

Cruise HE 451.1 with RV Heincke

Tromsø – Longyearbyen
September 11th – September 29th 2015

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Summary

This cruise was a part of the “Verbundprojekt BIOACID” (Biological Impacts of Ocean ACIDification) Phase II (consortium 4 of 5), funded by the German Ministry for Education and Research (BMBF). It was also connected to the Norwegian-German collaborative project Tibia (“Trophic interactions in the Barents Sea - steps towards an Integrated Ecosystem Assessment (TIBIA)”, see www.caff.is/marine/marine-expert-networks/benthos) between AWI and the IMR in Tromsø.

The main objectives of this cruise were to elucidate whether climate change (mainly ocean acidification and warming, OAW) affects interacting species differently due to divergent physiological optima and ranges, expressed in thermal tolerance windows and associated performance capacities and phenologies of specific life stages. To determine the degree of the ongoing ‘Atlantification’ of the waters around (Western) Svalbard, we took sediment samples to analyse the benthic epi- and meiofauna. Further, we intended to obtain specimens of both Polar cod (*B. saida*) and Atlantic cod (*G. morhua*) in the Atlantic and polar waters around Svalbard, which were used in experiments on board and back at the Alfred Wegener Institute.

We left port in Tromsø in the morning of September 11th, heading North towards Svalbard. In the morning of September 13th, we reached the first scientific station in Hornsund, where a CTD was deployed. Following this, we ran several juvenile fish trawls with fish lift at different depths from surface waters to close to the bottom, specifically aiming for flocks of juvenile fish under the surface, at the thermocline and above ground (water layers of interest derived from CTD and EK60 profiles). In Hornsund, bottom waters were around 0°C cold and contained polar cod (*Boreogadus saida*). After fishing, we deployed several box grabs for sampling the first 30cm of sediment.

This daily sampling protocol was repeated at all other stations unless stated otherwise.

After a day of cruising, we reached North East Svalbard and sampled two stations at the center and opening of Rijpfjorden on September 15th and 16th, the protocol here was substantiated by several bottom trawls that yielded surprisingly little material. Afterwards, we moved into Hinlopen Strait, sampling waters of Atlantic and Barents Sea origin in a northwest-southeast transect during September 17th and 18th. The following day found us back in biologically diverse Atlantic waters at the Northwestern tip of Svalbard around Møffen Island, yielding schools of larval/juvenile herring, capelin, redfish and polar cod (and a few 0-class Atlantic cod) in the surface waters as well as a bottom trawl of mostly adult Atlantic cod (*Gadus morhua*) and several haddock (*Melanogrammus aeglefinus*). On our way to the AWI Hausgarten, we stopped over on the Yermak plateau on September 20th, where we found similar diversity as the day before. On September 21st, we sampled AWI Hausgarten with CTD, box grabs and several shallow juvenile fish trawls under deteriorating weather conditions. We therefore had to abandon our sampling schedule and the following days found us moving back and forth between shelter in Kongsfjord, Forlandsundet and Krossfjorden and the open water towards the Hausgarten, trying to complete the transect Kongsfjord-Hausgarten. This transect showed a succession of juvenile/larval fish species dominated by redfish (*Sebastes sp.*) in the open ocean towards Polar cod (*B. saida*) close to the shore (further abundant species included herring and capelin). Sampling in Forlandsundet revealed a rich and diverse ecosystem with polychaetes, annelids, holothurians, echinoderms and crustaceans (mainly *Hyas araneus*), again dominated by Atlantic cod (*G. morhua*). The last stations of the cruise were carried out in Billefjord on September 27th and 28th, here, the very cold bottom waters (-1,7°C) were populated by Polar cod as the only fish species plus several spider crabs (*H. araneus*). On September 29th, we handed over RV Heincke in Longyearbyen to the chief scientist of HE 451.2, Dr. Katrin Latarius.

Thus ended a successful cruise, in which we were able to carry out about 90% of the planned station work, took a great amount of sediment and biological samples and brought around 150 juvenile Polar cod and about 60 juvenile Atlantic cod back to the home institute in Bremerhaven alive.

Sampling sites

In the following, the individual sampling sites are presented, together with some preliminary catch statistics for the fishery stations. We intended to revisit as many stations of the previous cruise HE408 (16.8.-15.9.2013; RIS ID 6332, Jnr 13/4976) as possible.

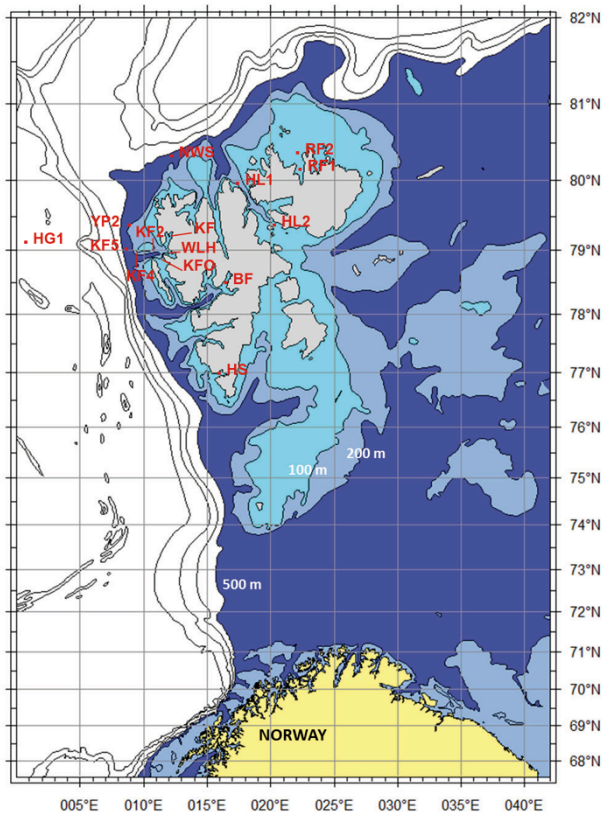


Figure 1: map of the stations of HE 451

1. **HS:** Hornsund (CTD, fishery, box corer)
2. **RF1:** Rijpfjorden South (CTD, fishery, box corer)
3. **RF2:** Rijpfjorden North (CTD, fishery, box corer)
4. **HL1:** Hinlopenstretet North (CTD, fishery, box corer)
5. **HL2:** Hinlopenstretet South (CTD, fishery, box corer)
6. **NWS:** North West Svalbard (CTD, fishery, box corer)
7. **YP2:** Yermak Plateau (CTD, fishery, box corer)
8. **HG1:** Hausgarten (CTD, fishery, box corer)
9. **KF:** Krossfjorden (CTD, fishery, box corer)
10. **KFO:** Forlandsundet (CTD, fishery, box corer)
11. **KF2:** Kongsfjorden 2 (CTD, fishery, box corer)
12. **KF4:** Kongsfjorden 4 (CTD, box corer)
13. **KF5:** Kongsfjorden 5 (CTD, fishery, box corer)
14. **WLH:** Western Kongsfjorden (CTD, fishery, box corer)
15. **BF:** Billefjorden (CTD, fishery, box corer)

Fishery stations:

For the detection of fish schools, a Simrad EK60 hydro-acoustic system was applied. To effectively catch small and juvenile fish and surface them alive, we used a so-called fish-lift (Holst&MDonald, 2000, figure 2) connected to the juvenile fish trawl. Trawl times never exceeded 15 minutes for each haul.



Figure 2: Fish-lift attached to the juvenile fish trawl of RV Heincke (photography: F. Mark).

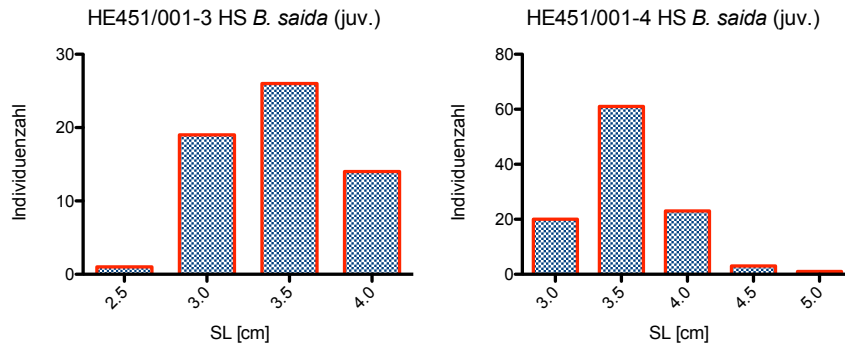
In the following, we provide size distribution frequencies of the main species of relevant hauls.

Hornsund (HS, #001) 13.09.2015

Juvenile Fish Trawl (pelagic)

Exclusively Polar cod at bottom of fjord (150-220m).

Depth of station 001-3: 100m, depth of station 001-4: 192m.



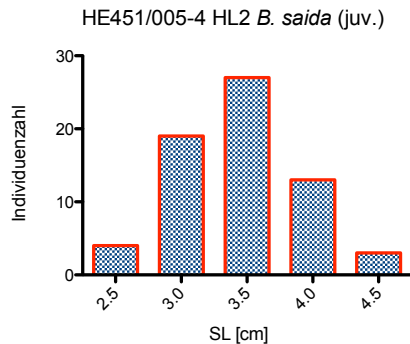
Rijpfjorden South (RF1, #002) 15.09.2015, Rijpfjorden North (RF2, #003) 16.09.2015

Hauls at both stations contained very few fish in pelagic and bottom trawls. Many ctenophores and chaetognaths in the surface waters, though. Only one pelagic trawl (003-3 at 36m depth) caught a significant amount of juv. 0-year class Polar cod (*Boreogadus saida*, <8 cm) and redfish (*Sebastes spec.*).

Hinlopenstretet North (HL1, #004) 17.09.2015, Hinlopenstretet South (HL2, #005) 18.09.2015

Few fish in surface waters, mainly schools of juvenile 0-year class haddock (*M. aeglefinus*), Polar cod (*B. saida*) and redfish (*Sebastes spec.*).

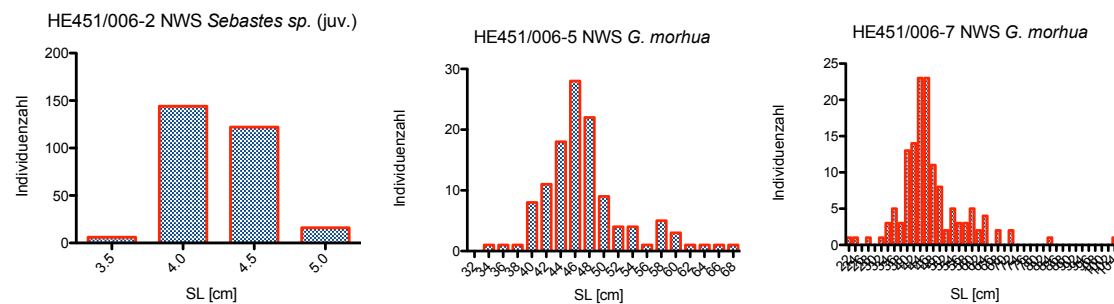
Depth of station 005-4: 121m.



North West Svalbard (NWS, #006) 19.09.2015

Surface waters dominated by large schools of 0-year class redfish (*Sebastes spec.*), few juvenile haddock (*M. aeglefinus*) and Atlantic cod (*G. morhua*). Bottom waters dominated by Atlantic cod (multi year classes).

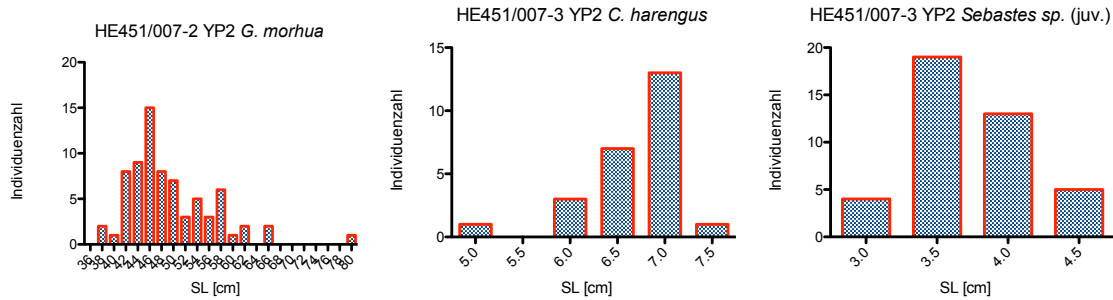
Depth of station 006-2: 20m, depth of station 006-5: 130m (bottom trawl), depth of station 006-7: 140m (bottom trawl).



Yermak Plateau (YP2, #007) 20.09.2015

Again, bottom habitat dominated by Atlantic cod (*G. morhua*). Surface waters dominated by large amounts of 0-year class redfish and herring (*C. harengus*), with a few 0-year class Atlantic cod, Polar cod and haddock.

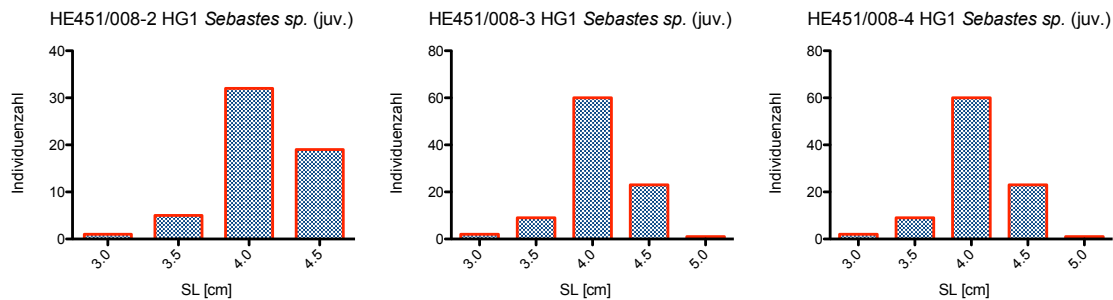
Depth of station 007-2: 160m (bottom trawl), depth of station 007-3: 24m.



Hausgarten (HG1, #008) 21.09.2015

Surface waters dominated by flocks of 0-year class redfish (*Sebastes spec.*), krill and herring. A few 0-year class Atlantic cod and haddock.

Depth of station 008-2: 18m, depth of station 008-3: 29m, depth of station 008-4: 128m.



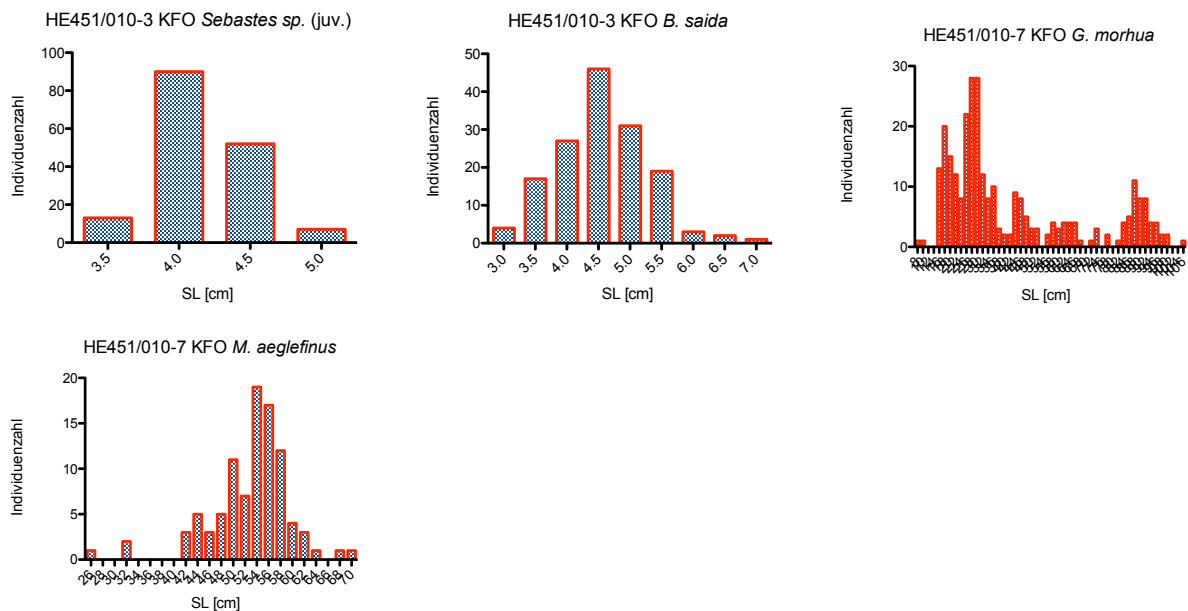
Krossfjorden (KF, #009) 22.09.2015

Very few fish in surface waters, schools of juvenile 0-year class Polar cod (*B. saida*) in midwater (150m, st. 009-5).

Forlandsundet (KFO, #010) 23.09.2015

Surface waters crowded with 0-year class schools of herring, capelin, redfish, Atlantic cod and Polar cod. Bottom waters dominated by multi-year classes of Atlantic cod and haddock.

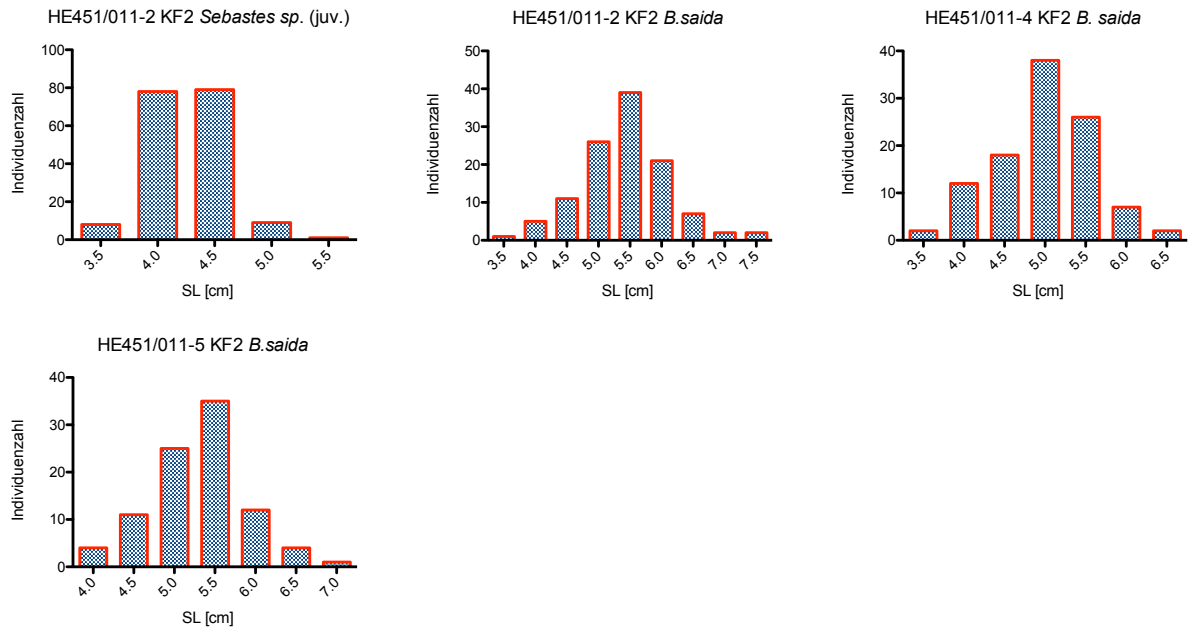
Depth of station 010-3: 21m, depth of station 010-7: 100m (bottom trawl).



Kongsfjorden 2 (KF2, #011) 24.09.2015

Surface waters (10-80m) mainly dominated by redfish and Polar cod 0-year class. But also numerous herring and Atlantic cod 0-year class.

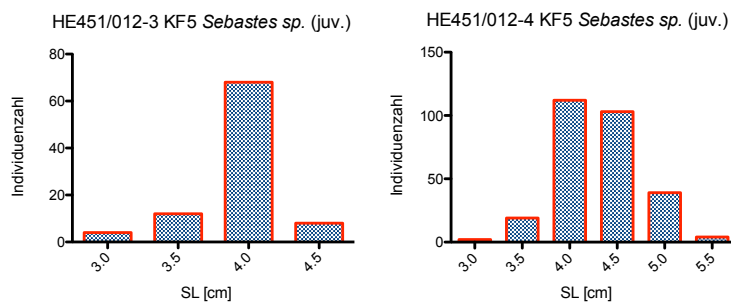
Depth of station 011-2: 34m, depth of station 011-4: 13m, depth of station 011-5: 30m.



Kongsfjorden 5 (KF5, #012) 25.09.2015

Surface waters (15-60m) almost exclusively dominated by 0-year class redfish.

Depth of station 012-3: 30m, depth of station 012-4: 64m.



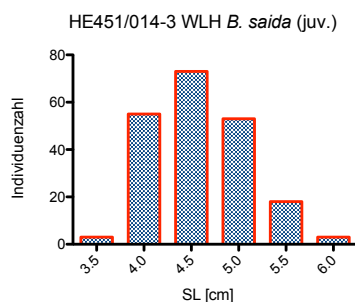
Kongsfjorden 4 (KF4, #013) 25.09.2015

No fishing here.

Western Kongsfjorden (WLH, #014) 26.09.2015

Water body (10-250m) dominated by 0-year class Polar cod. But also several larger Atlantic cod (900-3800g) among them.

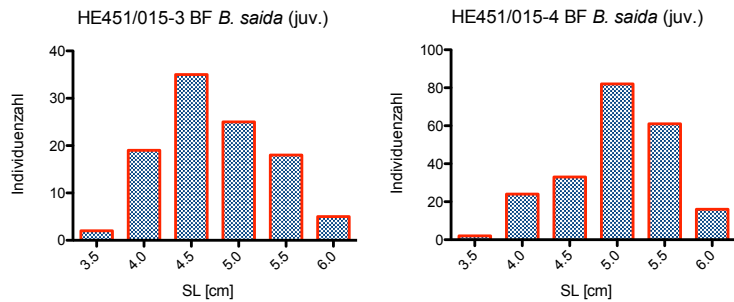
Depth of station 014-3: 16m.



Billefjorden (BF, #015-016) 27./28.09.2015

Many juvenile small Polar cod (<8 cm) in surface waters. Adult Polar cod (>10 cm) in bottom waters below 140m depth.

Depth of station 015-3: 19m, depth of station 015-4: 60m.



We also obtained sediment box cores from most stations for an overview of the benthic in- and epifauna (cf. station list, figure 3), those samples are still being analysed.



Figure 3: typical sediment sample from the box corer

Preliminary results

This cruise revisited many of the station of HE408 in 2013, albeit about one month later in the year (September instead of August). This may have influenced the species composition we found, mainly so in the surface waters. For example, we did not find 0-year class Polar cod in the surface waters of any of the stations of cruise HE408 in August 2013, while in late September 2015 they were abundant in the surface waters of the north-western shelf. In contrast, 0-year classes of haddock and Atlantic cod were abundant in the surface waters of e.g. Forlandsundet in 2013 but not in 2015. At this time of the year, they may have switched to a benthic lifestyle already. The full catch statistics and CTD data will be published and made available via PANGAEA later this year.

About 200 specimens of juvenile Polar and Atlantic cod were successfully transported to Bremerhaven using the capacities on board and a custom-made fish transport container that was equipped with aquaria systems. In Bremerhaven, the fish are being used in experimental incubations to test their response towards ocean acidification and warming within the framework of the research initiative “BIOACID”.

It is well documented that the distribution boundaries of Atlantic cod are moving northwards from the North East Atlantic into the Barents Sea, and Atlantic cod have recently also been discovered in East Greenland waters for the first time (Christiansen *et al.*, 2016). While we found adult Polar cod to be restricted to cold bottom waters in the fjords that ranged from -1.3 to 2.0°C in temperature, in bottom waters of higher temperature (ca. 2.5-3.0°C) and in midwater, 0-year classes and juveniles of the Polar cod and Atlantic cod appeared to share the habitat in a few cases. This has also been observed in Greenland waters by Christiansen and colleagues (Christiansen *et al.*, 2016). This will undoubtedly have a further impact on Polar cod recruitment around Svalbard, given the size difference between the predatory juvenile Atlantic cod (>10cm) and the small 0-year class Polar cod (about 5-6cm).

Appendix A

Literature cited:

Christiansen, J.S., Bonsdorff, E., Byrkjedal, I., Fevolden, S.-E., Karamushko, O.V., Lynghammar, A. *et al.* (2016).

Novel biodiversity baselines outpace models of fish distribution in Arctic waters. *The Science of Nature*, 103, 1-6.

Holst, JC; McDonald, A (2000) FISH-LIFT: a device for sampling live fish with trawls. *Fisheries Research* 48: 87-91

List of participants

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Station list

The CTD traces can be found in Appendix A, CTD raw data and track data of cruise HE 451 can be accessed on the PANGAEA database under: <http://doi.pangaea.de/10.1594/PANGAEA.855528>

Station	Date	PositionLat	PositionLon	Depth [m]	Gear	Station	Abbr.
HE451/001-1	13.09.15	76° 58,68' N	15° 43,75' E	230,2	CTD/rosette water sampler	Hornsund	HS
HE451/001-2	13.09.15	76° 59,16' N	15° 48,49' E	203,9	Juvenile Fish Trawl	Hornsund	HS
HE451/001-3	13.09.15	76° 58,98' N	15° 49,17' E	200,3	Juvenile Fish Trawl	Hornsund	HS
HE451/001-4	13.09.15	76° 59,41' N	15° 53,88' E	166	Juvenile Fish Trawl	Hornsund	HS
HE451/001-5	13.09.15	76° 59,47' N	15° 54,49' E	159,1	Juvenile Fish Trawl	Hornsund	HS
HE451/001-6	13.09.15	76° 58,72' N	15° 44,72' E	233,7	Beam Trawl	Hornsund	HS
HE451/001-7	13.09.15	76° 58,51' N	15° 43,61' E	221,2	Box grab	Hornsund	HS
HE451/001-8	13.09.15	76° 58,73' N	15° 43,49' E	230,7	Box grab	Hornsund	HS
HE451/001-9	13.09.15	76° 58,69' N	15° 43,29' E	220,6	Box grab	Hornsund	HS
HE451/001-10	13.09.15	76° 58,68' N	15° 43,09' E	207,1	Box grab	Hornsund	HS
HE451/001-11	13.09.15	76° 58,62' N	15° 42,69' E	184,2	Box grab	Hornsund	HS
HE451/002-1	15.09.15	80° 11,11' N	22° 6,07' E	203,9	CTD/rosette water sampler	Rijpfjorden 1	RF1
HE451/002-2	15.09.15	80° 10,54' N	22° 6,53' E	210,7	Juvenile Fish Trawl	Rijpfjorden 1	RF1
HE451/002-3	15.09.15	80° 12,05' N	22° 7,00' E	115,4	Juvenile Fish Trawl	Rijpfjorden 1	RF1
HE451/002-4	15.09.15	80° 9,68' N	22° 6,81' E	199,2	Juvenile Fish Trawl	Rijpfjorden 1	RF1
HE451/002-5	15.09.15	80° 10,06' N	22° 7,15' E	201,6	Juvenile Fish Trawl	Rijpfjorden 1	RF1
HE451/002-6	15.09.15	80° 10,43' N	22° 7,08' E	210,9	Box grab	Rijpfjorden 1	RF1
HE451/002-7	15.09.15	80° 10,44' N	22° 7,88' E	209,6	Box grab	Rijpfjorden 1	RF1
HE451/002-8	15.09.15	80° 10,30' N	22° 8,60' E	207,1	Box grab	Rijpfjorden 1	RF1
HE451/002-9	15.09.15	80° 10,23' N	22° 8,51' E	203,9	Box grab	Rijpfjorden 1	RF1
HE451/002-10	15.09.15	80° 10,05' N	22° 8,13' E	199,6	Box grab	Rijpfjorden 1	RF1
HE451/003-1	16.09.15	80° 30,17' N	22° 0,28' E	175,3	CTD/rosette water sampler	Rijpfjorden 2	RF2
HE451/003-2	16.09.15	80° 29,11' N	22° 1,62' E	203,4	Juvenile Fish Trawl	Rijpfjorden 2	RF2
HE451/003-3	16.09.15	80° 26,99' N	22° 3,15' E	221,3	Juvenile Fish Trawl	Rijpfjorden 2	RF2
HE451/003-4	16.09.15	80° 23,96' N	22° 6,19' E	204,9	Juvenile Fish Trawl	Rijpfjorden 2	RF2
HE451/003-5	16.09.15	80° 35,90' N	22° 28,23' E	143,1	Bottom trawl	Rijpfjorden 2	RF2
HE451/003-6	16.09.15	80° 30,21' N	22° 0,85' E	170,2	Box grab	Rijpfjorden 2	RF2

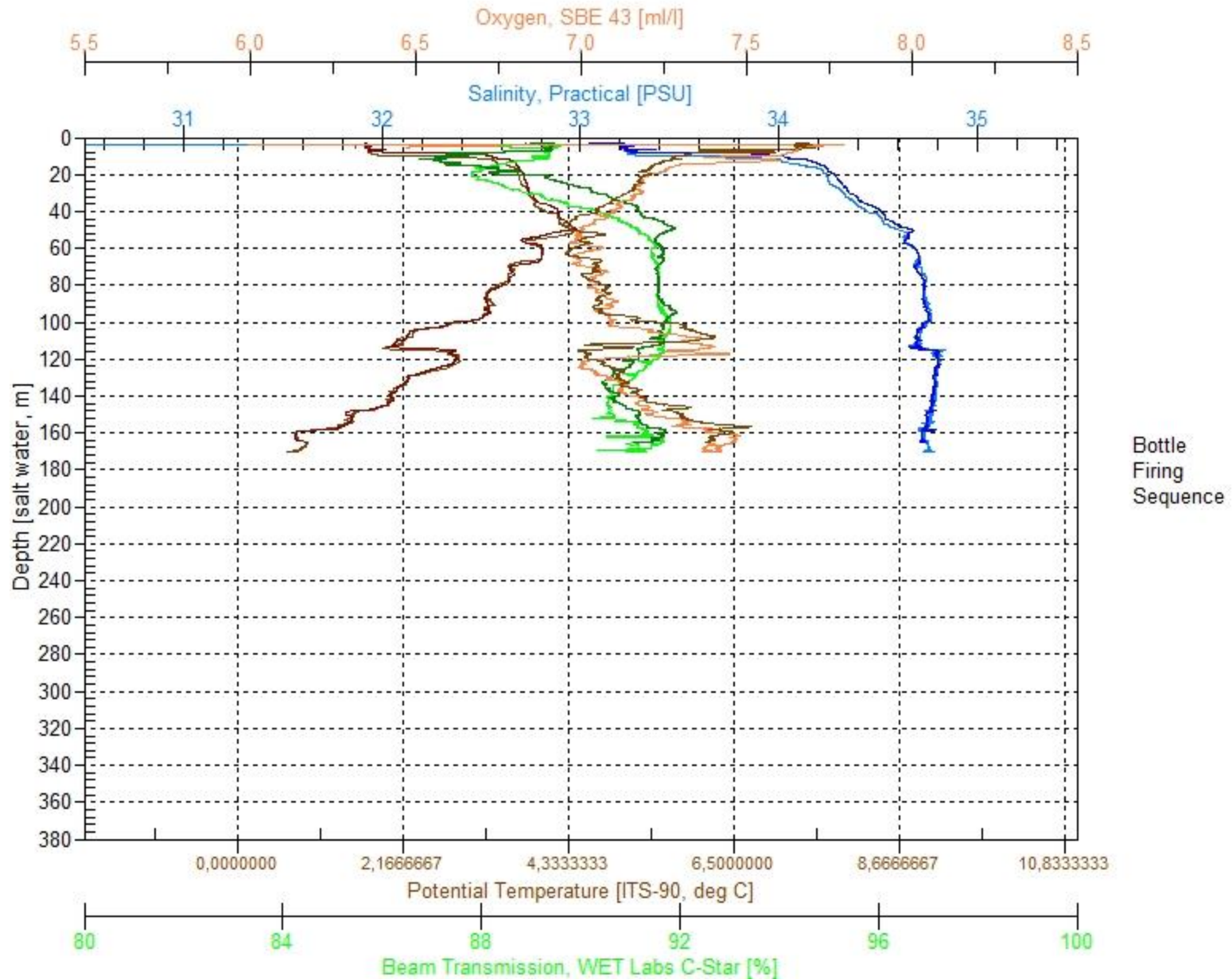
HE451/003-7	16.09.15	80° 30,19' N	22° 0,89' E	168,7	Box grab	Rijpfjorden 2	RF2
HE451/003-8	16.09.15	80° 30,13' N	22° 0,98' E	160,6	Box grab	Rijpfjorden 2	RF2
HE451/003-9	16.09.15	80° 30,31' N	21° 58,53' E	190,8	Box grab	Rijpfjorden 2	RF2
HE451/003-10	16.09.15	80° 30,23' N	21° 58,52' E	191	Box grab	Rijpfjorden 2	RF2
HE451/003-11	16.09.15	80° 30,19' N	21° 58,74' E	196,6	Box grab	Rijpfjorden 2	RF2
HE451/003-12	16.09.15	80° 30,13' N	21° 58,83' E	195,9	Box grab	Rijpfjorden 2	RF2
HE451/003-13	16.09.15	80° 30,11' N	21° 58,87' E	192,9	Box grab	Rijpfjorden 2	RF2
HE451/004-1	17.09.15	80° 0,55' N	17° 13,54' E	343,4	CTD/rosette water sampler	Hinlopen North	HL1
HE451/004-2	17.09.15	79° 59,16' N	17° 19,03' E	286,1	Juvenile Fish Trawl	Hinlopen North	HL1
HE451/004-3	17.09.15	79° 57,05' N	17° 28,29' E	378,9	Juvenile Fish Trawl	Hinlopen North	HL1
HE451/004-4	17.09.15	79° 58,11' N	17° 23,10' E	299,9	Juvenile Fish Trawl	Hinlopen North	HL1
HE451/004-5	17.09.15	79° 59,22' N	17° 10,76' E	167,1	Juvenile Fish Trawl	Hinlopen North	HL1
HE451/004-6	17.09.15	80° 0,56' N	17° 12,98' E	359,8	Box grab	Hinlopen North	HL1
HE451/004-7	17.09.15	80° 0,65' N	17° 14,56' E	191,1	Box grab	Hinlopen North	HL1
HE451/004-8	17.09.15	80° 0,51' N	17° 16,01' E	222,9	Box grab	Hinlopen North	HL1
HE451/004-9	17.09.15	80° 0,49' N	17° 14,99' E	197,3	Box grab	Hinlopen North	HL1
HE451/004-10	17.09.15	80° 0,42' N	17° 14,38' E	211,2	Box grab	Hinlopen North	HL1
HE451/005-1	18.09.15	79° 25,90' N	20° 1,51' E	168,9	CTD/rosette water sampler	Hinlopen South	HL2
HE451/005-2	18.09.15	79° 24,74' N	20° 9,92' E	144,4	Juvenile Fish Trawl	Hinlopen South	HL2
HE451/005-3	18.09.15	79° 23,65' N	20° 17,58' E	118,8	Juvenile Fish Trawl	Hinlopen South	HL2
HE451/005-4	18.09.15	79° 24,79' N	20° 9,84' E	145,6	Juvenile Fish Trawl	Hinlopen South	HL2
HE451/005-5	18.09.15	79° 22,57' N	20° 15,80' E	98,1	Juvenile Fish Trawl	Hinlopen South	HL2
HE451/005-6	18.09.15	79° 25,11' N	20° 7,83' E	161,3	Box grab	Hinlopen South	HL2
HE451/005-7	18.09.15	79° 25,14' N	20° 8,08' E	160,6	Box grab	Hinlopen South	HL2
HE451/005-8	18.09.15	79° 25,27' N	20° 8,28' E	155,3	Box grab	Hinlopen South	HL2
HE451/005-9	18.09.15	79° 25,32' N	20° 8,31' E	149,3	Box grab	Hinlopen South	HL2
HE451/005-10	18.09.15	79° 25,38' N	20° 8,73' E	147,9	Box grab	Hinlopen South	HL2
HE451/005-11	18.09.15	79° 25,45' N	20° 8,70' E	150,4	Box grab	Hinlopen South	HL2
HE451/006-1	19.09.15	80° 26,13' N	13° 36,38' E	252,3	CTD/rosette water sampler	North West Svalbard	NWS
HE451/006-2	19.09.15	80° 26,91' N	13° 44,07' E	211,7	Juvenile Fish Trawl	North West Svalbard	NWS
HE451/006-3	19.09.15	80° 26,58' N	13° 40,78' E	232,2	Juvenile Fish Trawl	North West Svalbard	NWS
HE451/006-4	19.09.15	80° 27,18' N	13° 48,84' E	180,3	Juvenile Fish Trawl	North West Svalbard	NWS
HE451/006-5	19.09.15	80° 28,75' N	13° 54,48' E	130	Bottom trawl	North West Svalbard	NWS
HE451/006-6	19.09.15	80° 29,62' N	13° 53,09' E	131,3	Bottom trawl	North West Svalbard	NWS
HE451/006-7	19.09.15	80° 27,85' N	13° 51,63' E	141,9	Bottom trawl	North West Svalbard	NWS
HE451/006-8	19.09.15	80° 30,66' N	13° 54,54' E	134,9	Box grab	North West Svalbard	NWS
HE451/006-9	19.09.15	80° 30,68' N	13° 54,63' E	135,3	Box grab	North West Svalbard	NWS
HE451/006-10	19.09.15	80° 30,71' N	13° 54,83' E	136	Box grab	North West Svalbard	NWS
HE451/006-11	19.09.15	80° 30,71' N	13° 54,83' E	136	Box grab	North West Svalbard	NWS
HE451/006-12	19.09.15	80° 30,65' N	13° 55,41' E	133	Box grab	North West Svalbard	NWS
HE451/007-1	20.09.15	79° 27,55' N	8° 42,30' E	160	CTD/rosette water sampler	Yermak Plateau	YP2
HE451/007-2	20.09.15	79° 23,78' N	8° 38,20' E	161	Bottom trawl	Yermak Plateau	YP2
HE451/007-3	20.09.15	79° 20,60' N	8° 32,29' E	160,8	Juvenile Fish Trawl	Yermak Plateau	YP2
HE451/007-4	20.09.15	79° 19,52' N	8° 22,85' E	193,5	Juvenile Fish Trawl	Yermak Plateau	YP2
HE451/007-5	20.09.15	79° 20,87' N	8° 33,51' E	162,9	Juvenile Fish Trawl	Yermak Plateau	YP2
HE451/007-6	20.09.15	79° 21,49' N	8° 38,88' E	161,9	Box grab	Yermak Plateau	YP2

HE451/007-7	20.09.15	79° 21,46' N	8° 38,78' E	161	Box grab	Yermak Plateau	YP2
HE451/007-8	20.09.15	79° 21,45' N	8° 38,57' E	160,5	Box grab	Yermak Plateau	YP2
HE451/007-9	20.09.15	79° 21,44' N	8° 38,37' E	160,5	Box grab	Yermak Plateau	YP2
HE451/008-1	21.09.15	79° 7,68' N	6° 5,89' E	1252,3	CTD/rosette water sampler	Hausgarten	HG1
HE451/008-2	21.09.15	79° 8,53' N	6° 11,41' E	1296,8	Juvenile Fish Trawl	Hausgarten	HG1
HE451/008-3	21.09.15	79° 7,98' N	6° 8,64' E	1254	Juvenile Fish Trawl	Hausgarten	HG1
HE451/008-4	21.09.15	79° 9,04' N	6° 14,37' E	1344,3	Juvenile Fish Trawl	Hausgarten	HG1
HE451/008-5	21.09.15	79° 7,76' N	6° 6,72' E	1252,3	Box grab	Hausgarten	HG1
HE451/008-6	21.09.15	79° 7,73' N	6° 8,25' E	1248,3	Box grab	Hausgarten	HG1
HE451/008-7	21.09.15	79° 7,59' N	6° 10,26' E	1245,6	Box grab	Hausgarten	HG1
HE451/008-8	21.09.15	79° 7,27' N	6° 10,72' E	1240,4	Box grab	Hausgarten	HG1
HE451/009-1	22.09.15	79° 14,41' N	11° 58,18' E	146,4	CTD/rosette water sampler	Krossfjorden	KF
HE451/009-2	22.09.15	79° 14,11' N	11° 55,36' E	253,3	Juvenile Fish Trawl	Krossfjorden	KF
HE451/009-3	22.09.15	79° 12,49' N	11° 49,26' E	276,1	Juvenile Fish Trawl	Krossfjorden	KF
HE451/009-4	22.09.15	79° 12,92' N	11° 56,00' E	230,6	Juvenile Fish Trawl	Krossfjorden	KF
HE451/009-5	22.09.15	79° 12,08' N	11° 45,25' E	285,9	Juvenile Fish Trawl	Krossfjorden	KF
HE451/009-6	22.09.15	79° 10,70' N	11° 42,75' E	319,6	Juvenile Fish Trawl	Krossfjorden	KF
HE451/009-7	22.09.15	79° 12,89' N	11° 55,58' E	232,8	Box grab	Krossfjorden	KF
HE451/009-8	22.09.15	79° 12,85' N	11° 55,94' E	236,8	Box grab	Krossfjorden	KF
HE451/009-9	22.09.15	79° 12,81' N	11° 56,02' E	223,7	Box grab	Krossfjorden	KF
HE451/009-10	22.09.15	79° 12,76' N	11° 56,09' E	211,5	Box grab	Krossfjorden	KF
HE451/010-1	23.09.15	78° 51,42' N	11° 33,24' E	104,8	CTD/rosette water sampler	Forlandsundet	KFO
HE451/010-2	23.09.15	78° 52,54' N	11° 27,62' E	114,8	Juvenile Fish Trawl	Forlandsundet	KFO
HE451/010-3	23.09.15	78° 54,22' N	11° 16,50' E	176,9	Juvenile Fish Trawl	Forlandsundet	KFO
HE451/010-4	23.09.15	78° 53,55' N	11° 18,70' E	147,6	Juvenile Fish Trawl	Forlandsundet	KFO
HE451/010-5	23.09.15	78° 53,67' N	11° 19,10' E	136,2	Juvenile Fish Trawl	Forlandsundet	KFO
HE451/010-6	23.09.15	78° 55,10' N	11° 19,30' E	126,6	Bottom trawl	Forlandsundet	KFO
HE451/010-7	23.09.15	78° 52,47' N	11° 23,72' E	82,5	Bottom trawl	Forlandsundet	KFO
HE451/010-8	23.09.15	78° 52,68' N	11° 24,42' E	81,8	Box grab	Forlandsundet	KFO
HE451/010-9	23.09.15	78° 52,70' N	11° 24,38' E	80,7	Box grab	Forlandsundet	KFO
HE451/010-10	23.09.15	78° 52,67' N	11° 24,46' E	82,4	Box grab	Forlandsundet	KFO
HE451/010-11	23.09.15	78° 52,77' N	11° 24,47' E	87,7	Box grab	Forlandsundet	KFO
HE451/011-1	24.09.15	79° 1,11' N	10° 44,27' E	325,4	CTD/rosette water sampler	Kongsfjorden 2	KF2
HE451/011-2	24.09.15	78° 59,94' N	10° 50,69' E	272,7	Juvenile Fish Trawl	Kongsfjorden 2	KF2
HE451/011-3	24.09.15	79° 1,03' N	10° 47,43' E	337,3	Juvenile Fish Trawl	Kongsfjorden 2	KF2
HE451/011-4	24.09.15	79° 0,52' N	10° 48,38' E	327,4	Juvenile Fish Trawl	Kongsfjorden 2	KF2
HE451/011-5	24.09.15	79° 1,30' N	10° 46,46' E	326,2	Juvenile Fish Trawl	Kongsfjorden 2	KF2
HE451/011-6	24.09.15	79° 1,18' N	10° 44,86' E	323,2	Box grab	Kongsfjorden 2	KF2
HE451/011-7	24.09.15	79° 1,07' N	10° 44,63' E	325,2	Box grab	Kongsfjorden 2	KF2
HE451/011-8	24.09.15	79° 1,07' N	10° 44,45' E	325,5	Box grab	Kongsfjorden 2	KF2
HE451/011-9	24.09.15	79° 1,04' N	10° 44,07' E	325,8	Box grab	Kongsfjorden 2	KF2
HE451/012-1	25.09.15	79° 0,18' N	8° 14,86' E	885,9	CTD/rosette water sampler	Kongsfjorden 5	KF5
HE451/012-2	25.09.15	79° 1,52' N	8° 15,05' E	903,7	Juvenile Fish Trawl	Kongsfjorden 5	KF5
HE451/012-3	25.09.15	79° 0,38' N	8° 14,50' E	894,3	Juvenile Fish Trawl	Kongsfjorden 5	KF5
HE451/012-4	25.09.15	79° 1,05' N	8° 14,52' E	908	Juvenile Fish Trawl	Kongsfjorden 5	KF5
HE451/012-5	25.09.15	79° 2,17' N	8° 16,08' E	898,5	Box grab	Kongsfjorden 5	KF5

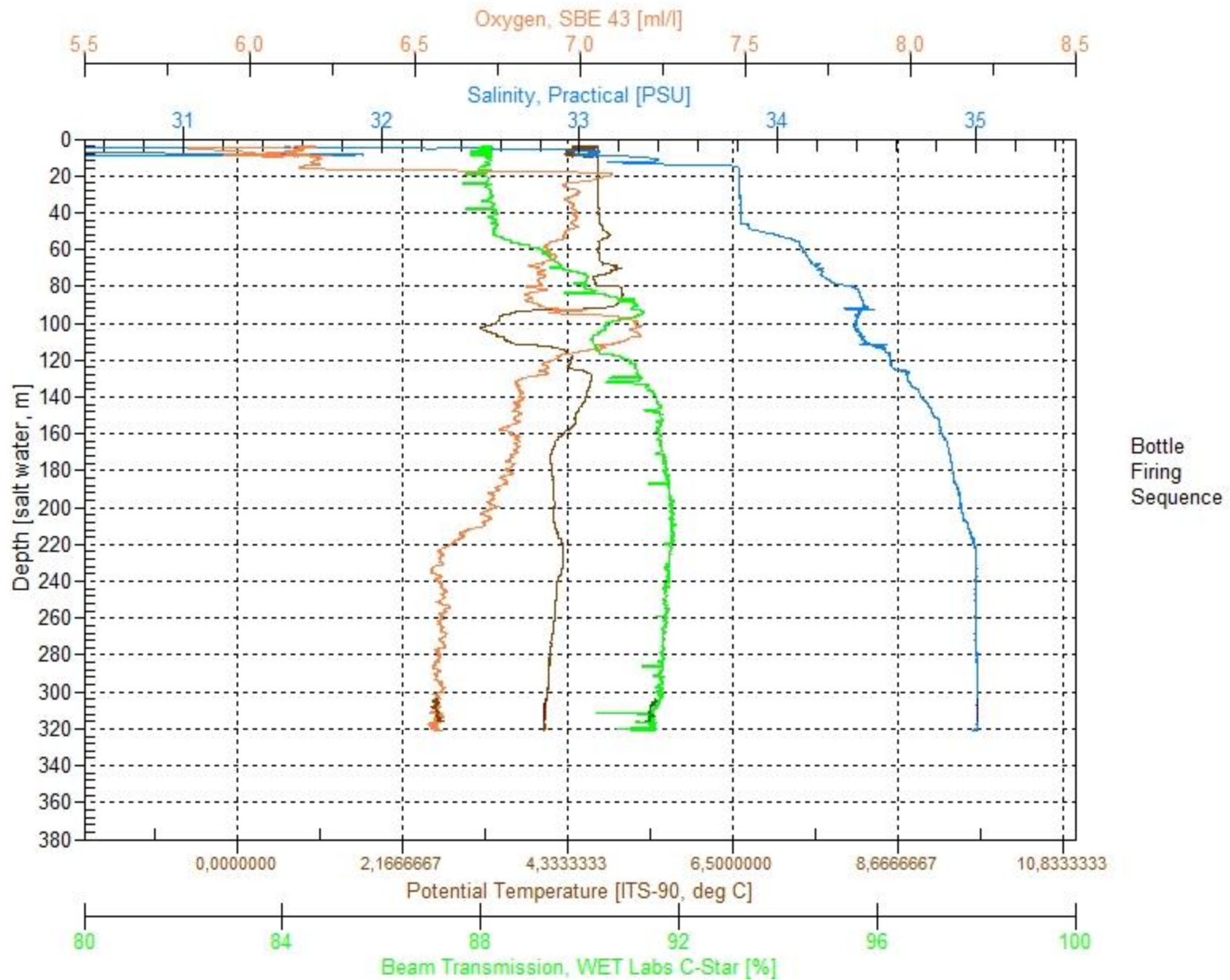
HE451/012-6	25.09.15	79° 2,54' N	8° 15,59' E	906,1	Box grab	Kongsfjorden 5	KF5
HE451/012-7	25.09.15	79° 2,96' N	8° 14,85' E	921	Box grab	Kongsfjorden 5	KF5
HE451/012-8	25.09.15	79° 3,23' N	8° 14,24' E	930,9	Box grab	Kongsfjorden 5	KF5
HE451/012-9	25.09.15	79° 2,42' N	8° 14,60' E	921,4	Box grab	Kongsfjorden 5	KF5
HE451/012-10	25.09.15	79° 2,15' N	8° 15,61' E	904,4	Box grab	Kongsfjorden 5	KF5
HE451/012-11	25.09.15	79° 2,15' N	8° 15,89' E	900,6	Box grab	Kongsfjorden 5	KF5
HE451/013-1	25.09.15	78° 58,16' N	8° 42,46' E	231,2	CTD/rosette water sampler	Kongsfjorden 4	KF4
HE451/013-2	25.09.15	78° 58,33' N	8° 42,47' E	231,1	Box grab	Kongsfjorden 4	KF4
HE451/013-3	25.09.15	78° 58,82' N	8° 42,17' E	235,4	Box grab	Kongsfjorden 4	KF4
HE451/013-4	25.09.15	78° 58,82' N	8° 41,89' E	235,6	Box grab	Kongsfjorden 4	KF4
HE451/013-5	25.09.15	78° 58,88' N	8° 41,83' E	234,2	Box grab	Kongsfjorden 4	KF4
HE451/014-1	26.09.15	79° 0,00' N	11° 38,24' E	255,9	CTD/rosette water sampler	Western Kongsfjorden	WLH
HE451/014-2	26.09.15	78° 58,92' N	11° 45,99' E	194	Juvenile Fish Trawl	Western Kongsfjorden	WLH
HE451/014-3	26.09.15	78° 59,15' N	11° 44,13' E	297,2	Juvenile Fish Trawl	Western Kongsfjorden	WLH
HE451/014-4	26.09.15	78° 58,16' N	11° 50,48' E	296,6	Juvenile Fish Trawl	Western Kongsfjorden	WLH
HE451/014-5	26.09.15	78° 58,86' N	11° 45,57' E	172,1	Juvenile Fish Trawl	Western Kongsfjorden	WLH
HE451/014-6	26.09.15	78° 55,87' N	12° 2,47' E	229,7	Box grab	Western Kongsfjorden	WLH
HE451/014-7	26.09.15	78° 55,86' N	12° 2,39' E	228,4	Box grab	Western Kongsfjorden	WLH
HE451/014-8	26.09.15	78° 55,84' N	12° 2,25' E	225,5	Box grab	Western Kongsfjorden	WLH
HE451/014-9	26.09.15	78° 55,85' N	12° 2,22' E	227,9	Box grab	Western Kongsfjorden	WLH
HE451/015-1	27.09.15	78° 35,44' N	16° 31,03' E	153,6	CTD/rosette water sampler	Billefjord	BF
HE451/015-2	27.09.15	78° 36,37' N	16° 30,74' E	149,9	Juvenile Fish Trawl	Billefjord	BF
HE451/015-3	27.09.15	78° 36,57' N	16° 31,08' E	153,2	Juvenile Fish Trawl	Billefjord	BF
HE451/015-4	27.09.15	78° 37,36' N	16° 32,40' E	139,5	Juvenile Fish Trawl	Billefjord	BF
HE451/015-5	27.09.15	78° 35,70' N	16° 30,62' E	159,1	Juvenile Fish Trawl	Billefjord	BF
HE451/015-6	27.09.15	78° 36,18' N	16° 31,48' E	151,9	Juvenile Fish Trawl	Billefjord	BF
HE451/015-7	27.09.15	78° 36,22' N	16° 31,98' E	152,3	Box grab	Billefjord	BF
HE451/015-8	27.09.15	78° 36,08' N	16° 32,11' E	151,7	Box grab	Billefjord	BF
HE451/015-9	27.09.15	78° 36,08' N	16° 32,32' E	149,1	Box grab	Billefjord	BF
HE451/015-10	27.09.15	78° 36,12' N	16° 32,25' E	148,6	Box grab	Billefjord	BF
HE451/016-1	28.09.15	78° 37,34' N	16° 35,14' E	142,6	Juvenile Fish Trawl	Billefjord	BF
HE451/016-2	28.09.15	78° 34,97' N	16° 29,36' E	161	Juvenile Fish Trawl	Billefjord	BF
HE451/016-3	28.09.15	78° 34,92' N	16° 22,77' E	156,3	Juvenile Fish Trawl	Billefjord	BF
HE451/016-4	28.09.15	78° 35,89' N	16° 33,39' E	145,9	Bottom trawl	Billefjord	BF
HE451/016-5	28.09.15	78° 36,37' N	16° 33,08' E	149,1	Juvenile Fish Trawl	Billefjord	BF

Appendix B – CTD traces of stations

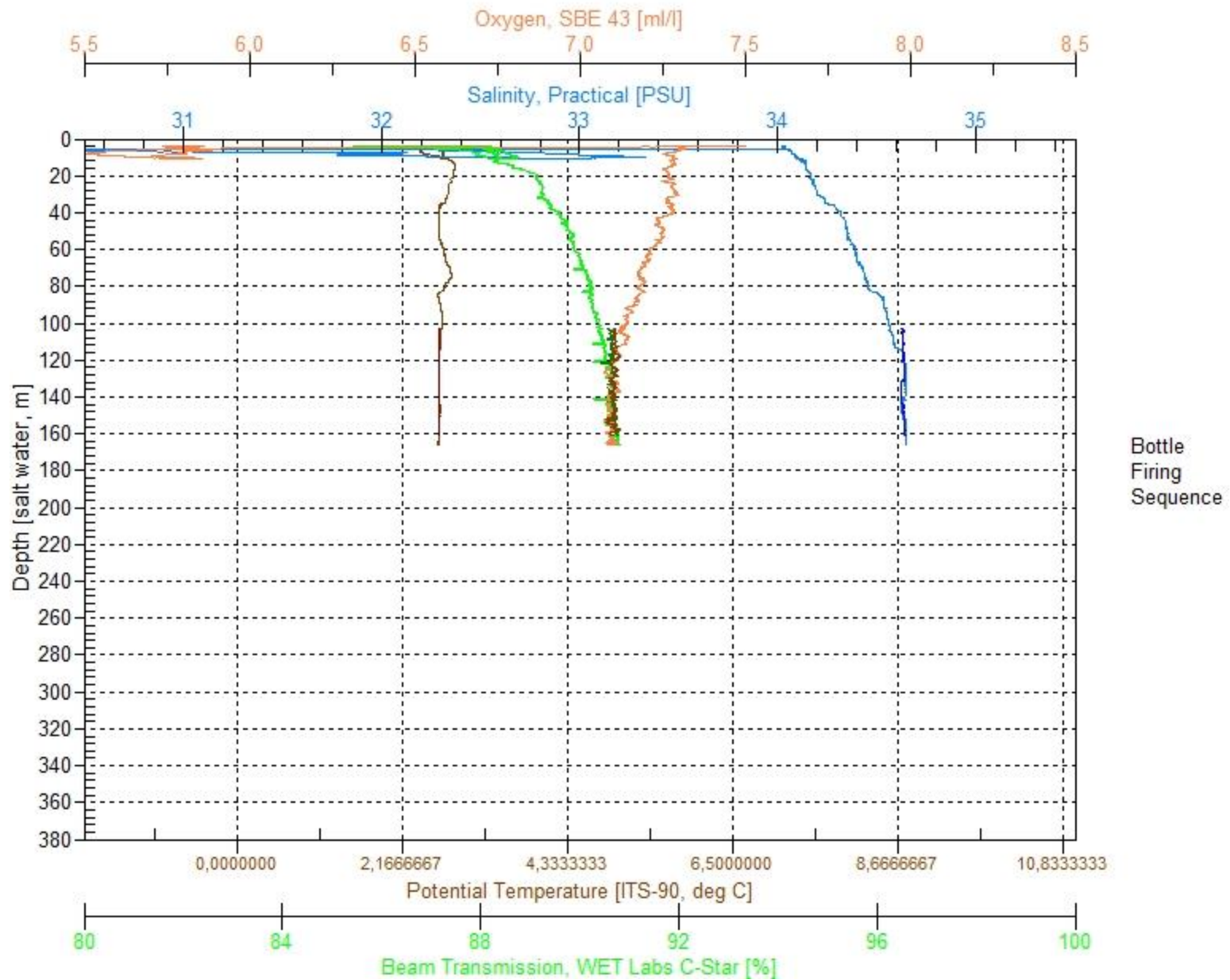
Station 003.1



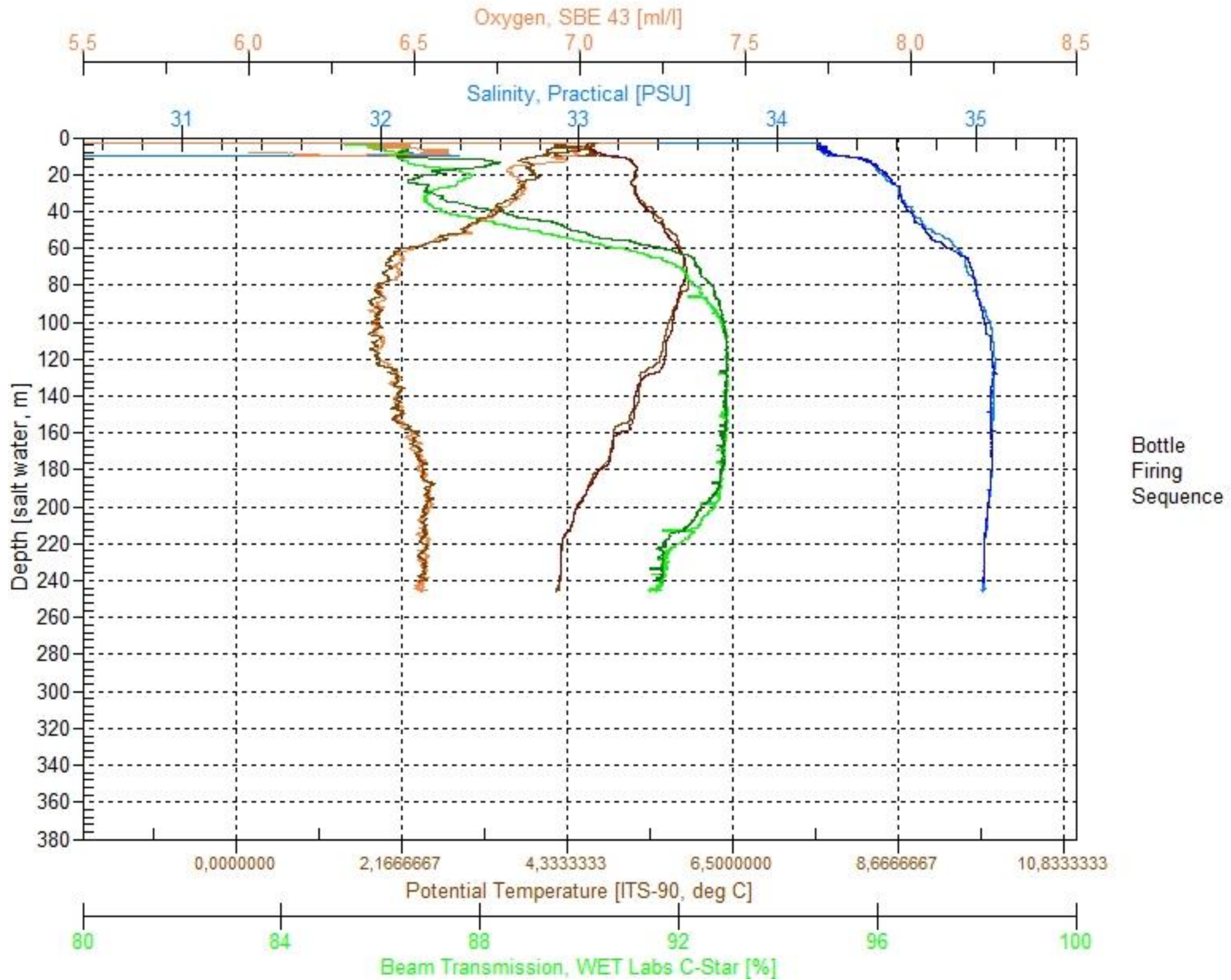
Station 004.1



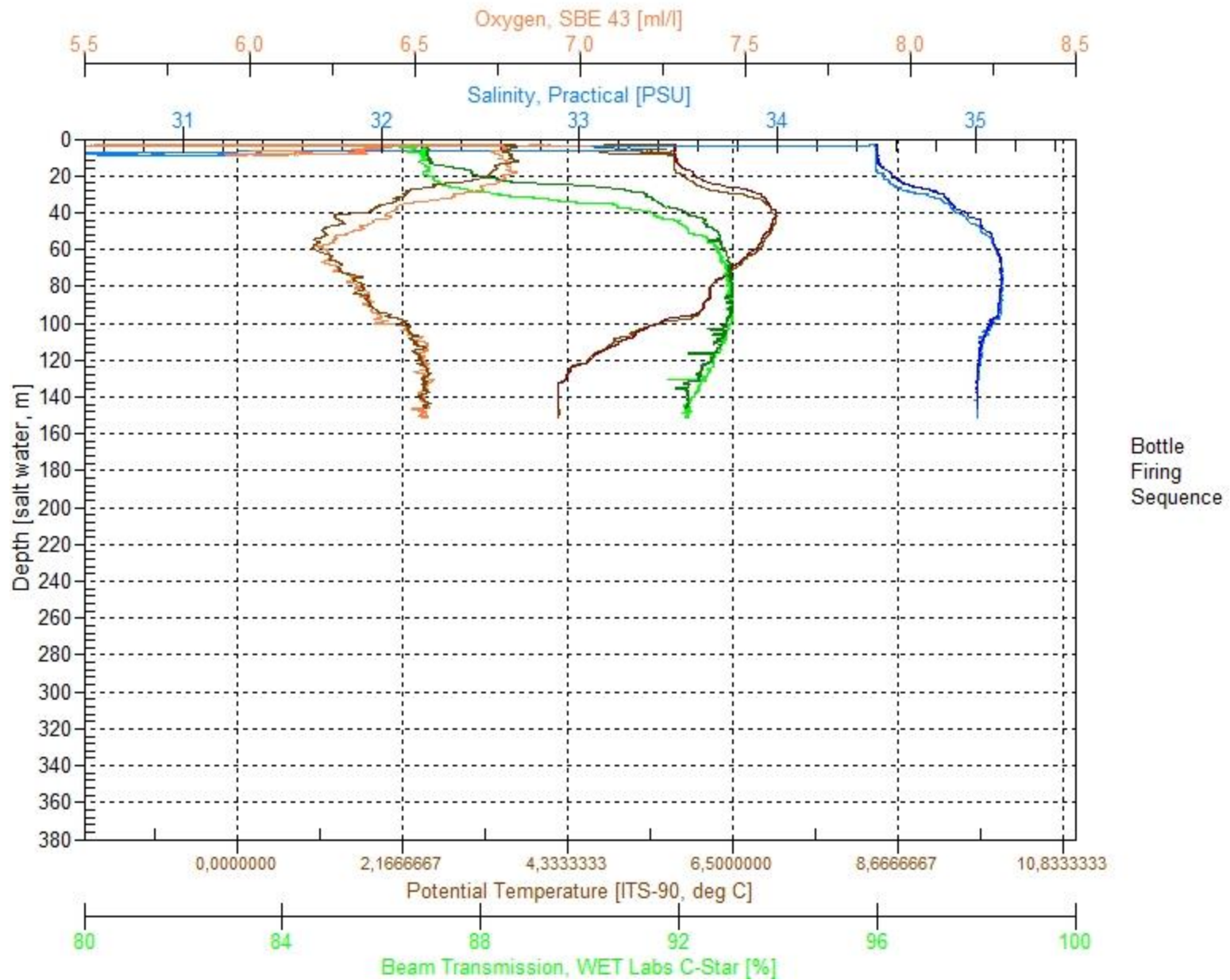
Station 005.1



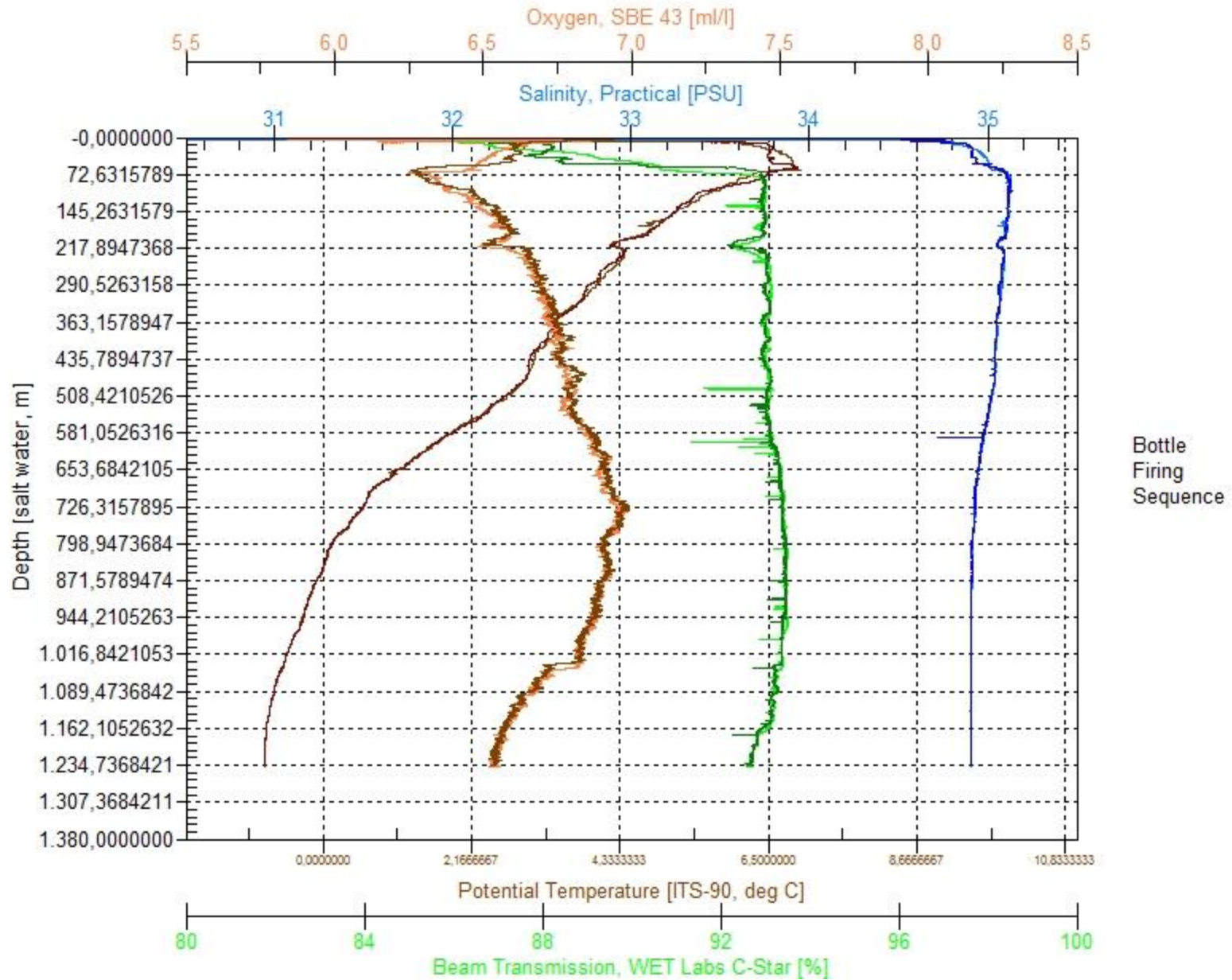
Station 006.1



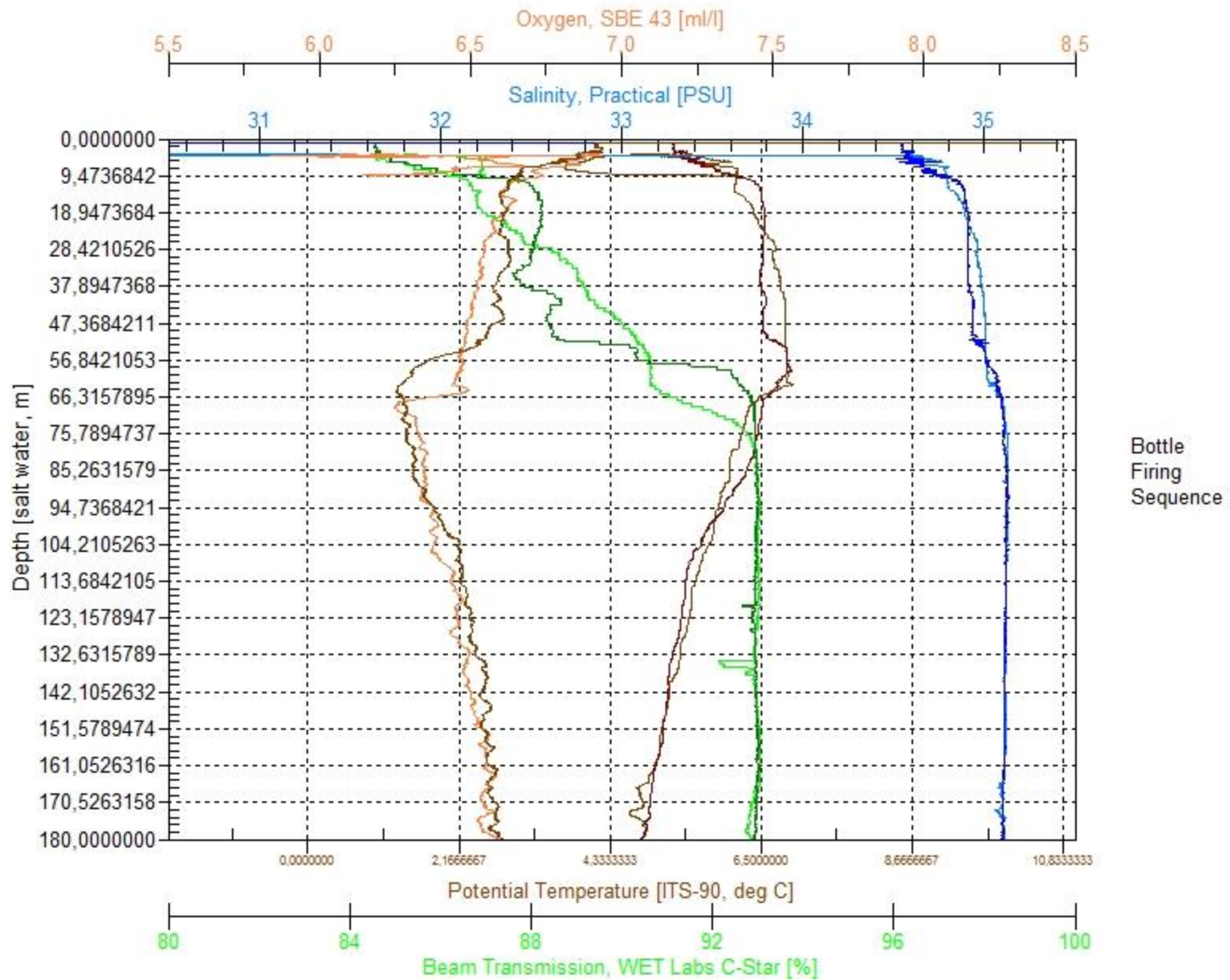
Station 007.1



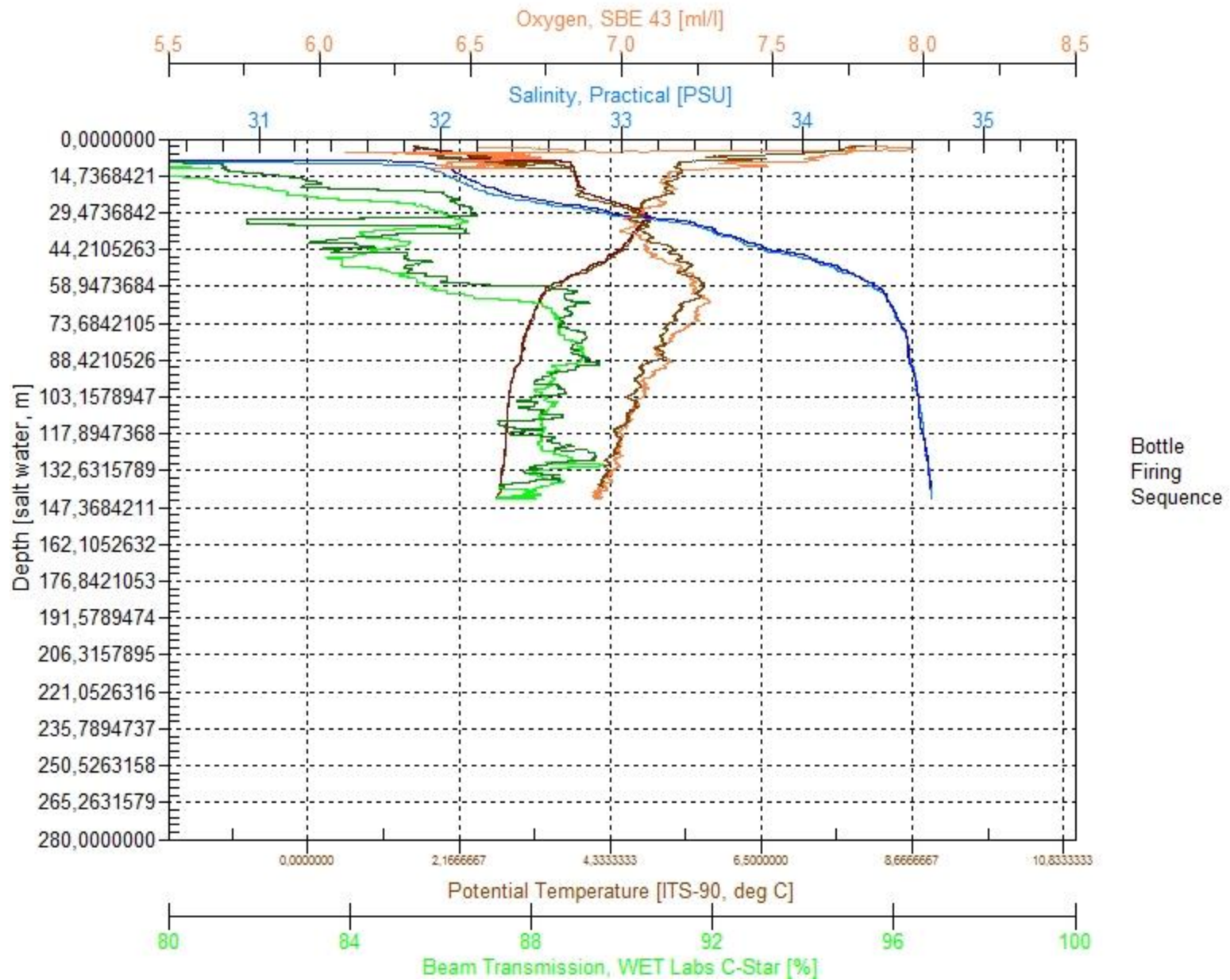
Station 008.1



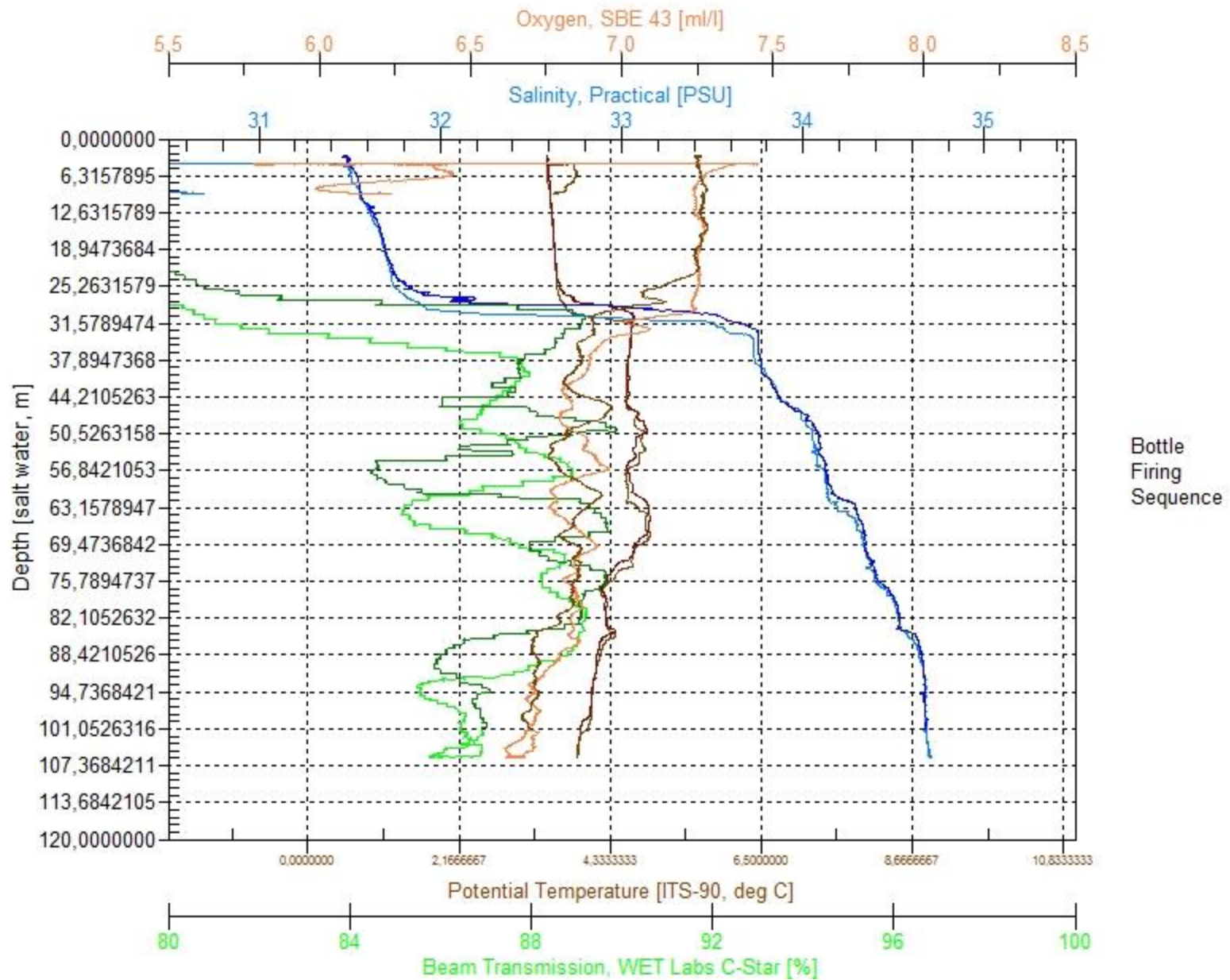
Station 008.1 (0-180m)



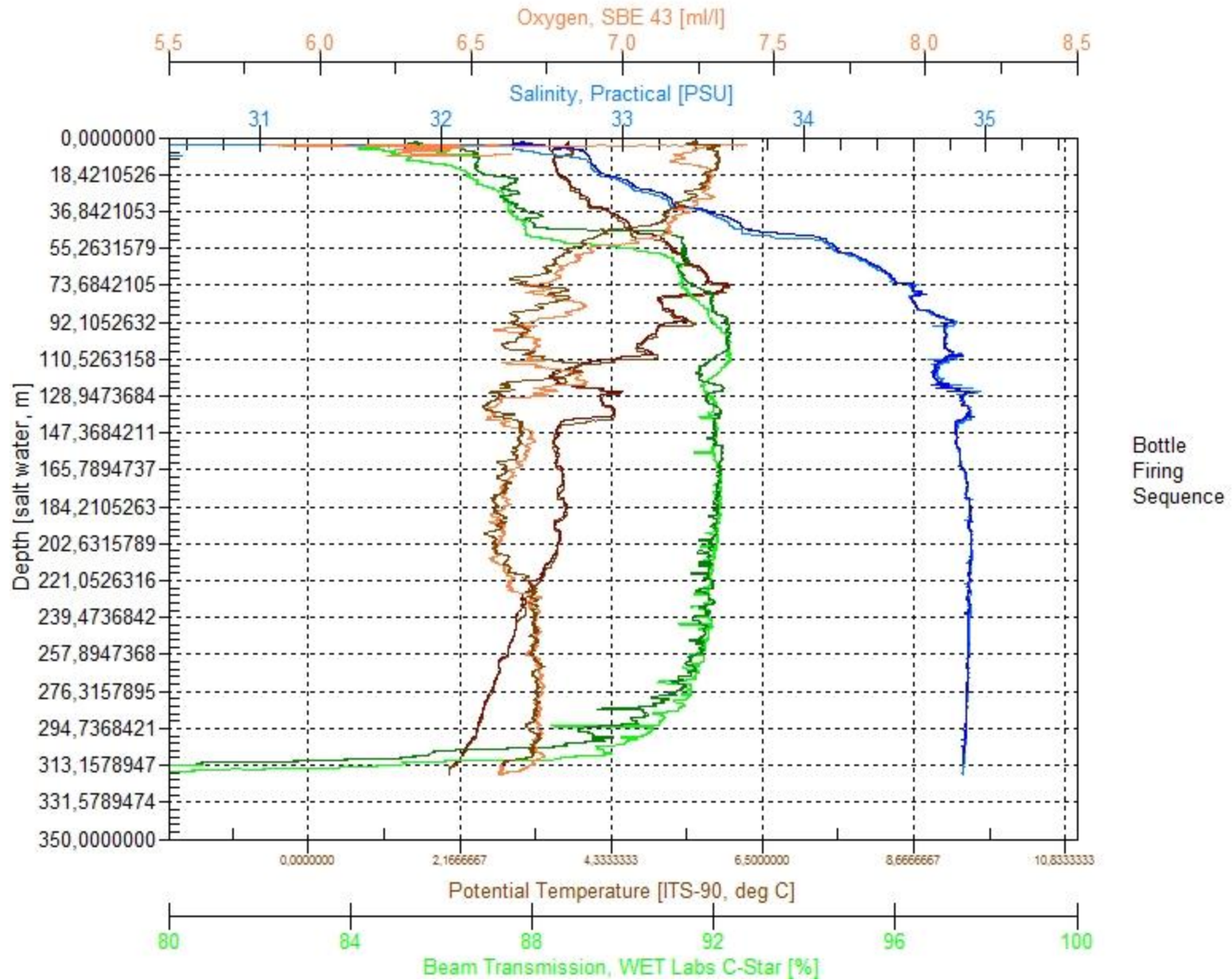
Station 009.1



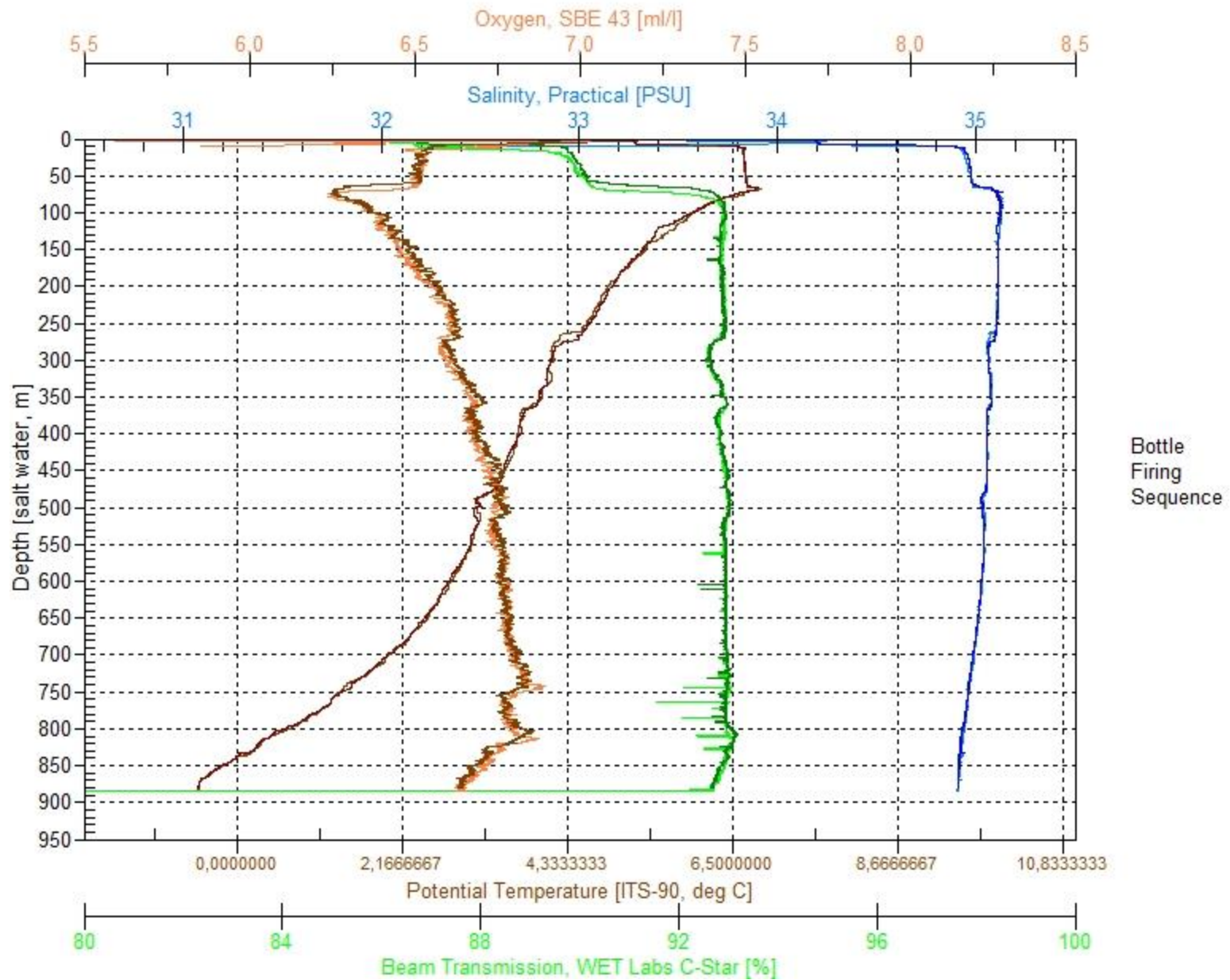
Station 010.1



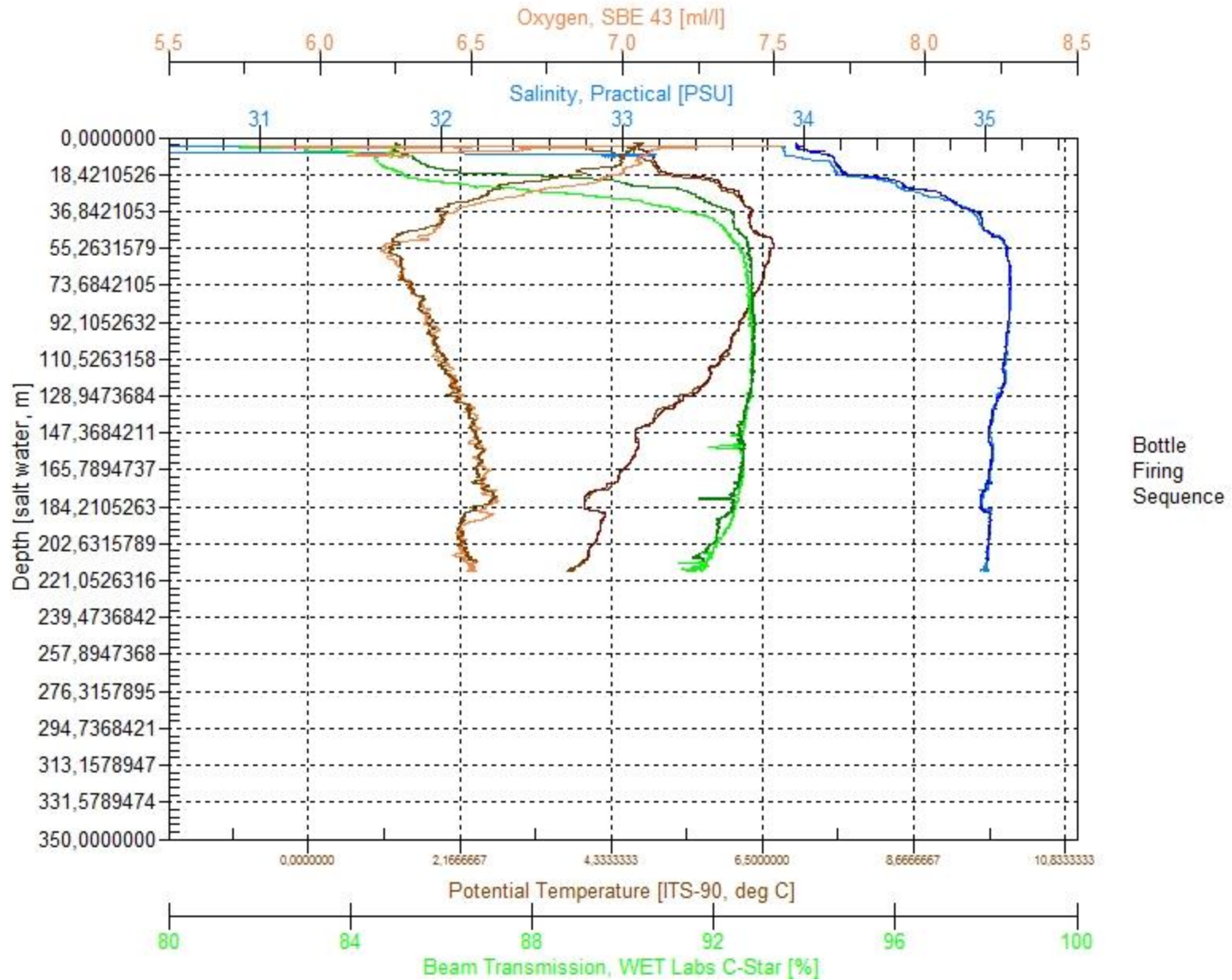
Station 011.1



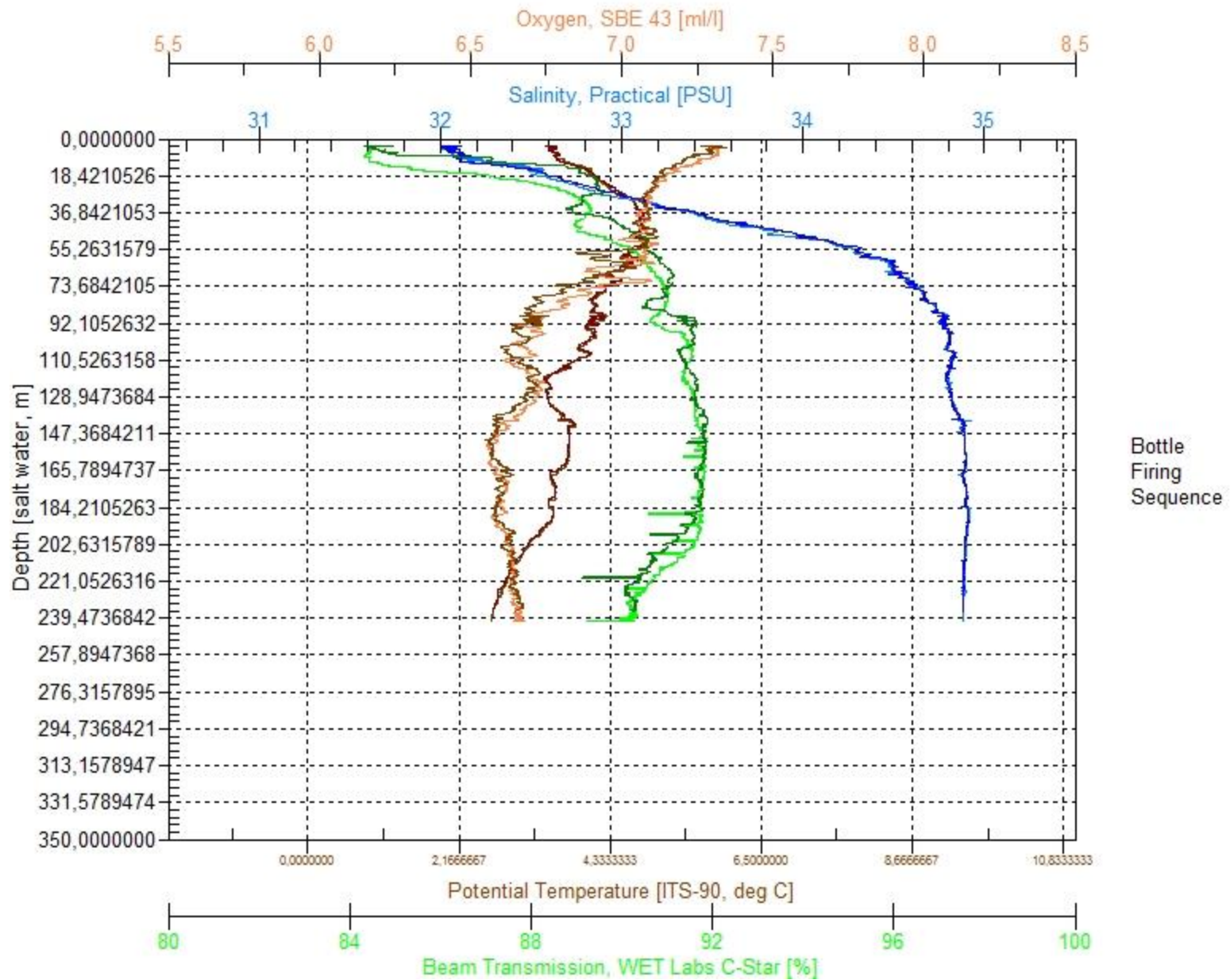
Station 012.1



Station 013.1



Station 014.1



Station 015.1

