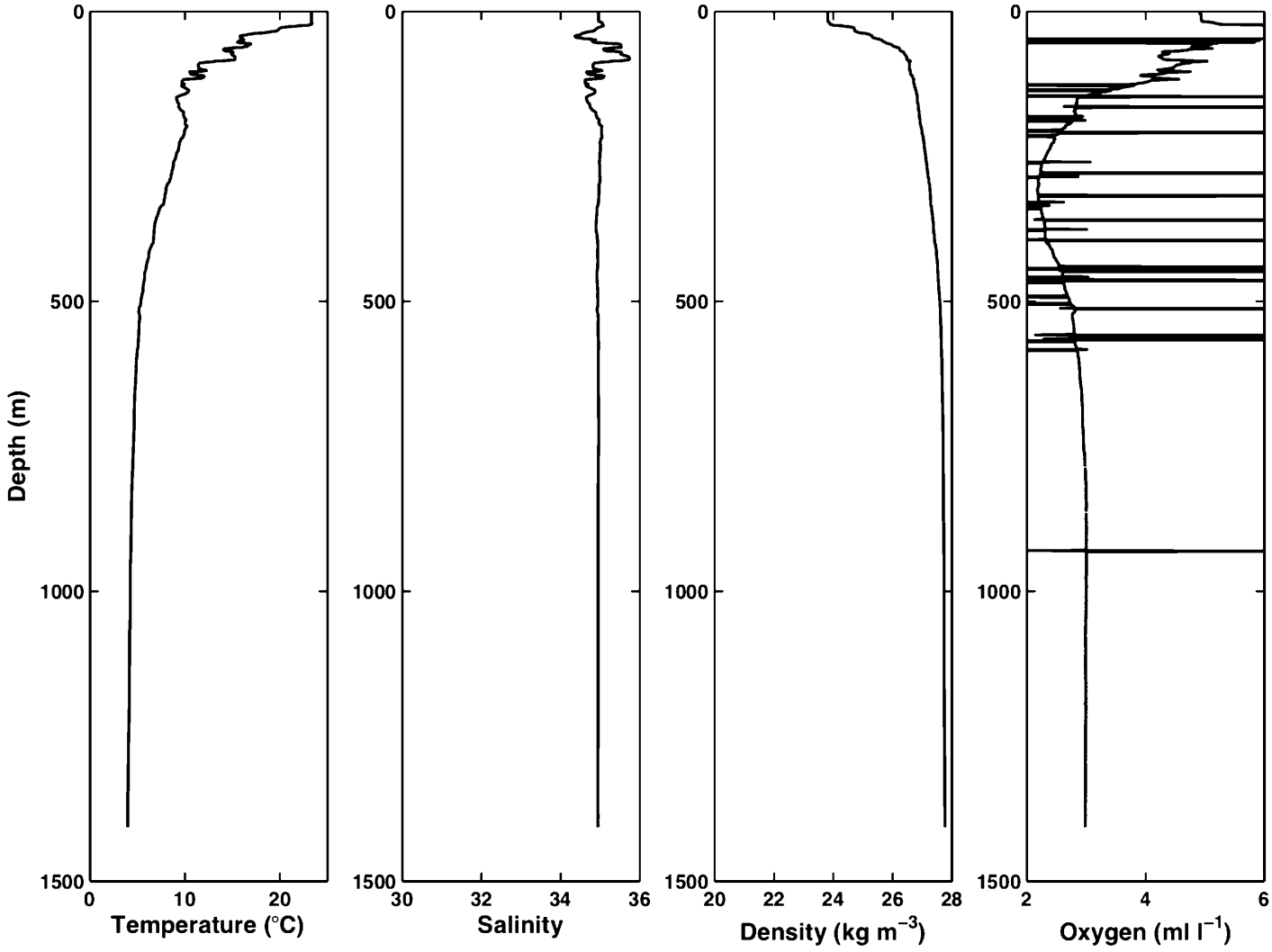


Figure 9c : Set 8 down (facing page) and up casts (Deep Station)

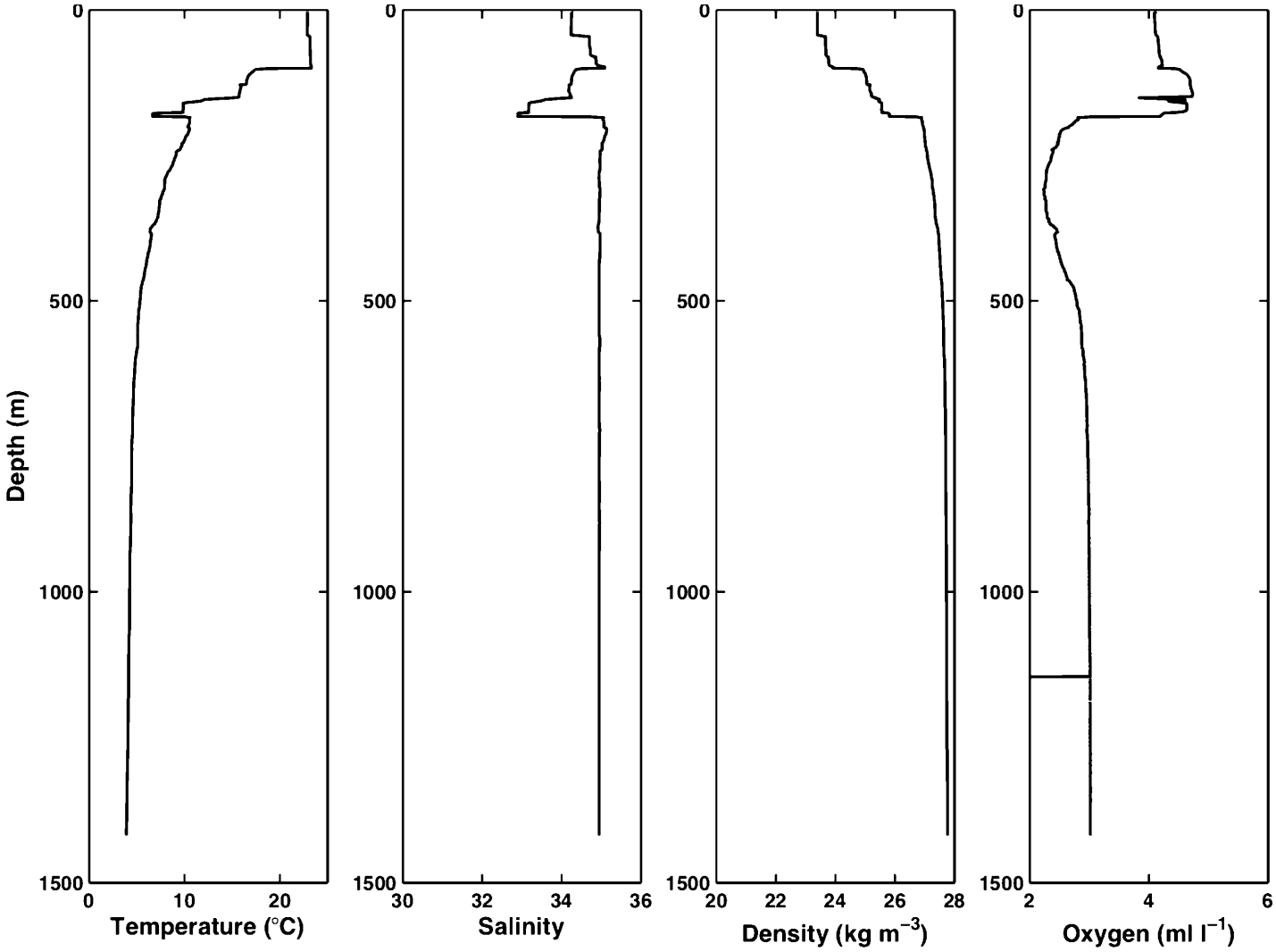


Figure 9d : Set 9 down cast (Deep Station)

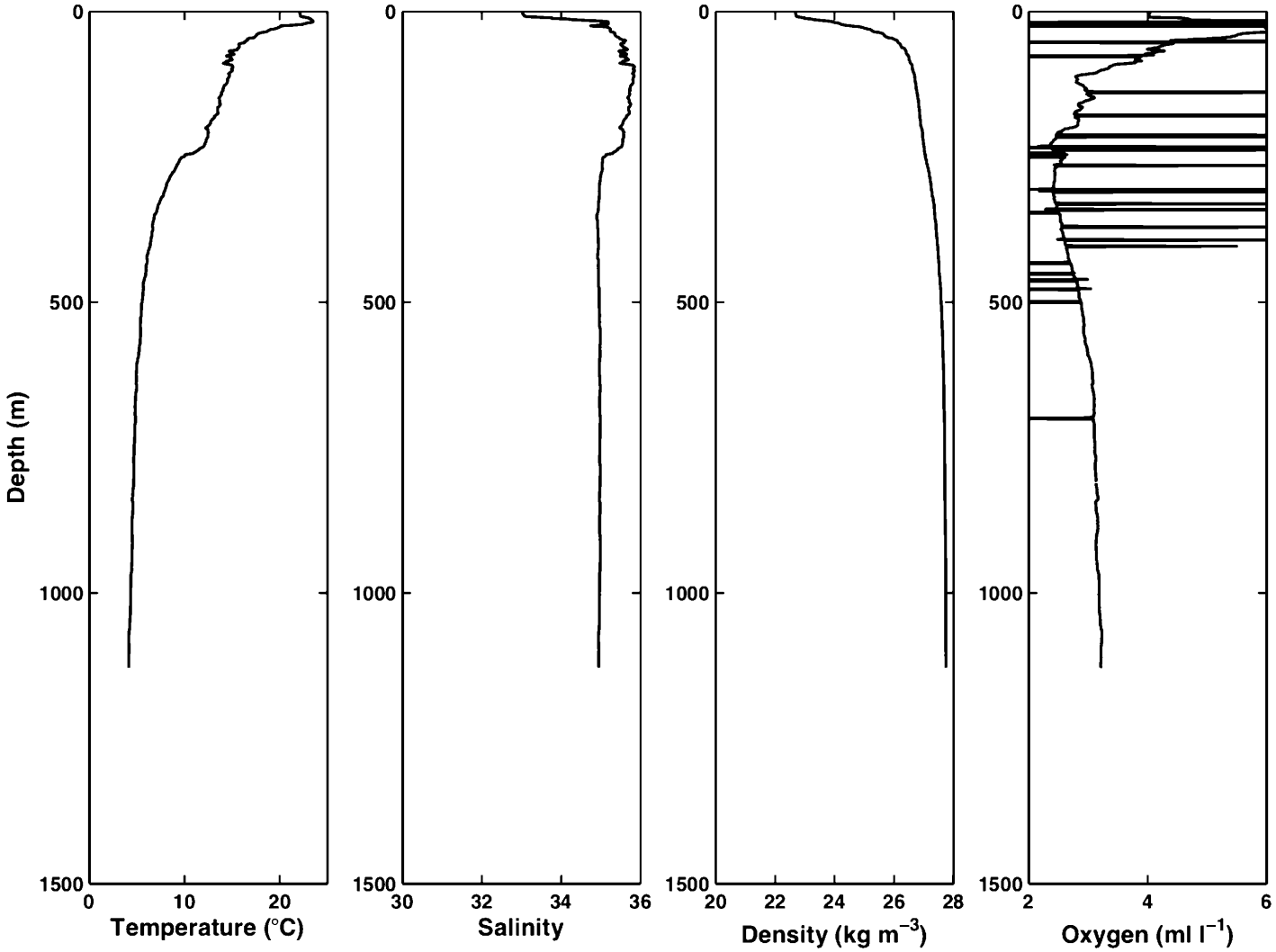


Figure 9e : Set 14 up cast (Deep Station)

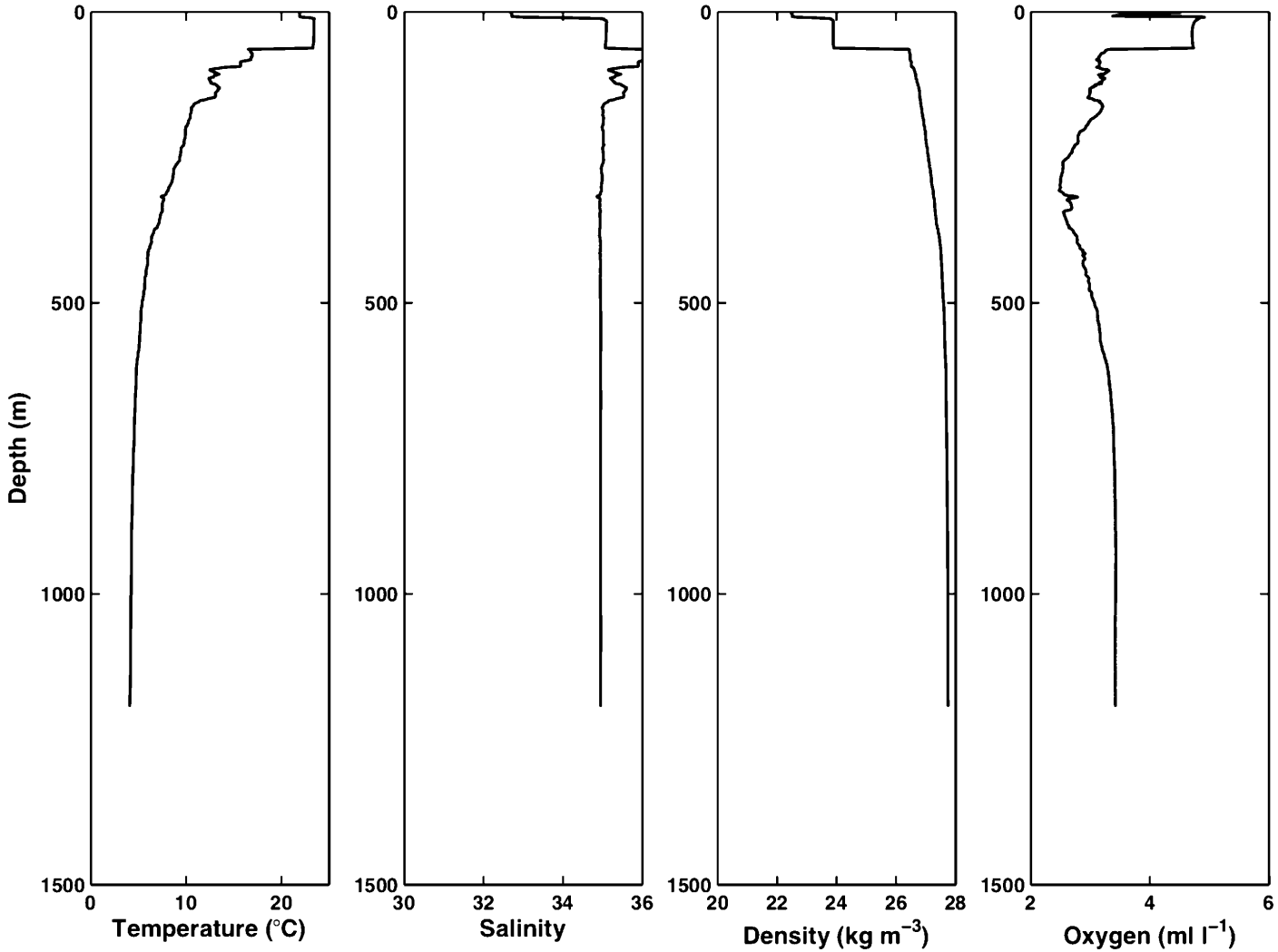
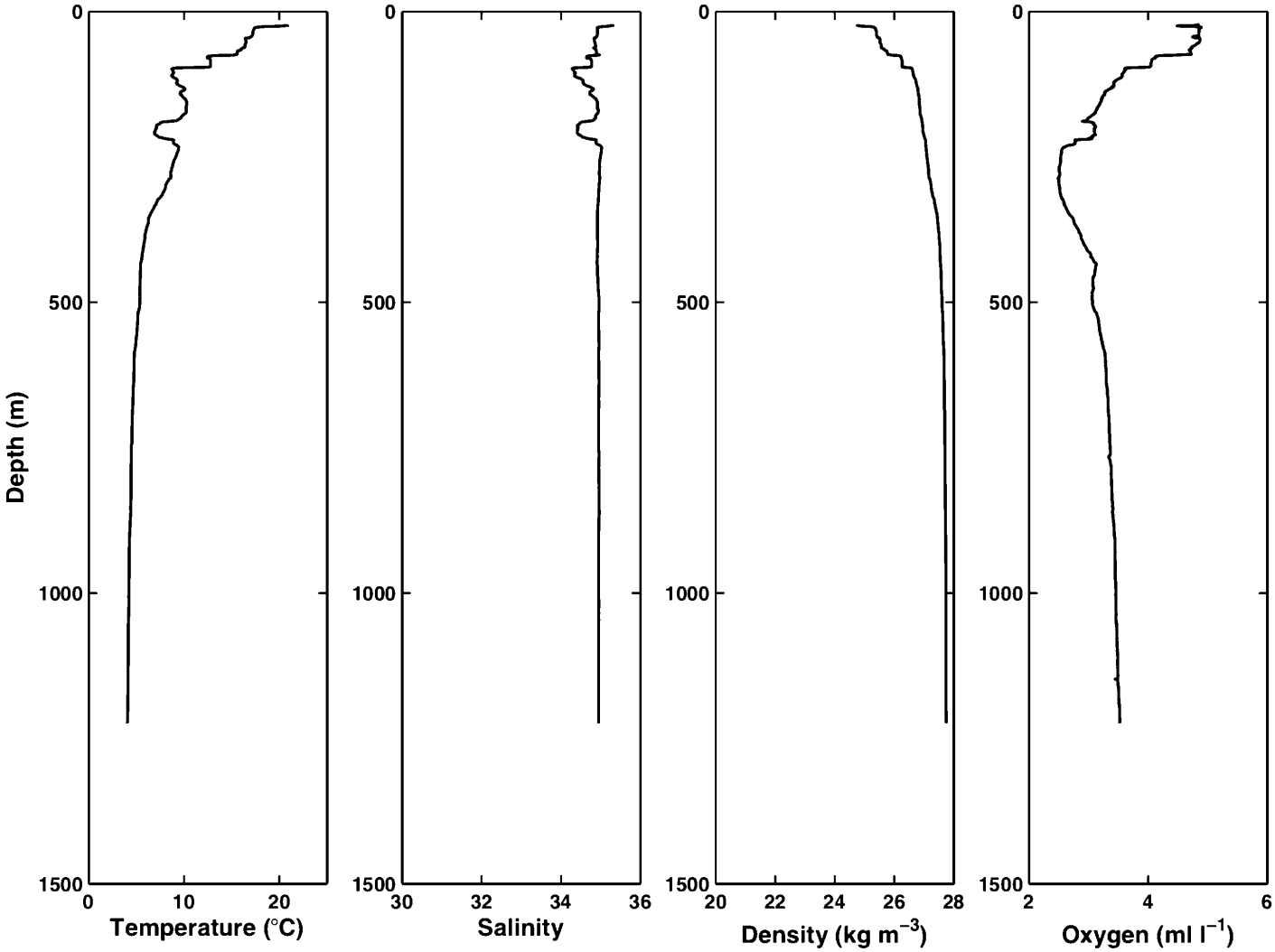


Figure 9f : Set 15 down cast (Deep Station)


Depth (m)
0
500
1000
1500
0
10
20
Temperature (°C)
30
32
34
36
Salinity
20
22
24
26
28
Density (kg m^{-3})
2
4
6
Oxygen (ml l^{-1})

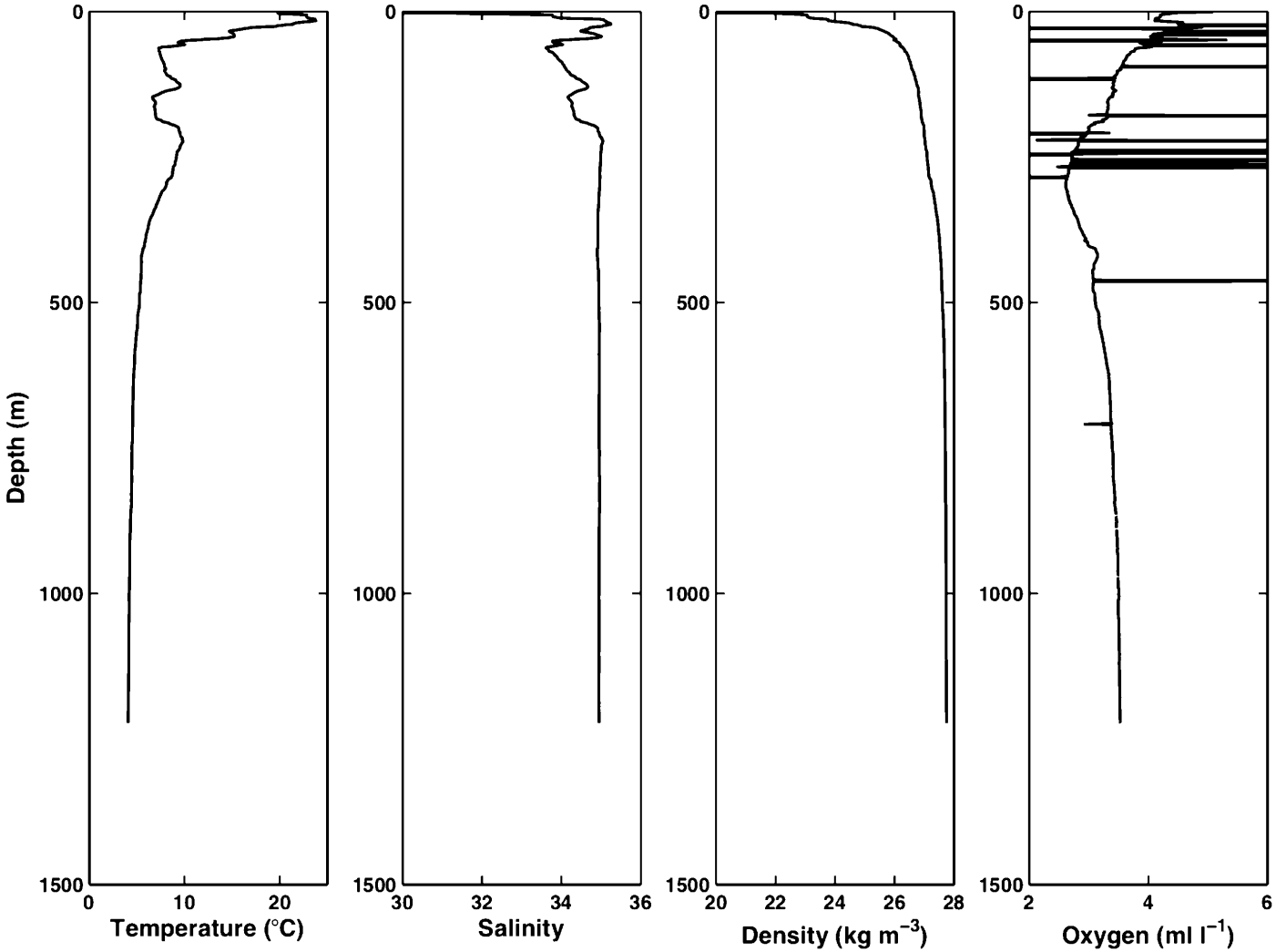


Figure 9g : Set 16 down (facing page) and up casts (Deep Station)

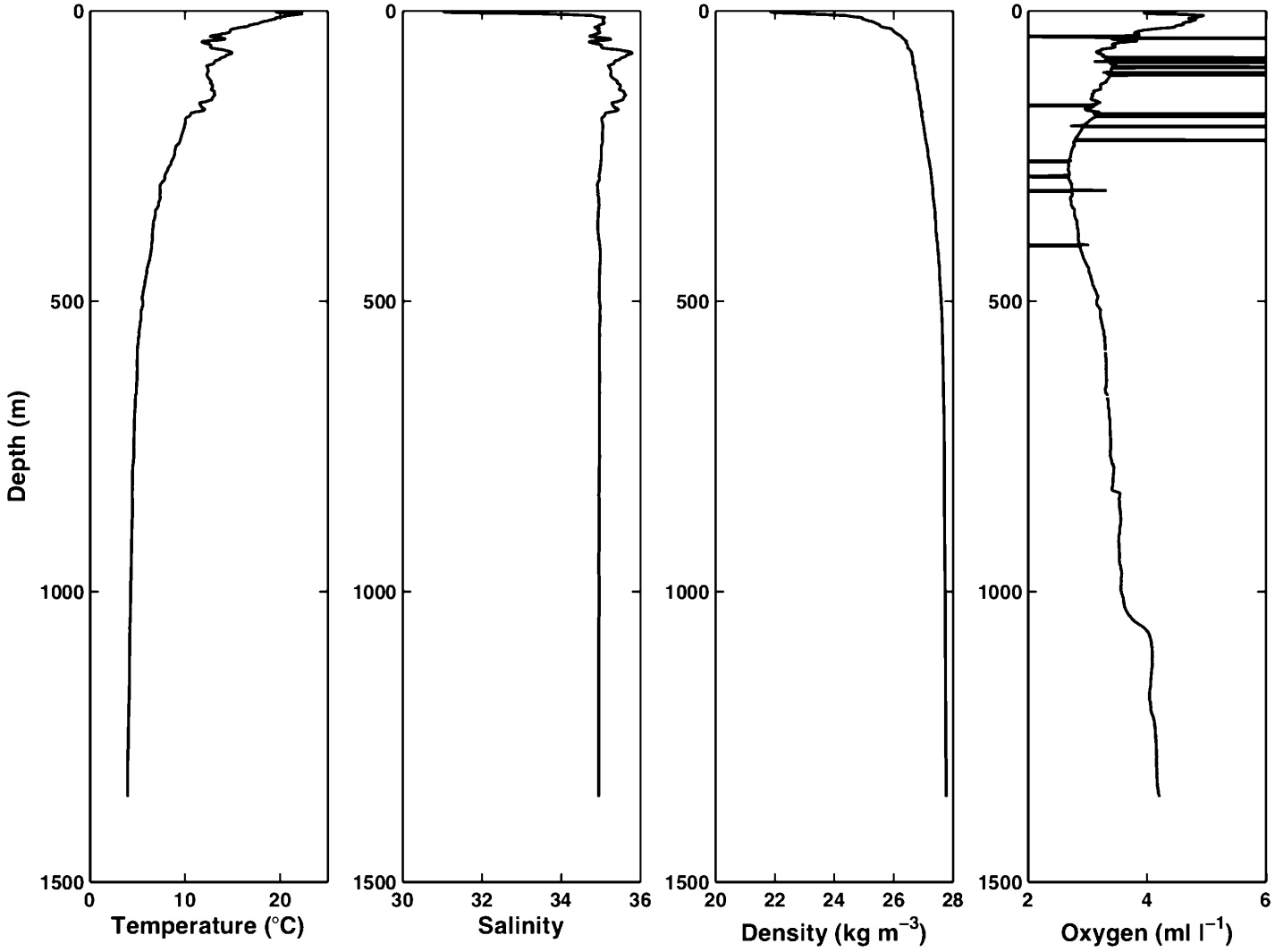


Figure 9h : Set 21 up cast (Deep Station)

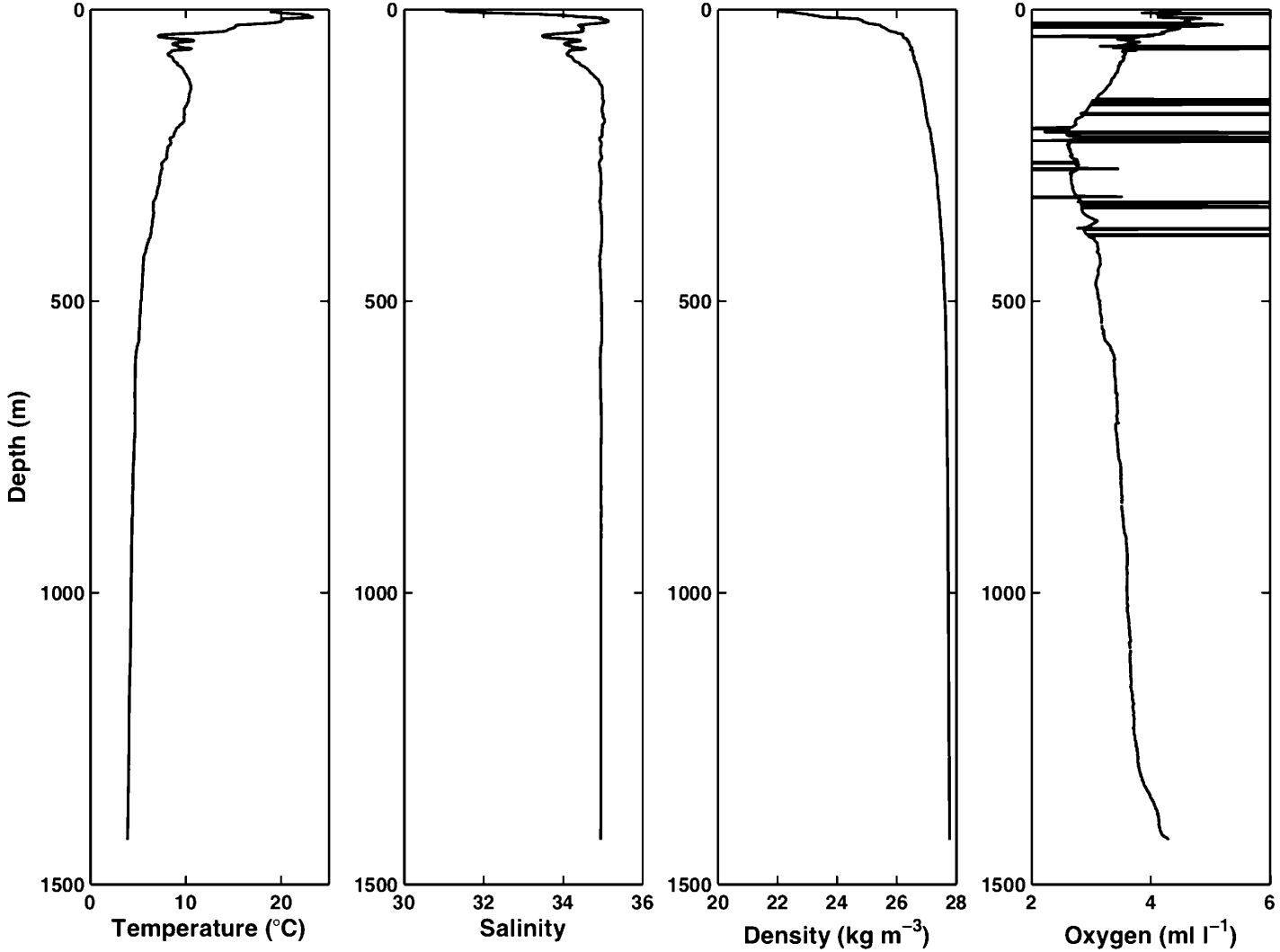


Figure 9i : Set 22 up cast (Banquereau Spur)

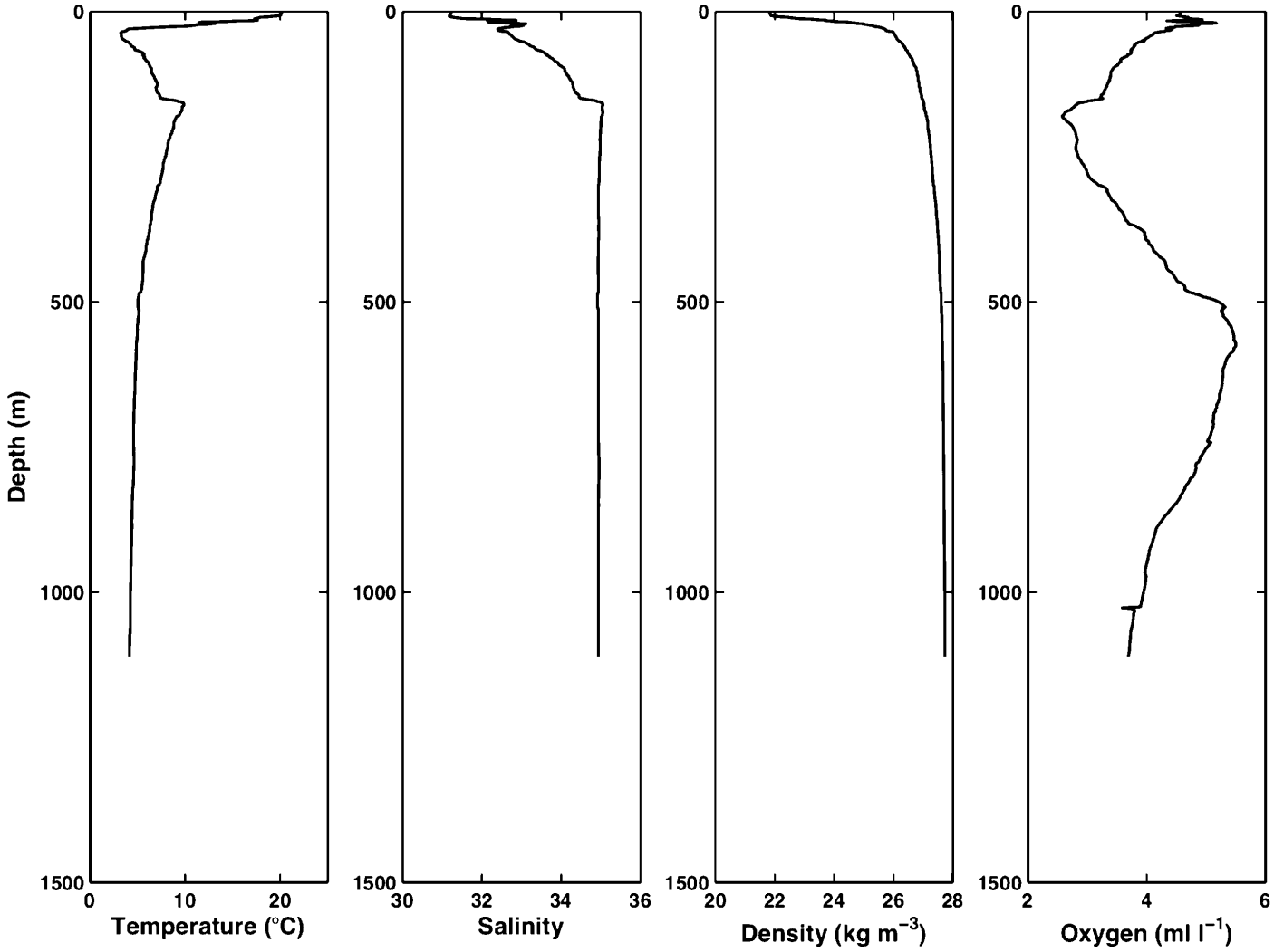
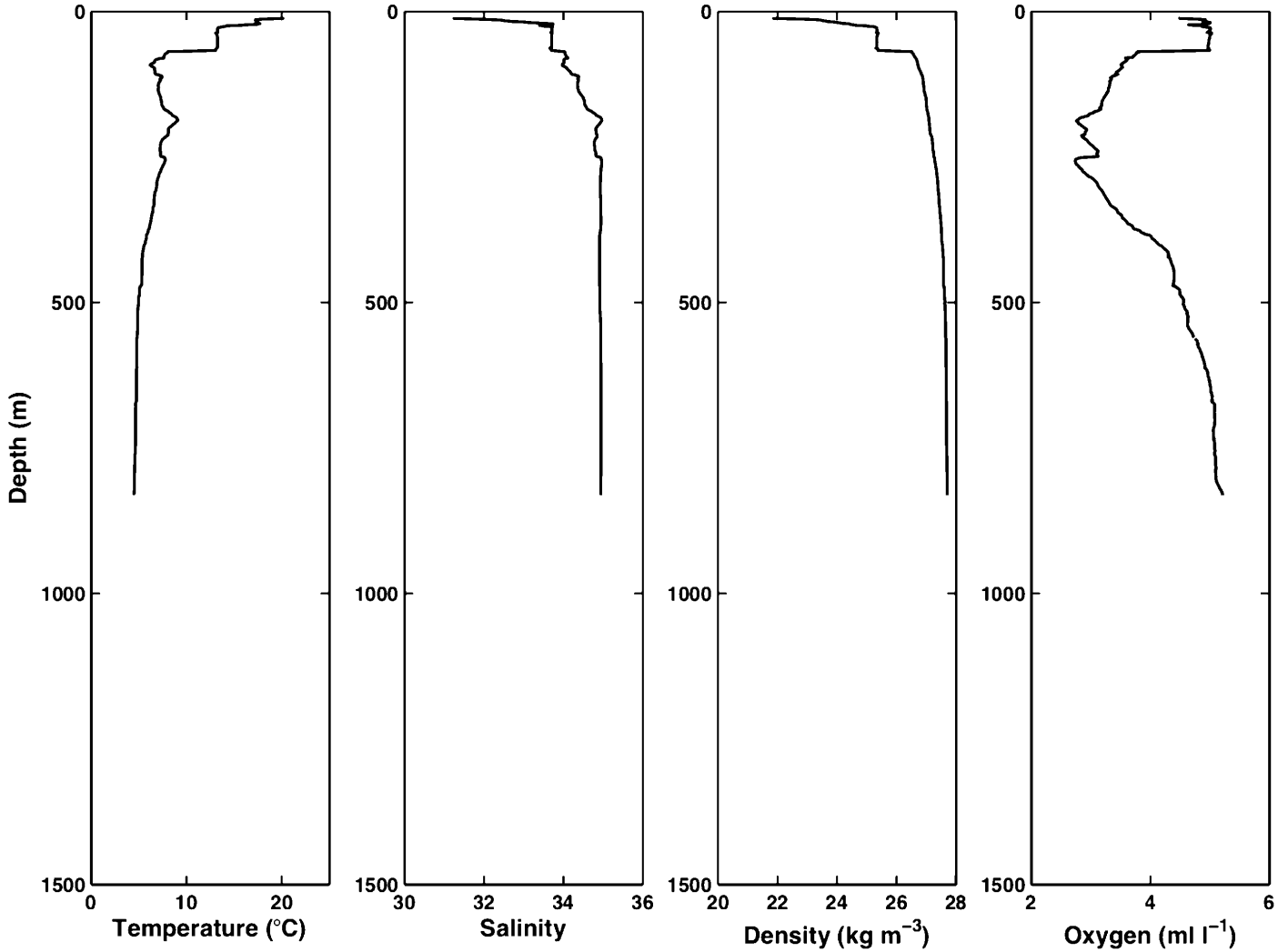


Figure 9j : Set 23 down cast (Main Station)


Depth (m)
0
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1000
1500
0
10
20
Temperature (°C)
30
32
34
36
Salinity
20
22
24
26
28
Density (kg m^{-3})
2
4
6
Oxygen (ml l^{-1})

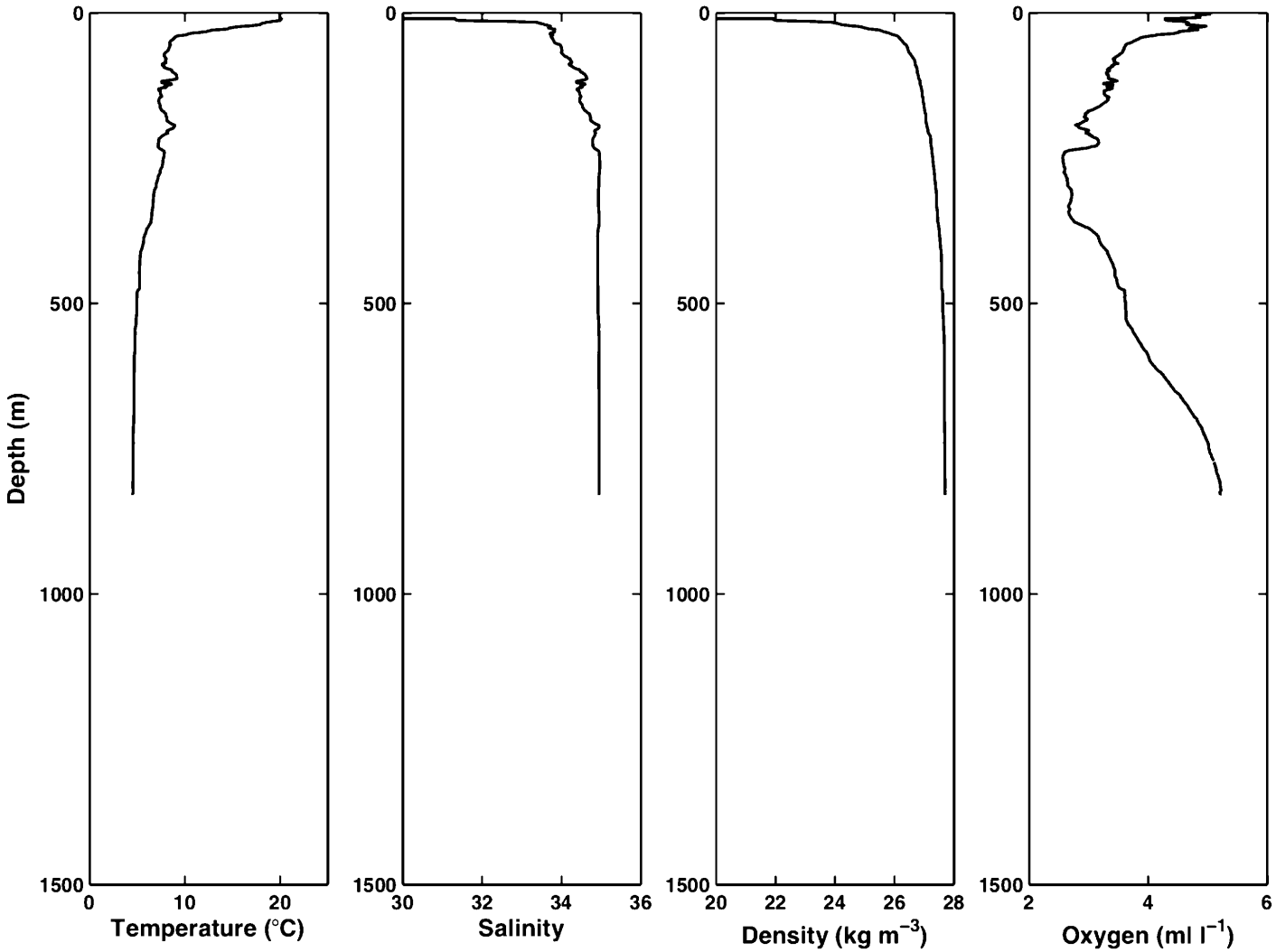
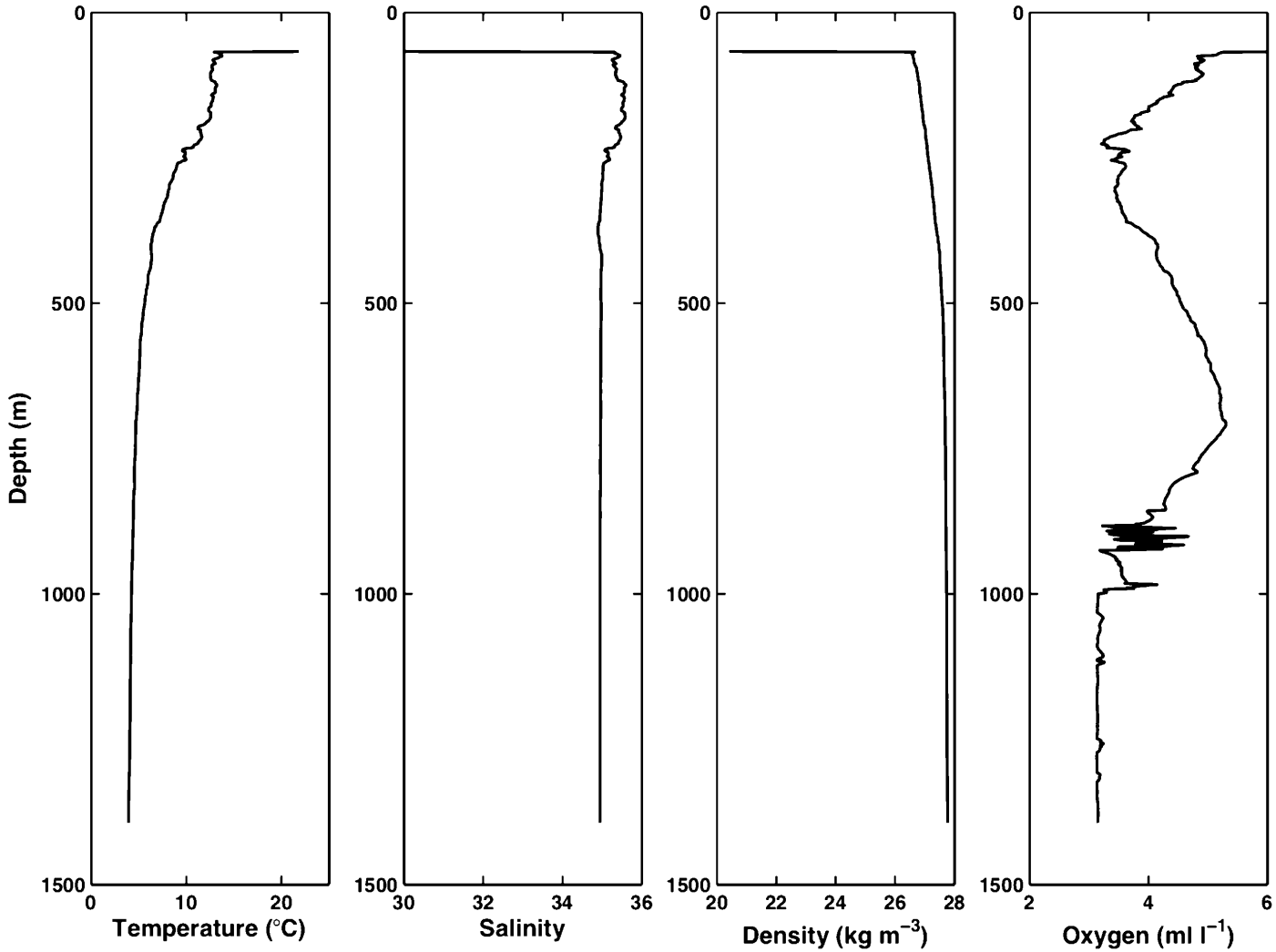


Figure 9k : Set 24 down (facing page) and up casts (Main Station)


Depth (m)
0
500
1000
1500
0
10
20
Temperature (°C)
30
32
34
36
Salinity
20
22
24
26
28
Density (kg m^{-3})
2
4
6
Oxygen (ml l^{-1})

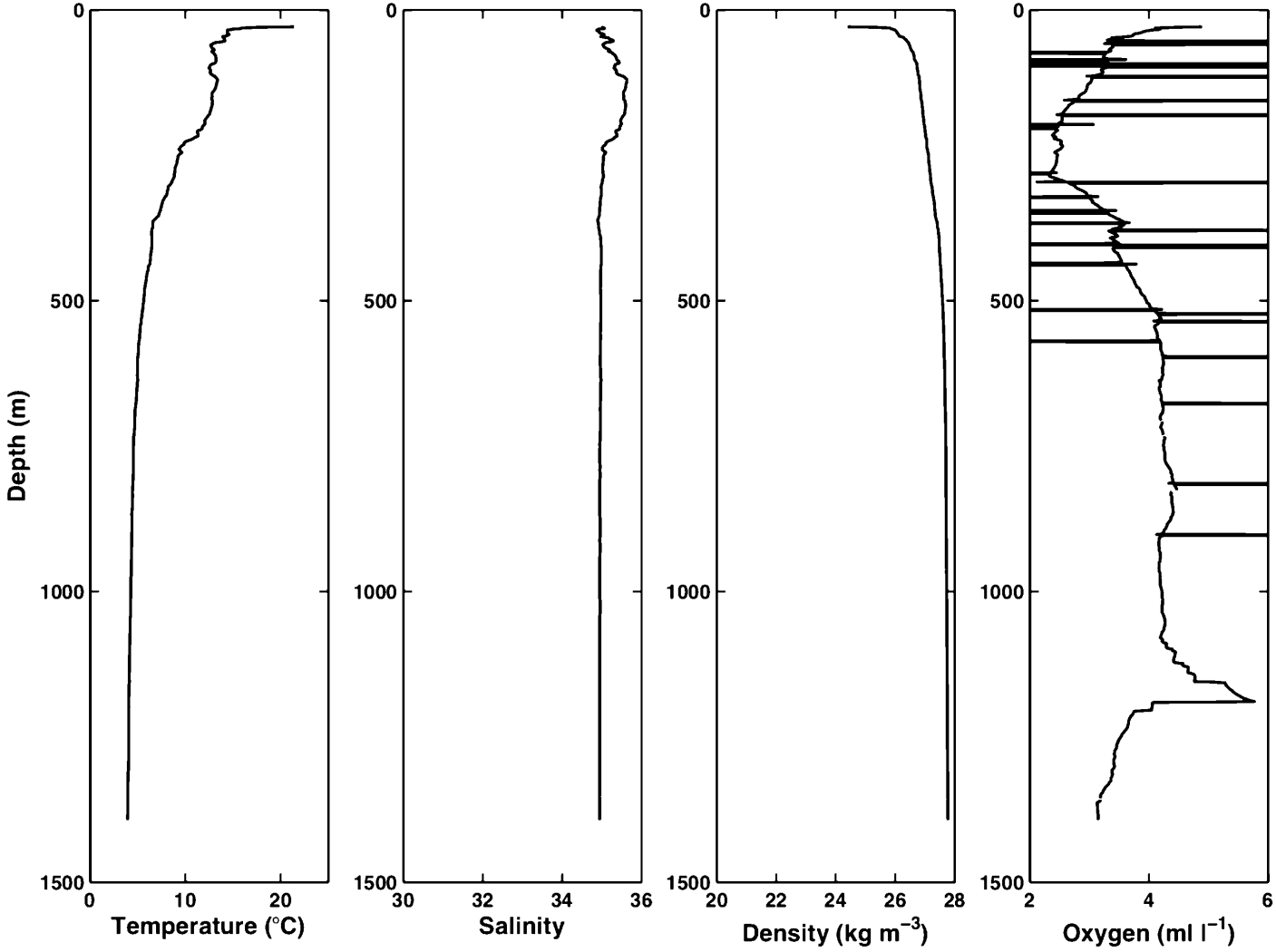


Figure 9l : Set 28 down (facing page) and up casts (Banquereau Spur)

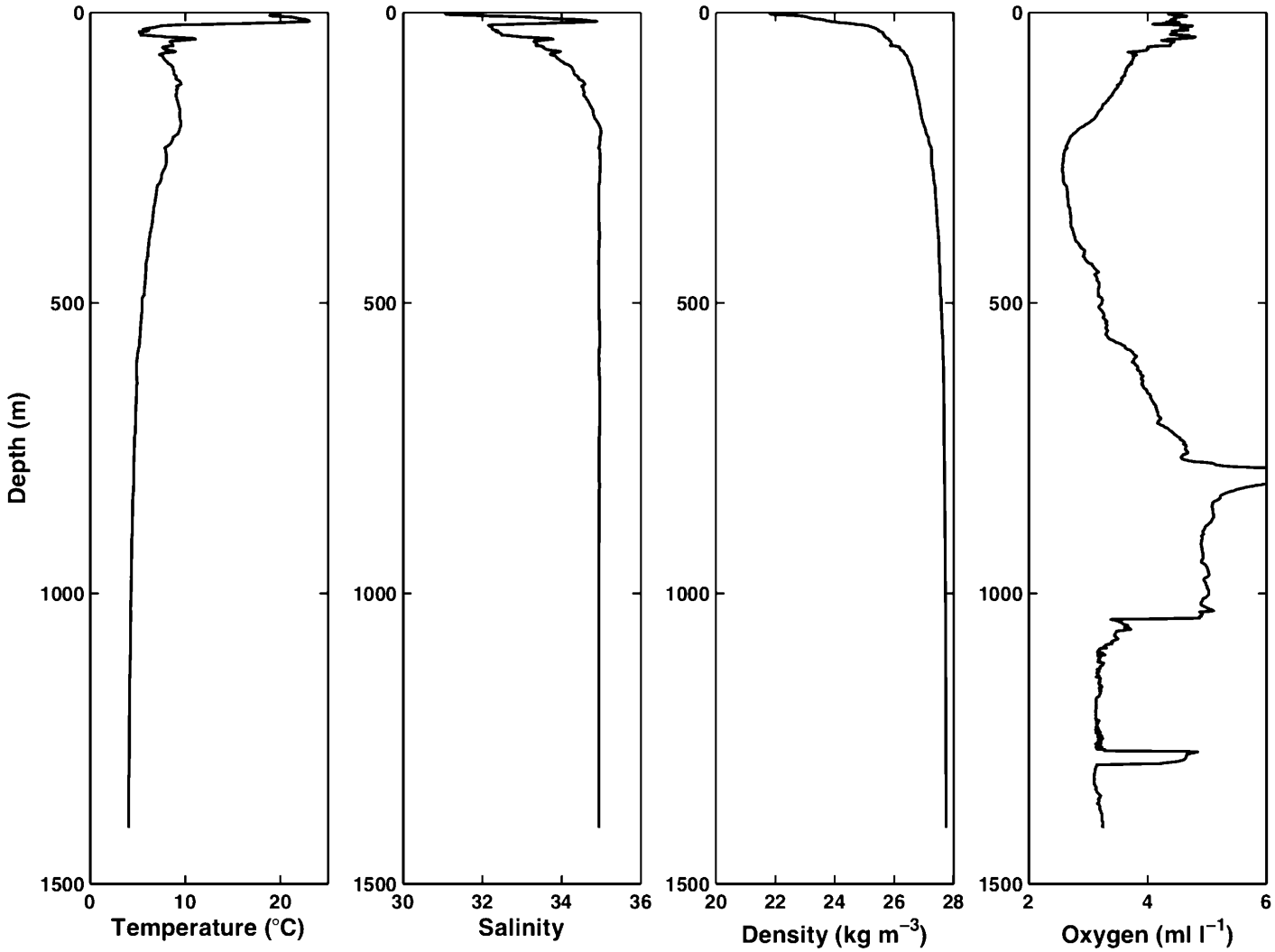
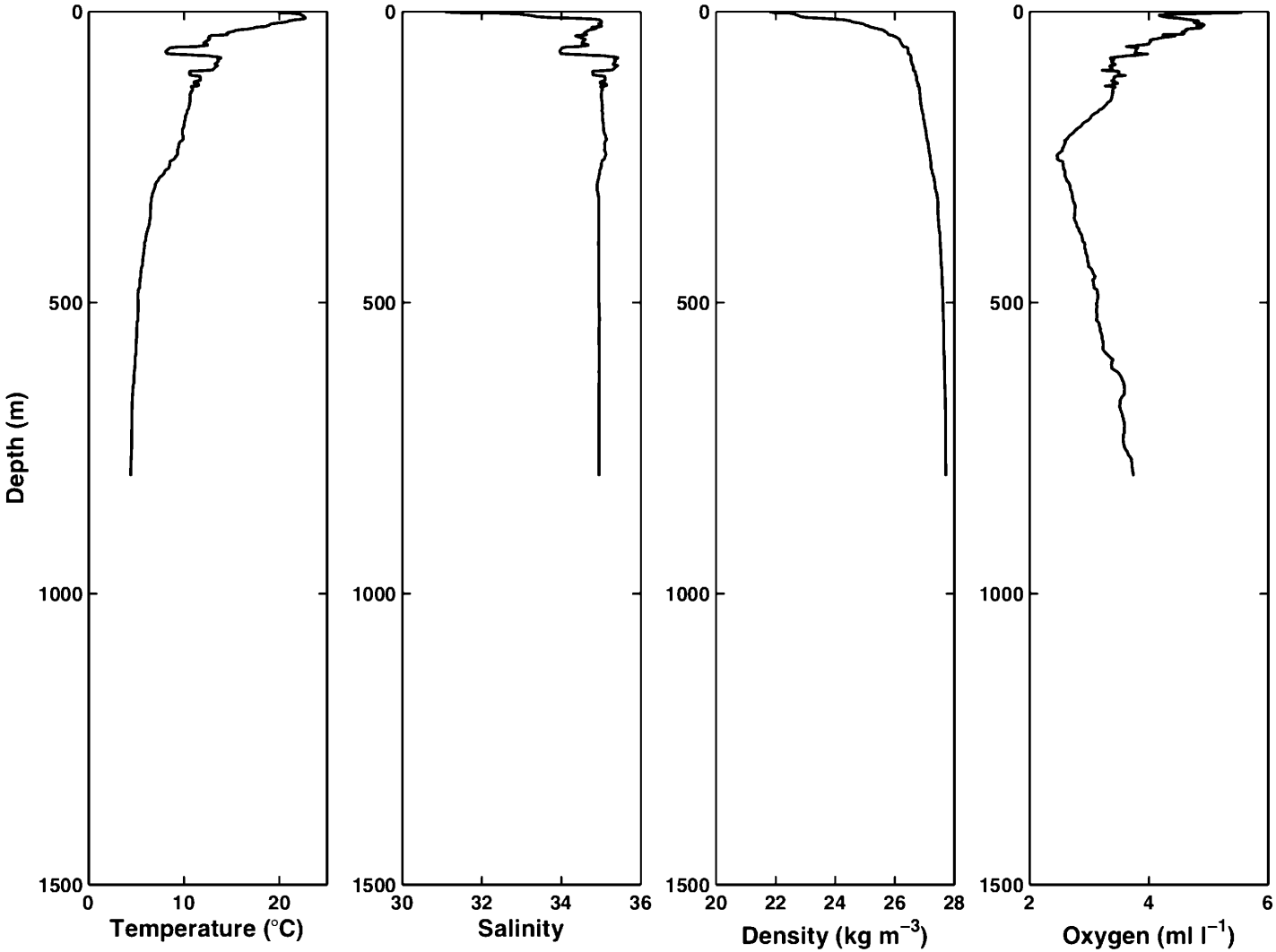


Figure 9m : Set 29 down cast (Banquereau Spur)


Depth (m)
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1500
0
10
20
Temperature (°C)
30
32
34
36
Salinity
20
22
24
26
28
Density (kg m^{-3})
2
4
6
Oxygen (ml l^{-1})

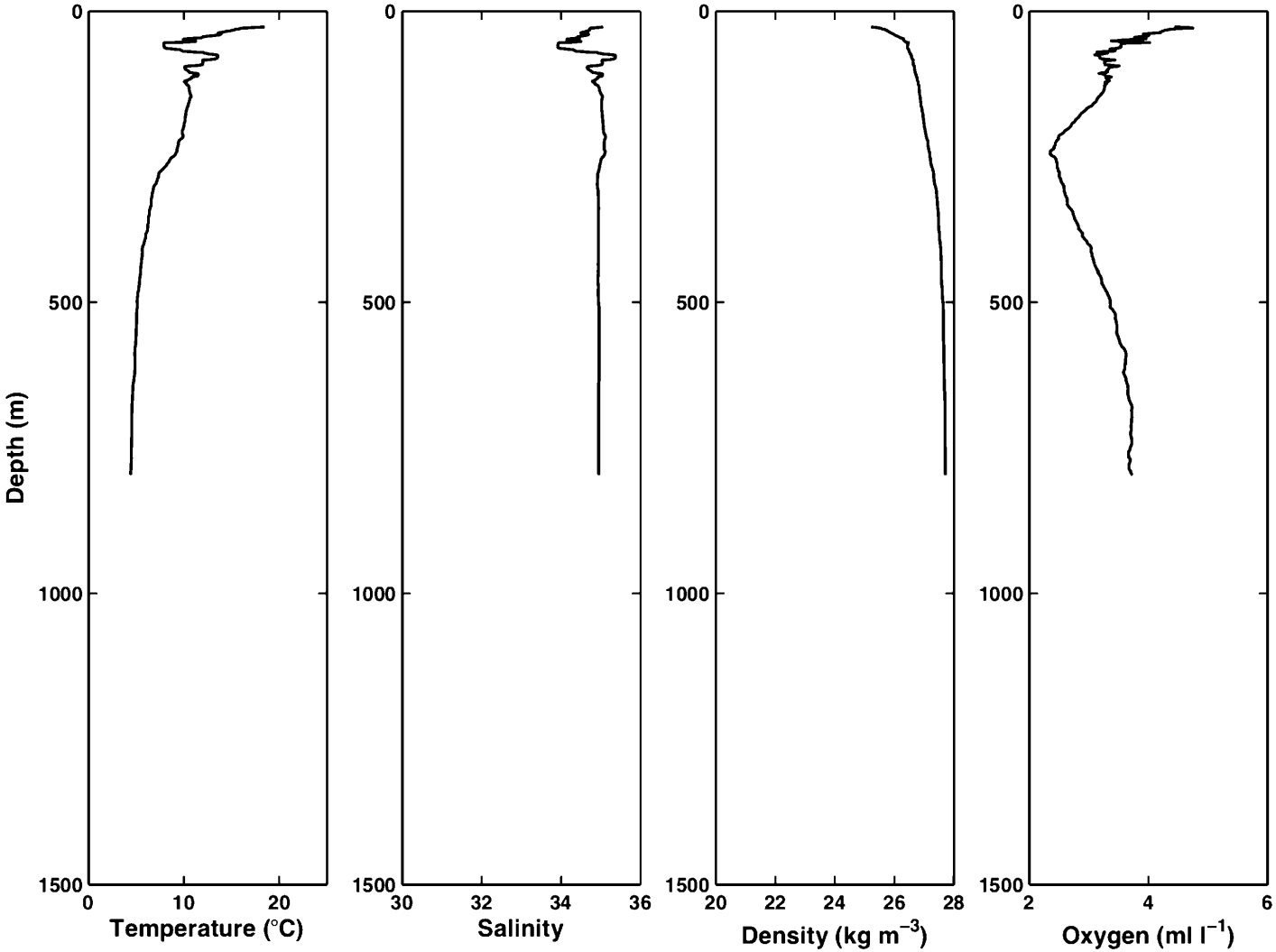
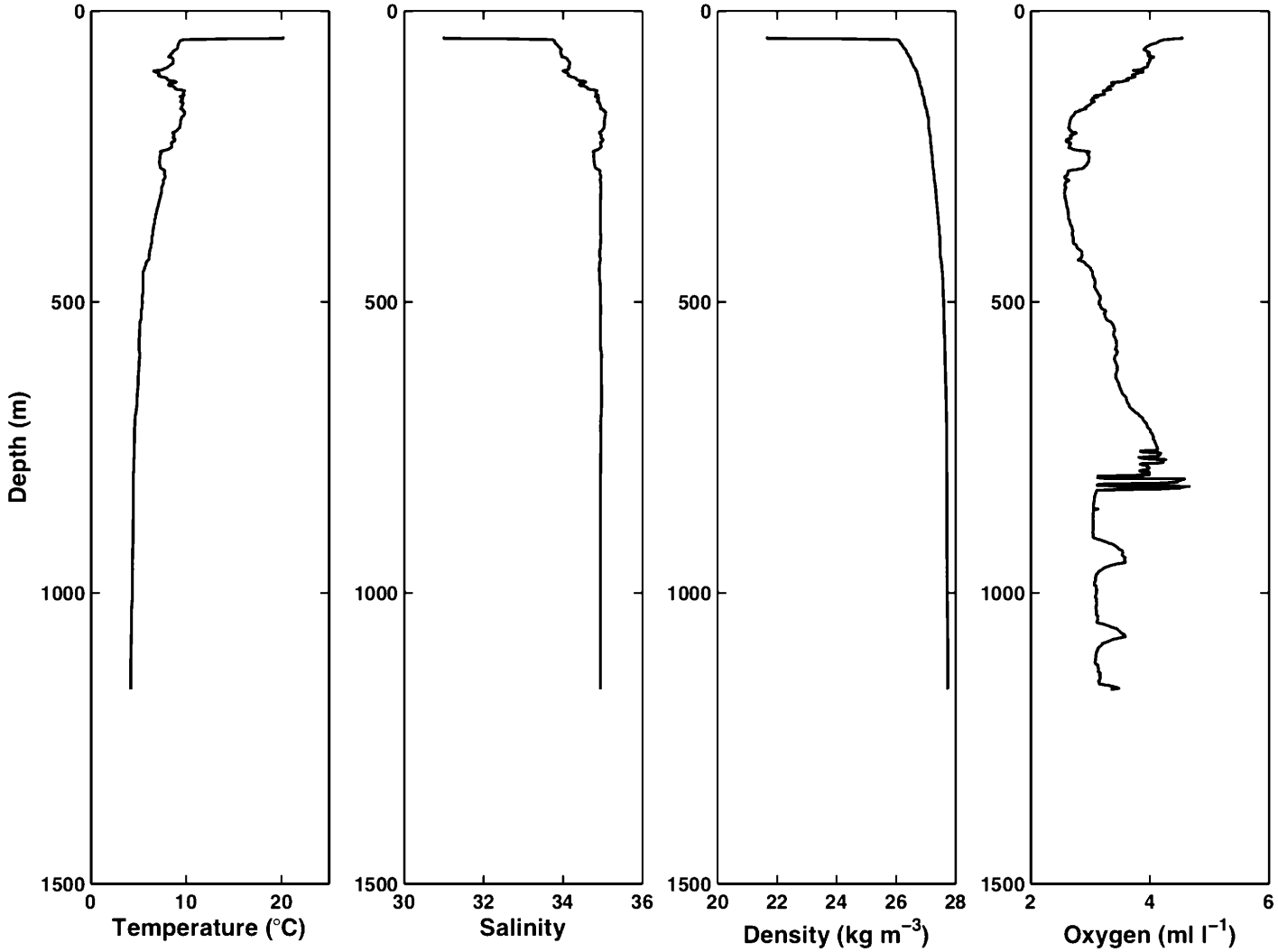


Figure 9n : Set 30 down (facing page) and up casts (Banquereau Spur)


Depth (m)
0
500
1000
1500
0
10
20
Temperature (°C)
30
32
34
36
Salinity
20
22
24
26
28
Density (kg m^{-3})
2
4
6
Oxygen (ml l^{-1})

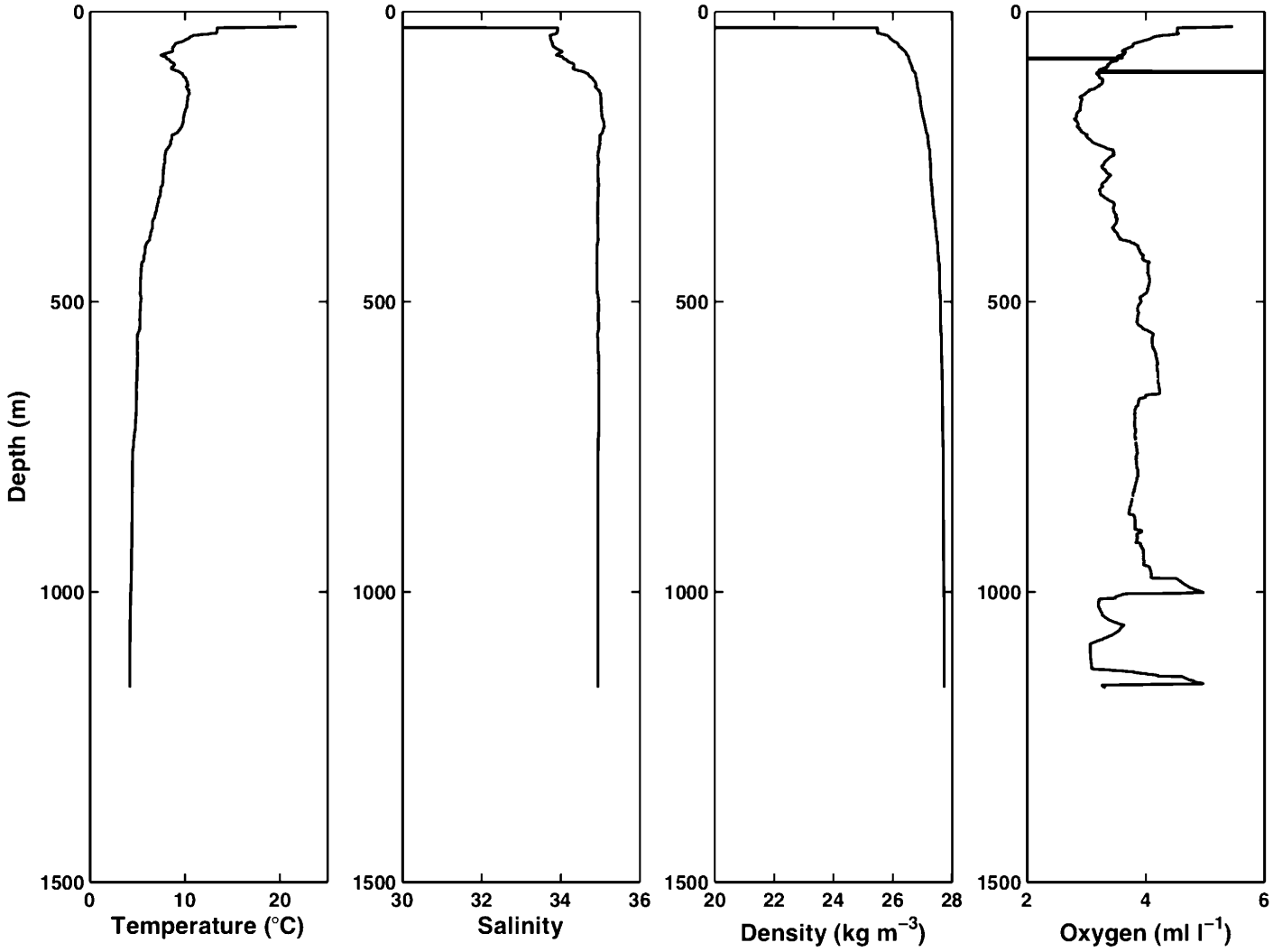


Figure 9o : Set 36 down (facing page) and up casts (Main Station)

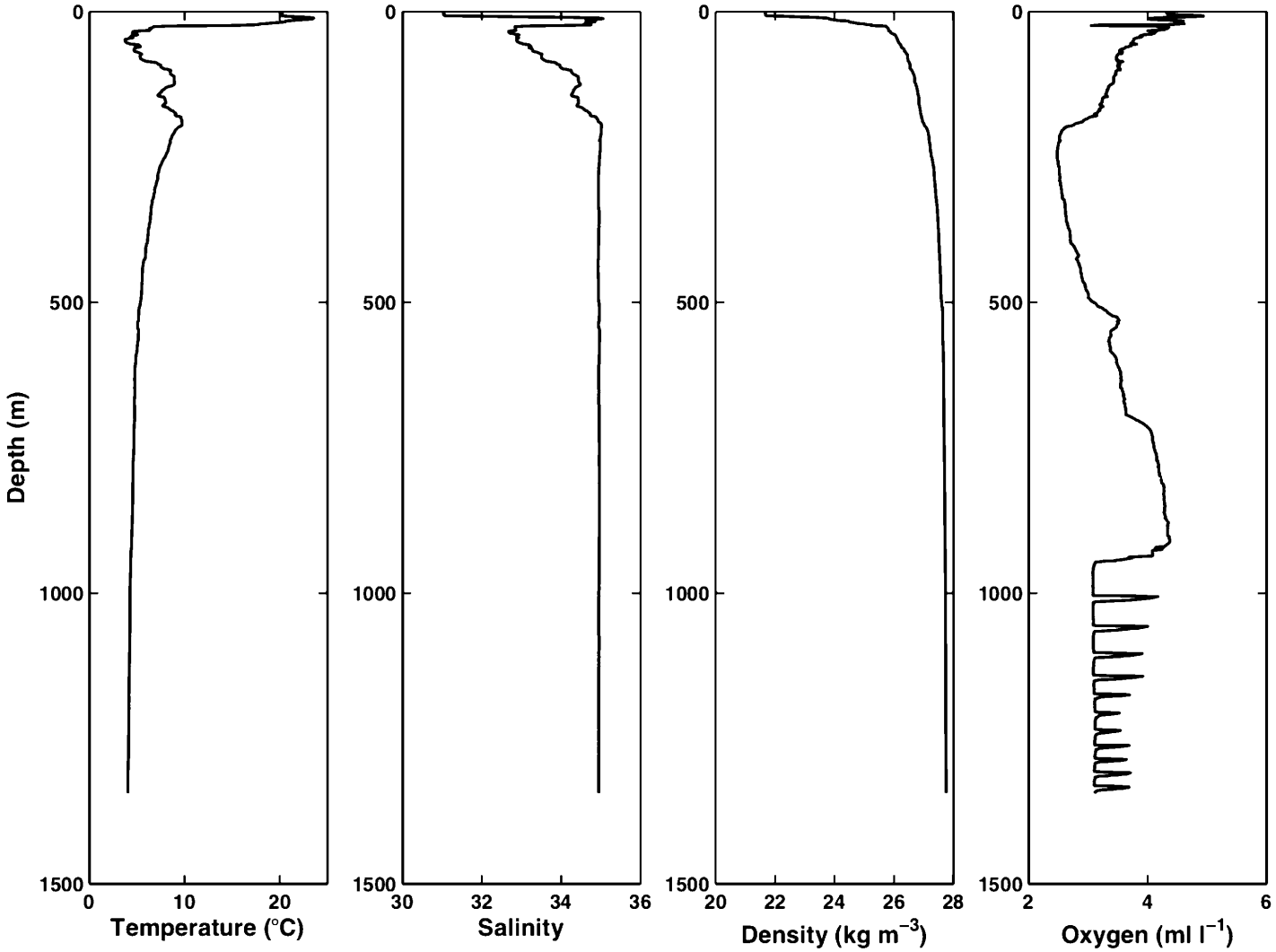


Figure 9p : Set 37 down cast (GULD4 Station)

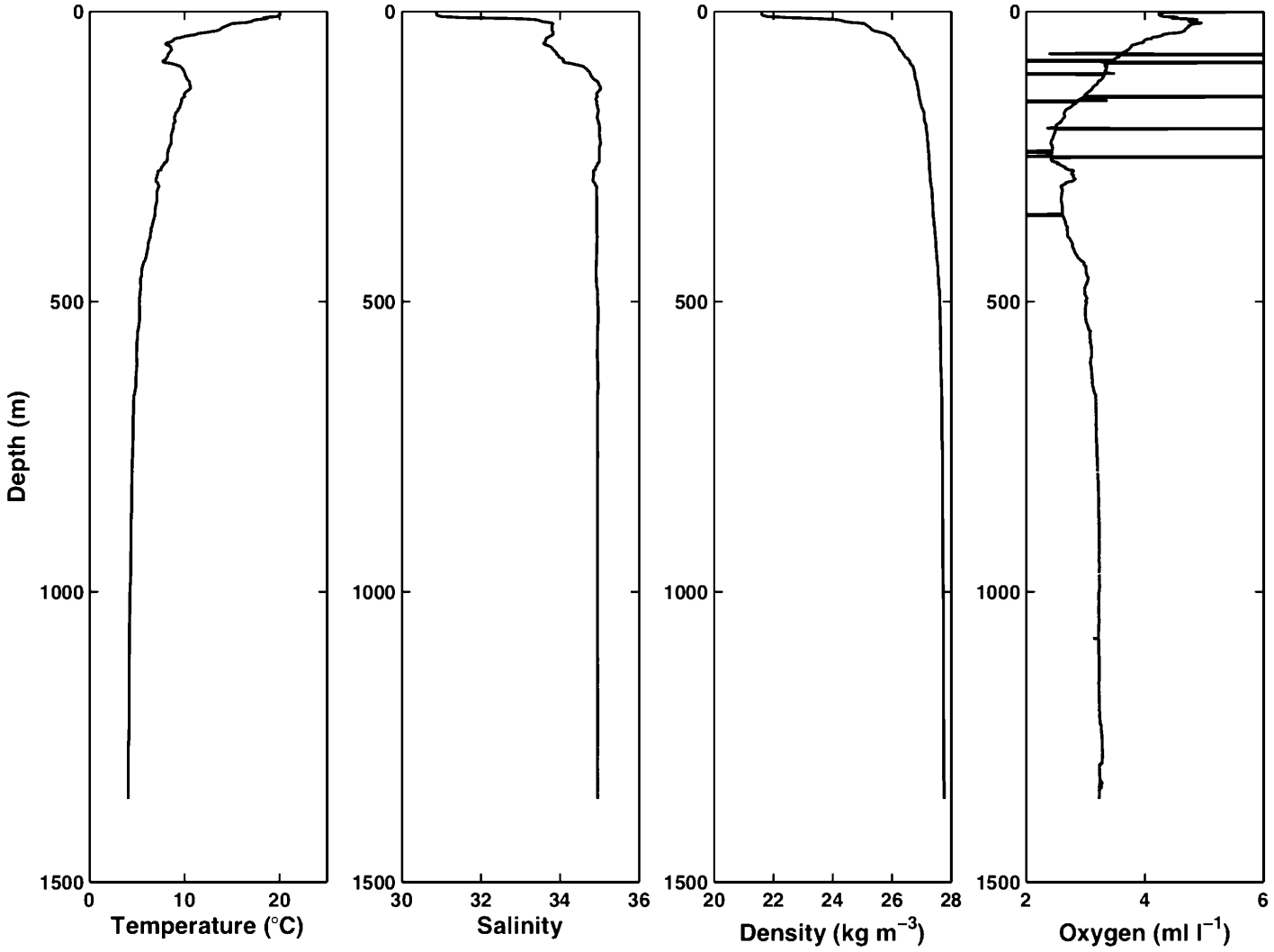


Figure 9q : Set 42 up cast (Main Station)

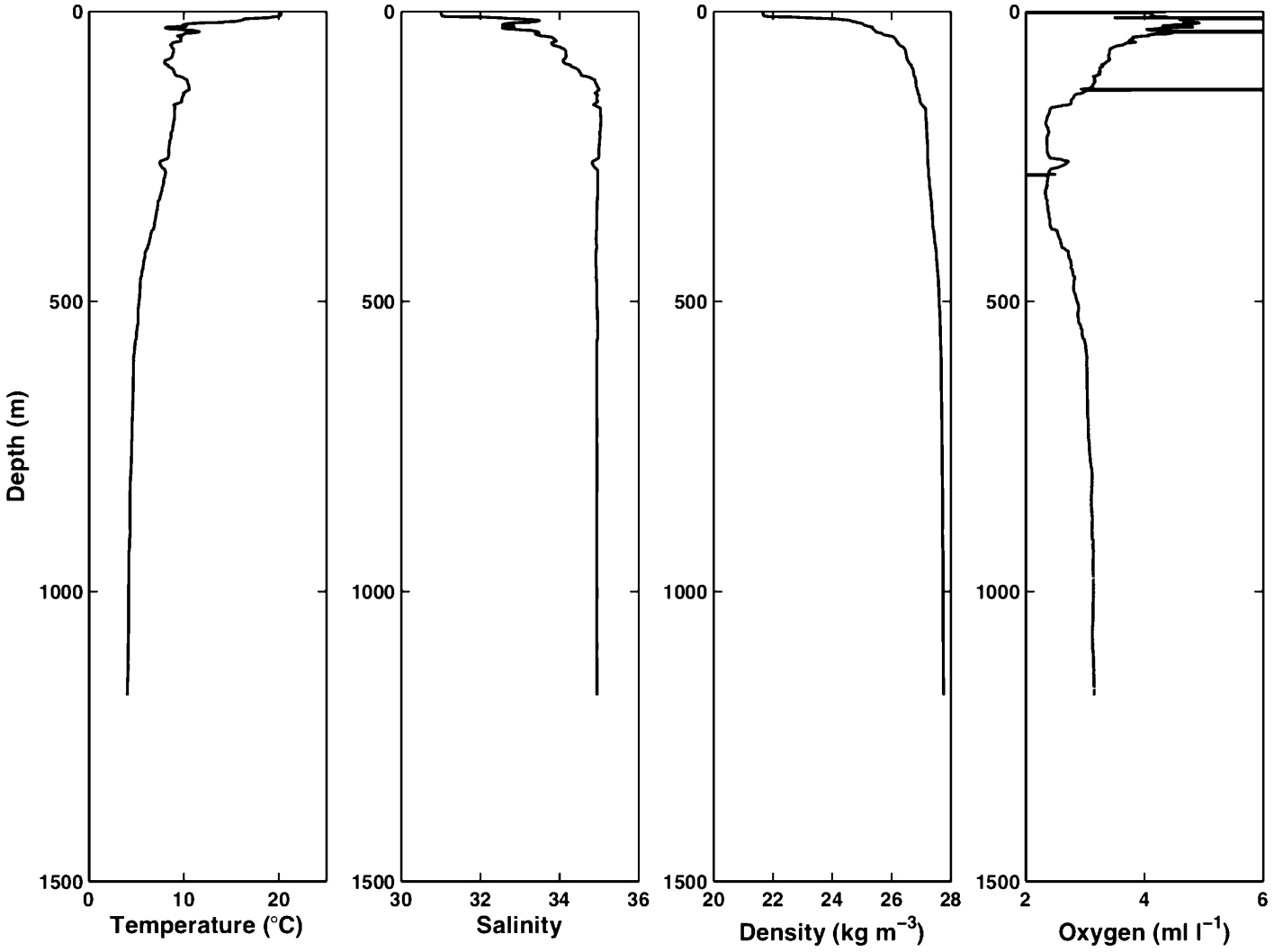


Figure 9r : Set 47 up cast (Main Station)

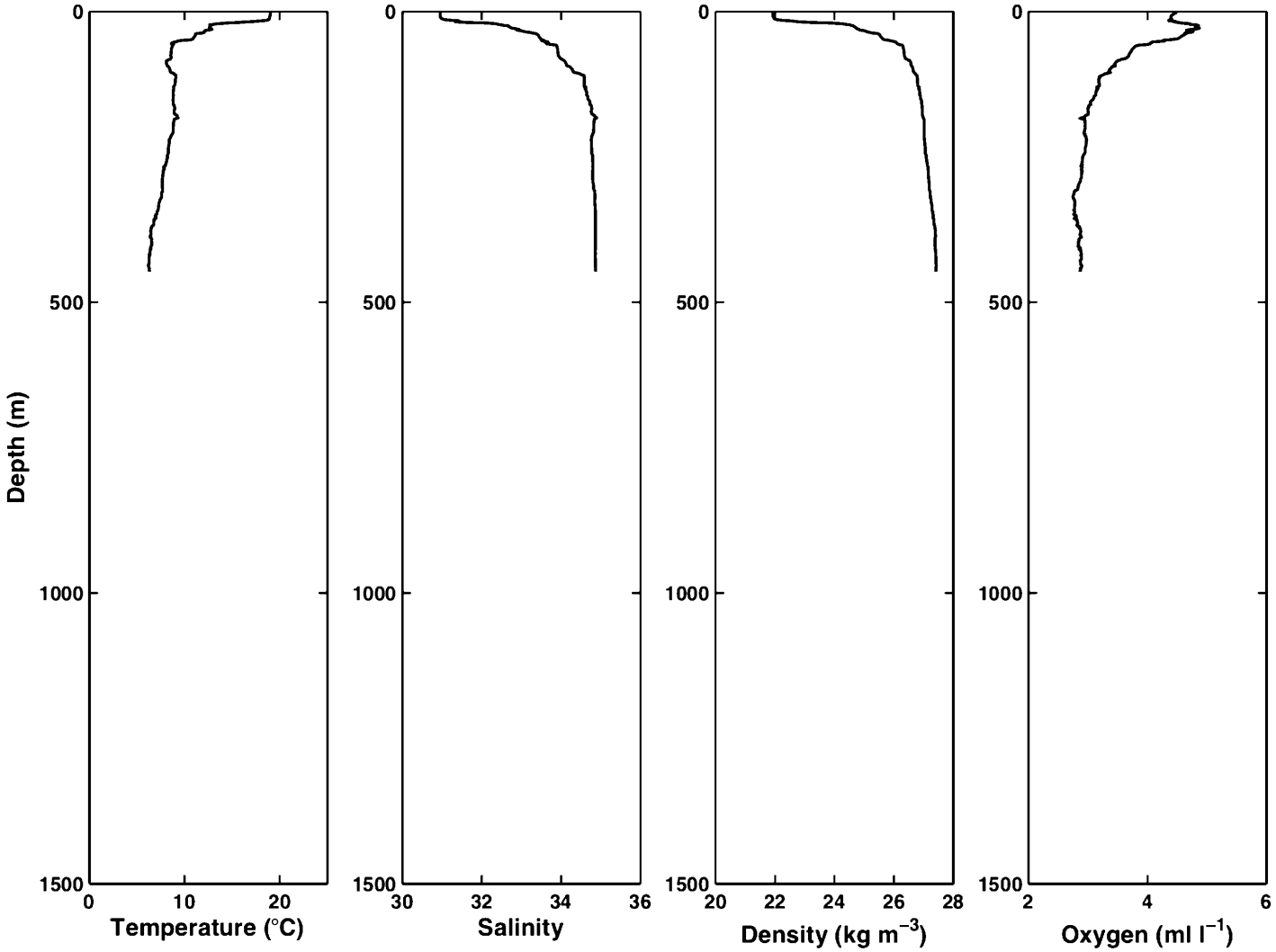


Figure 9s : Set 48 down cast (GULD3 Station)

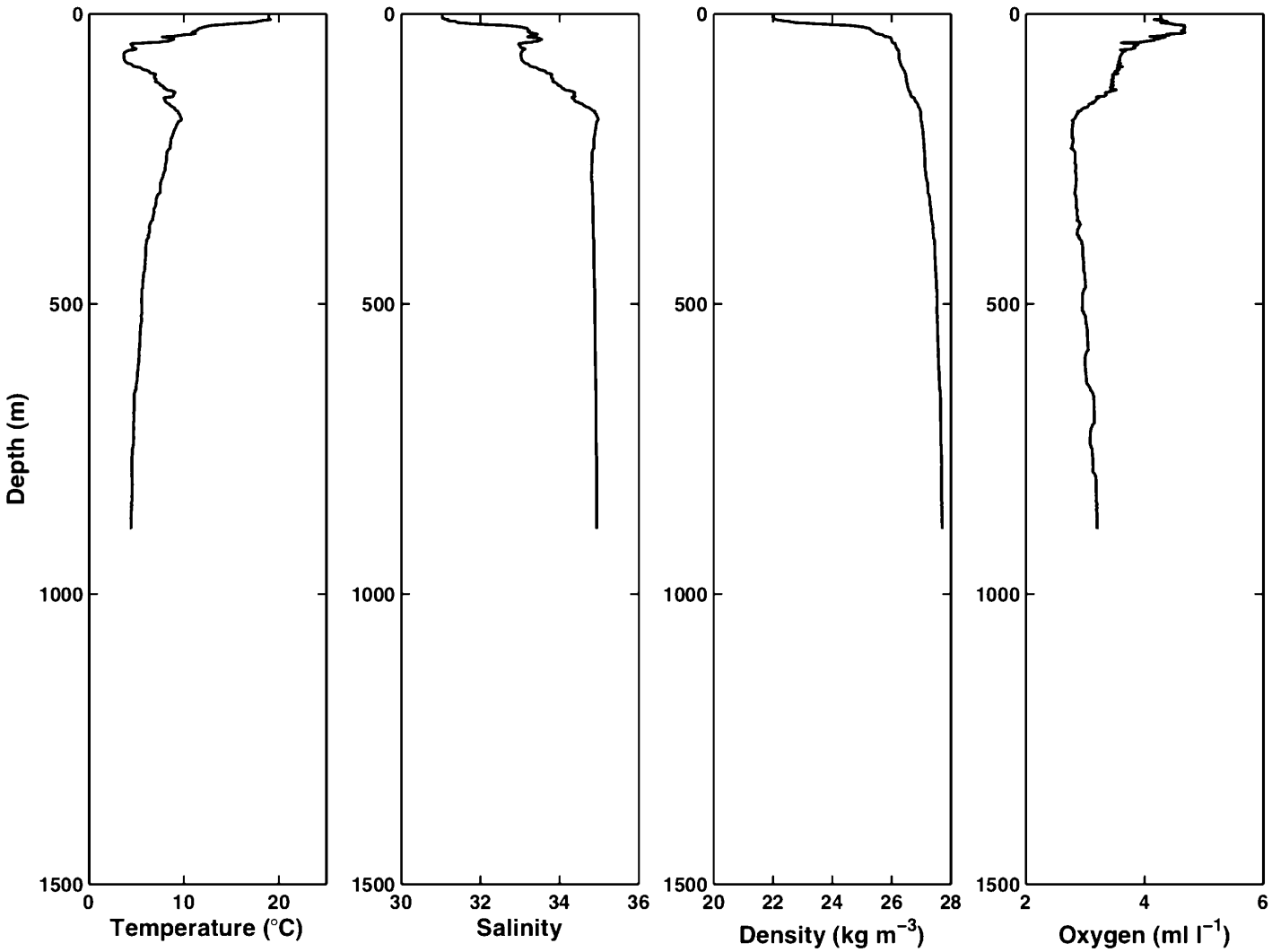


Figure 9t : Set 49 down cast (Head Station)

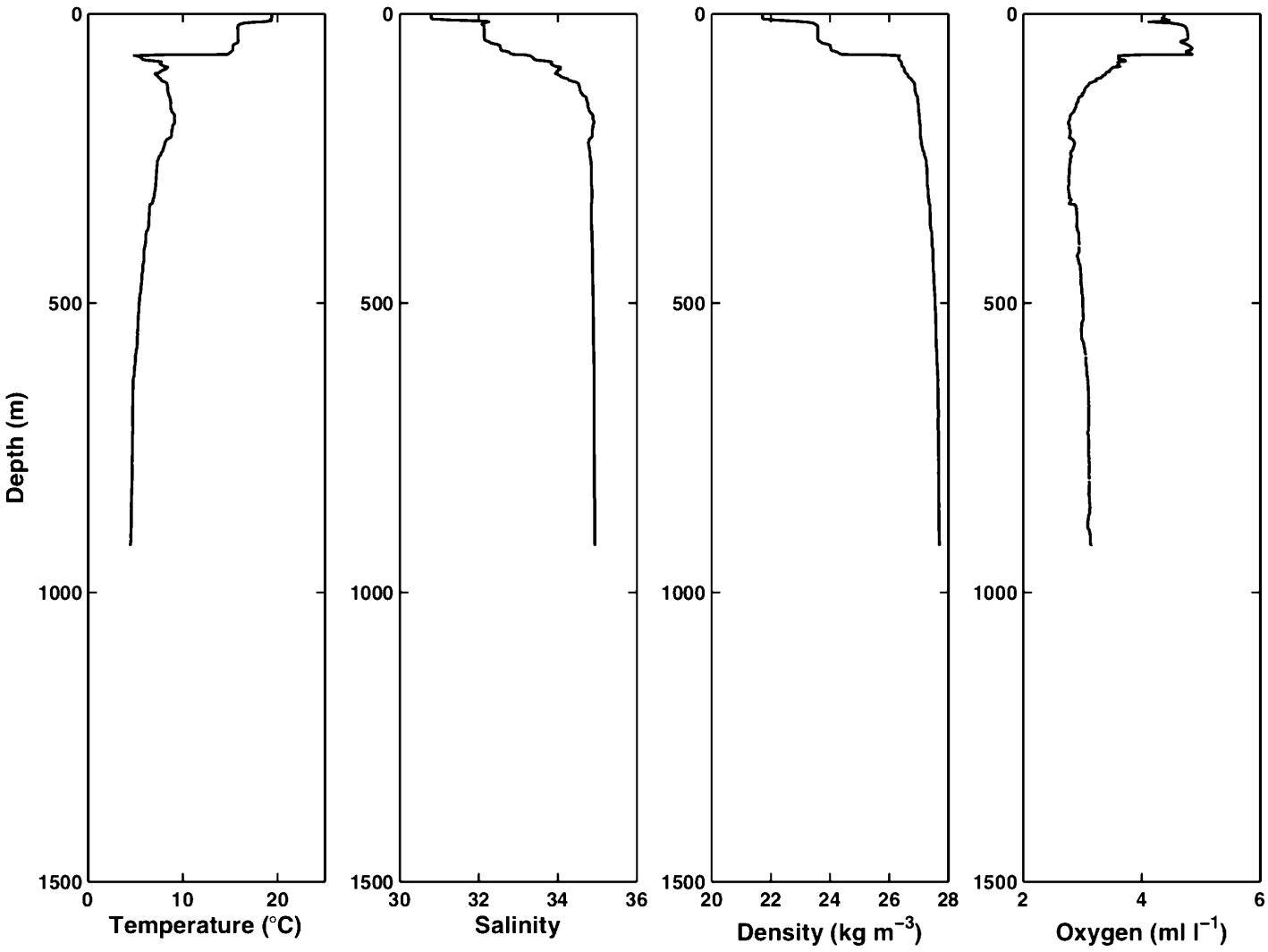


Figure 9u : Set 50 down cast (Head Station)

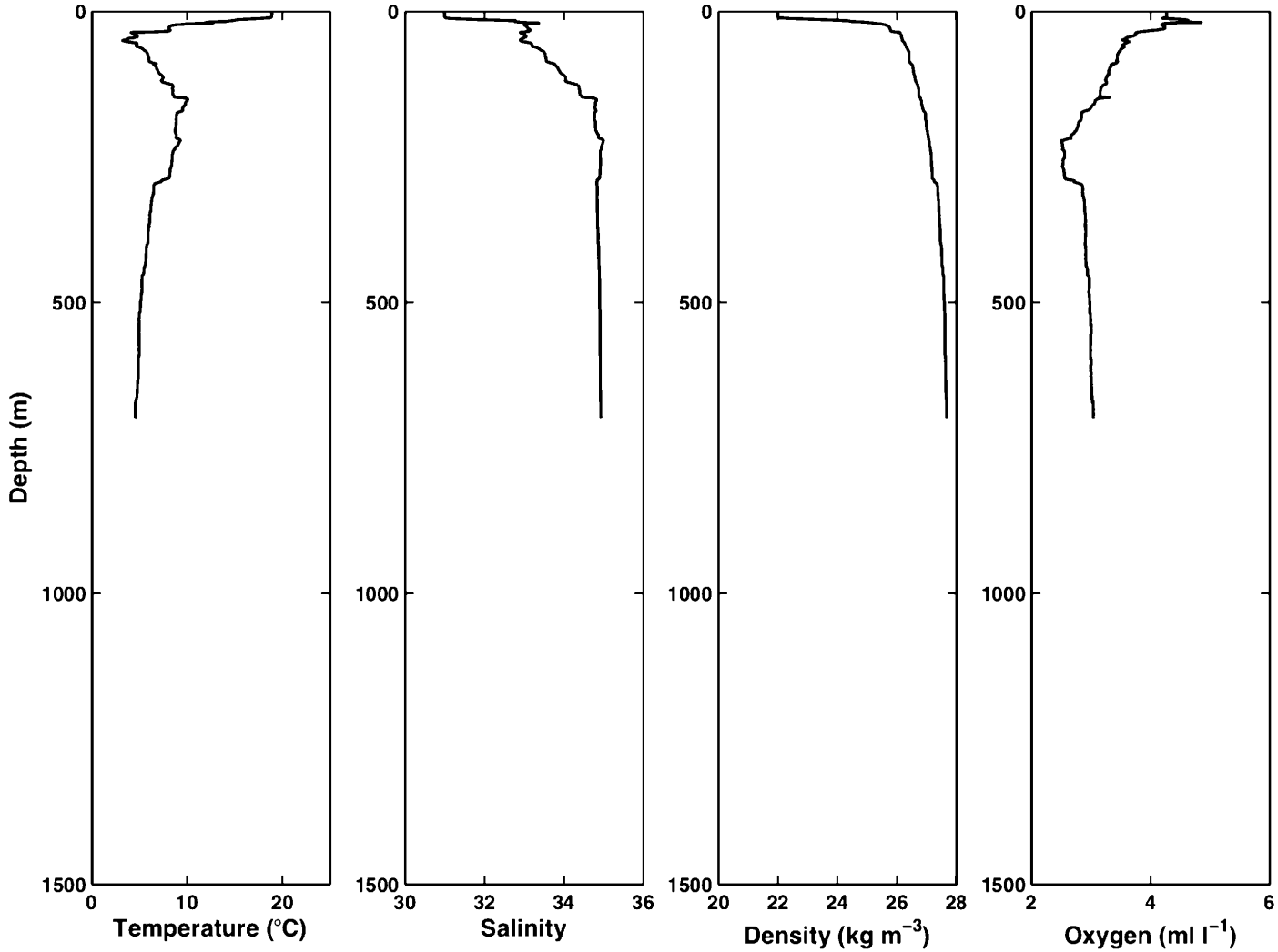


Figure 9v : Set 51 down cast (Head Station)

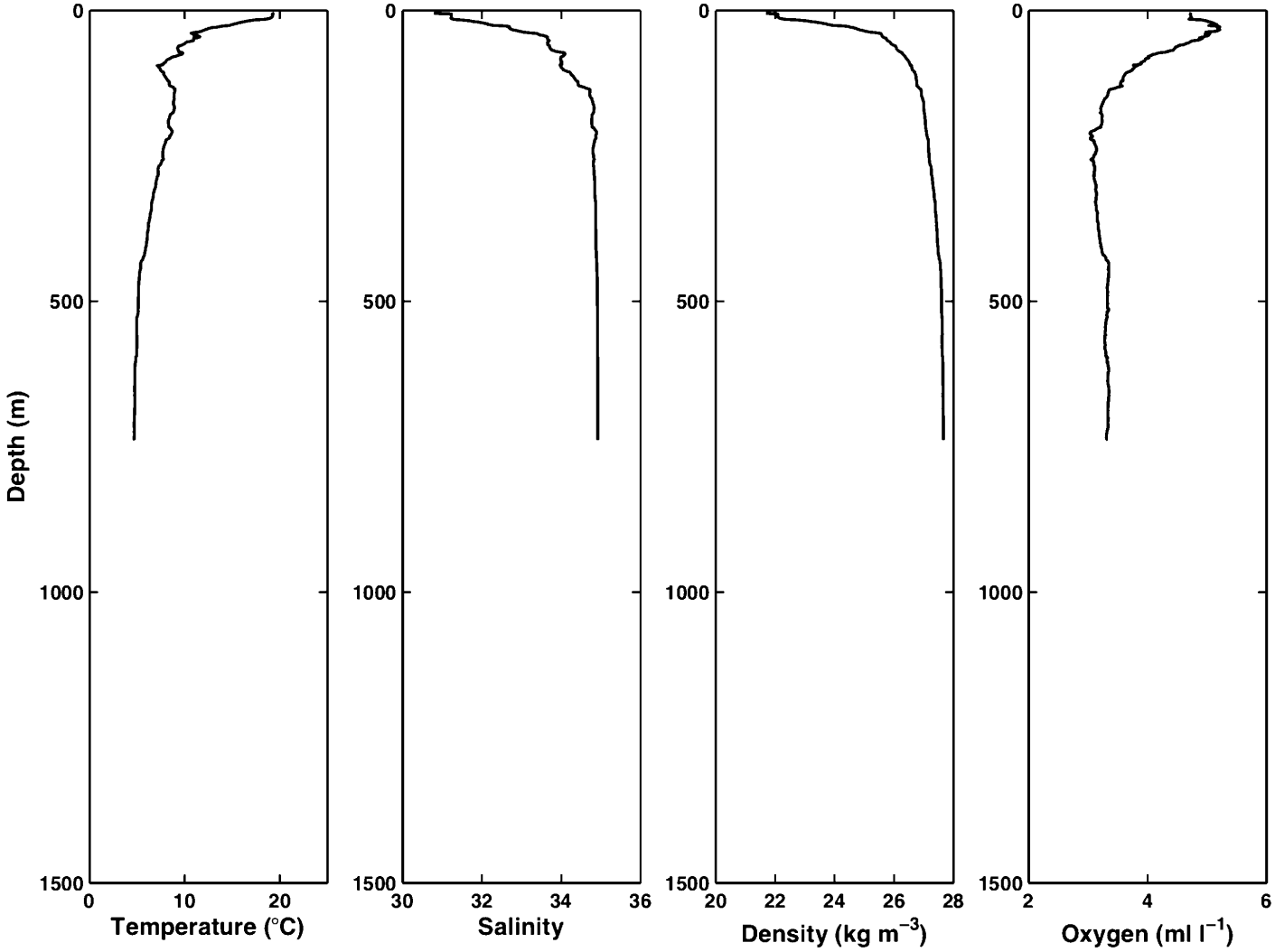


Figure 9w : Set 59 down cast (Head Station)

Figure 10 : Temperature / Salinity Plots from August 2009 CTD Data
Density contours are labelled in units of σ^T

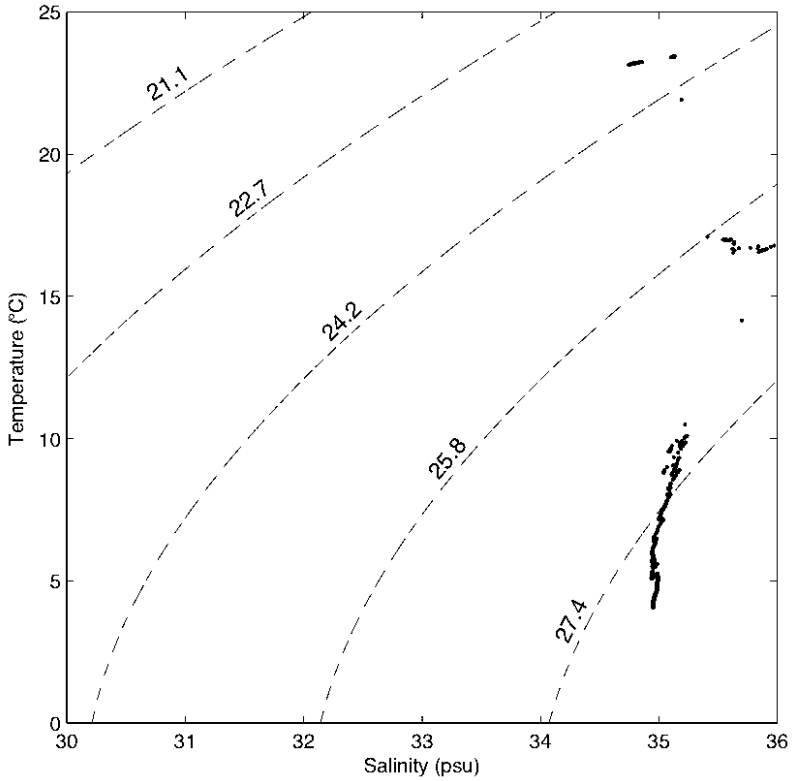


Figure 10a : Set 2 up cast (Slope Station)

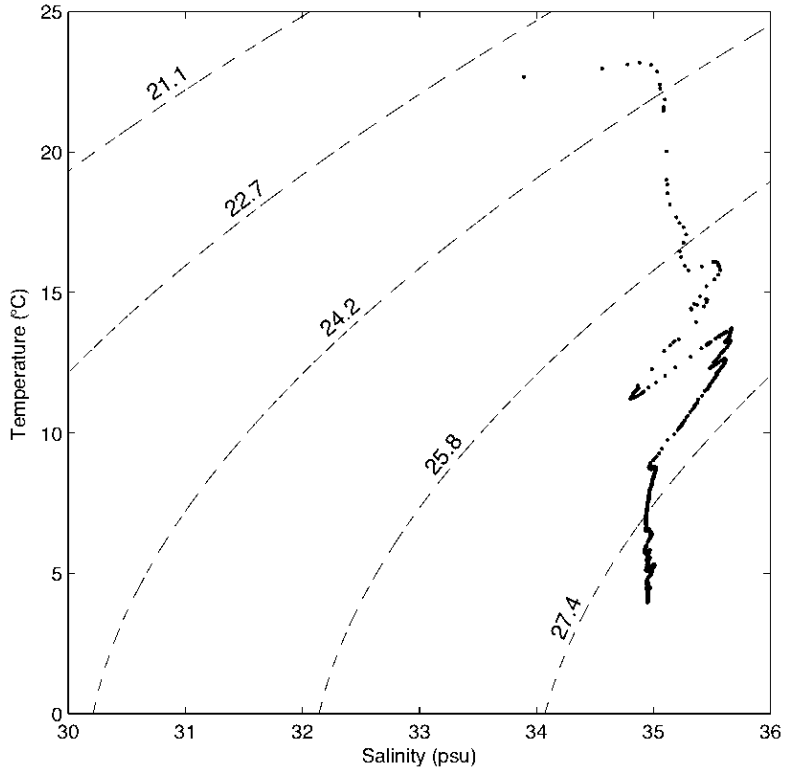


Figure 10b : Set 7 down cast (Deep Station)

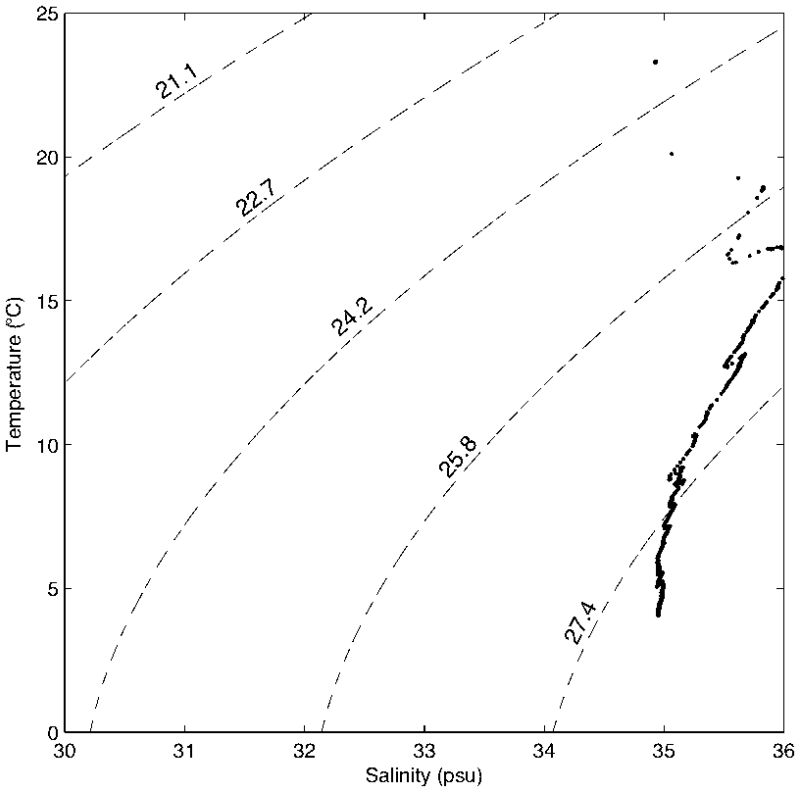


Figure 10c : Set 7 up cast (Deep Station)

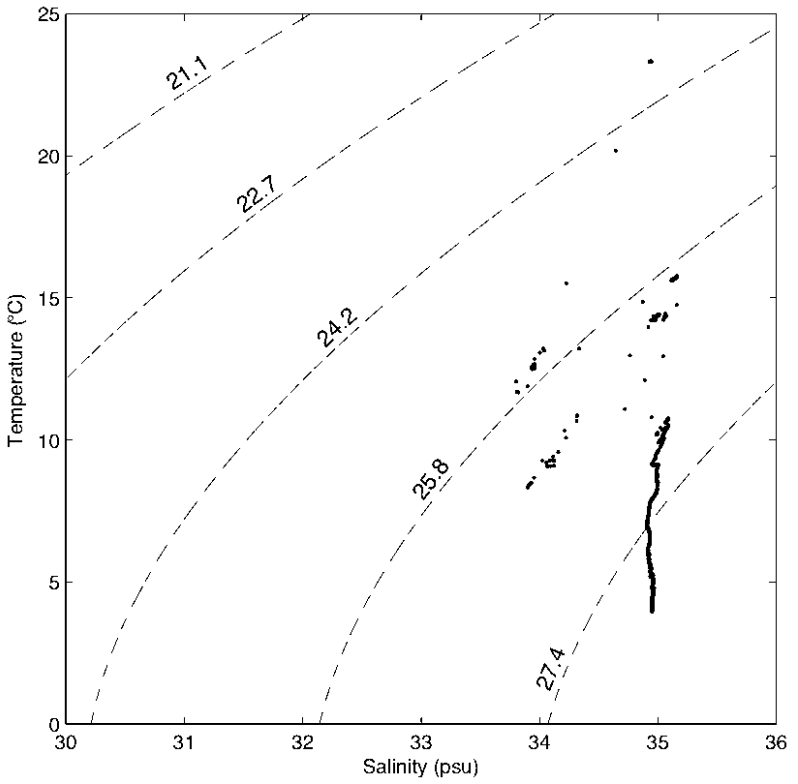


Figure 10d : Set 8 down cast (Deep Station)

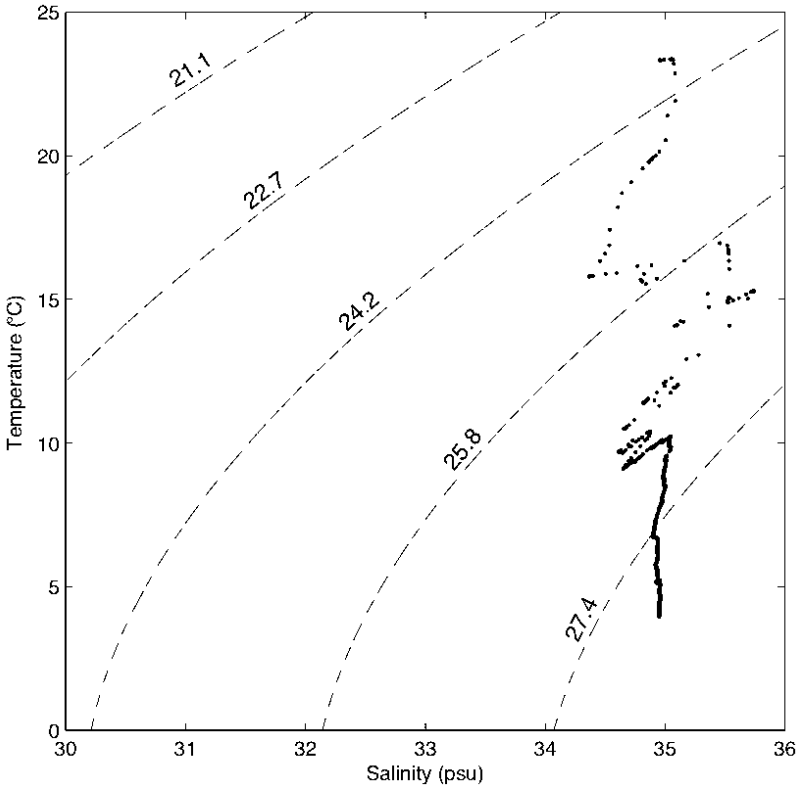


Figure 10e : Set 8 up cast (Deep Station)

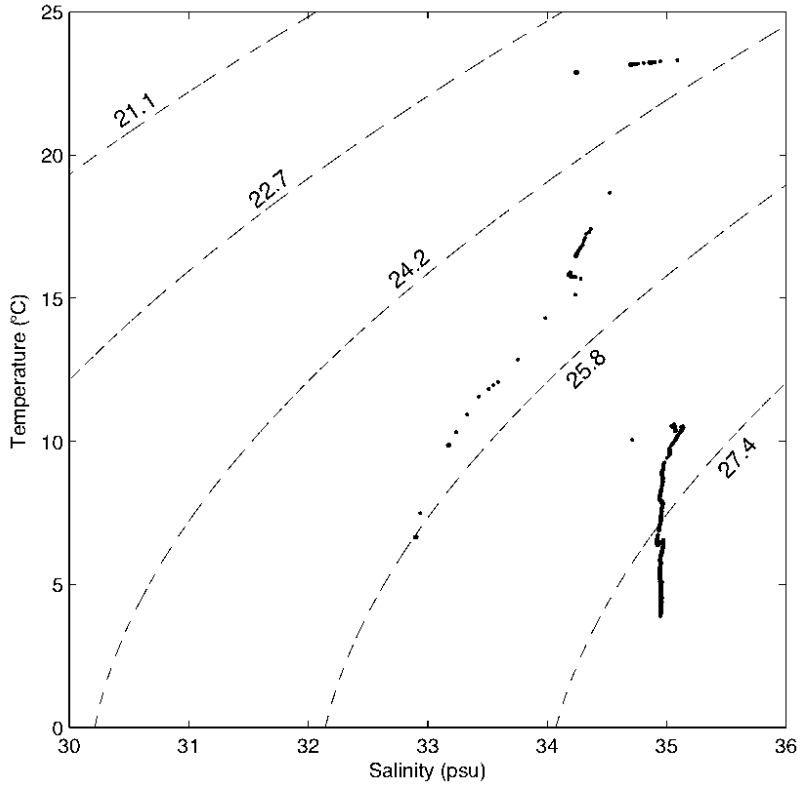


Figure 10f : Set 9 down cast (Deep Station)

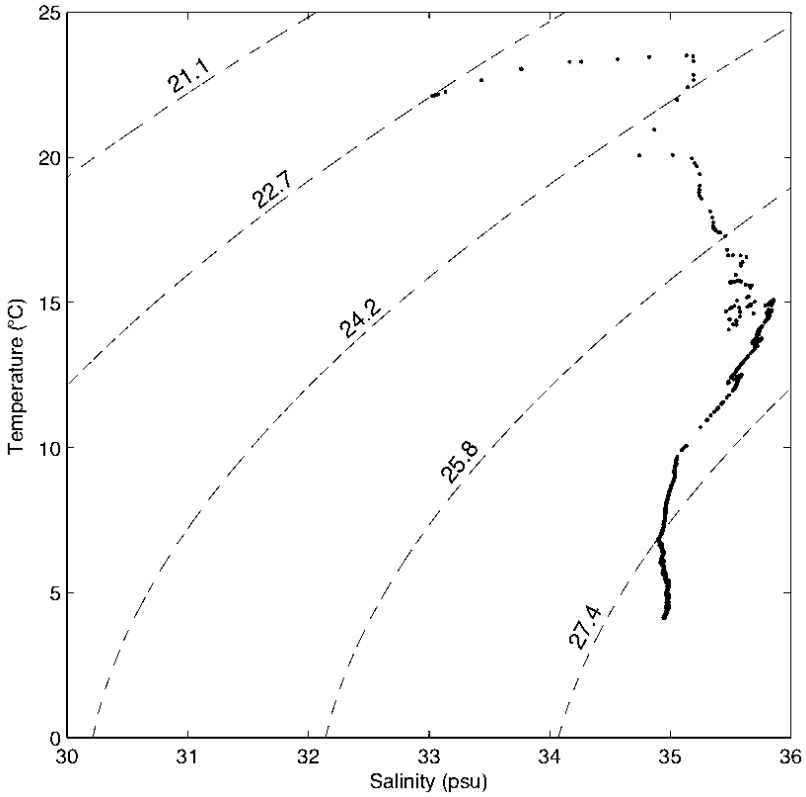


Figure 10g : Set 14 up cast (Deep Station)

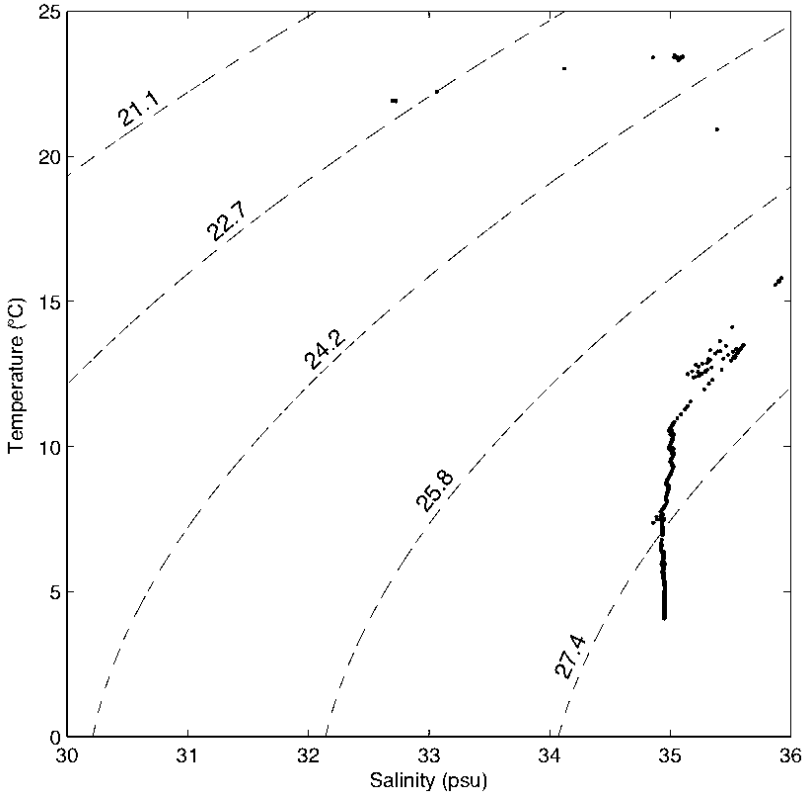


Figure 10h : Set 15 down cast (Deep Station)

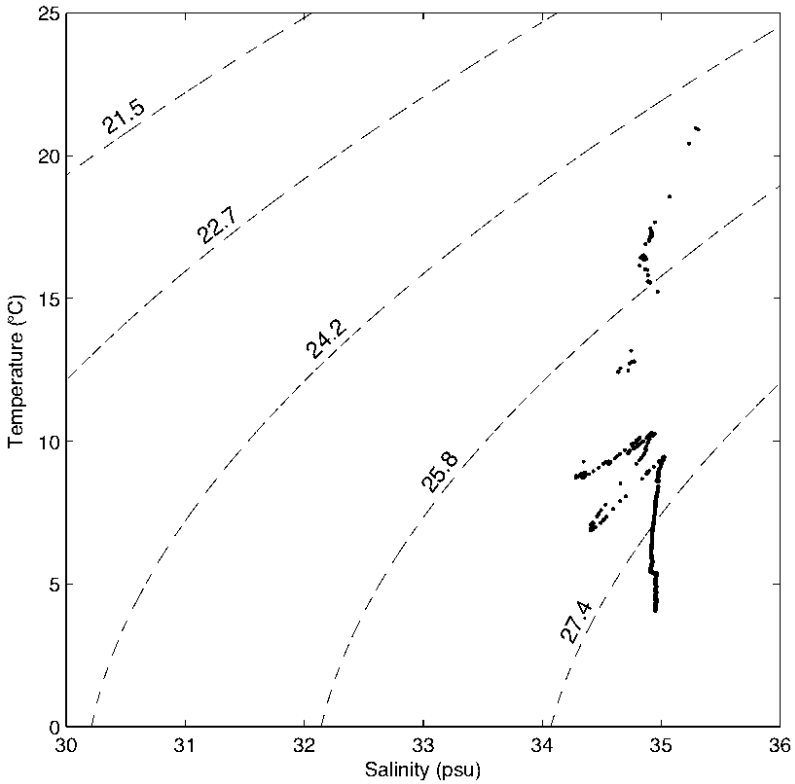


Figure 10i : Set 16 down cast (Deep Station)

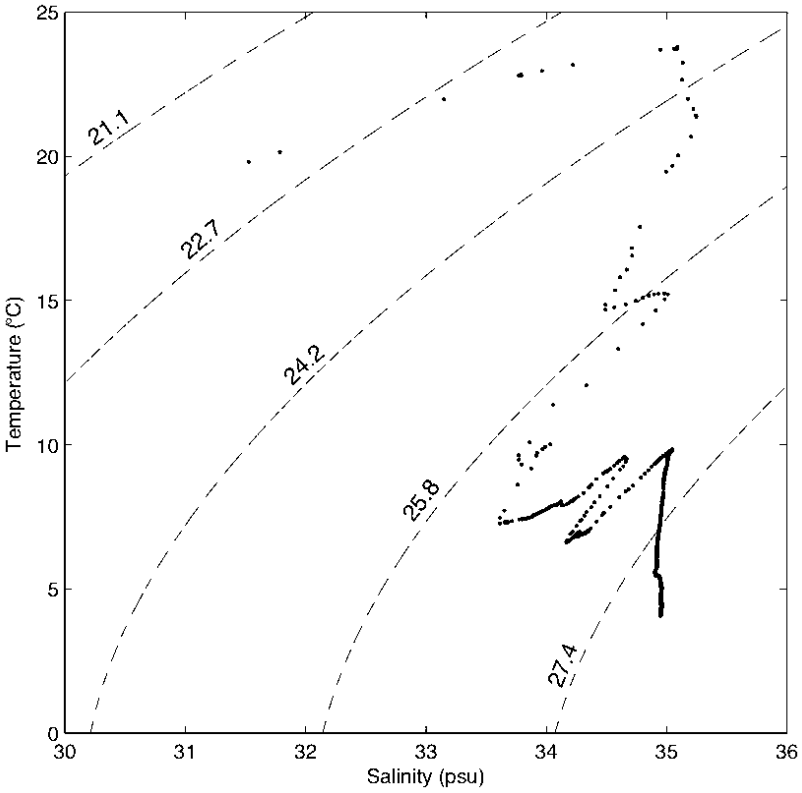


Figure 10j : Set 16 up cast (Deep Station)

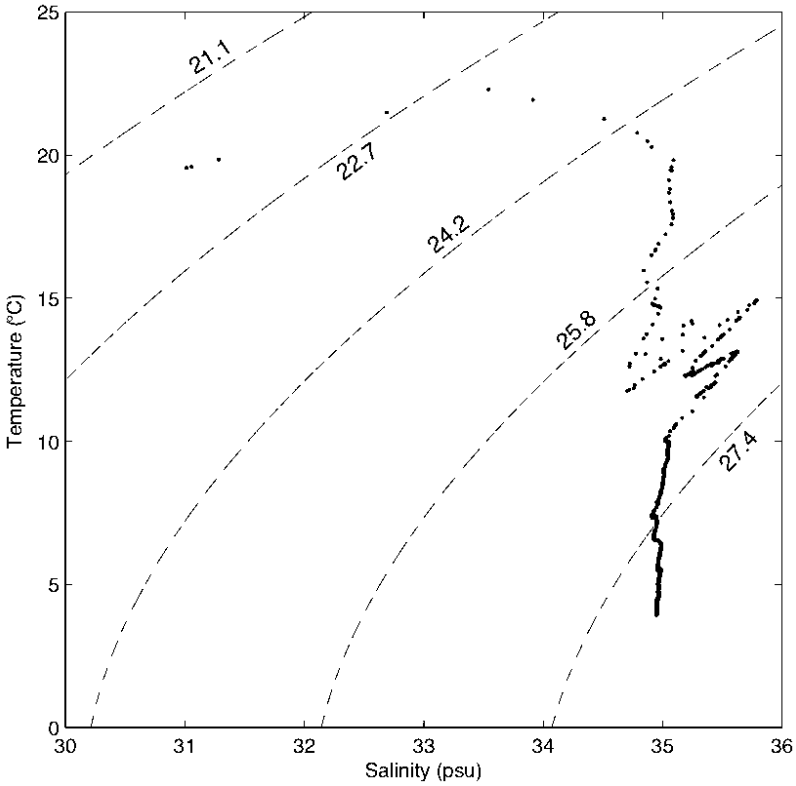


Figure 10k : Set 21 up cast (Deep Station)

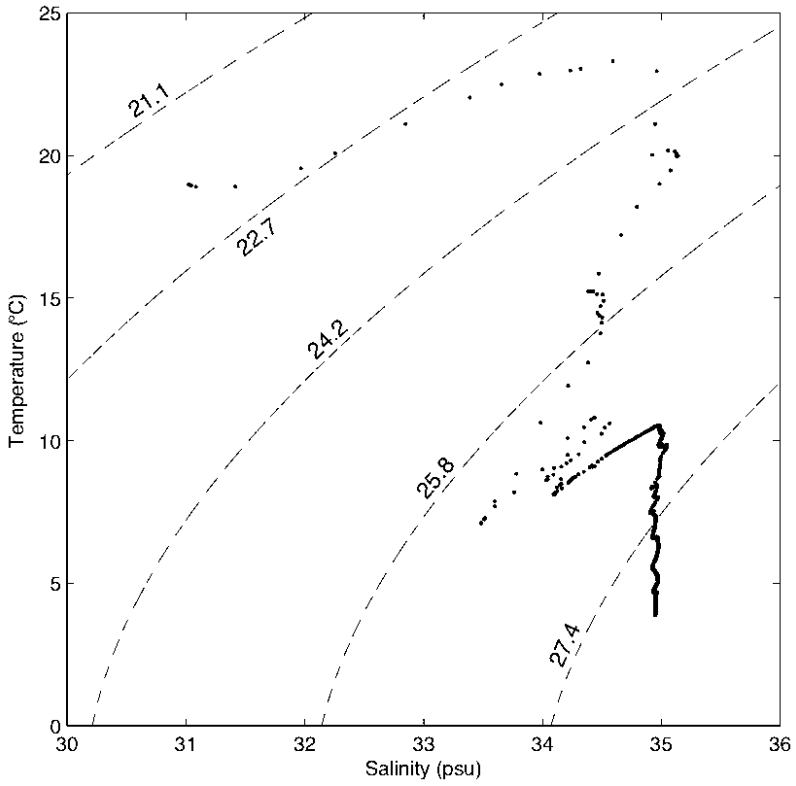


Figure 10l : Set 22 up cast (Banquereau Spur)

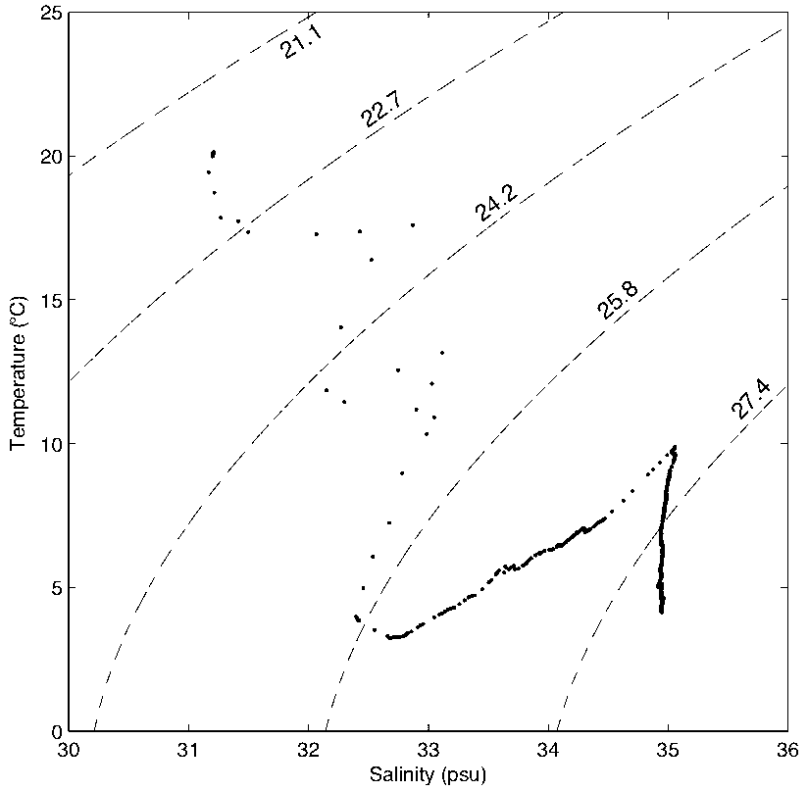


Figure 10m : Set 23 down cast (Main Station)

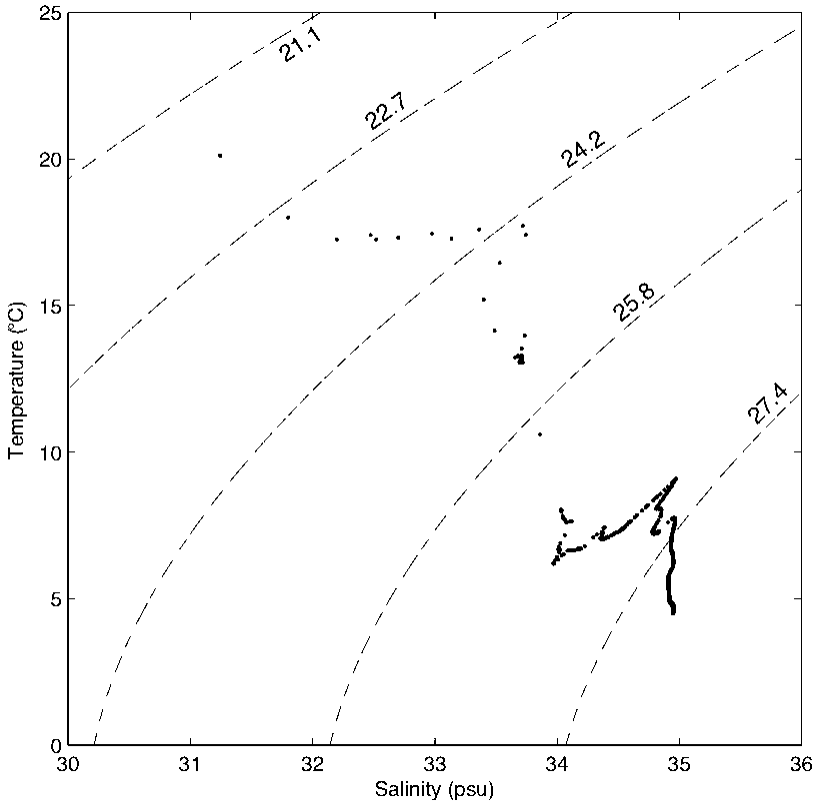


Figure 10n : Set 24 down cast (Main Station)

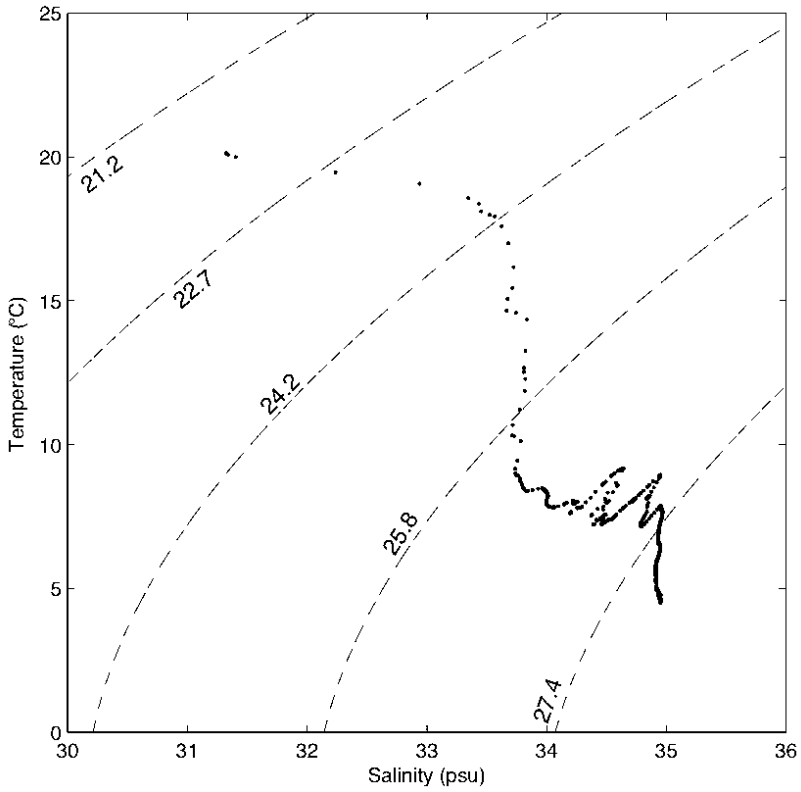


Figure 10o : Set 24 up cast (Main Station)

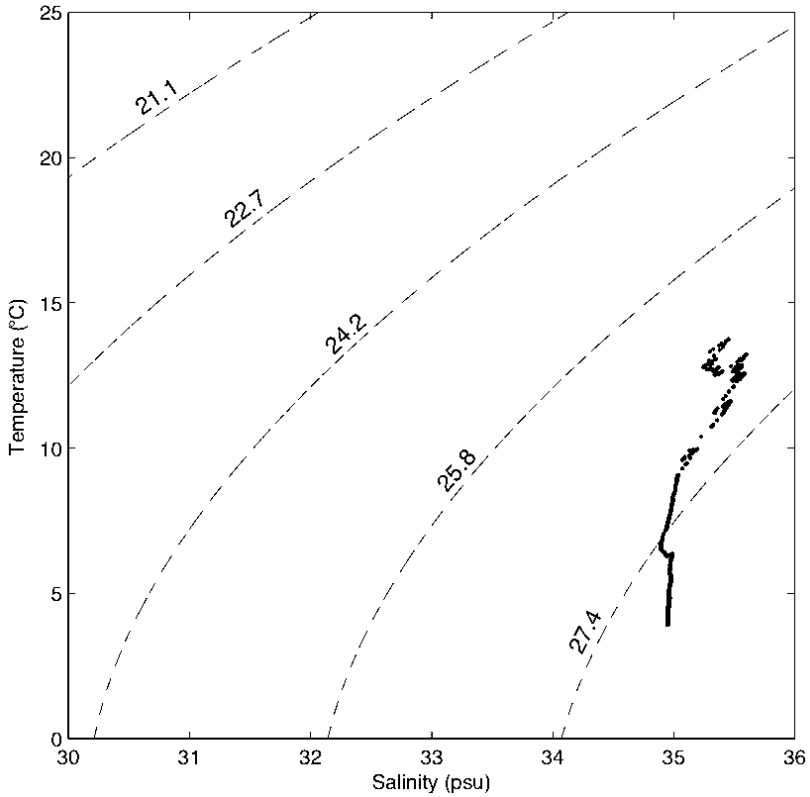


Figure 10p : Set 28 down cast (Banquereau Spur)

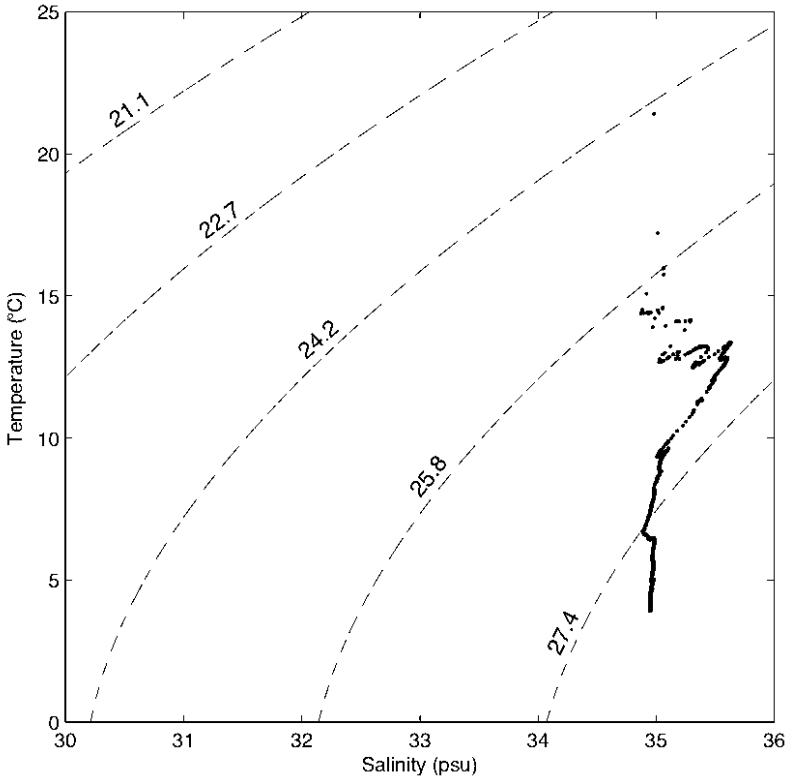


Figure 10q : Set 28 up cast (Banquereau Spur)

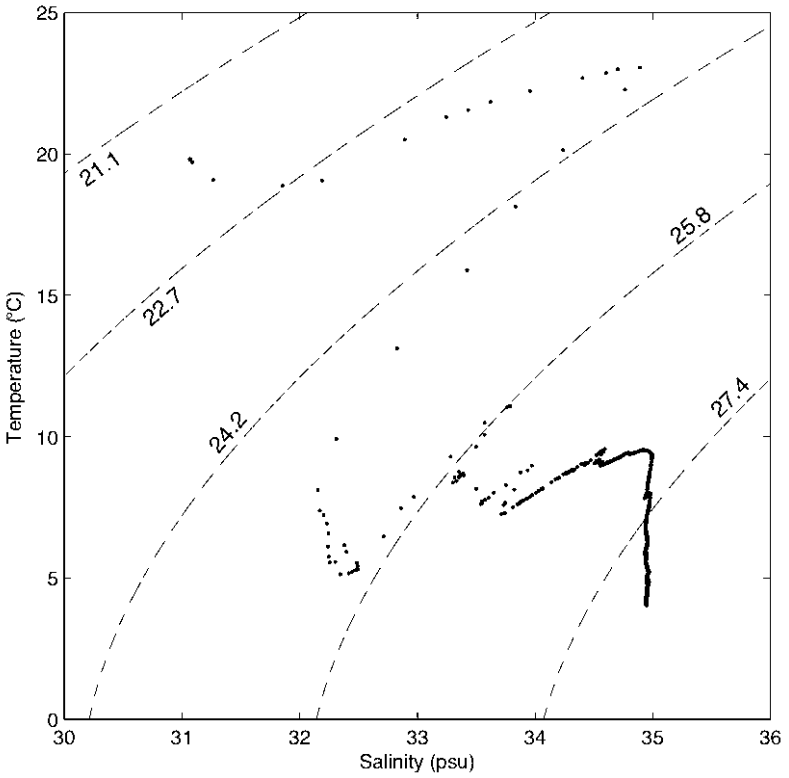


Figure 10r : Set 29 down cast (Banquereau Spur)

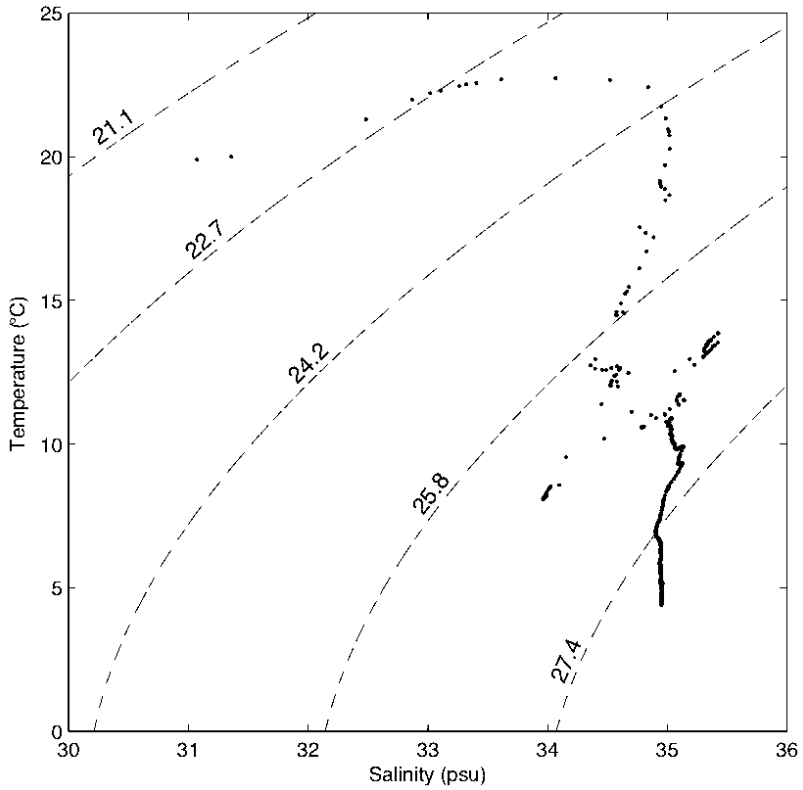


Figure 10s : Set 30 down cast (Banquereau Spur)

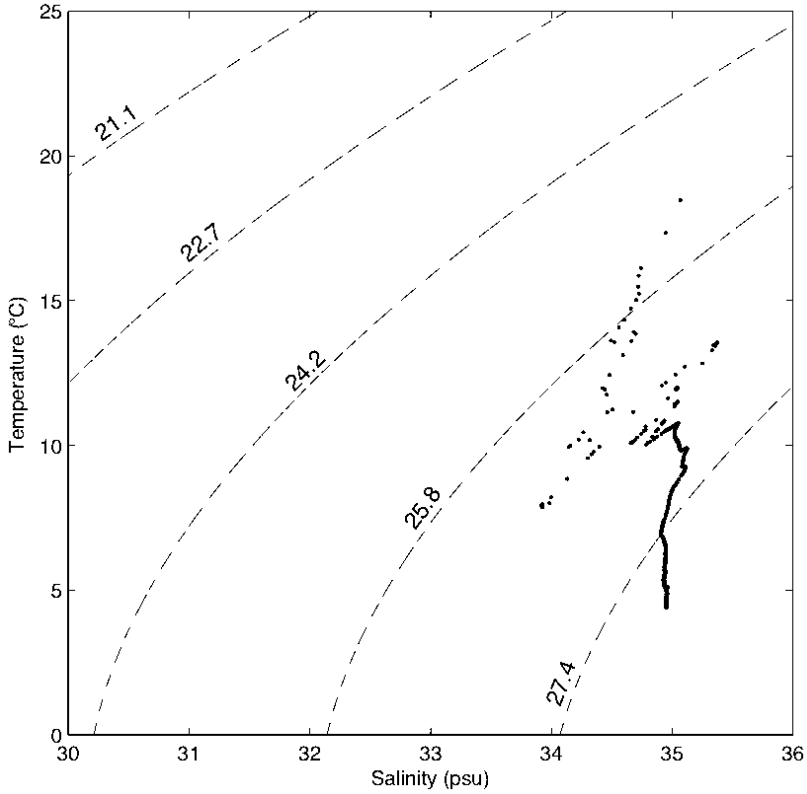


Figure 10t : Set 30 up cast (Banquereau Spur)

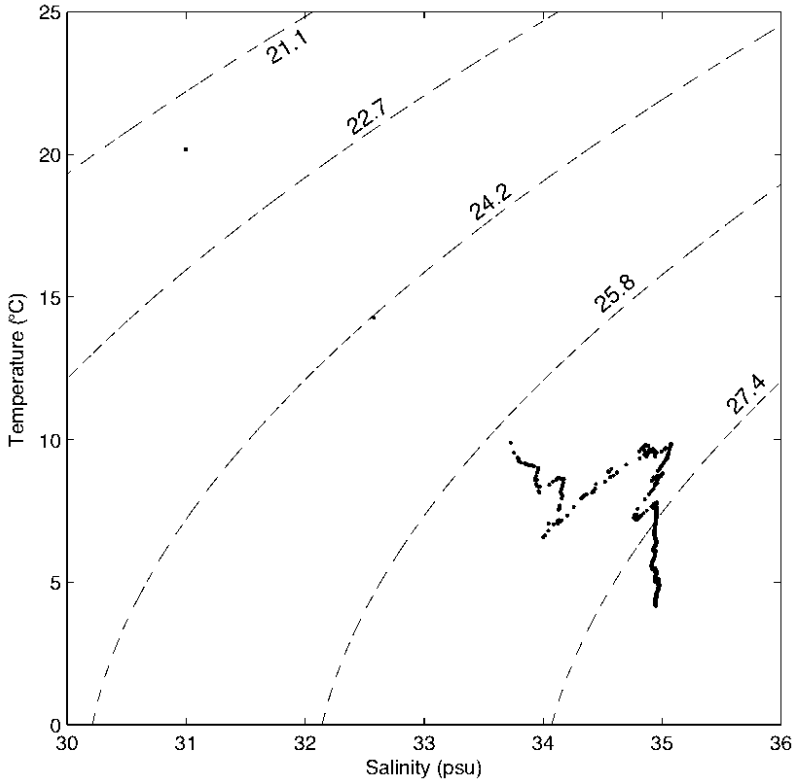


Figure 10u : Set 36 down cast (Main Station)

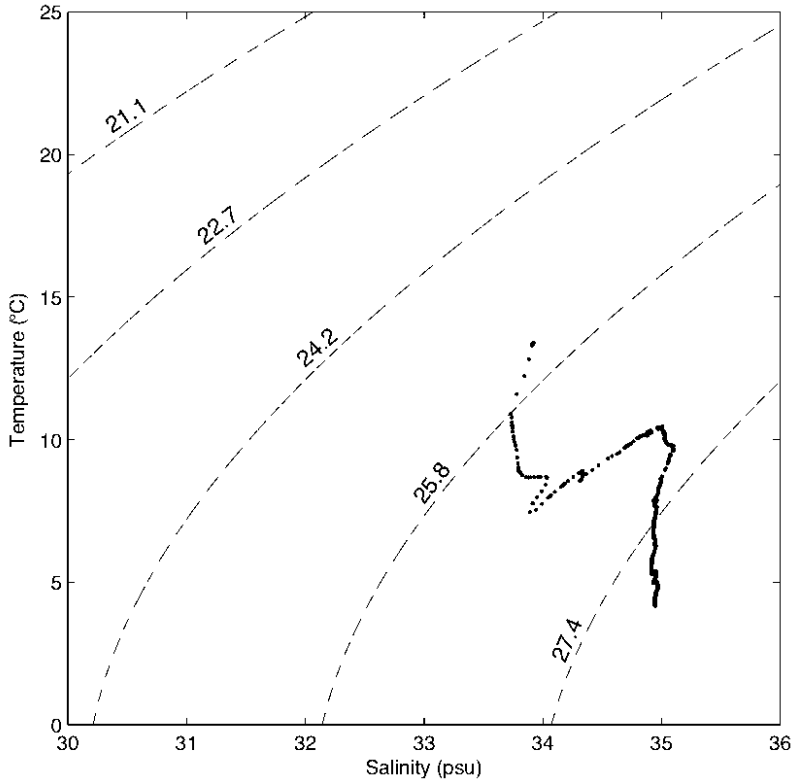


Figure 10v : Set 36 up cast (Main Station)

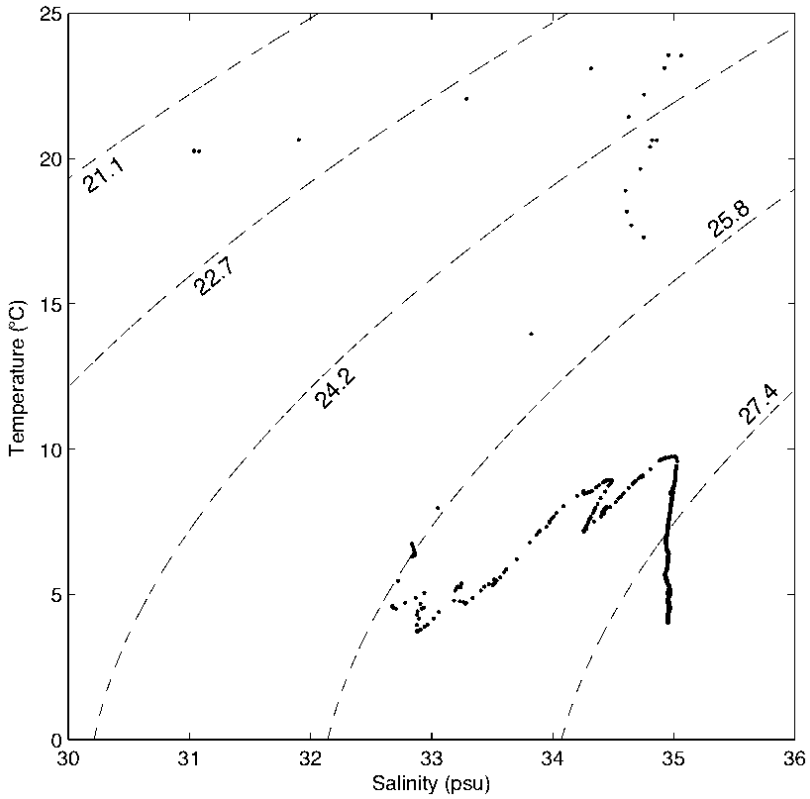


Figure 10w : Set 37 down cast (GULD4 Station)

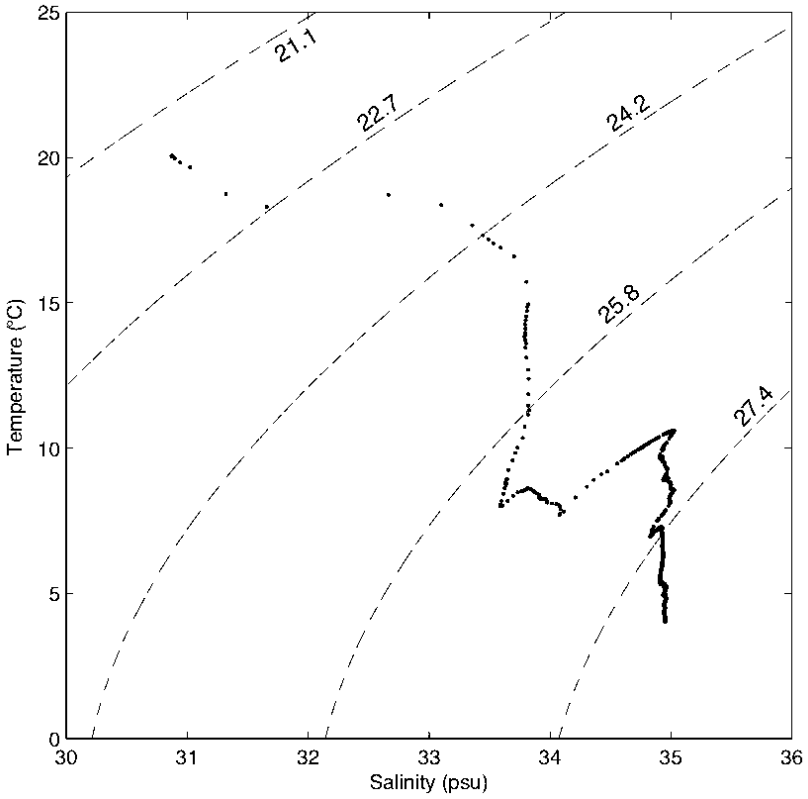


Figure 10x : Set 42 up cast (Main Station)

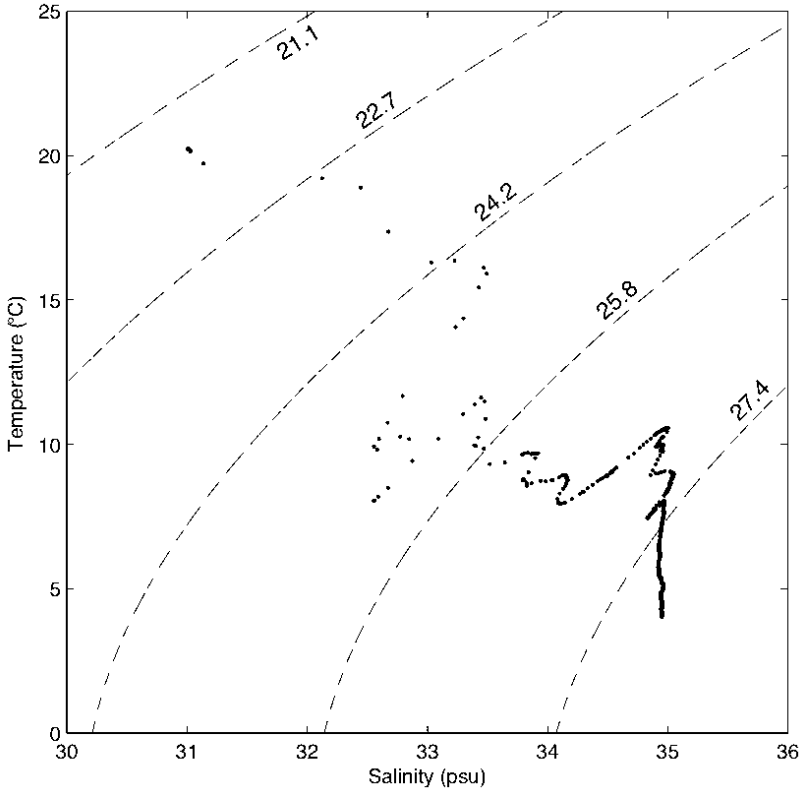


Figure 10y : Set 47 up cast (Main Station)

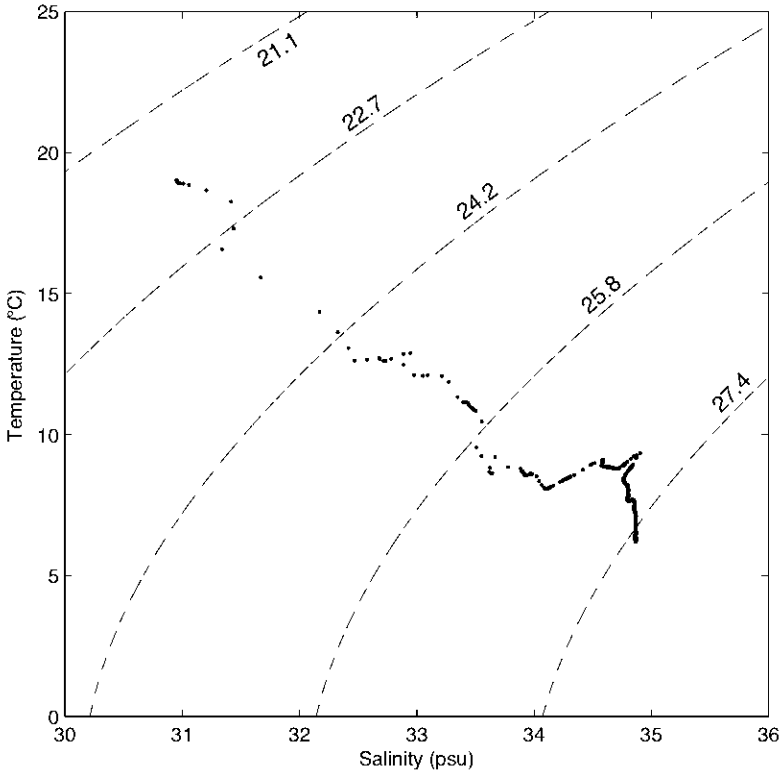


Figure 10z : Set 48 down cast (GULD3 Station)

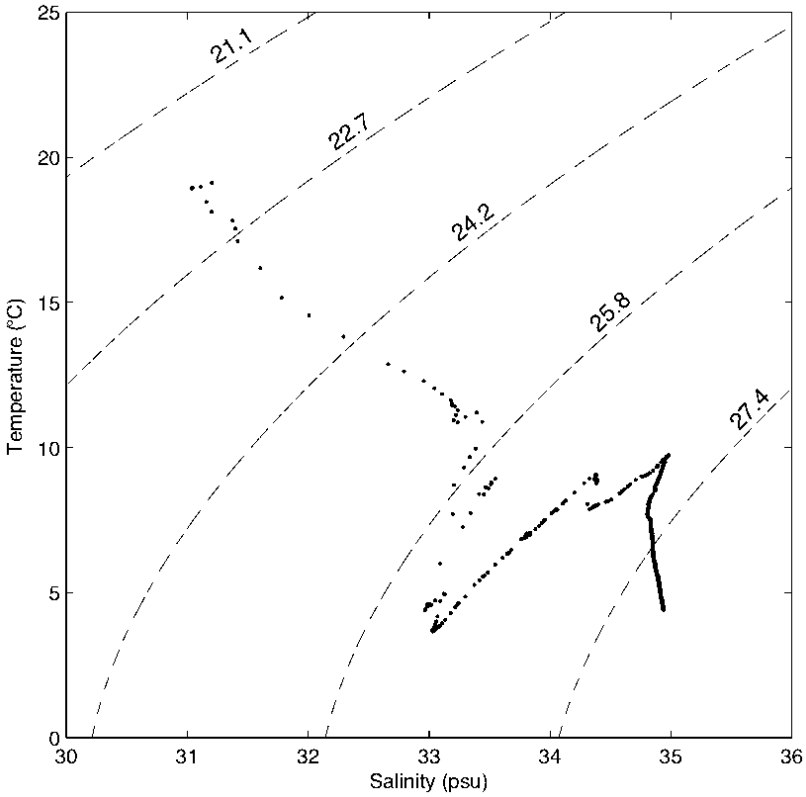


Figure 10aa : Set 49 down cast (Head Station)

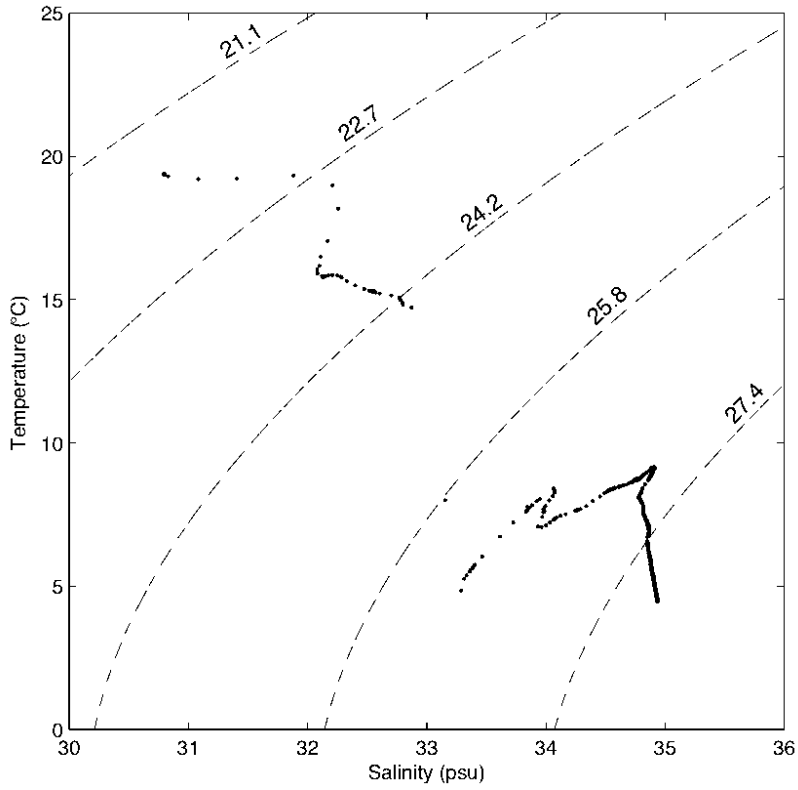


Figure 10bb : Set 50 down cast (Head Station)

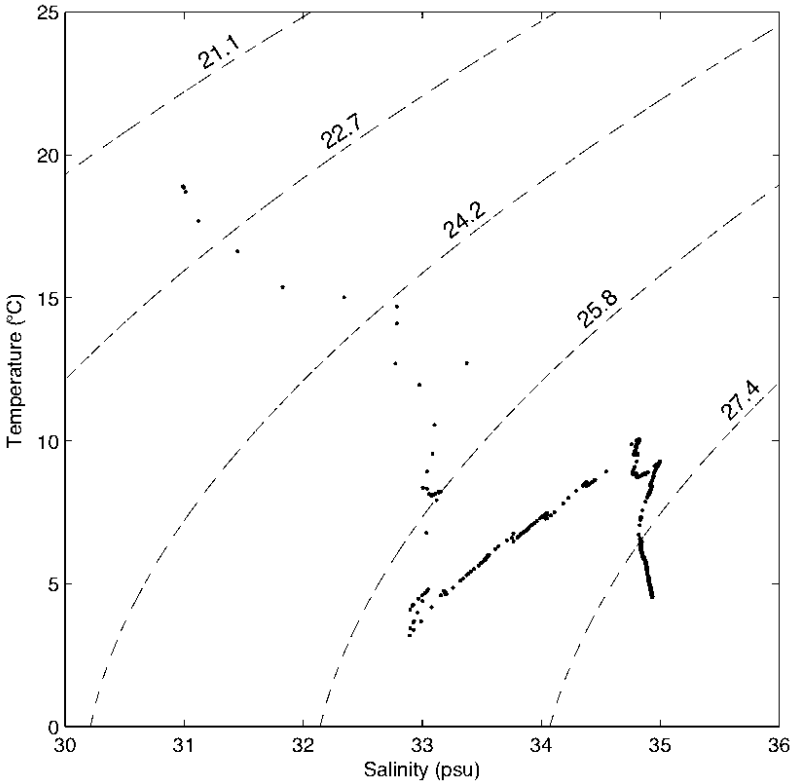


Figure 10cc : Set 51 down cast (Head Station)

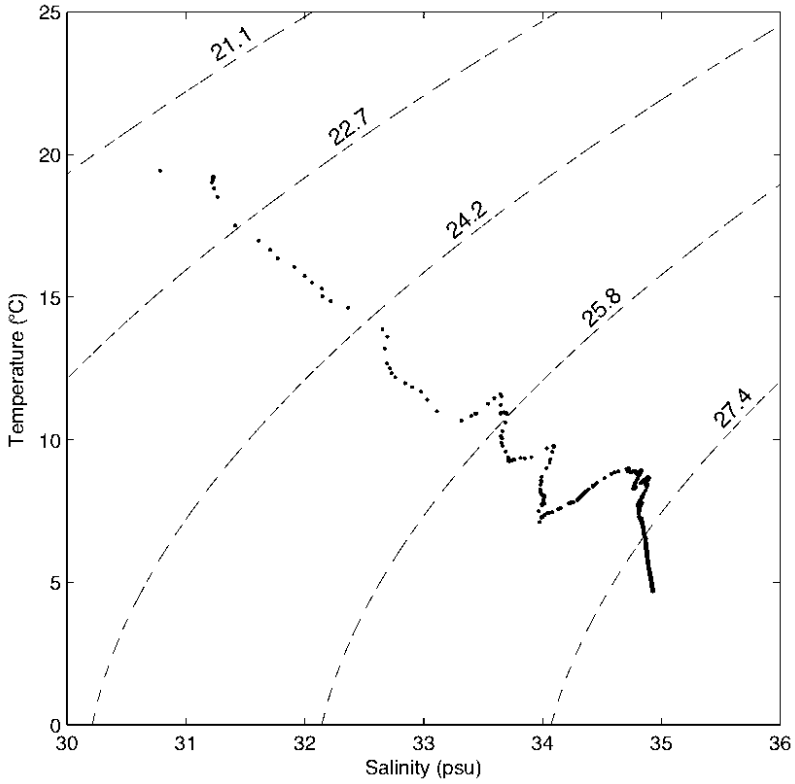


Figure 10dd : Set 59 down cast (Head Station)