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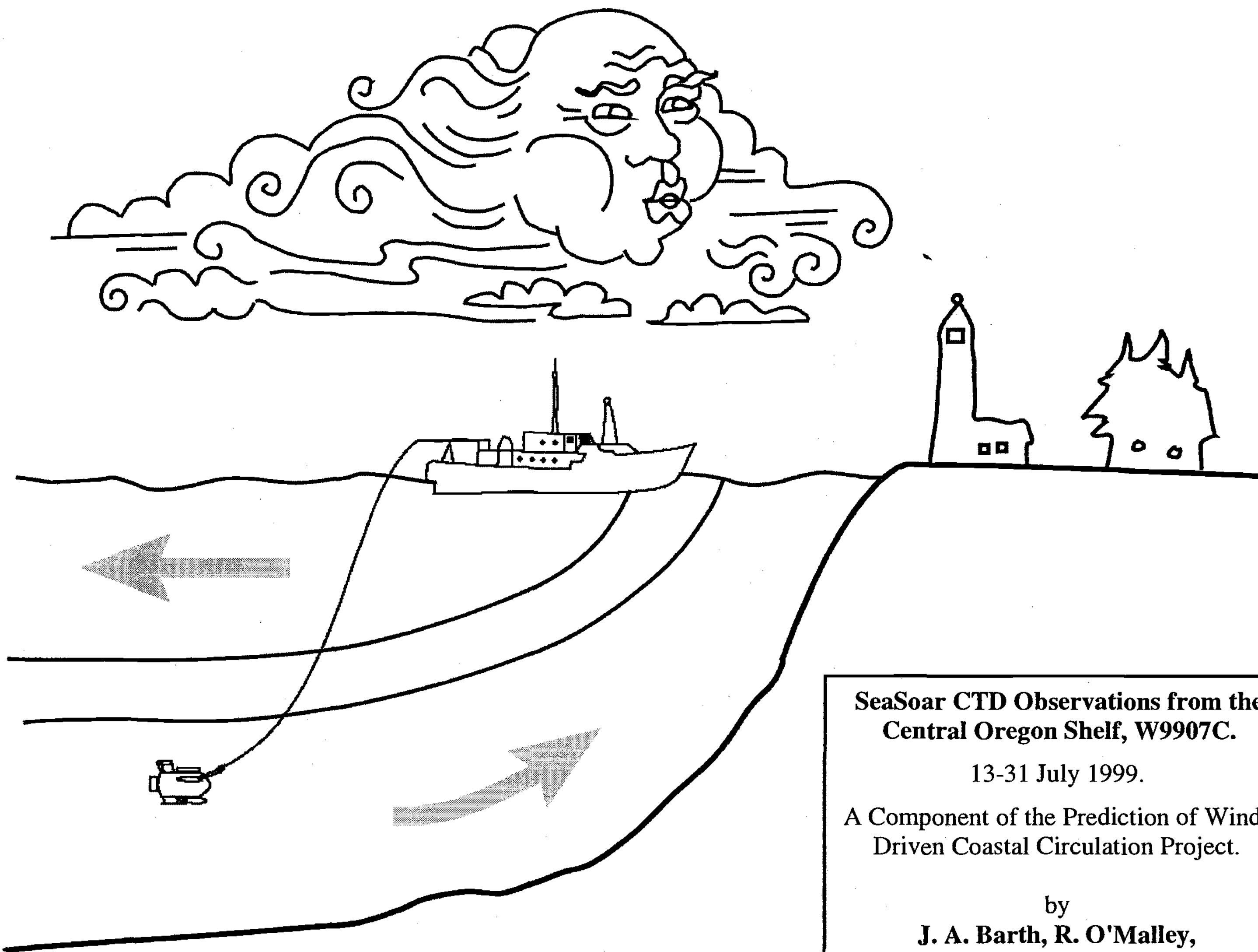

SeaSoar CTD Observations from the Central Oregon Shelf, W9907C.

13-31 July 1999.

A Component of the Prediction of Wind-Driven Coastal Circulation Project.

by

J. A. Barth, R. O'Malley, A.Y. Erofeev, J. Fleischbein, S. D. Pierce and P. M. Kosro

Reference 2001-5
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OREGON STATE UNIVERSITY

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Introduction

This report summarizes observations taken with a conductivity-temperature-depth (CTD) instrument aboard the towed, undulating vehicle SeaSoar during the 1999 National Oceanographic Partnership Program (NOPP)-sponsored Prediction of Wind-Driven Coastal Circulation project. The general goal of this project was to develop nowcast and forecast systems for wind-driven coastal ocean flow fields. The approach was to combine modeling and data assimilation with a coordinated observational program off central Oregon. The major focus was on wind-driven mesoscale processes (2-50 km) as influenced by the temporal and spatial variability of the atmospheric forcing, by spatial variability of the continental margin, and by internal mixing related to small-scale turbulence. Time scales for these mesoscale processes are generally in the 2-10 day band. Mesoscale variability typically involves the most energetic motion over the shelf and includes the physical processes associated with alongshore coastal jets, upwelling and downwelling fronts, and eddies. The Wind-Driven Coastal Circulation project included both a high-resolution coastal ocean model and a high-resolution coastal atmospheric model, the latter forced by an operational large-scale weather prediction model. The partnership involved modelers, data assimilation experts and observationalists from Oregon State University, fisheries scientists from NOAA NMFS Newport, radar specialists from NOAA Environmental Technology Laboratory Boulder, and industrial partners using satellite (Ocean Imaging) and radar (CODAR Ocean Sensors) remote sensing techniques. An overview of the OSU NOPP-sponsored project can be found on the web at *http://damp.coas.oregonstate.edu/nopp/.*

The observational program involved long-term measurements from the OSU Coastal Radar System supplemented by moored current meters and hydrographic surveys. Results from the land-based radar system can be found at *http://bragg.coas.oregonstate.edu/seasonde/* while the moored observations are summarized in Boyd et al. (2000). In addition to the hydrographic results presented here, CTD (along with fluorescence and light transmission) surveys were conducted using a small undulating vehicle (Guildline MiniBAT) towed from OSU's 37-foot R/V Sacajawea from May to September 2000 (Austin et al., 2000).

During July 1999, at the height of the coastal upwelling season, we conducted an 18-day intensive sampling program aboard the R/V Wecoma (cruise W9907C). High-resolution hydrographic, velocity and microstructure data were collected throughout the water column over the continental shelf and slope off central Oregon (Figure 1). Surveys were conducted over a roughly 80 (cross-shelf) by 130 (along shelf) km region and were split between a large-scale survey ("big box" or BB) and a smaller region ("small box" or SB) centered on the Newport Hydrographic line.

The high-resolution hydrographic fields were obtained with the towed, undulating measurement package SeaSoar (Pollard, 1986) and velocity fields were measured by a shipboard Acoustic Doppler Current Profiler (ADCP). The hydrographic and velocity surveys were alternated with periods of microstructure profiling (Figure 2). More can be found about the NOPP microstructure component at *http://nalu.coas.oregonstate.edu/research/shelf/nopp_files/index.htm*.

The primary objectives of R/V Wecoma cruise W9907C were to: 1) collect three-dimensional fields of temperature, salinity, and light absorption and attenuation using the towed, undulating vehicle SeaSoar; 2) collect 3-D fields of velocity using shipboard ADCP; 3) to make turbulence profiles along a single cross-shelf transect; and 4) locate, recover, and either redeploy or replace a NOPP mooring which had been damaged by a fishing trawler earlier in the season;

SeaSoar Instrumentation and Data Acquisition

The instrumentation aboard SeaSoar was similar to that used during the Coastal Mixing and Optics experiment (O'Malley et al., 1998). Photos of the SeaSoar setup can be seen at *http://diana.coas.oregonstate.edu/cmoweb/nopp*. SeaSoar was equipped with the pressure case of a Sea-Bird Electronics (SBE) 9/11+ CTD mounted inside the vehicle with dual temperature and conductivity (T/C) sensors both mounted pointing forward through SeaSoar's nose. Dual SBE pumps mounted inside the vehicle ensured a steady flow past the T/C sensors. A Western Environment Technology Laboratories (WET Labs) ac-9 was mounted on top of SeaSoar in a rigid saddle and with a streamlined nose cone to minimize drag. Water for the ac-9 was pumped from an

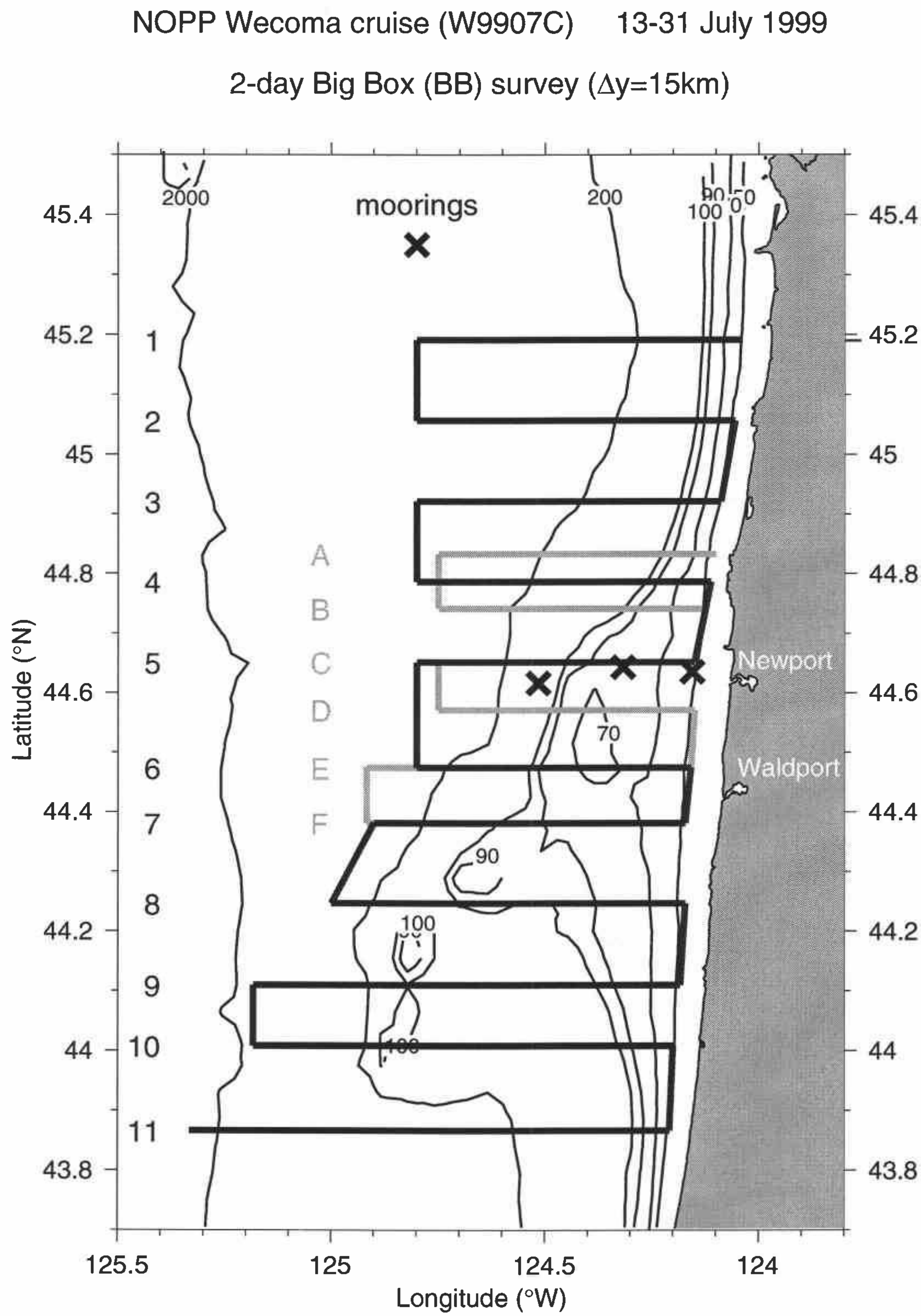

Figure 1: Map of the central Oregon continental shelf and slope showing the location of the SeaSoar sampling lines. Big box (BB) sampling lines are numbered 1-11 and Small Box (SB) lines are A-F. The locations of the NOPP moorings are indicated. Bottom topography is in meters.

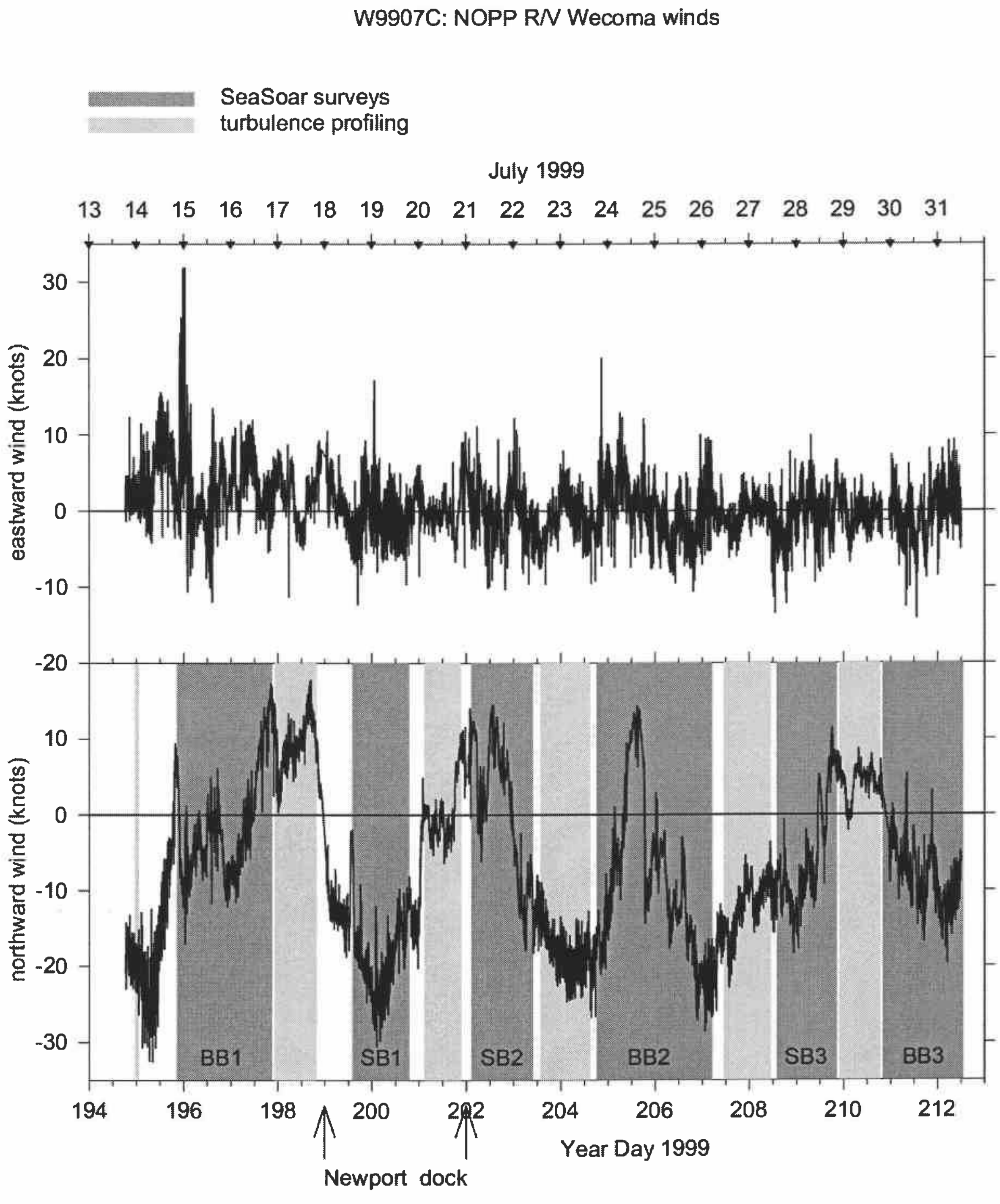

Figure 2: Wind as measured from the R/V Wecoma and cruise activities. SeaSoar surveys (BB1-BB3, SB1-SB3) alternated with periods of turbulence profiling.

inlet/outlet just above the CTD T/C sensors in the nose of SeaSoar. For more details of the ac-9 installation, operation and data processing see Barth and Bogucki (2000).

SeaSoar was towed using a bare (i.e., no streamlined fairing attached as required for deep tow profiling; see Barth *et al.*, 2000), 5/16" armored, seven-conductor (plus ground) cable from a trawl winch aboard Wecoma. The vehicle profiled from the surface to around 120 m and back in approximately 4 minutes at the deep ends of the east-west survey lines, and it took about 1.5 minutes to cycle down to 45 m and back at the shallow ends of the lines.

The SeaSoar vehicle was also equipped with an engineering package measuring pitch, roll and propeller rotation rate. These sensors were connected to the analog-to-digital (A/D) channels of the SBE CTD.

The CTD data stream was input to a PC-based data acquisition system. The acquisition system recorded the data on hard disk, distributed a subsample of the data to both the display and flight control systems, and echoed the entire 24-Hz stream to a UNIX SPARCstation for real-time data processing. The GPS navigation was input to the CTD acquisition system and merged with the CTD data. The display system included various user-specified plots in real time (e.g. time series of salinity, color raster vertical sections of temperature, etc.). The real-time data processing outputs one-second averaged values for quality control and scientific use at sea. A digital flight control system used the CTD pressure signal along with user specified minimum and maximum depths for the profiles as input to a simple expert system to control the SeaSoar flight path. Control signals were transmitted to the SeaSoar vehicle over two conducting cable wires. A hydraulic unit, taking power from the SeaSoar impeller, responds to the control signals to change the wing angle. Along with the maximum target depth, the flight control software also allowed the user to specify a height above the bottom at which to override the target and signal the vehicle to turn up. Bottom depth was detected using the Wecoma's echosounder. Using the ship's echosounder has the added advantage that a bottom obstacle or sudden depth change is observed several tens of seconds before the vehicle reaches the obstacle (depending on cable out and ship speed). This allows more than enough time for an operator override “wings up” command to be issued and the vehicle to respond.

The SeaSoar flight direction changes within just a few seconds while being towed on a short, bare cable.

Cruise Narrative

The R/V Wecoma sailed at 1700 13 July 1999 (all times UTC, plus seven hours from Pacific Daylight Time) from Newport, Oregon with a scientific party of fifteen aboard (Table 1). After completing a fire and boat drill, a WOCE-specification surface drifter (Argos PTT ID 15890) was deployed at 18:26 at 44^{o} 39.09' N, 124^{o} 17.72' W near NH-10 (NH stands for "Newport Hydrographic", the designation of the historic Newport sampling line). The turbulence group then successfully tested the microstructure profiler Chameleon by making three profiles near the mid-shelf NOPP mooring. At 21:10, we arrived at the location of the NOPP shelf break mooring, that is the place where it was moved to after being trawled and dragged earlier in the season (see Boyd et al., 2000). There was no visual sign of the mooring, although OSU researchers had visited the displaced mooring after it had been damaged and noted that a surface buoy was present. The mooring's acoustic release was interrogated and triangulated to the location consistent with the previous visit to the site. After searching visually and acoustically for the black subsurface flotation without luck, we decided not to try and release and recover the mooring at this time. We then proceeded to conduct a CTD profile using the ship's rosette at NH-20 (see Table 2 for list of CTD locations and Figure 3). Three additional turbulence profiles were made at NH-20 to test the equipment further. We then completed CTDs along the NH line out to NH-45 before proceeding to the northernmost latitude of the NOPP sampling region. CTDs were made at five locations along the Cape Kiwanda (CK) line (45^{o} 11.5'N), the shallowest in 144 m of water.

At 20:32 on 14 July 1999 SeaSoar was launched in 45 m of water for the start of survey BB1 (begin Tow 1). We proceed west along line 1 (Figure 1). At 05:20 on 15 July just after the turn at the east end of line 2, SeaSoar would not dive and cable tensions reached 3800 lbs. SeaSoar was brought to the surface and inspected while the ship slowed to one knot. Everything looked fine and undulating was resumed. Just after the turn at the east end of line 3, at 07:00 SeaSoar was pulled aboard due to high tensions (end Tow 1). The vehicle had two crab pot buoys stuck on it and the termination was sparking. The CTD deck unit was quickly powered down. A crab pot line had

Table 1: W9907C cruise participants (all from Oregon State University) with their primary responsibilities.

Jack Barth	Chief Scientist	SeaSoar
Linda Fayler	Marine Technician	SeaSoar
Jane Fleischbein	Technician	CTD, SeaSoar
Briged Gearen	Observer	turbulence profiling
Mike Kosro	Co-Chief Scientist	ADCP, moorings
Murray Levine	Co-Chief Scientist	moorings (13-20 July)
Toby Martin	Marine Technician	
Jim Moum	Co-Chief Scientist	turbulence profiling (13-17 July)
Jonathan Nash	Graduate Student	turbulence profiling
Robert O'Malley	Technician	SeaSoar
Scott Pegau	Scientist	ac-9 optics
Daryl Swenson	Marine Technician	
Walt Waldorf	Technician	moorings (13-20 July)
Hemantha Wijesekera	Scientist	turbulence profiling
Marc Willis	Marine Technician Superintendent	SeaSoar

been snagged and sawed into the termination necessitating a retermination of the cable at the SeaSoar end. After retermination, the Sea-Bird pump used to pump the ac9 on top of SeaSoar did not run, so it was replaced with a spare from the Marine Technician's supply. At 1125 on 15 July, SeaSoar was ready for redeployment but two CTDs were conducted on the inshore end of line 3 in order to wait for daylight so that we could see the crab pots while towing SeaSoar. In general, crab pots were found inshore of the 80 m isobath, sometimes in heavy concentrations along our sampling lines. To avoid future problems with snagging fishing gear we decided to adjust the order in which the survey lines were sampled to try and avoid the inshore ends during dark. The Wecoma deck officers also mapped the location of crab gear on the electronic navigation charts so that we could avoid them when we repeated the surveys (this assumes that the gear is not moved by fisherman in between our occupations of the lines). In addition, while inshore of approximately the

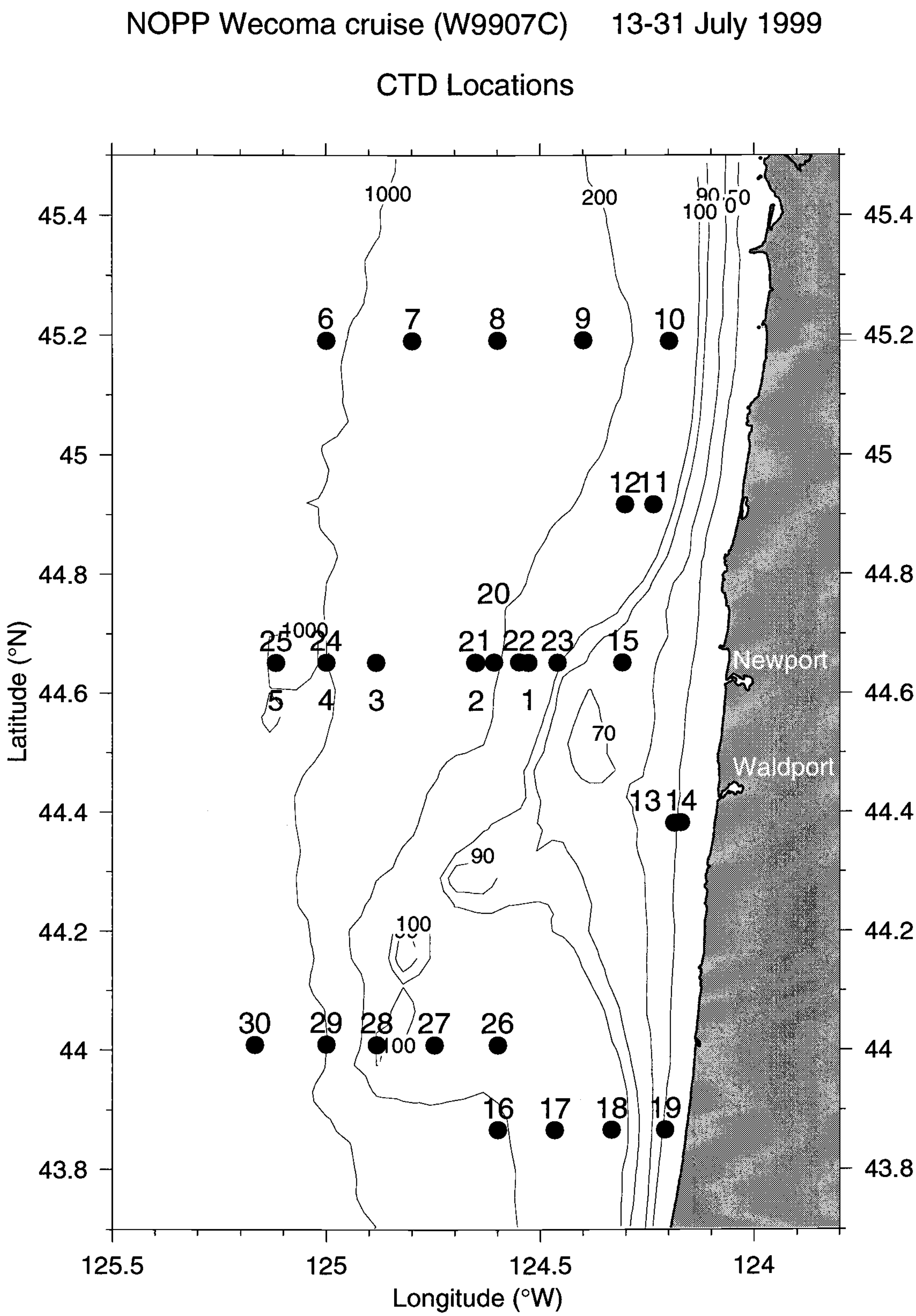

Figure 3: CTD station locations during W9907C. Bottom topography in meters.

Table 2: CTD stations during W9907C

Station#	Date(1999)	Time(UTC)	Latitude(N)	Longitude(W)	Depth(m)
1	13 July	01:04	44° 39.10	124° 31.70	142
2	14 July	02:42	44° 39.09	124° 39.02	293
3	14 July	04:24	44° 39.10	124° 53.00	442
4	14 July	05:33	44° 39.10	125° 00.00	969
5	14 July	07:16	44° 39.07	125° 07.08	719
6	14 July	11:28	45° 11.50	125° 00.00	978
7	14 July	13:36	45° 11.46	124° 47.92	651
8	14 July	15:12	45° 11.50	124° 36.00	373
9	14 July	16:29	45° 11.50	124° 24.00	378
10	14 July	18:27	45° 11.40	124° 11.90	144
11	15 July	08:46	44° 55.00	124° 14.09	125
12	15 July	09:45	44° 55.01	124° 18.13	150
13	22 July	08:42	44° 22.90	124° 11.22	52
14	22 July	09:15	44° 22.95	124° 10.30	48
15	22 July	13:07	44° 39.10	124° 18.50	80
16	26 July	02:14	43° 51.99	124° 35.98	234
17	26 July	03:14	43° 52.00	124° 28.00	128
18	26 July	04:09	43° 52.00	124° 20.00	113
19	26 July	04:59	43° 52.00	124° 12.50	52
20	26 July	18:51	44° 39.13	124° 36.50	210
21	27 July	10:52	44° 39.13	124° 39.12	294
22	29 July	03:30	44° 39.16	124° 32.98	142
23	29 July	18:33	44° 39.10	124° 27.60	104
24	30 July	05:38	44° 39.10	125° 00.00	966
25	30 July	06:53	44° 39.08	125° 07.04	706
26	30 July	18:24	44° 00.50	124° 36.00	149
27	30 July	19:26	44° 00.50	124° 44.90	119
28	30 July	20:22	44° 00.50	124° 52.95	93
29	30 July	21:11	44° 00.55	125° 00.00	968
30	30 July	22:25	44° 00.50	125° 10.02	1650

80-m isobath, members of the scientific party assisted the deck officer in locating fishing gear from the bridge so that it could be avoided.

At 12:08 15 July, SeaSoar was redeployed and towed west on line 3 (begin Tow 2). It was noticed that data from the ac-9 did not look right and at 15:15 the ac-9 data signal transmitted via the Sea-Bird CTD was lost. After turning south at the offshore end of line 3, SeaSoar was recovered at 16:02 to check on the ac-9 (end Tow 2). A test of the ac-9 with a bench top power supply and a test on the SeaSoar tow cable showed that the instrument was fine. At 17:11, SeaSoar was redeployed (begin Tow 3). The ac-9 data was still not 100% and it was diagnosed that the absorption side of the meter was bad above 20 m and that the attenuation side was bad throughout the water column. It was decided to continue the BB1 survey without replacing the damaged ac-9. At 22:30 near the east end of line 4, another crab pot was snagged but the buoy freed itself without damage to the SeaSoar. We turned south in the middle of line 6 to avoid shallow water during dark, completing the outer half of line 7 before sampling along line 8 and the inshore ends of lines 7 and 6 during daylight. The BB1 survey was completed with the recovery of SeaSoar at 20:58 on 16 July (end Tow 3).

At 2225 on 16 July we began Chameleon turbulence profiling at NH-10. During turbulence profiling ac-9 S/N 152 was removed from the lid of SeaSoar and replaced with ac-9 S/N 171. This was necessary because ac-9 152 was giving bad "a" values above 20 m (bad reference values) and the "c" channel was bad throughout the water column. Turbulence profiling, about 270 profiles, was completed about 1945 on 17 July when we departed for Newport to pick up gear for attempting to recover the damaged NOPP mooring.

The Wecoma docked in Newport at 2120 on 17 July and the tension head for the deep-sea, 0.680"-wire winch was onloaded to be used for dragging for the damaged mooring. A block for the 0.680-wire was hung on the A-frame and assorted dragging and mooring gear was loaded. Wecoma sailed at 0115 on 18 July and we arrived at the mooring site at 0317. The mooring was successfully dragged up with the 0.680 wire and the first instrument was aboard at 0505. The acoustic release was onboard at 0630 and we immediately departed for the start of a Small Box SeaSoar survey at AE.

SeaSoar was towed without incident on Small Box 1 from 1406 17 July to 1903 on 19 July. During this time the mooring group reported that the 250-kHz Sontek ADCP recovered from the damaged mooring was not working. It was decided to redeploy a new 500-kHz Sontek on the 90-m replacement mooring. There was heavy stainless-steel salmon fishing line wrapped on the mooring upon recovery. After SeaSoar was recovered at the end of SB1, we transited to the mooring deployment location and deployed the mooring from 2100-2326 19 July. Wecoma then transited to

Newport arriving at the whistle buoy at Yaquina Bay around 0130 on 20 July whereupon it was decided that it was too foggy to enter the Bay. We returned to the inshore mooring on the NH line and began a turbulence profiling section at 0230 intending to work offshore to NH-20. At 2122 microstructure profiling was complete and we again steamed for Newport. At 2345 on 20 July, Wecoma was dockside in Newport and we offloaded the mooring group and their equipment.

Wecoma departed Newport at 0126 on 21 July and transited to CE for the start of a SeaSoar/ADCP survey on Small Box 2. SeaSoar was towed on SB2 without incident until recovery at 0817 on 22 July at FE. We then made two CTD profiles (stations 13 and 14) near FE before transiting to the midshelf NOPP mooring near NH-10. A CTD cast (station 15) was made at NH-10 before microstructure profiling commenced at 1324 on 22 July. At 2300, Wecoma turned around at the offshore end of the NOPP mooring line and began turbulence profiling back to the east toward NH-10. At 1115 on 23 July Chameleon was recovered and Wecoma transited to a turbulence "hot spot" near NH-15. Microstructure profiling was done in this area from 1140 to 1445.

SeaSoar was deployed at 2E at 1811 on 23 July for the start of Big Box 2. SeaSoar towing proceeded south on the BB grid until after 11W when, around 0047 on 26 July, frequent error lights were noted on the CTD deck unit. SeaSoar was recovered at 0109 on 26 July and it was determined that the SeaSoar underwater termination needed repair. While the repair was done, four CTD stations (16-19) were occupied from 124 35.98' to 124 12.5'W on a line off the Siltcoos River (43 52.0'N) to complete the inshore end of line 11. These will be combined with the existing SeaSoar profiles on the offshore end of Line 11 to make a complete section.

After completing the Siltcoos River CTD stations we transited to the midshelf NOPP mooring arriving at 0930 and observed that the meteorological buoy had its flashing light but the guard buoy was missing its light. At 1050 26 July, turbulence profiling was started at NH-10. Profiling proceeded until 1845 when Chameleon was recovered and a CTD (station 20) was done at NH-20. Wecoma proceeded back to NH-5 and inspected the midshelf meteorological mooring along the way. The anemometer cup was missing and one stay wire holding up the mast was broken. This was reported to the mooring group ashore. At 2142 on 26 July, turbulence profiling was begun at

NH-5 and proceeded until 1035 on 27 July when Chameleon was recovered. A CTD (station 21) was done at the end of the turbulence profiling line for calibration purposes.

SeaSoar was deployed at 1355 on 27 July at AE for the start of Small Box 3. At 1420 we snagged a crab pot and SeaSoar was brought to the surface where the crab pot line was removed. All instruments were fine and we proceeded with the survey. At 2200 on 27 July near BE it was determined that SeaSoar might have brushed the bottom while control was temporarily lost when switching between control units. SeaSoar was brought to the surface for inspection and everything was fine so towing continued. SB3 was completed at 2036 on 28 July at DE.

Turbulence profiling was started near NH-10 at 2141 on 28 July and proceeded until 0323 on 29 July. A CTD (station 22) was done just after Chameleon recovery before transiting to the site of a turbulence profiling repeat station at 44 39.12'N, 124 28.13'W. Repeated turbulence profiling at this location proceeded until 1828 on 29 July when a CTD (station 23) was done for calibration purposes.

SeaSoar was deployed at 4W at 1952 on 29 July for the start of Big Box 3. SeaSoar was towed south onto line 5, then offshore to 124 55.4'W where a deep cast was made with SeaSoar before recovering it at 0510 on 30 July. Two deep CTD stations (24 and 25) were made at NH-40 and NH-45 before deploying the SeaSoar again at 0850 at 6W. At about 1130 it was noted that the "a" values on the ac-9 looked bad. At 1410 after passing waypoint 6E, error lights were seen on the SeaSoar CTD deck unit and SeaSoar was recovered at 1425. While on deck the "c" to "a" ac9 tube was reattached, hence the bad a" values previously. The errors could not be reproduced on the deck so SeaSoar was redeployed at 1517 and then promptly recovered at 1545 after error lights reappeared on the down cycles. It was decided to reterminate the SeaSoar.

We transited to HH3 on the 40 0.5'N line and occupied CTD stations (26-30) from HH3 (124 36.0'W) to 10W (125 10.02'W) from 1825 to 2227 on 30 July. An intermediate nephaloid layer/mixed layer presumably coming off Heceta Bank was noted at HH6 (125 0.0'W)

SeaSoar was redeployed at 2334 on 30 July at 9W after completion of the termination repair. Towing on BB3 proceeded to the north until 1239 on 31 July near 7E when SeaSoar was recovered for the last time. We departed for Newport and were dockside at 1450 on 31 July.

Overall a very successful cruise with the following statistics:

- 30 CTD stations
- about 1,388 Chameleon turbulence profiles
- about 12,100 SeaSoar profiles during 9.25 days of towing
- 18 days of underway, 5-m observations
- 18 days of meteorological observations

ADCP Data Collection

Current profiles were measured underway throughout the cruise, using a 150kHz narrowband Acoustic Doppler Current Profiler (ADCP) from RD Instruments. The currents were referenced using navigation data from a P-CODE GPS receiver (Trimble Tasman P(Y)). Heading was determined from the ship's gyrocompass, and post-processed using corrections from an Ashtech 3DF GPS attitude sensing system. All hardware was ship's equipment. The ADCP was set up to use an 8-m pulse, 64 8-m bins, and a 4-m blanking interval; the first bin was centered at 17m depth. The profile ensemble averaging length was 150 seconds. Bottom tracking data were collected when the ship was in waters less than 500m deep. The University of Hawaii user-exit ue4 was used to collect navigation and attitude data. Shortly after completion of each survey, initial plots of maps and sections were made to assist in planning of the next survey.

Microstructure Data Collection (contributed by Jonathan Nash and Jim Moum)

The objective of the turbulence profiling during this cruise was to characterize turbulent processes associated with the wind-driven circulation on the Oregon Shelf during summer upwelling. A second objective was to determine the effects of tides on turbulent signals. Measurements were made with CHAMELEON, the OSU microstructure group's loosely tethered turbulence profiler, deployed profiling downward at 0.7 m/s from the surface to within 10 cm of the bottom. The CHAMELEON was equipped with: two shear probes (to measure turbulent kinetic energy dissipation rate); a Thermometrics FPO7 fast thermistor (temperature and temperature gradient spectrum); a Neil-Brown conductivity cell; a pitot tube (to measure turbulent vertical velocity, to estimate TKE); and a Seapoint turbidity sensor. More about the microstructure component of COAST can be found at: *http://nalu.coas.oregonstate.edu/research/shelf/nopp_files/index.htm*. The following is a summary of the turbulence profiling activities during W9907C:

Survey 1 (Tidal study 1):

- July 16-17, 270 profiles over 21 hours near NH10 to isolate the tidal signal

Survey 2 (NH transect 1):

- July 20, 260 profiles over 19 hours between NH5 and NH20+

Survey 3 (NH transects 2-4):

- July 22-23, 318 profiles over 26 hours. Two transects between NH10-22; one transect between NH14-20

Survey 4 (NH transects 5-6):

- July 26-27, 273 profiles over 24 hours. One transect NH5-22, one NH10-22.

Survey 5 (NH transect 7 plus Tidal study 2):

- July 28-29, 267 profiles over 20.5 hours. One transect from NH10-22 followed by six short transects between NH13.5-17.5.

Bio-Optics Data Collection (contributed by Scott Pegau)

The objective of the bio-optics component of this cruise was to investigate the scales of horizontal variability of the optical properties. To address this question, an ac-9 was connected to the ship's flow-through system next to the temperature and conductivity cells. The source of water was the starboard seachest at about 5 m depth. Data was logged continuously throughout the periods at sea with breaks for calibration and when the water system was shut down for entering port. For the first few days of the cruise ac-9 S/N 171 was used in the flow-through mode. After the ac-9 on the SeaSoar failed (ac-9 S/N 152), ac-9 171 was placed on the SeaSoar and ac-9 S/N 117 was used in the flow-through system. Maintenance of both meters included cleaning and calibration on a 1 to 2 day cycle.

Stability tests were conducted on a WETLabs histar (ac-100), a new optical sensor, connected to the Wecoma's flow-through system. These tests included sampling in the flow-through mode and regular calibration. It was found that the absorption side was not stable and did not provide useful data. The attenuation side is fairly stable, but there was a difference in values between the ac-9 and the histar. These differences may be a result of different acceptance angles in the two instruments. Further analysis is required to fully evaluate the histar's performance and the results will be reported to WETLabs.

A short test was conducted on July 28 during which a 0.2 um filter was inserted after the water passed through the absorption meter and before entering the attenuation meter on the ac-9 in the ship's flow-through system. This sampling technique should allow us to determine the spectal absorption of the particulates directly from the measurements.

CTD Data Acquisition, Calibration and Data Processing

All 30 CTD/rosette casts were made with a SBE 9/11-plus CTD system equipped with dual ducted temperature and conductivity sensors (Table 3). A SeaTech transmissometer (S/N 1024D - 20cm) and SeaTech Fluorometer (S/N 101S) were mounted adjacent to the CTD. A Sea-Bird Beckman-type dissolved oxygen sensor was mounted on the rosette adjacent to the CTD sensors. The calibration dates for the sensors are shown in Table 3 .

The SeaTech fluorometer (SN 101S) had the time constant set to 1 second, and the range set to medium (X3=10 mg m^{-3} chlorophyll). Both the fluorometer and transmissometer were recorded as voltages by the CTD system. Air calibrations of the transmissometer during the cruise resulted in the following correction of transmission voltage for the cruise:

$$V_c = (4.681/4.671)*0.9987(V_x-0.000),$$

where V_c = calibrated output voltage and V_x = raw output voltage.

Table 3: Instruments and sensors used during W9907 for CTD and underway salinity sampling, and date of most recent manufacturer's pre-cruise calibration.

System (Instrument)	Sensor	SN	Pre-Cruise Calibration
W9907 CTD/Rosette SBE 9/11 plus SN 256	P	50130	18 December 1997
	T0	1384	1 December 1998
	T1	1371	1 December 1998
	C0	1538	31 December 1998
	C1	1041	1 December 1998
	Transmissometer	1024D	11 February 1998
	Fluorometer	101S	1 November 1994
	Oxygen	130504	8 March 1999
Shipboard underway sensors	Flo-thru T	854	6 October 1998
	Flo-thru C	1054	25 August 1998
	Sea-Surface T	573	27 February 1999

The pressure sensor, a Digiquartz pressure transducer, and the Sea-Bird temperature and conductivity sensors were calibrated by Sea-Bird (Table 3). The deck unit provided a correction for the time lag between T0 and C0, and no correction for the lag between T1 and C1. Plots of T0-T1 differences were used to check the stability of the temperature calibrations. At each CTD station duplicate samples were collected from Niskin bottles fired at two or more depths for *in situ* calibration of the conductivity sensors. The pressure, temperature and conductivity data for each bottle firing depth were extracted from the recorded up cast data using the Sea-Bird Seasoft DATCNV and ROSSUM utilities.

One set of the duplicate salinity samples were run at sea on a Guildline Portasal. IAPSO Standard Water was used to standardize and check the salinometer at the beginning and end of each batch of 24 samples. The Guildline Portasal determines water sample salinity with a precision of ±0.002 and an accuracy of ±0.003. Sample conductivity was calculated using the sample salinity value with the CTD temperature and pressure values; a value of 4.2914 S m-1 for the conductivity of standard sea water at 15°C (Culkin and Smith, 1980) was used to convert the measured sample conductivity ratios to conductivity. Occasionally the CTD-sample differences were large (> 1 standard deviation from the mean); these occurred in regions of sharp vertical gradients and were eliminated from the final calibration data sets. The results of the CTD - bottle comparison are shown in Table 4. Analysis showed corrections were needed for both sensors. Due to an intermittent problem with the secondary sensor pair possibly related to pump flow, the primary sensor pair was the preferred sensor pair for final processing of all casts. The primary conductivity was corrected using the formula:

Corrected Conductivity = *correction* (slope) * *computed conductivity* + 0.0 (offset),

where

correction = 1.00041080.

Table 4. Results of *in situ* conductivity calibration for both sensor pairs. Columns show the station numbers, number of samples (N), correction applied to CTD conductivity, and the average and standard deviation of the bottle - CTD conductivity differences.

		Correction		***Average***		***Standard Deviation***	
Sta	**N**	**C0**	**C1**	**C0**	**C1**	**C0**	**C1**
30	53	1.00041080	1.00026417	0.014	0.009	0.003	0.003

CTD data were processed using the Sea-Bird SEASOFT software, and included all of the normal steps, i.e., using SEASOFT modules DATCNV, ALIGNCTD, WILDEDIT, CELLTM, FILTER, LOOPEDIT, DERIVE (to calculate dissolved oxygen concentration), and BINAVG to obtain 1-dbar average values of pressure, primary and secondary temperature, primary and secondary conductivity, and the voltages for the fluorometer and transmissometer. The ALIGNCTD module was run with the T-C offset for the primary sensor pair as 0.000 sec, and the T-C offset for the secondary sensor pair as 0.073 seconds; oxygen was advanced 3.0 seconds relative to pressure. Derived parameters, including salinity, potential temperature (theta), density anomaly (sigma-theta) and specific volume anomaly were computed from the processed and calibrated 1-dbar values of temperature and conductivity using standard algorithms (Fofonoff and Millard, 1983).

SeaSoar Data Acquisition and At-Sea Processing

The Chelsea Instruments SeaSoar vehicle was equipped with a SBE 9/11-plus CTD with dual temperature and conductivity sensors (Table 5). The inlets and outlets of both dual T/C ducts were plumbed pointing forward through a hole in the nose of the SeaSoar (Barth et al., 1996). Data from the WetLABS ac9 was sent through the high speed modem channel on the CTD, and was subsequently extracted as a serial stream from the CTD deckunit.

Raw 24-Hz CTD data from the SeaSoar vehicle were logged and distributed by a PC-based acquisition system. The acquisition software allowed for user placement of flags in the data stream to mark, for example, heading changes along sampling lines. The GPS data was logged by the CTD acquisition system as an incoming serial stream, and merged with the incoming CTD data.

The acquisition system logged the raw 24-Hz CTD data and any additional serial streams onto a JAZ disk. The logged file was also echoed to a SUN SPARCstation by serial stream, and the receiving program made a redundant copy of the original file to an external disk. The SPARCstation was used to process the data in real-time, producing one-second averages of the CTD data and all possible A/D channels. Position information was supplied by the merged GPS data. For real-time examination of the data, fixed offsets between the T and C time series were applied, along with a fixed amplitude and time constant for the thermal mass corrections for each sensor pair.

Table 5: Instruments and sensors used during W9907 for SeaSoar salinity sampling, and date of most recent manufacturer's pre-cruise calibration.

System (Instrument)	Sensor	SN	Pre-Cruise Calibration
	P	64256	28 November 1995
W9907	T1	2128	20 February 1999
SeaSoar CTD	T2	2127	20 February 1999
SBE 9/11 plus, SN 428	C1	1738	23 February 1999
	C2	1737	23 February 1999
(tows 1-4)	AC9	152	October 1996
(tows 5-12)	AC9	171	March 1999

Time-series and vertical profile plots of the one-second data were made at the end of each hour for science analysis and to monitor data quality. The lag between the T and C time series for each up- and down-trace of the SeaSoar were also calculated and plotted hourly for each sensor pair as part of the quality control. The 1-Hz real-time data were used to calculate four-minute average temperature and salinity values in two-db vertical bins. These gridded values were used for at-sea analysis of the changing three-dimensional structure observed in the small and large box areas.

SeaSoar Temperature and Conductivity Calibration

The SBE temperature and conductivity sensors used calibration values obtained by SeaBird Electronics in February of 1999. We used these precruise calibrations in the final processing of the data. The precruise calibrations indicated that conductivity sensor 1737 had a drift of 0.00010 [PSU]/month, and that conductivity sensor 1738 had a drift of 0.00020 [PSU]/month. Similarly, temperature sensor 2127 had a drift of 0.00016 degrees C/year, and temperature sensor 2128 showed a drift of 0.00040 degrees C/year.

Post-cruise calibrations were obtained from SeaBird Electronics at the end of August in 1999. The drift per month of the conductivity cells was approximately the same as before (1737:

0.00020 [PSU]/month; 1738: -0.00020 [PSU]/month), while the temperature probes reversed and increased their drift: (2127: -0.00205 degrees C/year; 2128: -0.00072 degrees C/year).

Given the observed drift between precruise and postcruise calibrations, it was felt that use of the precruise calibrations was acceptable.

Post-processing of SeaSoar Data

Salinity data derived from SeaBird ducted temperature and conductivity sensors are subject to errors from three separate sources (Larson, 1992): (1) poor alignment of the 24-Hz temperature and conductivity data, (2) poor compensation for the transfer of heat between the mantle of the conductivity cell and the water flowing through it, and (3) mismatch of the effective time constants of the temperature and conductivity measurements. High-speed pumps, ducted-flow geometry, and sensor design to match response times are hardware measures which help to reduce these errors. Software is then used to align the temperature and conductivity data by some offset (typically 1.75 scans); a two-point recursive formula is applied to correct for the thermal mass of the conductivity cell (Lueck, 1991); and, in the case where one wishes to examine fine-scale features with high-frequency data, digital filtering can be applied to assure response function matching between the temperature and conductivity sensors (N. Larson, 1992, personal communication). For the results reported here, only the thermal mass correction and the offset between T and C need to be addressed in post-processing.

The primary complication for processing CTD data from the SeaSoar is that the sensors experience a variable flow rate (Huyer *et al*, 1993). Although this variability is diminished with the use of the forward pointing sensors, it is still present in the data (Barth *et al*, 1996). Variable flow rate has been attributed to dynamic pressure differences, partly between the inside and outside of the vehicle and partly along the exterior of the vehicle nose where duct inlet and outlet ports may be on different streamlines. Possible sources of such pressure gradients include high dive/climb rates (sometimes greater than 3m s^{-1}, superimposed on a horizontal tow speed of 4m s^{-1}) and perturbations of the flow field around the vehicle, associated perhaps with a persistent roll angle or strong cross-currents. Rather than having a constant offset between the T and C signals, we must correct for a variable lag. The variable flow rate also impacts the thermal mass correction, where the amplitude and time constant of the correction are inversely proportional to flow rate (Lueck, 1991; Morrison *et al*, 1994). Note that biology may further impact the calculated lags between T and C, independent of flow rate. The time response of the thermistor can be lengthened due to the presence of a thin film on the temperature probe, resulting in an offset in the observed lags between T and C (Kosro *et al*, 1995), which returns to normal if the fouling clears. However, in environments where growth is possible, the time response can gradually change over a period of days. Such fouling often precludes the use of data from those sensors.

Because of the repeated sampling of the water column by the SeaSoar, it is possible to examine the T-S plots of consecutive profiles to determine the effects of the thermal mass correction. This was done qualitatively in the early SeaSoar reports to determine the scaling of the amplitude of the thermal mass correction (α) to the observed lags, given a fixed time constant (τ) (Huyer *et al*, 1993; Kosro *et al*, 1995). It can be done quantitatively (Barth *et al* 1996) and allows both α and τ to be variables, which is consistent with Morrison *et al* (1994). Using the hourly T-S diagrams we can find the optimal proportionality of α and τ to the lags (described below).

Before the data can be post-processed, three preliminary steps are required: (1) the sensors are calibrated (described above) using recent calibrations from the manufacturer and/or *in situ* data, (2) the time-series of lags between 24-Hz temperature and conductivity data are computed and cleaned (see below), and (3) the optimal proportionality values between the observed lags and the thermal mass correction variables are determined. Once these steps are completed, the SeaSoar data can be post-processed. The final calibration values are used for the sensors; the time-series of lags are used to offset the temperature and conductivity signals; and a thermal mass correction is applied to the data, where the thermal mass variables α and τ are scaled proportional to the observed lags. The final data are output as 1-Hz values, using a 24-point boxcar filter on the input (24 Hz) data.

Use and cleaning of the time-series of lags between first-differenced temperature and conductivity has been described in previous reports (e.g. Huyer *et al*, 1993). This time we added a statistical method for initial cleaning of the values. A single depth zone was applied to the SeaSoar data, extending from 1 meter down to 150 meters. Lags are calculated in this zone for each ascending and descending trajectory. Each lag is then compared with the mean and standard deviation of the (ascending or descending) lags for that tow; any lag value more than three standard deviations away from the mean is nulled and removed from the set, and the statistics for the tow are recalculated. This continues until all lags fall within 3 sigma of the mean, and then the nulled values are replaced with the average (ascending or descending) value for the given tow. The ascending lag is applied until the SeaSoar reverses direction and dives, and then the descending lag is applied until the SeaSoar hits a maximum depth and starts to climb, etc. The final lags are also examined to determine the preferred sensor pair. It has been our experience that the sensor pair with the least noisy time-series of lags also yields the most reliable T-S diagrams. In this case, the secondary sensors were the preferred sensor pair for all tows, with the exception of the latter half of tow 7. Towards the end of tow 7, the secondary sensor briefly clogged, and when it unclogged the noise level in the lags had increased; the primary sensors now had the better quality lags, and was used as the prefer sensor pair for the last part of tow 7 (identified as tow 7b). The final lags for the preferred sensor pair of each tow are shown in the Appendix.

To apply a thermal mass correction we follow Lueck (1991), who presented a two-point recursive formula involving an amplitude (α) and a time constant (τ). We implement this with a recursive algorithm provided by SeaBird:

$$\Delta C_n = -bC_{n-1} + a(dC/dT)(T_n - T_{n-1}),$$

where

$$a = 2\,\alpha / (2 + \beta\,\Delta t)$$

$$b = 1 - 2a / \alpha$$

$$\beta = 1 / \tau$$

$$dC/dT = 0.1(1 + 0.006(T_n - 20)),$$

and ΔC_n is the conductivity correction at time n, C_{n-1} is the conductivity (in $S \cdot m^{-1}$)at the preceding time, T_n and T_{n-1} are the temperatures (°C) at times n and n-1, and Δt is the time between scans (1/24 sec). The amplitude of the correction is α and τ denotes the time constant.

Lueck suggested that α was inversely proportional to flow rate, and that τ was weakly proportional to the inverse of the flow rate. Morrison *et al* (1994) developed this further: α is inversely proportional as before, but now τ is inversely proportional to the square root of the flow rate. In our data, the observed T-C lag is also inversely proportional to flow rate. Note that if α is proportional to 1/V, and 1/V is proportional to the lag, then α is also proportional to the lag; therefore α and τ can instead be posed in terms of the lag: α is now directly proportional to the T-C lag, and τ is directly proportional to the square root of the lag. The advantage in doing this is that lag values are readily observable from the data while flow rates are not.

Suppose we did not correct for the thermal mass of the conductivity cell. During a down trace the cell would be warmer than the water and would be leaking heat into the water within the conductivity cell; the measured conductivity would then be higher than the conductivity of the surrounding water. If no thermal mass correction is applied, then salinity is too high during descent, and too low during ascent. This has the appearance of a hysteresis loop when plotted on a T-S diagram. If a thermal mass correction is applied by systematicly increasing its amplitude (α) and time constant (τ), the hysteresis loop would diminish until the up-trace lies on top of the down-trace, yielding the best estimates for α and τ. If the thermal mass correction is too strong (α and τ too large, for instance) the hysteresis loop would reappear on the other side, with the salinity now too low during descent.

If we calculate the area (in T-S space) between successive up- and down-traces, then the optimal thermal mass correction is the one which minimizes this area; we would then have the proper settings for α and τ. Since α and τ are both proportional to the observed lags but with the possibility of a constant offset, we seek optimal settings for the slopes and offsets of α and τ.

$$\alpha = \alpha_{offset} + (\alpha_{slope} * lag)$$

$$\tau = \tau_{offset} + (\tau_{slope} * \sqrt{lag})$$

If we consider the area in T-S space as our function and the slopes and offsets as variables, optimal settings are found by minimizing the function of four variables. There are well established routines for this. We chose to use one from the International Math and Science Library (IMSL) which uses a quasi-Newton method and a finite-difference gradient (routine UMINF).

Each tow was optimized for its thermal mass correction. Some tows were very short, in which case the results from a nearby tow were applied to them. Test hours were chosen for each tow and optimizations run on both sensor pairs (see Table 5). This test data set was then processed with an initial slope and offset for α and τ, and the area in T-S space between every successive up- and down-traces was computed for each test hour, and then summed as a whole. The IMSL routine was used to modify the values for the slopes and offsets until a minimum of the summed area was found. The slope and offset for alpha and τ which minimized the area for the test data was then applied as the settings for the appropriate tows. The results are summarized in Table 6.

Table 6: Optimized thermal mass corrections.

Survey	**tow**	**preferred sensors**	**α slope**	**α offset**	**τ slope**	**τ offset**
W9907	1	T2,C2	0.00000	1.56515E-02	1.33112	7.14399
	2-4	T2,C2	0.00000	1.35114E-02	1.33619	7.14737
	5	T2,C2	0.00000	1.24385E-02	1.34359	7.15045
	6	T2,C2	2.27570E-05	1.32230E-02	1.33915	7.14660
	7a	T2,C2	0.00000	1.28822E-02	1.33917	7.15117
	7b	T1,C1	0.00000	1.48576E-02	1.33437	7.14843
	8	T2,C2	0.00000	1.44506E-02	1.33610	7.14802
	9	T2,C2	0.00000	1.36486E-02	1.34925	7.15314
	10-11	T2,C2	0.00000	1.46291E-02	1.32233	7.15426
	12	T2,C2	2.21989E-03	1.33906E-02	1.34020	7.15009

Using the variable lags (shown in the Appendix) and the optimal thermal mass slopes and offsets (Table 6), realigned and corrected 24-Hz temperature and conductivity data were obtained and used to calculate 24-Hz salinity, and these were averaged to yield 1-Hz values stored in hourly files. A repeated statistical cleaning was then applied, which checked the difference of the primary and secondary sensor salinity estimates against the average and standard deviation of that same difference for the entire tow. This was done until the minimum and maximum differences were within about seven standard deviations of the mean. Hand cleaning the T-S diagrams, whereby obvious outliers in T-S space were removed, then followed.

Data Presentation

The final 1-Hz data files contain unfiltered GPS latitude and longitude; pressure; temperature, salinity and sigma-t from the preferred sensor pair; date and time (in both decimal day-of-year and integer year, month, day, hour, minute, second); an integer representing various flags (thousands digit of 1 indicates collection of a water sample from the 5-m intake, hundreds digit of 1 indicates the beginning of a new ascending or descending profile, tens digit of 1 indicates missing GPS data filled by linear interpolation, and ones digit indicates preferred sensors from the port side (0) or the starboard side (1) of the forward-pointing intakes).

In the body of this report, we summarize the results of the conventional CTD casts and the thermohaline data from the SeaSoar tows. For the CTD stations, we provide plots of the vertical profiles of temperature, salinity, σ_t, fluorescence, light transmission and oxygen, and listings of observed and calculated variables at standard pressures. Header data in the listings includes the CTD Station Number, Latitude (degrees and minutes North), Longitude (degrees and minutes West), Date and Time (UTC), and Bottom Depth (in meters).

For the SeaSoar observations, we split the tow data into the small box and big box surveys. See Table 7 and Figure 4. Sections which connect one box to another were used in the maps for both boxes. Maps of temperature, salinity, and sigma-t are shown for every ten meters between 5 and 115 meters depth for both the big and small box surveys. Data used in the maps were obtained

Table 7: Section Times

	Section name	Start time	Stop time
Big Box 1	line01	14-Jul-99 20:43:21	15-Jul-99 00:39:12
(tow 1,	line01-02	15-Jul-99 00:39:13	15-Jul-99 01:37:39
Tow 2,	line02	15-Jul-99 01:37:40	15-Jul-99 05:24:18
Tow 3 &	line02-03	15-Jul-99 05:24:19	15-Jul-99 06:35:22
Tow 4)	line03	15-Jul-99 06:35:23	15-Jul-99 15:23:00
	line03-04	15-Jul-99 15:28:32	15-Jul-99 18:06:54
	line04	15-Jul-99 18:06:55	15-Jul-99 21:53:57
	line04-05	15-Jul-99 21:53:58	15-Jul-99 23:09:27
	line05	15-Jul-99 23:09:28	16-Jul-99 02:48:02
	line05-06	16-Jul-99 02:48:03	16-Jul-99 03:58:42
	line06	16-Jul-99 03:58:43	16-Jul-99 20:56:20
	line06-07	16-Jul-99 05:28:08	16-Jul-99 06:05:51
	line07	16-Jul-99 06:05:52	16-Jul-99 18:15:36
	line07-08	16-Jul-99 09:56:45	16-Jul-99 10:53:14
	line08	16-Jul-99 10:53:15	16-Jul-99 15:24:22
	line08-07	16-Jul-99 15:24:23	16-Jul-99 16:25:40
	line07-06	16-Jul-99 18:15:37	16-Jul-99 18:58:24
Small Box 1	LineA	18-Jul-99 14:22:15	18-Jul-99 17:52:31
(tow 5)	lineA-B	18-Jul-99 17:52:32	18-Jul-99 18:33:35
	LineB	18-Jul-99 18:33:36	18-Jul-99 21:44:04
	lineB-C	18-Jul-99 21:44:05	18-Jul-99 22:27:17
	LineC	18-Jul-99 22:27:18	19-Jul-99 01:54:36
	lineC-D	19-Jul-99 01:54:37	19-Jul-99 02:35:10
	Lined	19-Jul-99 02:35:11	19-Jul-99 18:55:01
	lineD-E	19-Jul-99 04:05:38	19-Jul-99 04:54:49
	LineE	19-Jul-99 04:54:50	19-Jul-99 16:05:53
	lineE-F	19-Jul-99 07:57:46	19-Jul-99 08:45:47
	LineF	19-Jul-99 08:45:48	19-Jul-99 13:25:14
	lineF-E	19-Jul-99 13:25:15	19-Jul-99 14:14:39
	lineE-D	19-Jul-99 16:05:54	19-Jul-99 16:54:28
Small Box 2	lineC	21-Jul-99 02:42:48	21-Jul-99 07:02:41
(tow 6)	lineC-A	21-Jul-99 07:26:54	21-Jul-99 08:54:33
	lineA	21-Jul-99 09:23:06	21-Jul-99 13:47:39
	lineA-B	21-Jul-99 13:47:40	21-Jul-99 14:34:40
	lineB	21-Jul-99 14:34:41	21-Jul-99 18:05:24
	lineB-D	21-Jul-99 18:05:25	21-Jul-99 19:22:12
	lineD	21-Jul-99 19:22:13	21-Jul-99 22:35:00
	lineD-E	21-Jul-99 22:35:01	21-Jul-99 23:20:33
	lineE	21-Jul-99 23:20:34	22-Jul-99 03:30:24
	lineE-F	22-Jul-99 03:30:25	22-Jul-99 04:13:08
	lineF	22-Jul-99 04:13:09	22-Jul-99 08:16:25

Table 7: (continued)

Big Box 2	line02	23-Jul-99 18:21:34	23-Jul-99 21:58:32
(tow 7a & tow 7b)	line02-03	23-Jul-99 21:58:33	23-Jul-99 23:02:18
	line03	23-Jul-99 23:02:19	24-Jul-99 02:22:32
	line03-04	24-Jul-99 02:22:33	24-Jul-99 03:28:41
	line04	24-Jul-99 03:28:42	24-Jul-99 07:12:47
	line04-05	24-Jul-99 08:08:35	24-Jul-99 09:23:06
	line05	24-Jul-99 09:30:44	24-Jul-99 13:56:58
	line05-06	24-Jul-99 13:56:59	24-Jul-99 15:22:37
	line06	24-Jul-99 15:22:38	24-Jul-99 19:08:01
	line06-07	24-Jul-99 19:08:02	24-Jul-99 19:59:56
	line07	24-Jul-99 20:08:38	25-Jul-99 00:14:27
	line07-08	25-Jul-99 00:14:28	25-Jul-99 01:19:17
	line08	25-Jul-99 01:19:18	25-Jul-99 06:58:12
	line08-09	25-Jul-99 06:58:13	25-Jul-99 07:54:16
	line09	25-Jul-99 07:54:17	25-Jul-99 13:36:29
	line09-10	25-Jul-99 13:36:30	25-Jul-99 14:28:12
	line10	25-Jul-99 14:28:13	25-Jul-99 19:58:18
	line10-11	25-Jul-99 19:58:19	25-Jul-99 21:21:51
	line11	25-Jul-99 21:21:52	26-Jul-99 00:44:39
Small Box 3 (tow 8)	lineA	27-Jul-99 14:04:19	27-Jul-99 17:45:01
	lineA-B	27-Jul-99 17:45:02	27-Jul-99 18:27:15
	lineB	27-Jul-99 18:27:16	27-Jul-99 22:08:43
	lineB-C	27-Jul-99 22:08:44	27-Jul-99 22:54:10
	lineC	27-Jul-99 22:54:11	28-Jul-99 02:18:33
	lineC-D	28-Jul-99 02:18:34	28-Jul-99 03:09:48
	lineD	28-Jul-99 03:09:49	28-Jul-99 20:32:45
	lineD-E	28-Jul-99 04:37:39	28-Jul-99 05:22:03
	lineE	28-Jul-99 05:22:04	28-Jul-99 17:11:32
	lineE-F	28-Jul-99 08:03:29	28-Jul-99 08:46:05
	lineF	28-Jul-99 08:46:06	28-Jul-99 13:56:08
	lineF-E	28-Jul-99 13:56:09	28-Jul-99 14:47:51
	lineE-D	28-Jul-99 17:11:33	28-Jul-99 18:01:46
Big Box 3 (tow 9, tow 10, tow 11 & tow 12)	line04	29-Jul-99 19:55:06	29-Jul-99 23:15:44
	line04-05	29-Jul-99 23:15:45	30-Jul-99 00:27:02
	line05	30-Jul-99 00:27:03	30-Jul-99 04:54:55
	line06	30-Jul-99 09:18:59	30-Jul-99 14:05:51
	line06-07	30-Jul-99 14:05:42	30-Jul-99 15:38:47
	line09	30-Jul-99 23:47:11	31-Jul-99 03:57:55
	line09-08	31-Jul-99 03:57:56	31-Jul-99 05:01:06
	line08	31-Jul-99 05:01:07	31-Jul-99 07:53:46
	line08-07	31-Jul-99 07:53:47	31-Jul-99 09:07:09
	line07	31-Jul-99 09:07:10	31-Jul-99 12:35:18

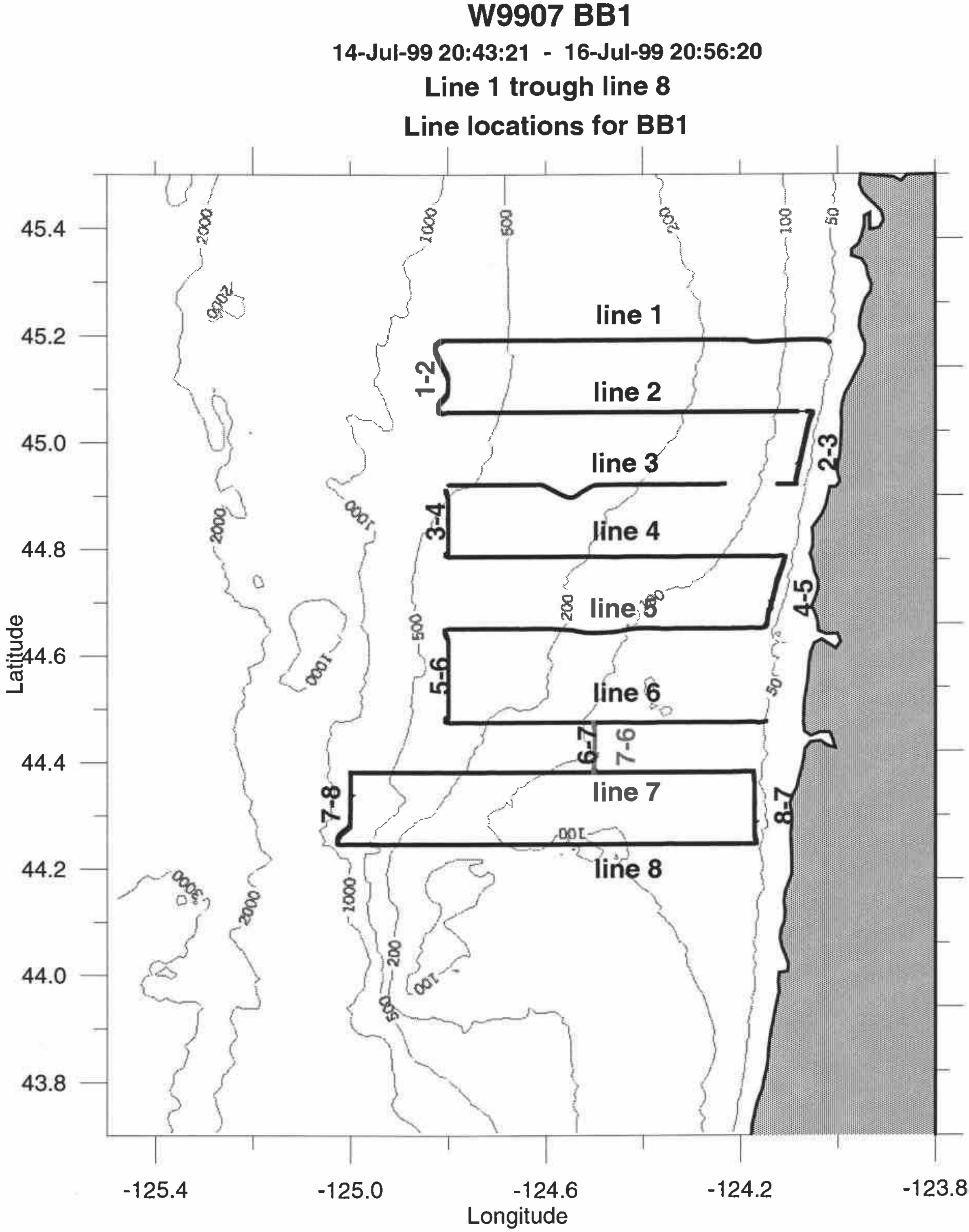

Figure 4a: Cruise tracks during the W9907 SeaSoar surveys. See table 7 for individual line start end stop times.

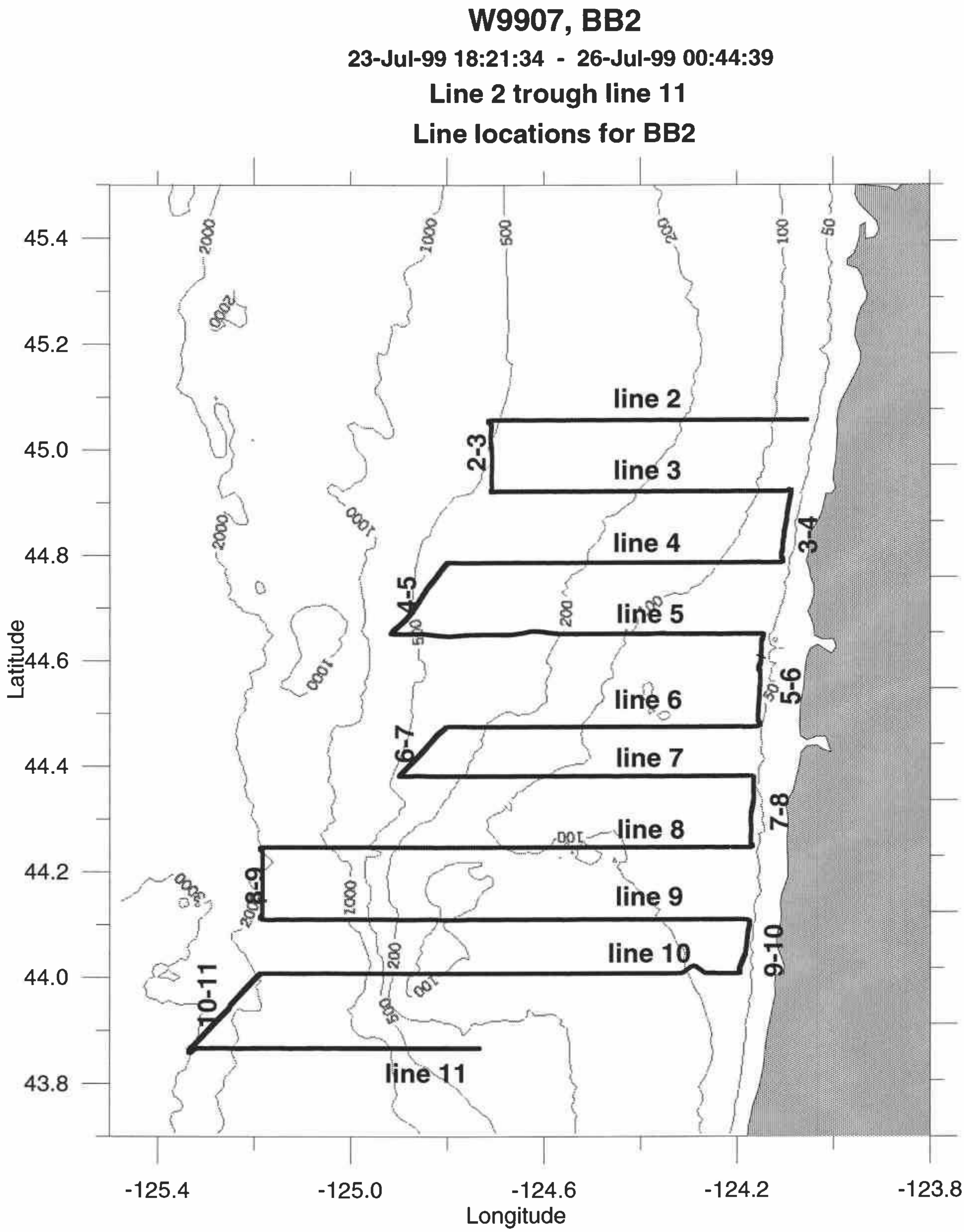

Figure 4b: Cruise tracks during the W9907 SeaSoar surveys. See Table 7 for individual line start and stop times.

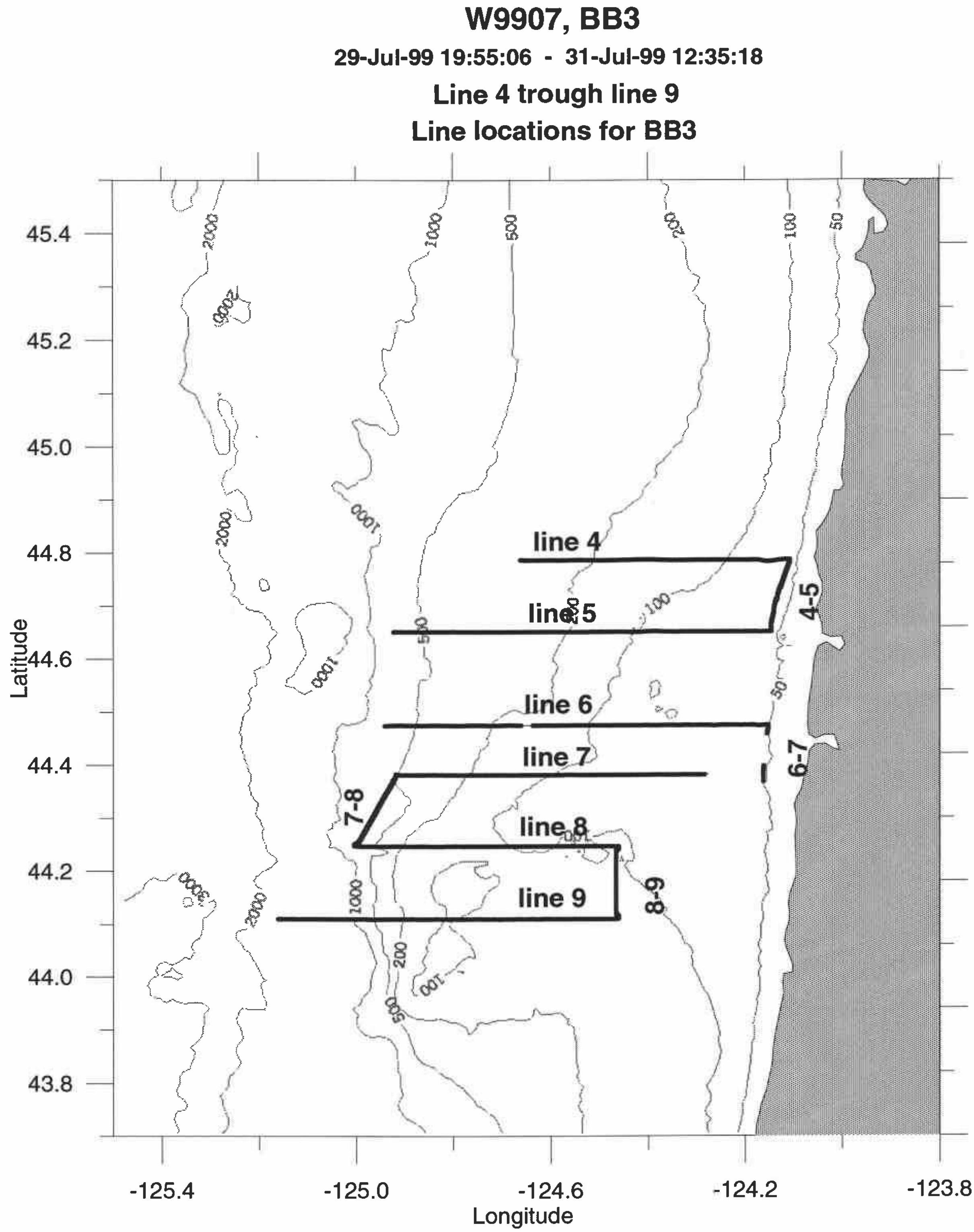

Figure 4c: Cruise tracks during the W9907 SeaSoar surveys. See Table 7 for individual line start and stop times.

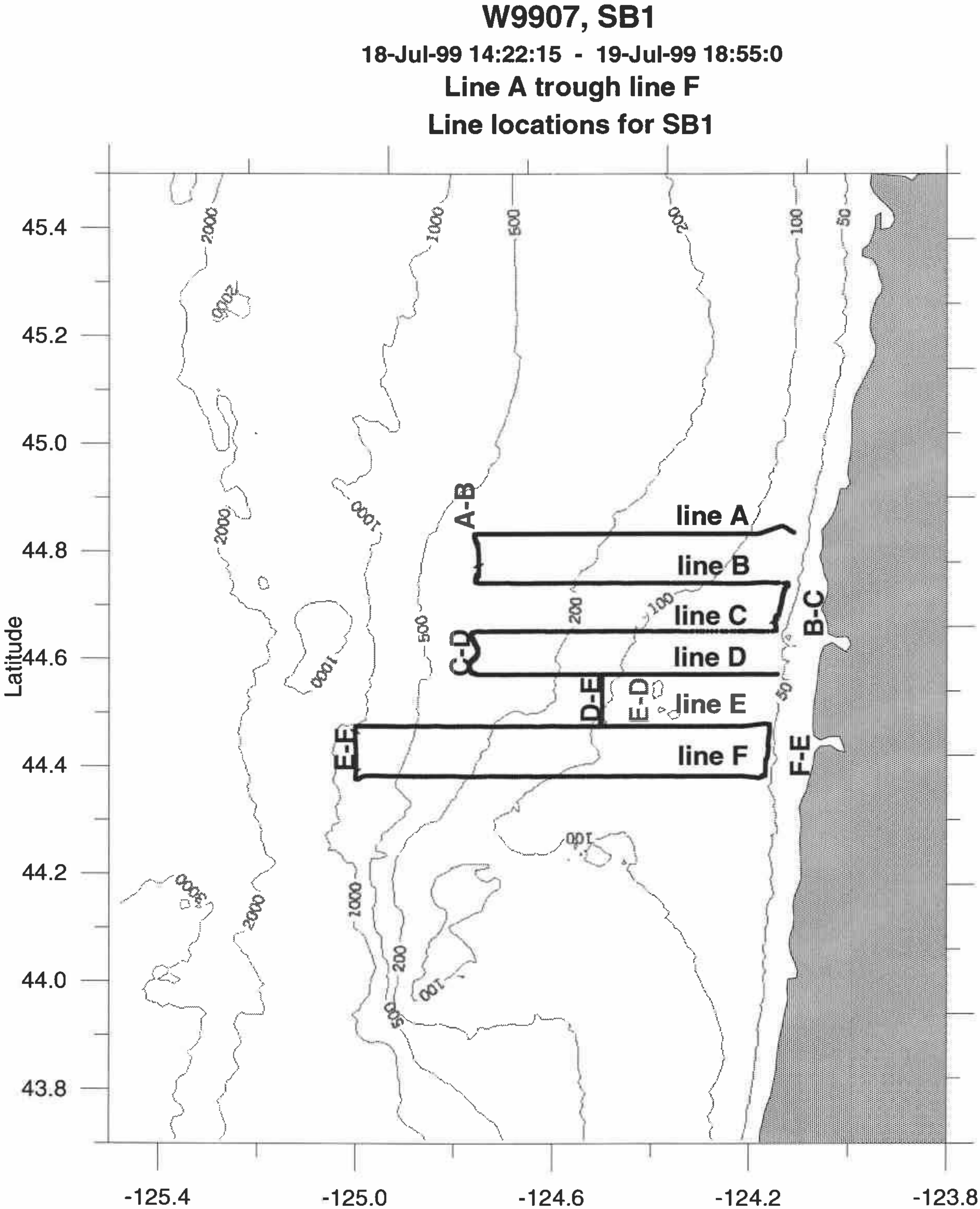

Figure 4d: Cruise tracks during the W9907 SeaSoar surveys. See Table 7 for individual line start and stop times.

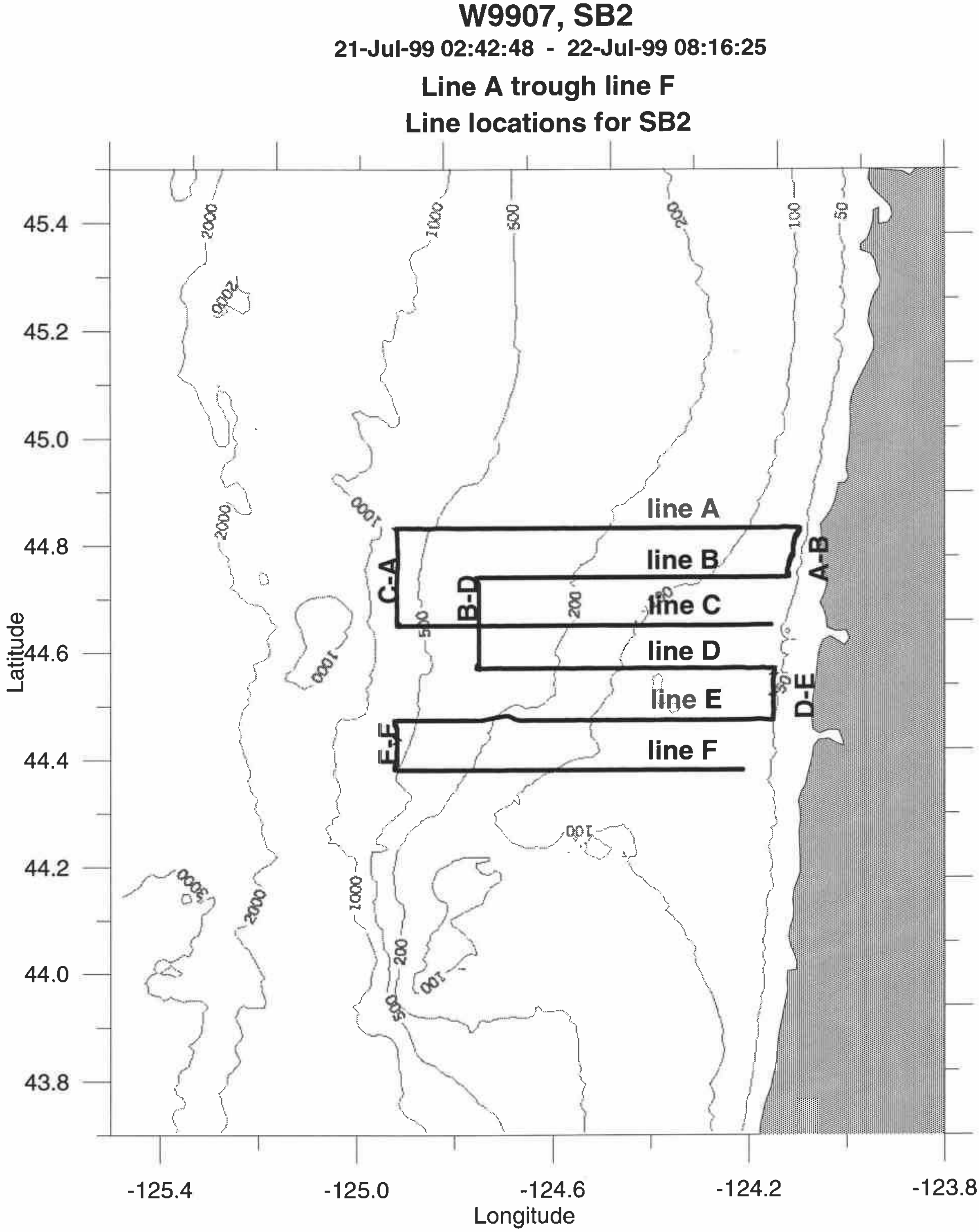

Figure 4e: Cruise tracks during the W9907 SeaSoar surveys. See Table 7 for individual line start and stop times.

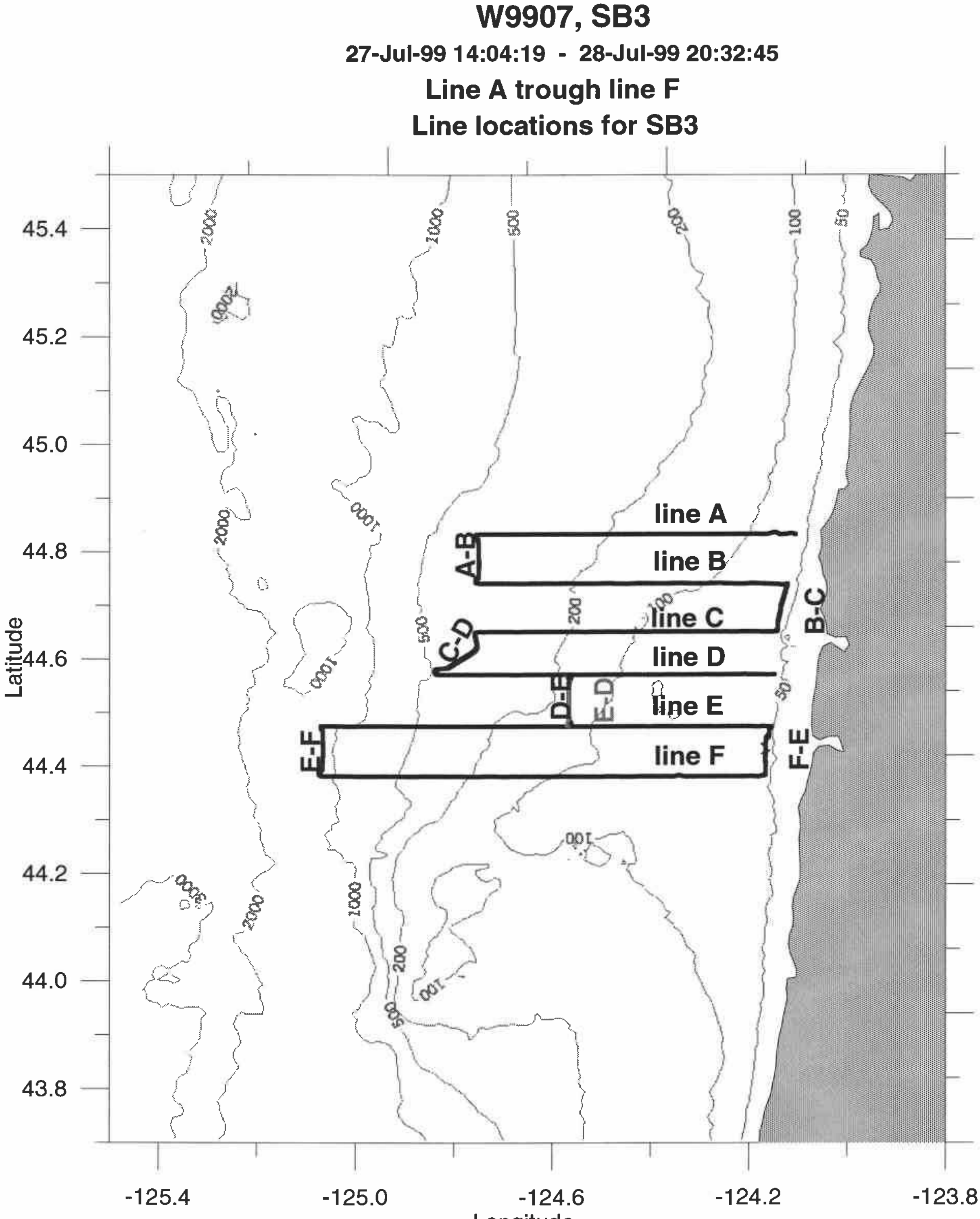

Figure 4f: Cruise tracks during the W9907 SeaSoar surveys. See Table 7 for individual line start and stop times.

by first binning the data into 2-db bins in the vertical, and 1.25 km bins in the horizontal. Then, the depth of interest was extracted from the appropriate sections for the maps. Contour maps were then created by gridding these data using "zgrid" (Crain, 1968, unpublished). The small box grid used a spacing of 0.025^{o} longitude (2.13 km) in E-W spacing, and 0.0125^{o} latitude (1.4 km) in N-S spacing, while the big box grids used twice that (0.05^{o} = 4.25 km E-W and 0.025^{o} = 2.8 km N-S spacing). Any grid point more that two grid spaces away from a data point was set to be undefined.

Vertical sections of temperature, salinity and sigma-t are shown for each of the SeaSoar lines. These sections are countoured using "zgrid" from the 1.25-km, 2-db averaged data.

Acknowledgements

We thank the OSU Marine Technician group, led by Marc Willis and including Linda Fayler and Daryl Swenson, who were responsible for the highly successful SeaSoar operations. Toby Martin, OSU Marine Technician, lent a hand with a variety of activities throughout the cruise. The officers, mates and crew of the R/V Wecoma contributed greatly to the success of the cruise. The bridge officers were particularly helpful in helping to slalom SeaSoar through the crab pots on the inshore ends of our survey lines. We appreciate the assistance in flying SeaSoar from Briged Gearen and Scott Pegau. This work was funded by the National Oceanographic Partnership Program through the Office of Naval Research Grant N00014-98-1-0787.

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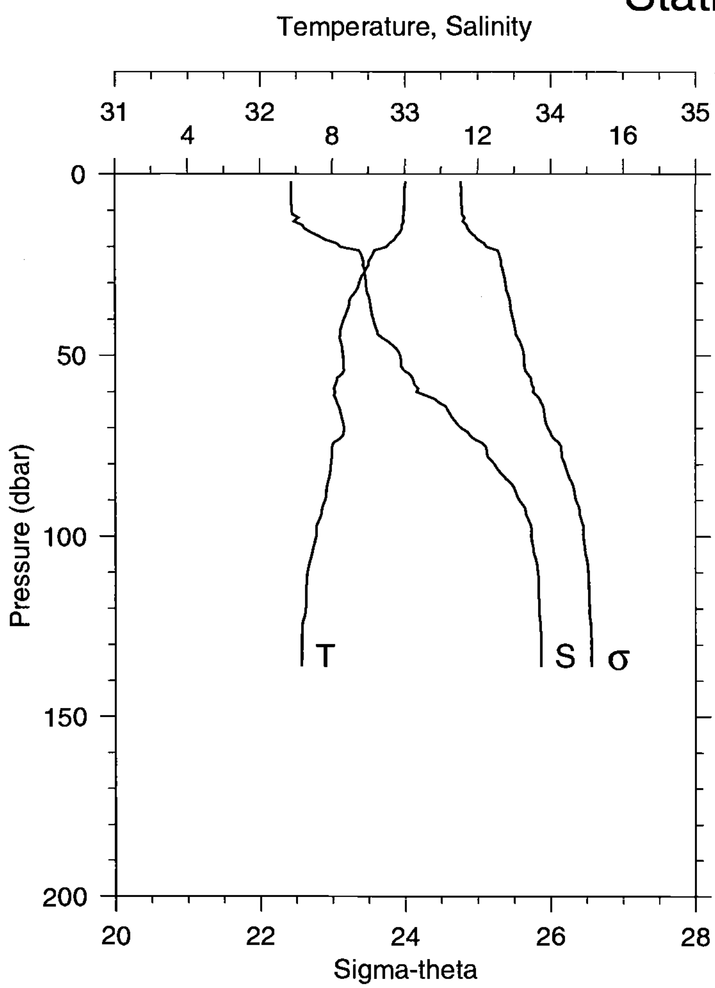
CTD Data

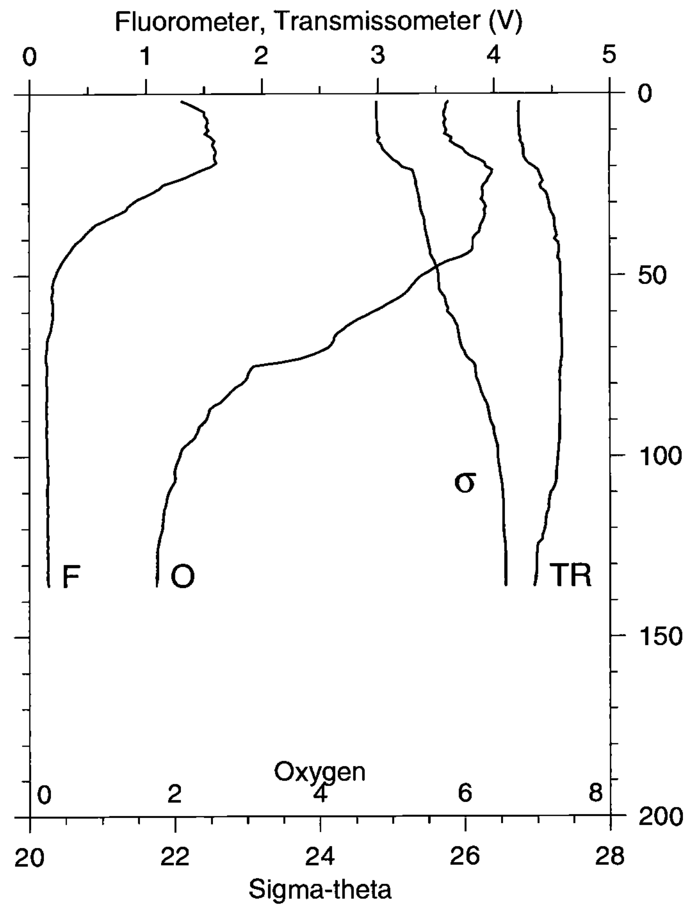
Profiles of Temperature, Salinity, and Density Anomaly

Profiles of Fluorescence, Light Transmission, Oxygen, and Density Anomaly

Tabulated Values at Standard Depths

Station 1

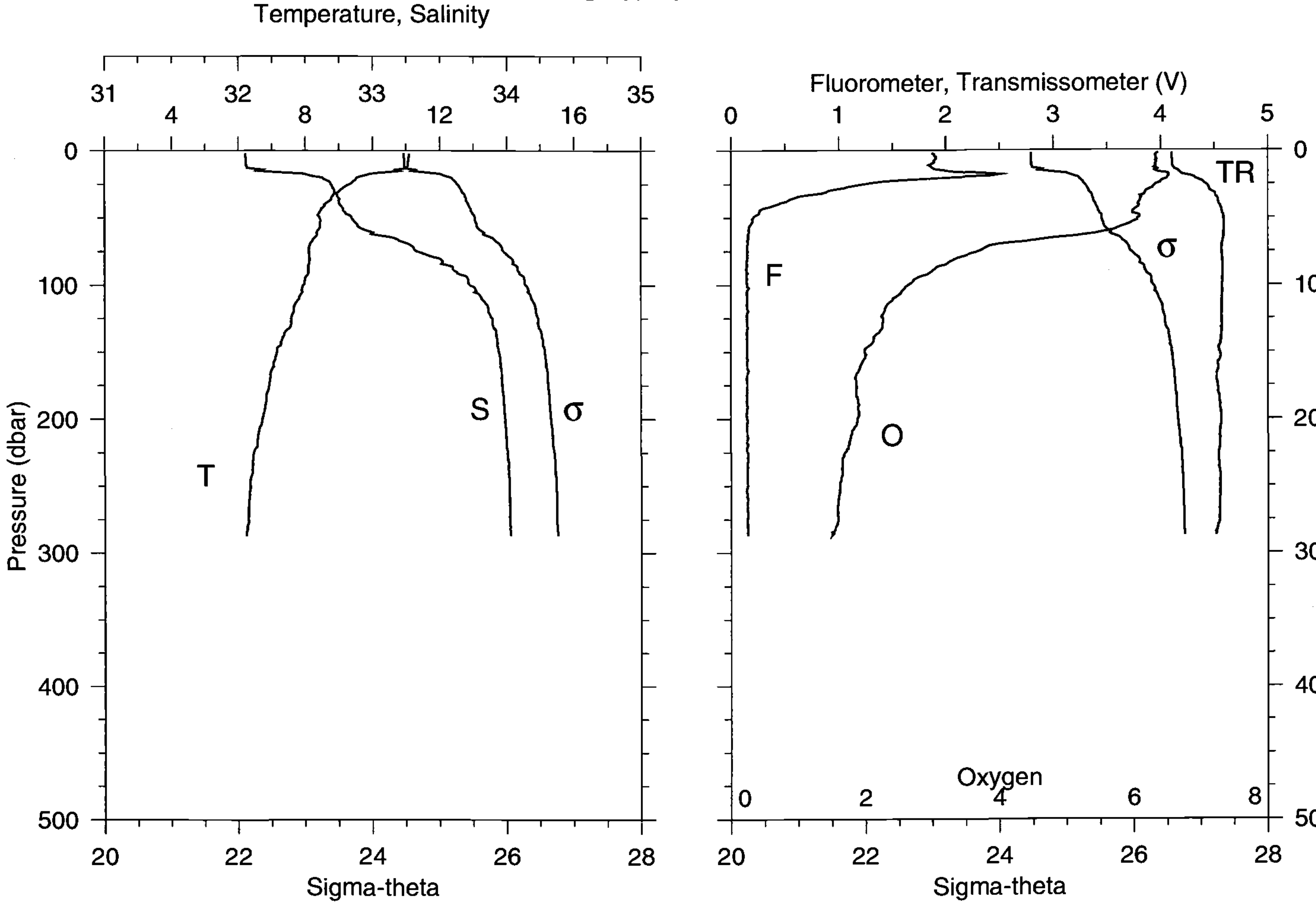




STA NO 1 LAT: 44 39.1 N LONG: 124 31.8 W
14 JUL 1999 0104 GMT DEPTH 142

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	10.028	32.218	10.028	24.776	0.063	1.31	4.22
10	9.986	32.221	9.985	24.785	0.316	1.54	4.22
20	9.490	32.560	9.488	25.131	0.620	1.56	4.34
30	8.738	32.731	8.735	25.383	0.884	0.89	4.48
40	8.314	32.785	8.310	25.490	1.138	0.44	4.52
50	8.295	32.969	8.290	25.637	1.380	0.23	4.57
60	8.074	33.081	8.068	25.757	1.610	0.20	4.58
70	8.321	33.388	8.314	25.962	1.821	0.15	4.59
80	7.956	33.618	7.948	26.196	2.012	0.15	4.57
90	7.795	33.787	7.787	26.352	2.187	0.15	4.57
100	7.540	33.868	7.530	26.453	2.348	0.15	4.55
110	7.302	33.913	7.292	26.522	2.504	0.16	4.49
120	7.254	33.920	7.243	26.535	2.655	0.16	4.44
130	7.147	33.933	7.135	26.560	2.804	0.16	4.37
136	7.140	33.934	7.127	26.562	2.893	0.17	4.35

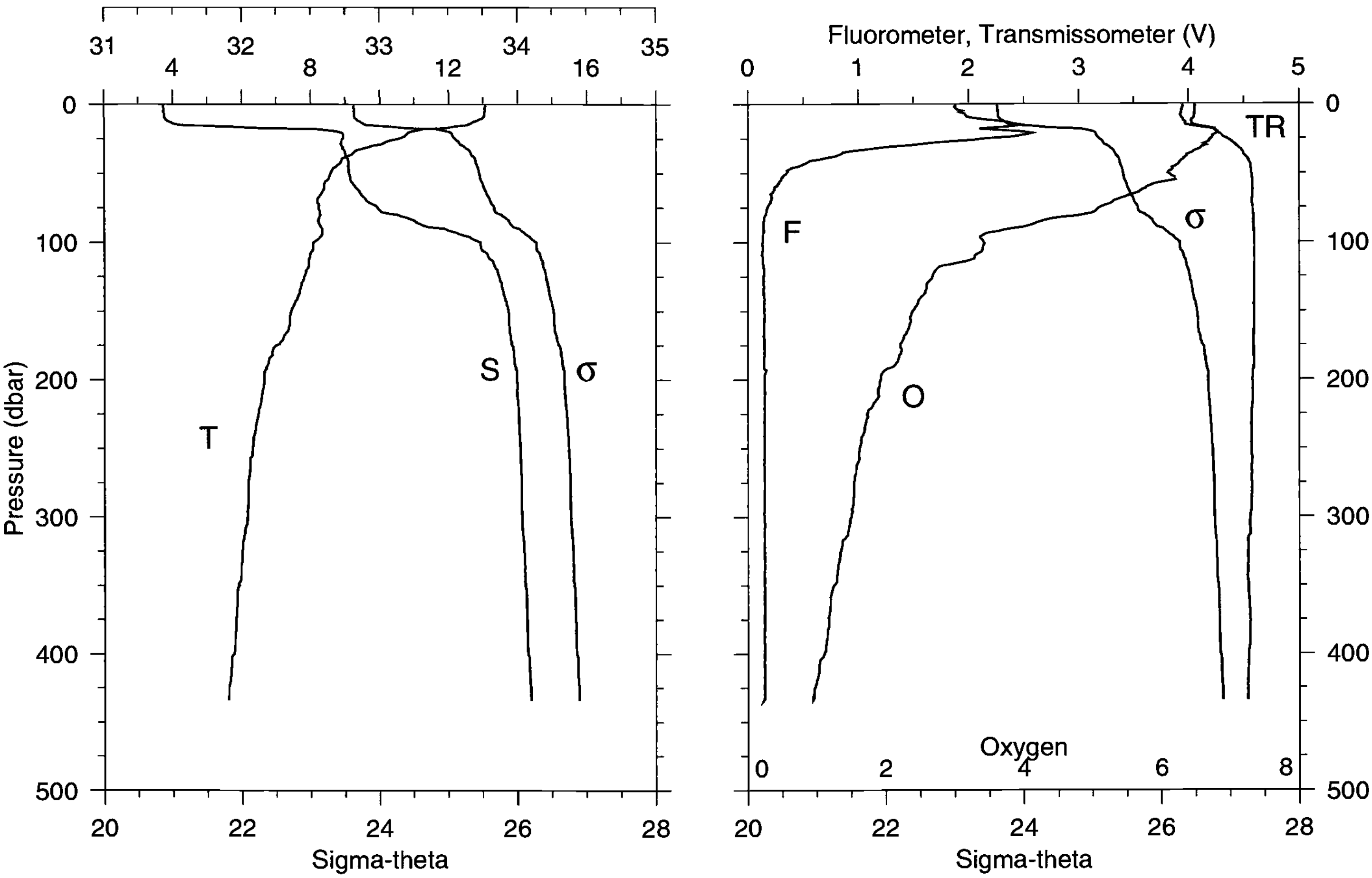
Station 2



STA NO 2 LAT: 44 39.1 N LONG: 124 39.0 W
14 JUL 1999 0242 GMT DEPTH 293

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	11.088	32.054	11.088	24.467	0.069	1.87	4.10
10	11.060	32.058	11.059	24.476	0.345	1.87	4.11
20	9.538	32.629	9.535	25.177	0.665	2.14	4.32
30	9.022	32.718	9.019	25.329	0.935	0.91	4.46
40	8.568	32.757	8.564	25.429	1.194	0.44	4.55
50	8.431	32.847	8.426	25.521	1.444	0.21	4.59
60	8.353	32.978	8.347	25.635	1.687	0.17	4.59
70	8.139	33.279	8.132	25.903	1.910	0.16	4.57
80	8.131	33.494	8.123	26.073	2.114	0.15	4.58
90	8.093	33.630	8.084	26.185	2.303	0.14	4.58
100	7.936	33.728	7.926	26.286	2.481	0.15	4.57
110	7.820	33.810	7.809	26.368	2.650	0.15	4.57
120	7.655	33.864	7.643	26.434	2.813	0.16	4.57
130	7.569	33.896	7.556	26.472	2.971	0.15	4.57
140	7.314	33.930	7.301	26.535	3.125	0.15	4.56
150	7.159	33.942	7.145	26.565	3.275	0.15	4.55
175	6.926	33.967	6.910	26.618	3.639	0.15	4.53
200	6.723	33.989	6.705	26.662	3.993	0.15	4.57
225	6.467	34.008	6.447	26.711	4.338	0.15	4.54
250	6.347	34.017	6.325	26.734	4.674	0.15	4.55
275	6.297	34.021	6.273	26.744	5.007	0.15	4.55
287	6.234	34.027	6.209	26.757	5.166	0.15	4.52

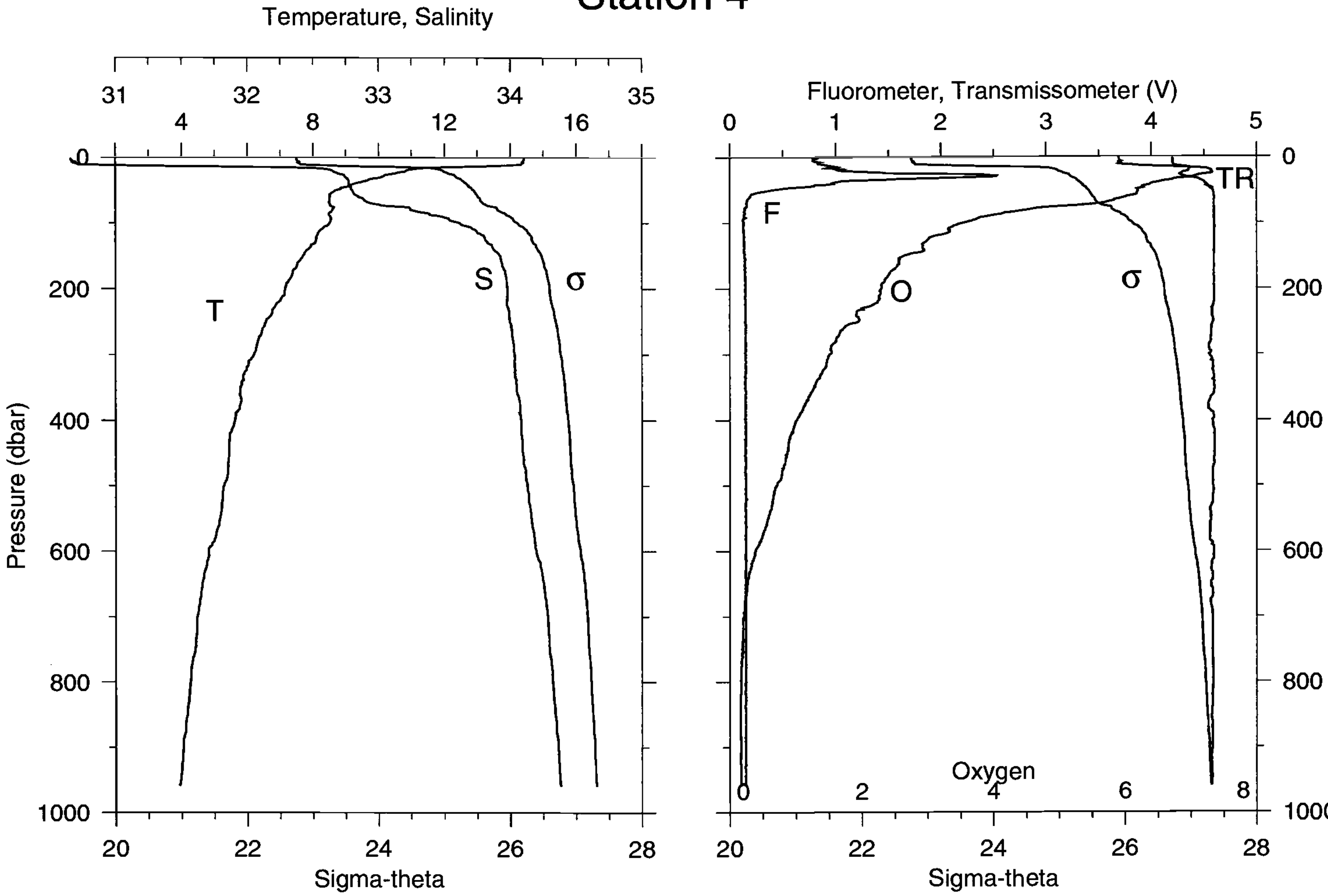
Station 3



STA NO 3 LAT: 44 39.1 N LONG: 124 53.0 W
14 JUL 1999 0424 GMT DEPTH 442

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	13.073	31.431	13.073	23.616	0.043	1.89	4.06
10	12.983	31.439	12.982	23.640	0.426	2.04	4.05
20	10.866	32.707	10.864	25.015	0.804	2.48	4.25
30	9.804	32.723	9.800	25.207	1.090	1.46	4.43
40	8.896	32.768	8.892	25.388	1.356	0.64	4.54
50	8.568	32.777	8.563	25.445	1.611	0.35	4.57
60	8.394	32.825	8.388	25.509	1.862	0.24	4.58
70	8.186	32.907	8.179	25.604	2.105	0.20	4.57
80	8.273	33.128	8.265	25.765	2.338	0.16	4.59
90	8.335	33.474	8.326	26.027	2.551	0.14	4.59
100	8.070	33.732	8.060	26.269	2.739	0.13	4.59
110	7.972	33.787	7.961	26.328	2.913	0.13	4.59
120	7.869	33.853	7.857	26.394	3.080	0.14	4.59
130	7.726	33.884	7.713	26.440	3.243	0.14	4.59
140	7.612	33.908	7.598	26.475	3.402	0.14	4.59
150	7.427	33.933	7.413	26.521	3.557	0.15	4.59
175	6.988	33.961	6.972	26.604	3.932	0.15	4.59
200	6.642	33.997	6.625	26.679	4.284	0.15	4.57
225	6.466	34.008	6.446	26.712	4.627	0.15	4.57
250	6.294	34.021	6.273	26.744	4.962	0.15	4.57
275	6.170	34.027	6.146	26.766	5.292	0.15	4.57
300	6.145	34.032	6.120	26.773	5.619	0.15	4.56
350	5.914	34.055	5.885	26.821	6.260	0.15	4.54
400	5.756	34.074	5.722	26.856	6.883	0.15	4.54
434	5.602	34.098	5.566	26.894	7.296	0.14	4.53

Station 4

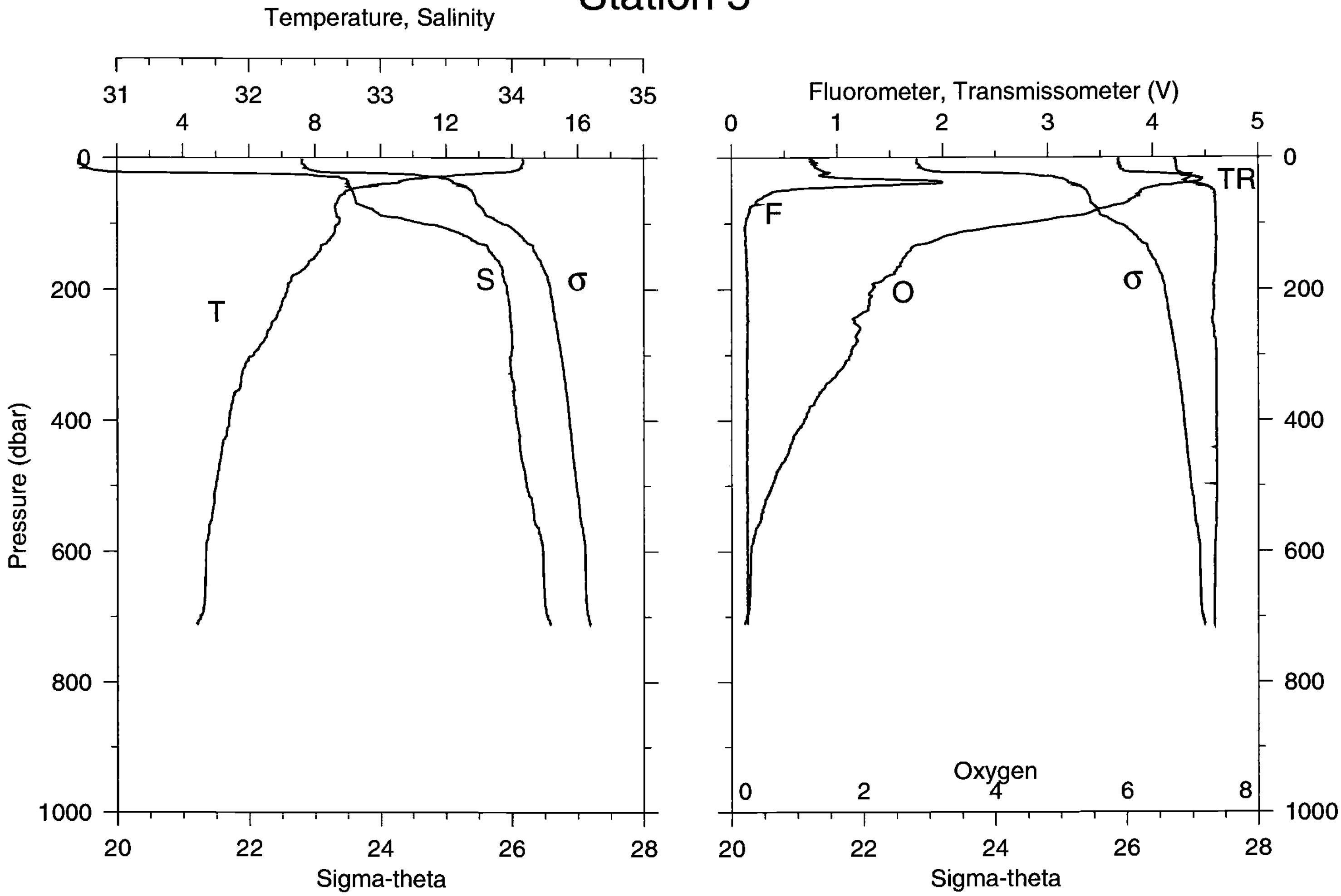


STA NO 4 LAT: 44 39.1 N LONG: 125 0.1 W
14 JUL 1999 0533 GMT DEPTH 969

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	14.411	30.663	14.411	22.755	0.102	0.78	4.20
10	14.330	30.712	14.329	22.810	0.508	0.83	4.20
20	10.862	32.643	10.859	24.966	0.896	1.02	4.35
30	10.103	32.746	10.099	25.176	1.184	2.52	4.32
40	9.282	32.773	9.278	25.331	1.455	0.97	4.51
50	8.728	32.797	8.723	25.437	1.714	0.42	4.58
60	8.522	32.848	8.516	25.508	1.965	0.19	4.59
70	8.506	32.943	8.499	25.585	2.209	0.16	4.59
80	8.600	33.241	8.592	25.805	2.437	0.15	4.60
90	8.534	33.475	8.525	25.998	2.648	0.13	4.60
100	8.501	33.616	8.491	26.114	2.844	0.13	4.60
110	8.233	33.732	8.222	26.246	3.029	0.13	4.60
120	8.113	33.800	8.101	26.317	3.205	0.13	4.60
130	8.071	33.825	8.058	26.343	3.375	0.14	4.60
140	7.840	33.876	7.827	26.417	3.540	0.13	4.60
150	7.693	33.924	7.679	26.476	3.700	0.14	4.59

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
175	7.379	33.962	7.363	26.551	4.085	0.15	4.59
200	7.149	33.978	7.130	26.596	4.455	0.15	4.59
225	6.857	33.977	6.837	26.635	4.818	0.15	4.59
250	6.568	33.996	6.546	26.690	5.169	0.14	4.59
275	6.352	34.018	6.328	26.735	5.508	0.15	4.56
300	6.199	34.033	6.172	26.766	5.840	0.15	4.55
350	5.794	34.047	5.765	26.829	6.480	0.15	4.60
400	5.625	34.086	5.592	26.881	7.099	0.15	4.58
450	5.436	34.096	5.399	26.912	7.698	0.15	4.60
500	5.288	34.128	5.248	26.955	8.285	0.15	4.59
600	4.817	34.195	4.770	27.063	9.397	0.15	4.59
700	4.468	34.284	4.415	27.173	10.396	0.15	4.58
800	4.261	34.321	4.200	27.225	11.335	0.15	4.59
900	4.046	34.363	3.978	27.282	12.226	0.15	4.58
959	3.927	34.384	3.855	27.311	12.732	0.14	4.57

Station 5

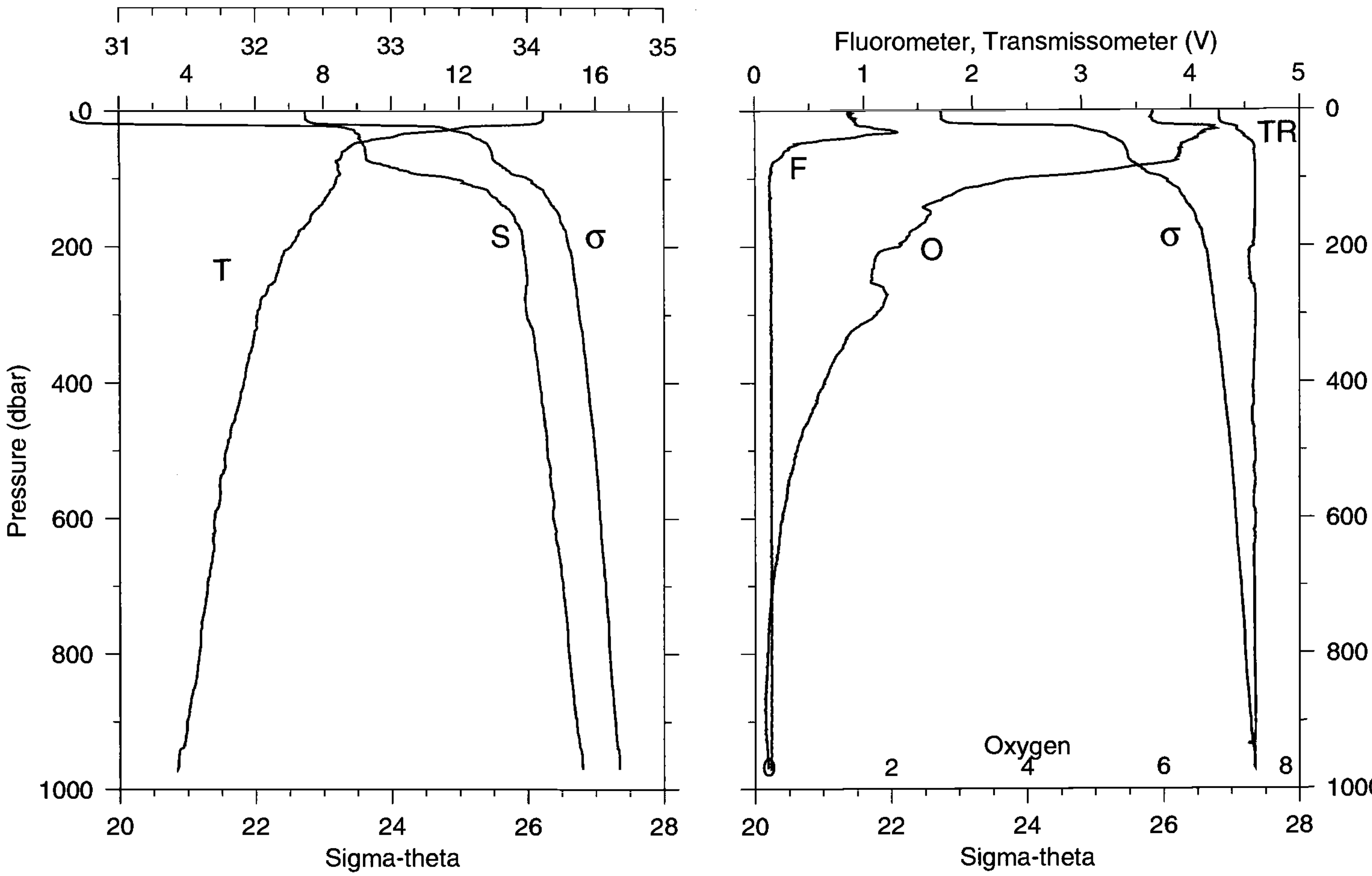


STA NO 5 LAT: 44 39.0 N LONG: 125 7.1 W
14 JUL 1999 0716 GMT DEPTH 719

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	14.337	30.711	14.337	22.807	0.101	0.77	4.22
10	14.313	30.733	14.312	22.829	0.504	0.77	4.22
20	14.046	30.894	14.043	23.008	1.001	0.86	4.23
30	11.457	32.689	11.453	24.896	1.378	0.97	4.36
40	10.019	32.758	10.014	25.200	1.667	1.85	4.42
50	8.967	32.785	8.962	25.390	1.935	0.48	4.58
60	8.746	32.803	8.740	25.439	2.191	0.30	4.59
70	8.626	32.822	8.619	25.472	2.444	0.23	4.59
80	8.632	32.947	8.624	25.569	2.690	0.17	4.59
90	8.684	33.089	8.675	25.672	2.929	0.15	4.60
100	8.724	33.315	8.714	25.844	3.153	0.13	4.60
110	8.611	33.534	8.600	26.033	3.358	0.13	4.60
120	8.500	33.668	8.488	26.155	3.551	0.14	4.60
130	8.352	33.742	8.339	26.236	3.734	0.13	4.60
140	8.157	33.825	8.143	26.330	3.907	0.14	4.60
150	8.005	33.866	7.990	26.385	4.076	0.14	4.60

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
175	7.507	33.928	7.490	26.506	4.474	0.15	4.59
200	7.160	33.963	7.141	26.583	4.850	0.15	4.58
225	6.967	33.981	6.946	26.624	5.214	0.15	4.58
250	6.692	33.992	6.670	26.669	5.571	0.15	4.56
275	6.470	34.001	6.445	26.706	5.917	0.15	4.59
300	6.130	33.994	6.104	26.745	6.254	0.14	4.60
350	5.723	34.016	5.694	26.813	6.902	0.14	4.60
400	5.384	34.036	5.351	26.870	7.522	0.14	4.60
450	5.151	34.065	5.115	26.921	8.120	0.14	4.60
500	4.984	34.110	4.944	26.976	8.695	0.14	4.61
600	4.682	34.234	4.636	27.109	9.761	0.15	4.59
700	4.531	34.270	4.477	27.155	10.764	0.15	4.58
711	4.427	34.290	4.373	27.182	10.870	0.15	4.58

Station 6

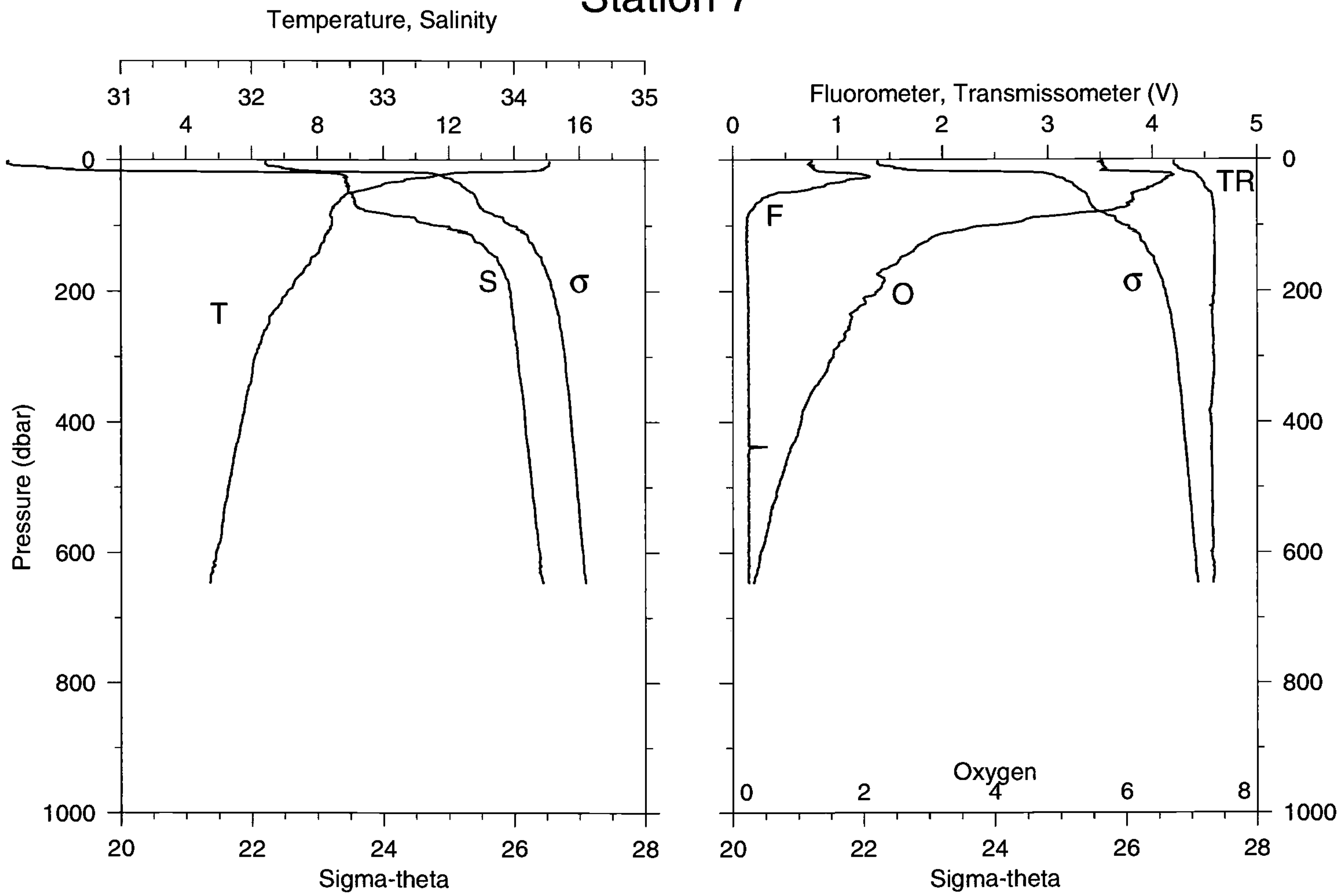


STA NO 6 LAT: 45 11.6 N LONG: 125 0.1 W
14 JUL 1999 1128 GMT DEPTH 978

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	14.473	30.646	14.473	22.729	0.102	0.85	4.26
10	14.467	30.659	14.466	22.740	0.511	0.87	4.26
20	14.030	30.982	14.027	23.079	1.017	0.93	4.30
30	11.462	32.732	11.458	24.929	1.359	1.25	4.42
40	9.910	32.767	9.906	25.224	1.643	0.92	4.50
50	8.877	32.793	8.872	25.410	1.907	0.39	4.58
60	8.582	32.802	8.576	25.463	2.161	0.28	4.58
70	8.493	32.812	8.486	25.484	2.412	0.23	4.59
80	8.418	32.940	8.410	25.596	2.657	0.15	4.59
90	8.443	33.126	8.434	25.738	2.890	0.15	4.59
100	8.368	33.449	8.358	26.003	3.104	0.14	4.59
110	8.299	33.590	8.288	26.124	3.299	0.13	4.59
120	8.174	33.714	8.162	26.240	3.482	0.14	4.59
130	8.036	33.774	8.023	26.308	3.658	0.14	4.59
140	7.866	33.836	7.852	26.382	3.828	0.13	4.59
150	7.680	33.882	7.666	26.445	3.991	0.14	4.59

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
175	7.314	33.952	7.298	26.552	4.381	0.14	4.59
200	7.030	33.968	7.011	26.605	4.750	0.15	4.58
225	6.705	33.986	6.684	26.663	5.106	0.15	4.54
250	6.566	33.996	6.544	26.690	5.454	0.15	4.55
275	6.175	33.980	6.151	26.728	5.794	0.14	4.60
300	6.048	33.992	6.023	26.753	6.127	0.14	4.60
350	5.878	34.053	5.848	26.824	6.771	0.15	4.59
400	5.647	34.088	5.614	26.880	7.389	0.15	4.57
450	5.396	34.119	5.360	26.935	7.984	0.15	4.56
500	5.110	34.143	5.071	26.988	8.553	0.15	4.59
600	4.786	34.186	4.739	27.060	9.639	0.15	4.60
700	4.569	34.259	4.515	27.142	10.663	0.15	4.59
800	4.329	34.302	4.268	27.203	11.623	0.15	4.59
900	3.966	34.359	3.899	27.287	12.526	0.15	4.59
970	3.698	34.403	3.627	27.349	13.109	0.15	4.59

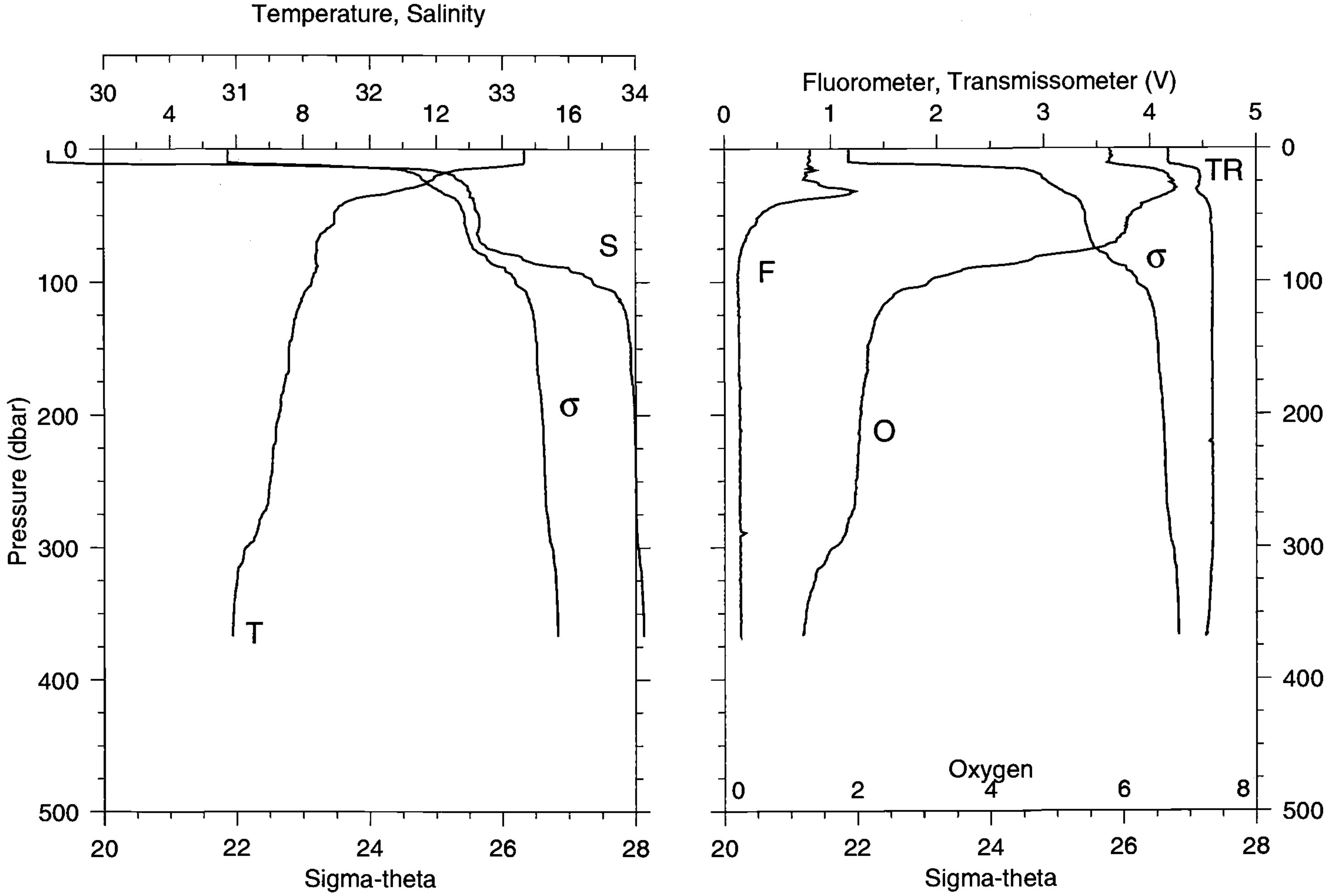
Station 7



STA NO 7 LAT: 45 11.6 N LONG: 124 48.0 W
14 JUL 1999 1336 GMT DEPTH 651

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	15.075	30.150	15.074	22.221	0.112	0.75	4.20
10	15.018	30.351	15.017	22.389	0.559	0.75	4.22
20	12.130	32.610	12.128	24.710	1.046	1.04	4.39
30	10.660	32.717	10.657	25.059	1.351	1.12	4.47
40	9.851	32.723	9.847	25.200	1.633	0.88	4.50
50	8.966	32.754	8.961	25.366	1.902	0.43	4.56
60	8.705	32.781	8.699	25.428	2.160	0.28	4.58
70	8.511	32.794	8.504	25.467	2.413	0.21	4.58
80	8.405	32.961	8.397	25.614	2.660	0.16	4.59
90	8.447	33.247	8.438	25.833	2.886	0.14	4.59
100	8.426	33.431	8.416	25.980	3.099	0.13	4.59
110	8.328	33.592	8.317	26.121	3.294	0.13	4.59
120	8.212	33.689	8.200	26.215	3.478	0.13	4.59
130	8.101	33.762	8.088	26.289	3.656	0.13	4.59
140	8.043	33.803	8.029	26.330	3.829	0.13	4.59
150	7.802	33.871	7.787	26.418	3.995	0.14	4.59
175	7.477	33.928	7.460	26.510	4.392	0.14	4.59
200	7.096	33.968	7.078	26.595	4.767	0.14	4.59
225	6.788	33.978	6.768	26.646	5.127	0.15	4.57
250	6.515	33.994	6.493	26.694	5.474	0.15	4.57
275	6.287	34.012	6.263	26.738	5.812	0.15	4.58
300	6.089	34.022	6.064	26.772	6.142	0.15	4.59
350	5.891	34.055	5.861	26.823	6.785	0.15	4.57
400	5.689	34.079	5.656	26.868	7.406	0.14	4.56
450	5.466	34.107	5.429	26.917	8.008	0.15	4.56
500	5.284	34.134	5.243	26.960	8.590	0.15	4.57
600	4.906	34.193	4.858	27.052	9.700	0.14	4.57
647	4.720	34.220	4.670	27.095	10.195	0.16	4.58

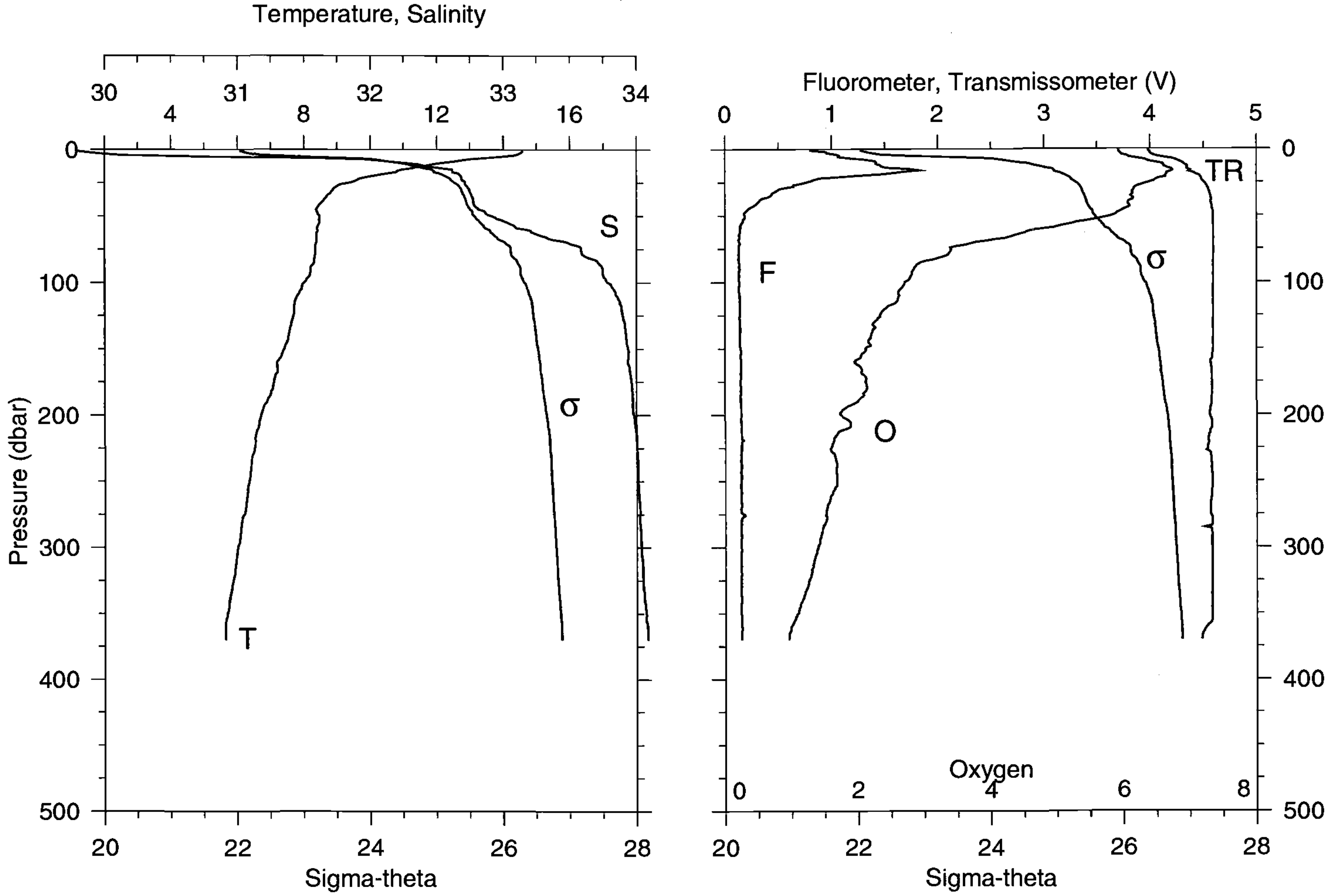
Station 8



STA NO 8 LAT: 45 11.6 N LONG: 124 36.0 W
14 JUL 1999 1512 GMT DEPTH 373

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	14.655	29.582	14.655	21.872	0.059	0.81	4.17
10	14.658	29.583	14.656	21.872	0.594	0.80	4.17
20	11.998	32.635	11.995	24.754	0.993	0.78	4.47
30	11.069	32.744	11.065	25.008	1.302	1.10	4.45
40	9.272	32.784	9.268	25.341	1.580	0.61	4.54
50	8.934	32.824	8.929	25.426	1.839	0.34	4.58
60	8.712	32.822	8.706	25.459	2.093	0.25	4.58
70	8.401	32.834	8.394	25.515	2.343	0.19	4.59
80	8.378	33.119	8.370	25.742	2.583	0.15	4.59
90	8.391	33.505	8.382	26.044	2.798	0.14	4.59
100	8.260	33.681	8.250	26.201	2.987	0.13	4.59
110	8.014	33.858	8.004	26.376	3.160	0.13	4.59
120	7.859	33.916	7.848	26.445	3.323	0.14	4.59
130	7.731	33.943	7.718	26.486	3.480	0.14	4.59
140	7.681	33.952	7.667	26.499	3.636	0.13	4.59
150	7.578	33.965	7.563	26.525	3.789	0.14	4.59
175	7.459	33.976	7.442	26.551	4.169	0.14	4.58
200	7.258	33.991	7.239	26.591	4.540	0.14	4.59
225	7.089	33.997	7.068	26.620	4.905	0.15	4.59
250	7.001	34.000	6.978	26.634	5.265	0.14	4.59
275	6.759	34.004	6.734	26.670	5.621	0.14	4.59
300	6.271	34.019	6.245	26.747	5.966	0.15	4.59
350	5.903	34.055	5.873	26.822	6.610	0.15	4.55
367	5.871	34.060	5.840	26.830	6.824	0.15	4.53

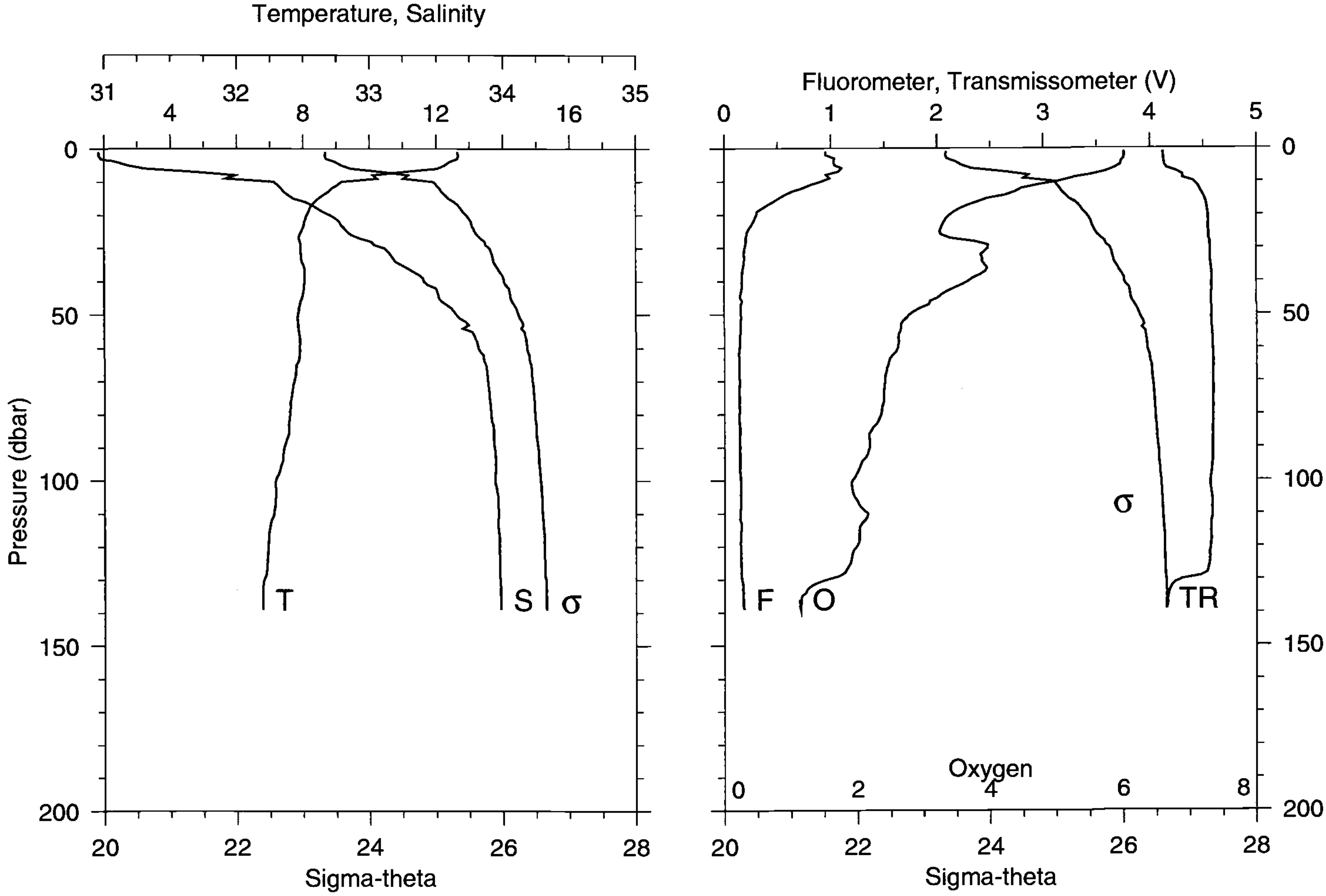
Station 9



STA NO 9 LAT: 45 11.6 N LONG: 124 24.0 W
14 JUL 1999 1629 GMT DEPTH 378

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	14.601	29.783	14.601	22.038	0.058	0.80	3.98
10	12.140	32.261	12.138	24.437	0.481	1.42	4.30
20	10.055	32.682	10.053	25.134	0.790	1.28	4.46
30	8.876	32.746	8.873	25.373	1.059	0.51	4.55
40	8.522	32.777	8.518	25.452	1.315	0.31	4.57
50	8.473	32.915	8.468	25.568	1.563	0.19	4.59
60	8.408	33.170	8.402	25.778	1.796	0.14	4.59
70	8.374	33.487	8.367	26.031	2.007	0.13	4.59
80	8.335	33.610	8.327	26.134	2.199	0.13	4.59
90	8.202	33.746	8.193	26.261	2.379	0.14	4.59
100	8.014	33.787	8.005	26.321	2.554	0.14	4.59
110	7.803	33.853	7.792	26.404	2.721	0.14	4.59
120	7.709	33.889	7.697	26.446	2.882	0.14	4.59
130	7.633	33.912	7.621	26.475	3.040	0.14	4.59
140	7.545	33.922	7.531	26.496	3.196	0.14	4.59
150	7.421	33.938	7.406	26.526	3.350	0.14	4.59
175	7.109	33.963	7.093	26.589	3.723	0.14	4.58
200	6.724	33.983	6.706	26.657	4.082	0.15	4.56
225	6.518	34.001	6.498	26.700	4.428	0.15	4.54
250	6.348	34.010	6.326	26.729	4.765	0.14	4.58
275	6.200	34.024	6.176	26.759	5.097	0.18	4.57
300	6.008	34.033	5.982	26.791	5.422	0.15	4.58
350	5.698	34.070	5.669	26.859	6.052	0.15	4.58
370	5.642	34.084	5.612	26.877	6.296	0.15	4.48

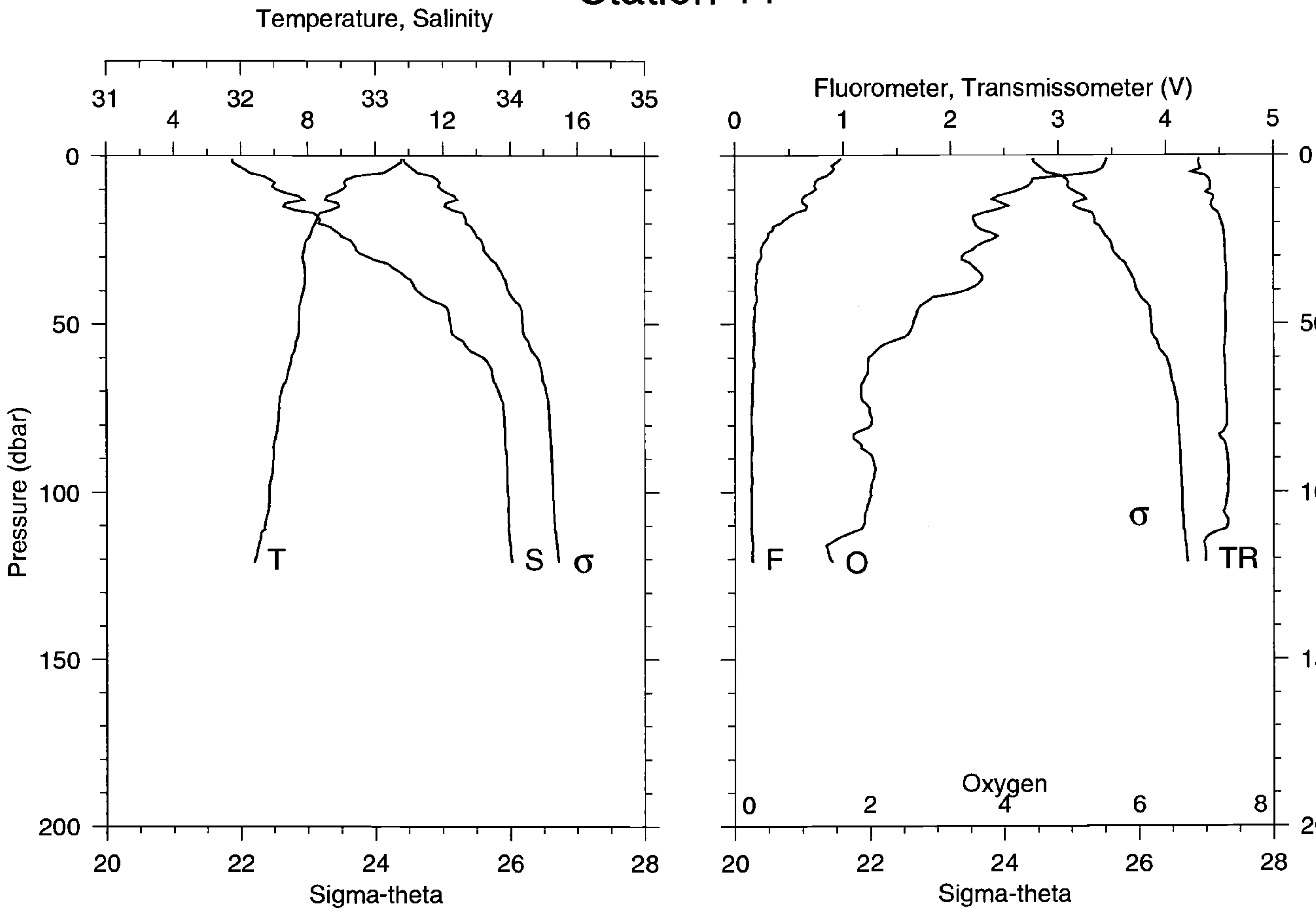
Station 10



STA NO 10 LAT: 45 11.4 N LONG: 124 11.9 W
14 JUL 1999 1827 GMT DEPTH 144

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	12.634	30.962	12.633	23.338	0.045	0.95	4.12
10	9.163	32.280	9.162	24.964	0.407	0.92	4.41
20	8.110	32.703	8.108	25.455	0.682	0.30	4.55
30	7.926	33.113	7.923	25.804	0.920	0.19	4.57
40	8.043	33.410	8.039	26.020	1.129	0.16	4.58
50	7.847	33.653	7.842	26.239	1.317	0.16	4.57
60	7.899	33.814	7.893	26.358	1.488	0.14	4.59
70	7.723	33.886	7.716	26.441	1.649	0.14	4.59
80	7.587	33.910	7.580	26.479	1.806	0.14	4.59
90	7.421	33.935	7.413	26.523	1.960	0.14	4.59
100	7.161	33.940	7.152	26.563	2.110	0.15	4.56
110	7.109	33.967	7.099	26.592	2.256	0.15	4.58
120	6.933	33.971	6.922	26.619	2.400	0.15	4.57
130	6.802	33.978	6.790	26.642	2.542	0.16	4.30
139	6.773	33.981	6.761	26.649	2.669	0.18	4.15

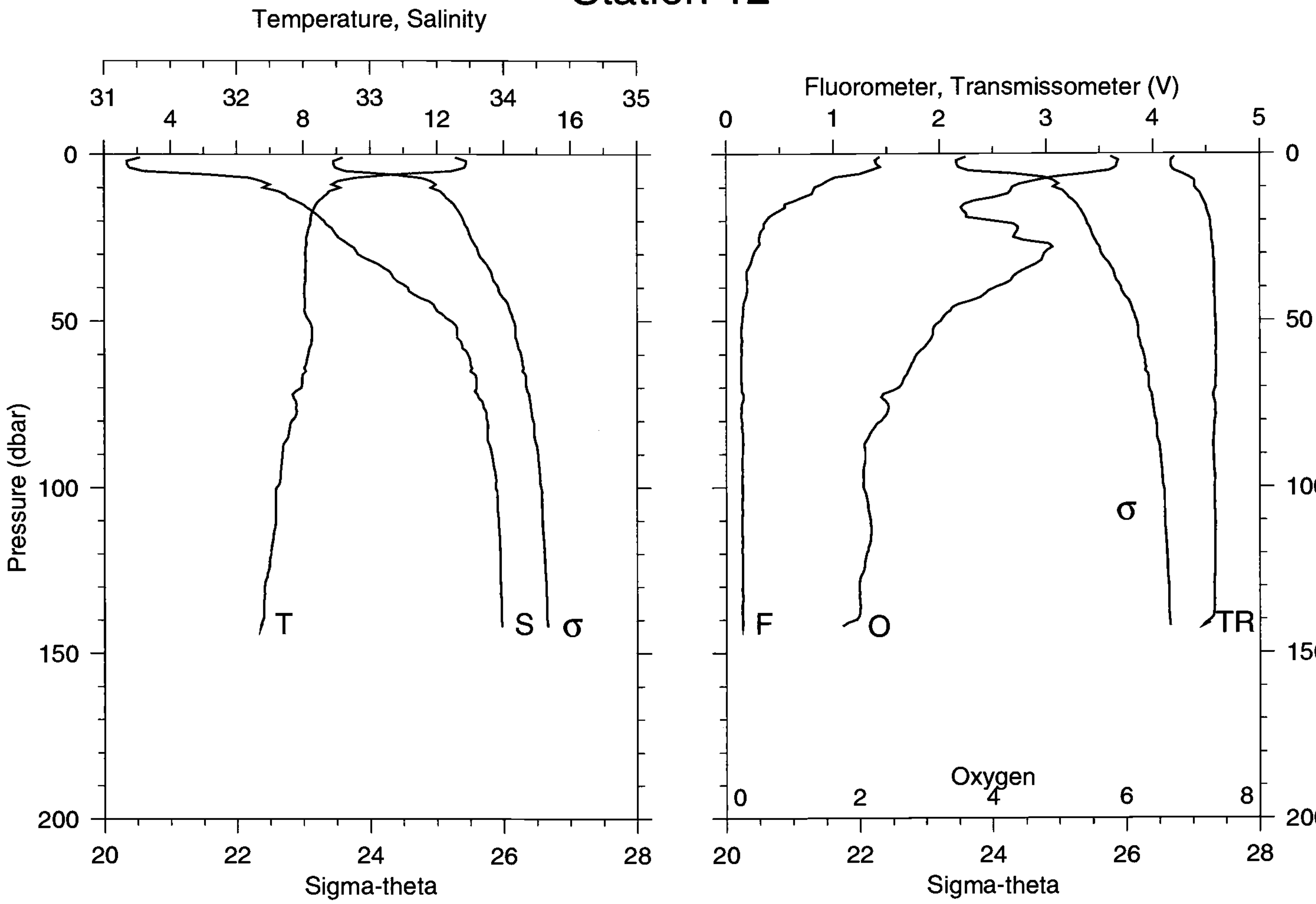
Station 11



STA NO 11 LAT: 44 55.0 N LONG: 124 14.2 W
15 JUL 1999 0846 GMT DEPTH 125

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	10.783	31.936	10.783	24.429	0.035	0.98	4.31
10	9.016	32.266	9.015	24.976	0.324	0.75	4.41
20	8.221	32.579	8.219	25.341	0.603	0.42	4.52
30	7.844	32.946	7.841	25.684	0.847	0.24	4.55
40	7.862	33.309	7.858	25.967	1.061	0.19	4.56
50	7.728	33.556	7.723	26.180	1.250	0.17	4.55
60	7.498	33.799	7.492	26.404	1.426	0.17	4.54
70	7.217	33.910	7.210	26.531	1.582	0.16	4.55
80	7.095	33.955	7.087	26.584	1.729	0.15	4.57
90	6.970	33.972	6.962	26.614	1.873	0.15	4.57
100	6.850	33.979	6.840	26.637	2.015	0.15	4.58
110	6.708	33.987	6.699	26.662	2.155	0.15	4.57
121	6.393	34.012	6.382	26.723	2.304	0.16	4.36

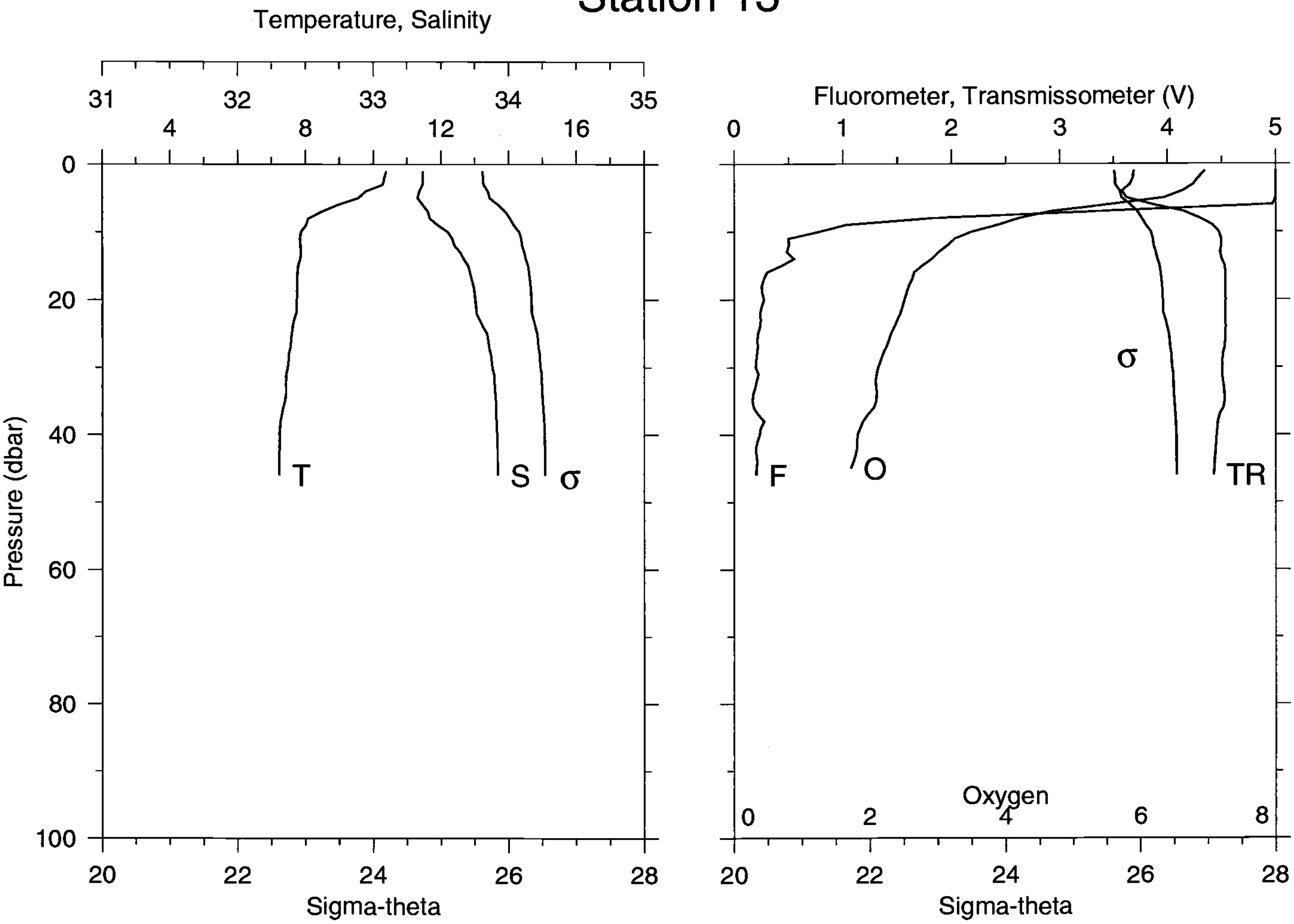
Station 12



STA NO 12 LAT: 44 55.0 N LONG: 124 18.1 W
15 JUL 1999 0945 GMT DEPTH 150

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	12.551	31.270	12.551	23.591	0.043	1.43	4.20
10	9.109	32.197	9.108	24.907	0.382	0.83	4.39
20	8.217	32.657	8.215	25.403	0.656	0.37	4.54
30	8.060	32.911	8.057	25.626	0.902	0.25	4.57
40	8.022	33.284	8.018	25.924	1.122	0.19	4.57
50	8.177	33.608	8.172	26.156	1.319	0.15	4.59
60	8.140	33.732	8.134	26.258	1.501	0.14	4.59
70	7.937	33.796	7.930	26.339	1.673	0.14	4.59
80	7.634	33.877	7.626	26.447	1.836	0.14	4.58
90	7.367	33.911	7.358	26.512	1.992	0.15	4.57
100	7.185	33.940	7.176	26.560	2.142	0.15	4.57
110	7.160	33.961	7.150	26.580	2.289	0.15	4.58
120	7.023	33.972	7.012	26.607	2.434	0.15	4.58
130	6.828	33.978	6.816	26.639	2.577	0.15	4.58
140	6.775	33.981	6.762	26.649	2.718	0.15	4.55
142	6.715	33.987	6.702	26.661	2.746	0.15	4.47

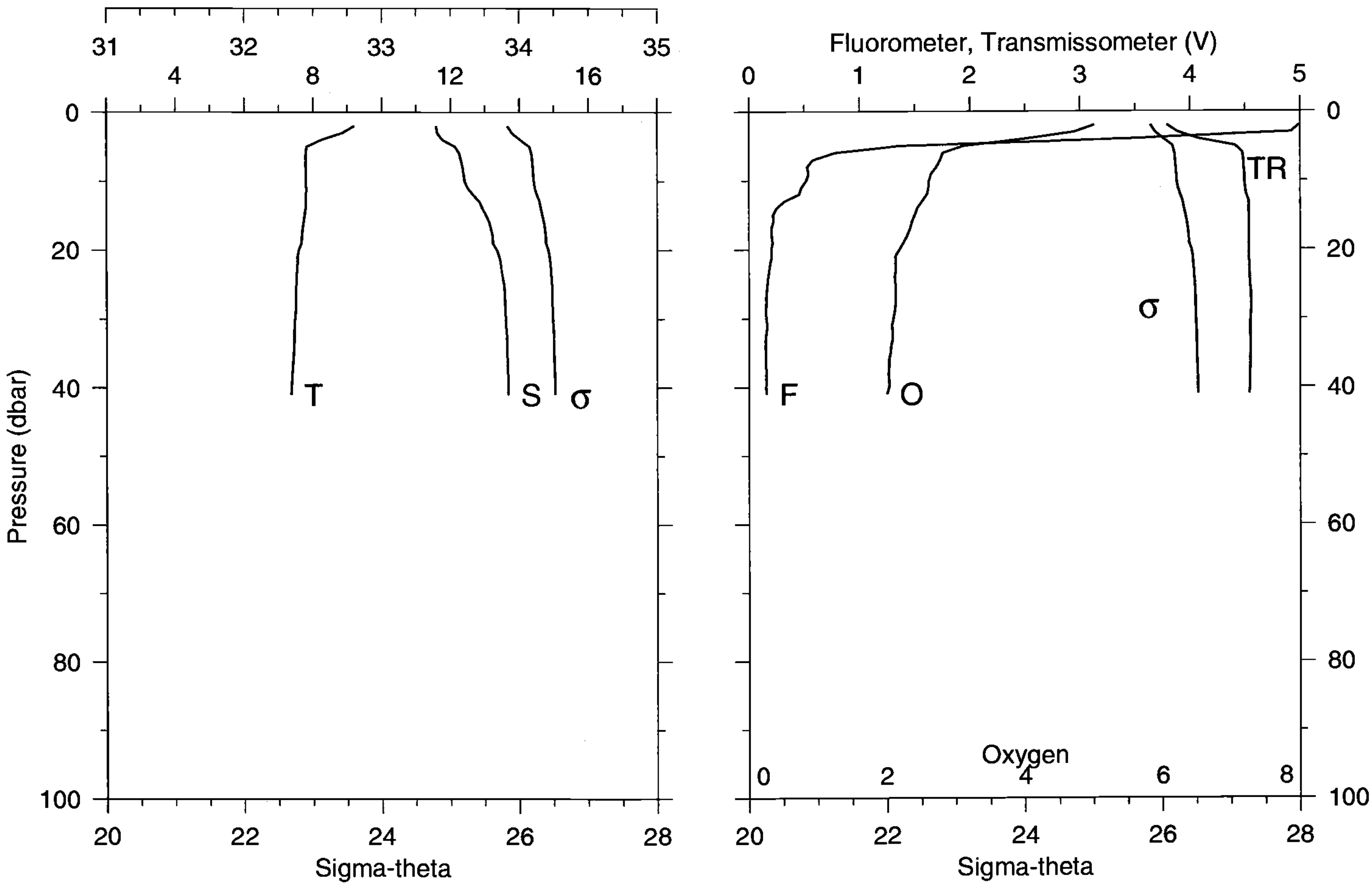
Station 13



STA NO 13 LAT: 44 22.9 N LONG: 124 11.2 W
22 JUL 1999 0840 GMT DEPTH 52

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	10.383	33.368	10.383	25.613	0.024	5.00	3.69
10	7.869	33.551	7.868	26.155	0.218	0.78	4.47
20	7.744	33.753	7.742	26.333	0.393	0.27	4.54
30	7.479	33.878	7.476	26.469	0.555	0.20	4.51
40	7.236	33.914	7.232	26.532	0.707	0.24	4.45
46	7.223	33.919	7.219	26.537	0.797	0.20	4.43

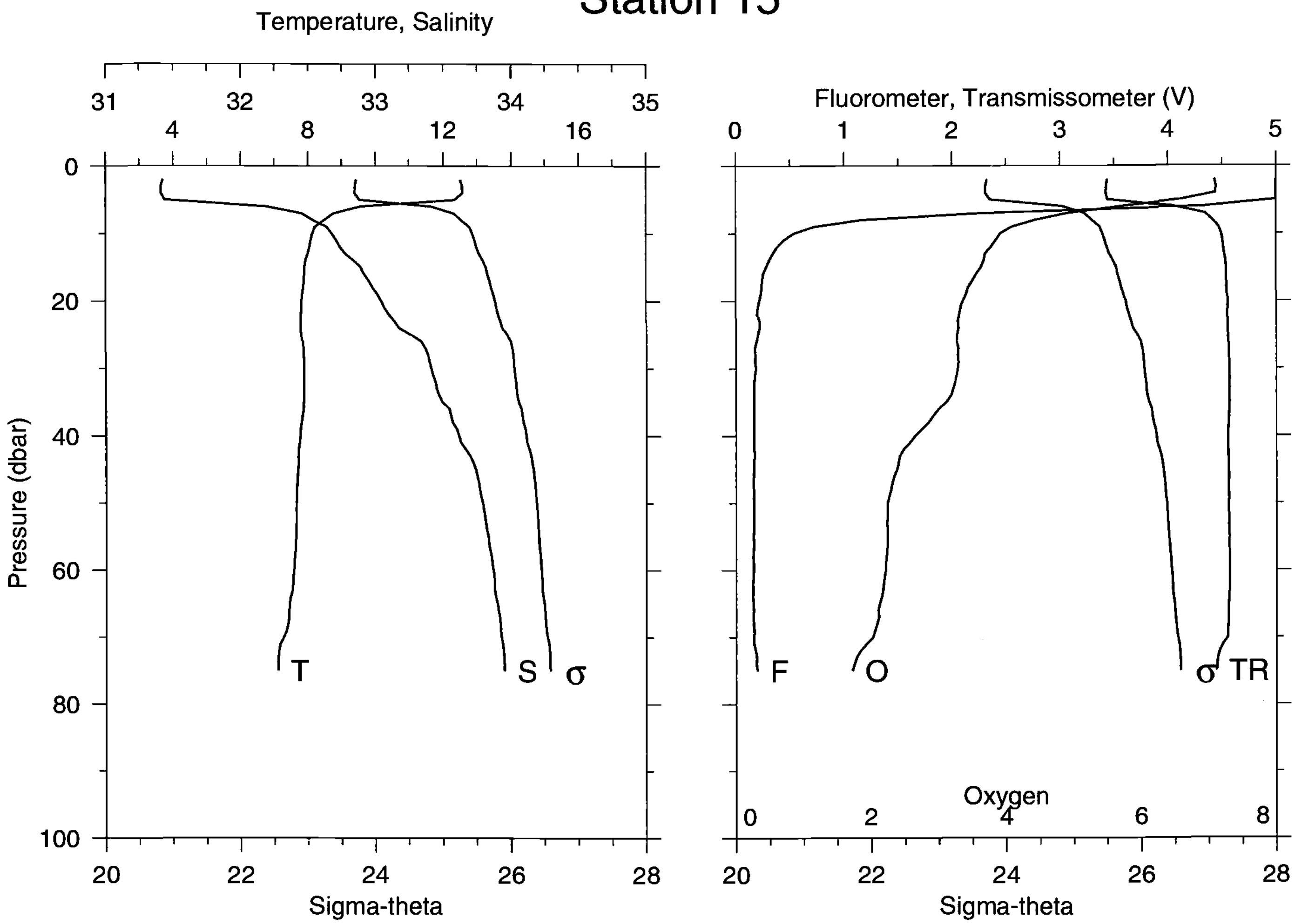
Station 14



STA NO 14 LAT: 44 22.9 N LONG: 124 10.4 W
22 JUL 1999 0915 GMT DEPTH 48

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	9.200	33.396	9.200	25.831	0.043	4.99	3.79
10	7.781	33.603	7.780	26.209	0.195	0.52	4.49
20	7.581	33.838	7.579	26.423	0.364	0.20	4.53
30	7.469	33.900	7.466	26.487	0.520	0.16	4.55
40	7.365	33.920	7.362	26.518	0.672	0.15	4.55
41	7.360	33.918	7.356	26.517	0.687	0.16	4.54

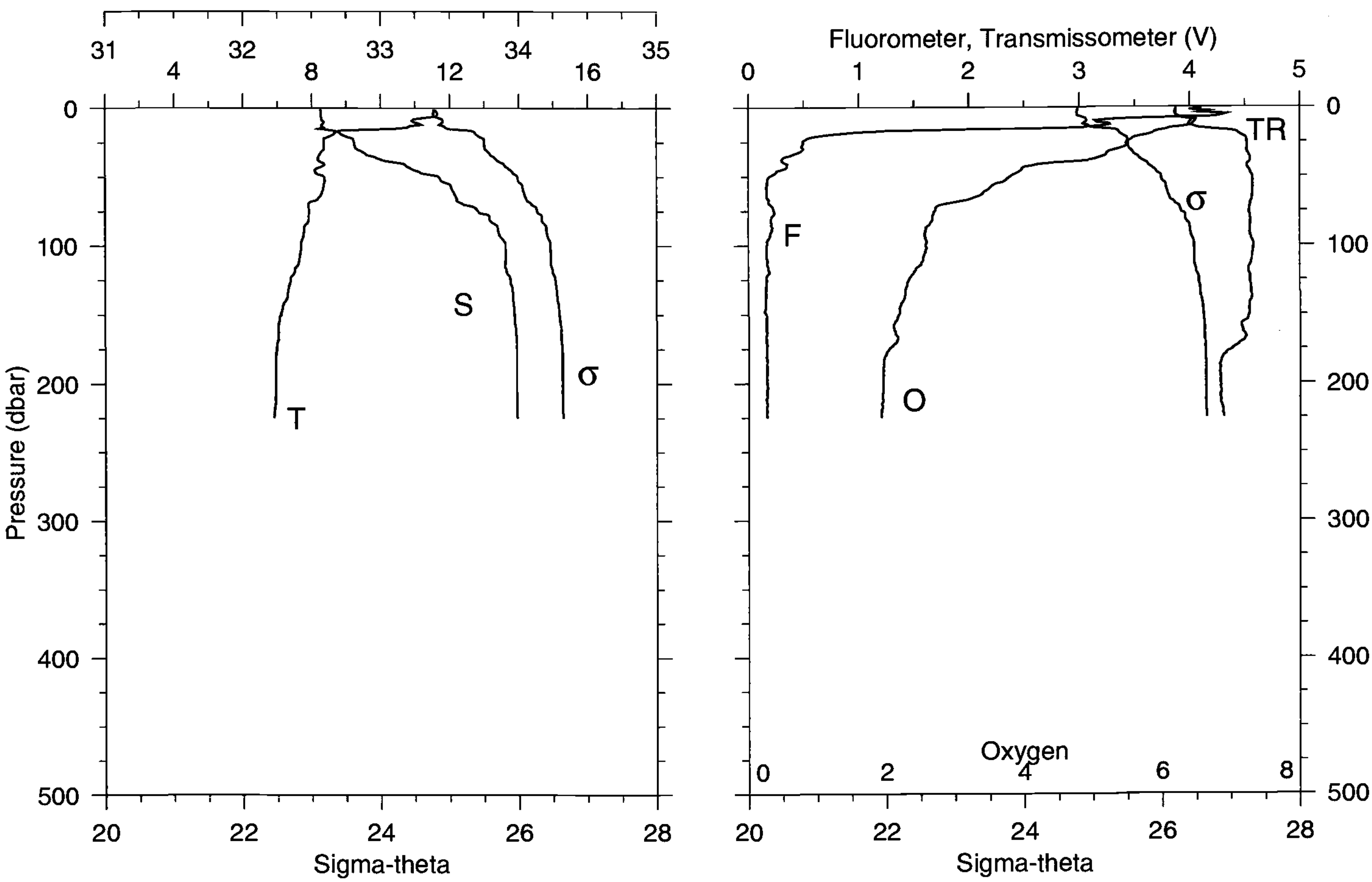
Station 15



STA NO 15 LAT: 44 39.1 N LONG: 124 18.5 W
22 JUL 1999 1307 GMT DEPTH 81

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	12.513	31.424	12.513	23.718	0.083	5.00	3.44
10	8.136	32.678	8.135	25.431	0.354	0.53	4.49
20	7.811	33.045	7.809	25.767	0.591	0.22	4.55
30	7.877	33.411	7.874	26.044	0.798	0.18	4.56
40	7.764	33.616	7.760	26.223	0.987	0.17	4.55
50	7.647	33.792	7.642	26.378	1.157	0.16	4.56
60	7.569	33.870	7.564	26.450	1.319	0.16	4.56
70	7.270	33.928	7.263	26.538	1.473	0.16	4.55
75	7.100	33.951	7.093	26.580	1.547	0.20	4.44

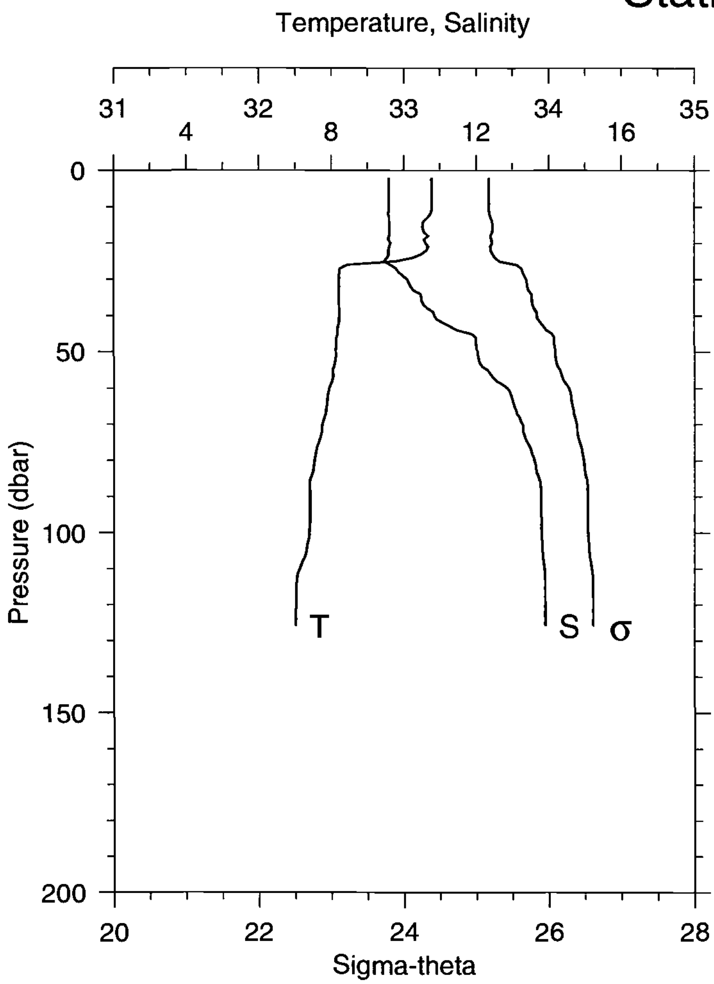
Station 16

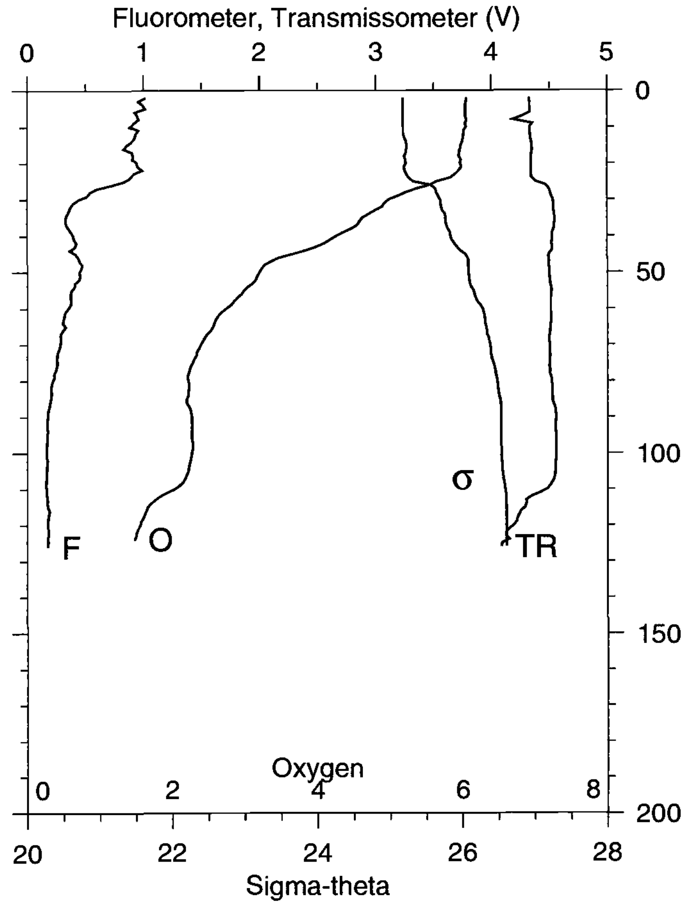


STA NO 16 LAT: 43 52.0 N LONG: 124 36.0 W
26 JUL 1999 0214 GMT DEPTH 234

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	11.585	32.564	11.585	24.775	0.032	4.11	3.87
10	10.950	32.586	10.949	24.906	0.313	3.14	4.01
20	8.551	32.734	8.549	25.414	0.597	0.69	4.46
30	8.345	32.833	8.343	25.522	0.845	0.50	4.52
40	8.354	33.164	8.349	25.781	1.081	0.33	4.54
50	8.367	33.426	8.362	25.985	1.292	0.19	4.57
60	8.309	33.525	8.303	26.071	1.490	0.17	4.57
70	7.905	33.604	7.898	26.193	1.680	0.19	4.55
80	7.912	33.790	7.904	26.338	1.854	0.21	4.55
90	7.776	33.854	7.767	26.408	2.019	0.21	4.55
100	7.695	33.906	7.685	26.461	2.179	0.17	4.58
110	7.640	33.906	7.629	26.469	2.336	0.17	4.57
120	7.482	33.919	7.470	26.502	2.492	0.19	4.54
130	7.336	33.954	7.324	26.550	2.643	0.16	4.56
140	7.233	33.961	7.220	26.570	2.792	0.16	4.55
150	7.122	33.969	7.108	26.592	2.938	0.16	4.54
175	6.964	33.983	6.948	26.625	3.299	0.16	4.39
200	6.939	33.984	6.921	26.630	3.656	0.17	4.28
225	6.886	33.989	6.865	26.641	4.013	0.16	4.31
224	6.892	33.988	6.871	26.639	3.999	0.17	4.31

Station 17

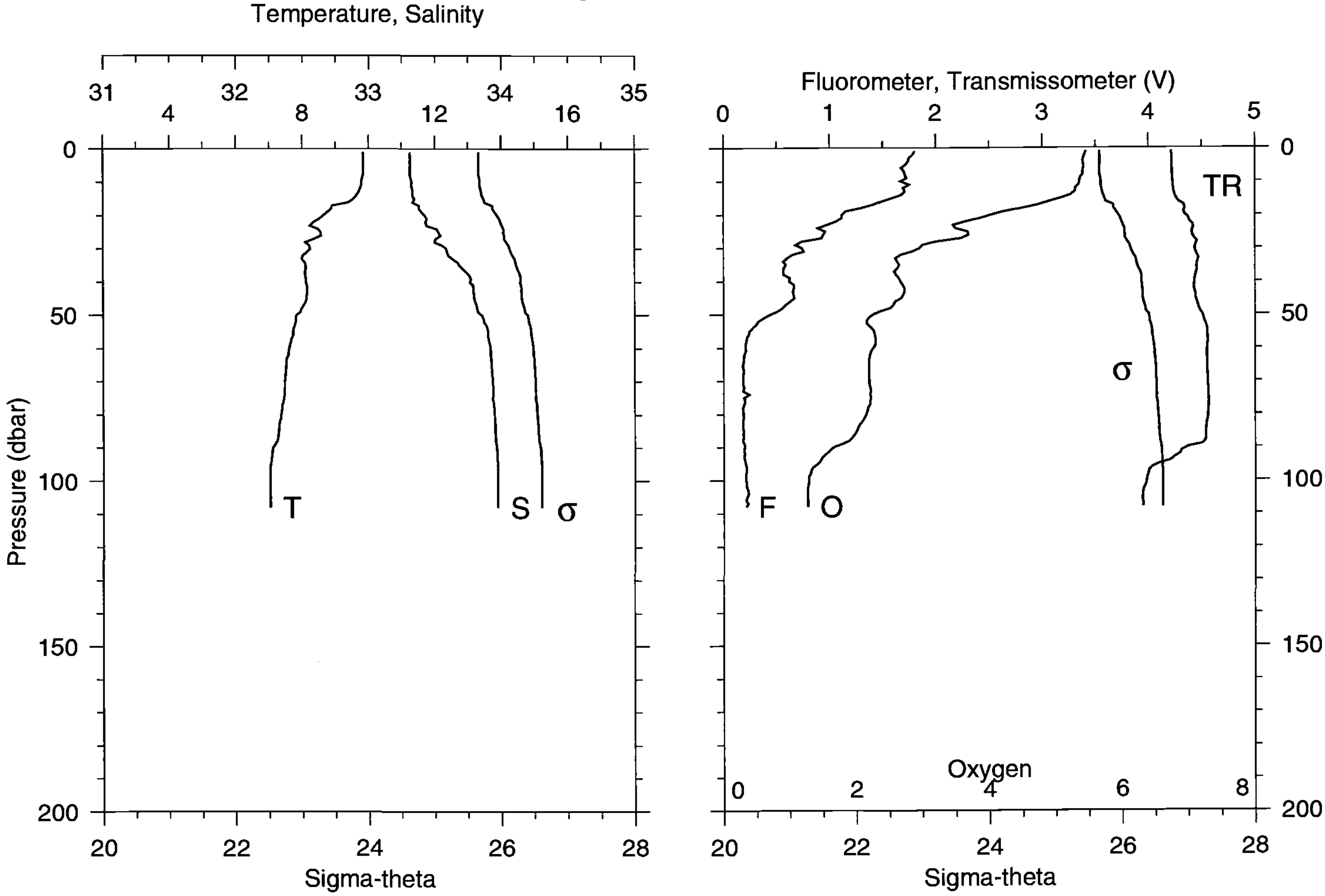




STA NO 17 LAT: 43 52.0 N LONG: 124 28.0 W
26 JUL 1999 0314 GMT DEPTH 128

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	10.772	32.896	10.771	25.178	0.056	1.02	4.32
10	10.769	32.896	10.768	25.179	0.278	0.88	4.33
20	10.602	32.908	10.600	25.217	0.553	0.95	4.34
30	8.213	33.024	8.210	25.692	0.809	0.44	4.53
40	8.226	33.212	8.222	25.838	1.032	0.40	4.52
50	8.128	33.506	8.123	26.082	1.233	0.45	4.50
60	7.932	33.714	7.926	26.275	1.419	0.35	4.51
70	7.741	33.817	7.734	26.384	1.589	0.28	4.50
80	7.526	33.901	7.519	26.481	1.749	0.22	4.52
90	7.404	33.944	7.395	26.532	1.902	0.17	4.56
100	7.385	33.948	7.376	26.538	2.052	0.16	4.56
110	7.125	33.968	7.115	26.590	2.201	0.17	4.48
120	7.018	33.974	7.007	26.610	2.345	0.18	4.20
126	7.012	33.974	7.001	26.611	2.431	0.18	4.09

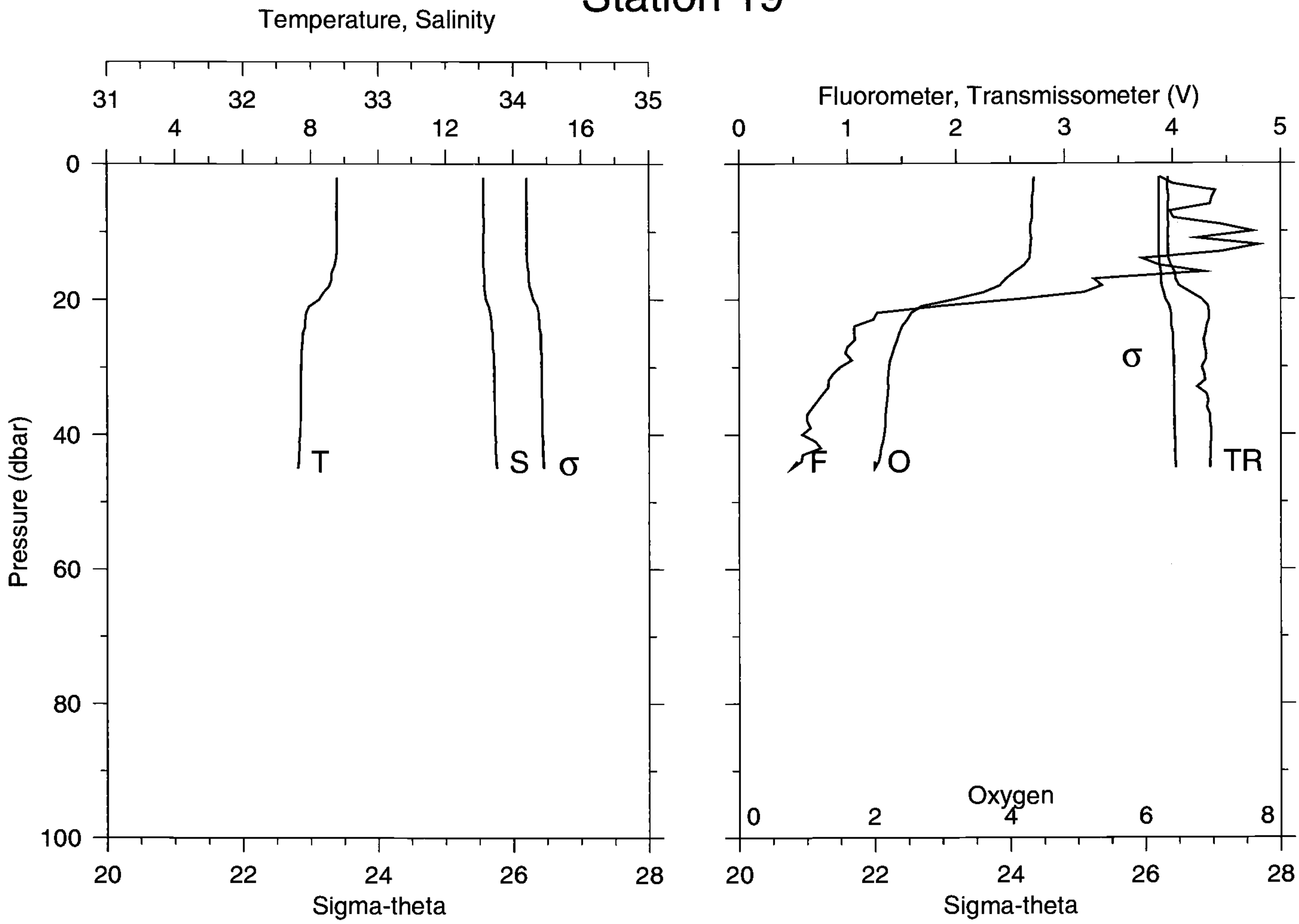
Station 18



STA NO 18 LAT: 43 52.0 N LONG: 124 20.0 W
26 JUL 1999 0409 GMT DEPTH 113

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	9.840	33.313	9.840	25.662	0.023	1.81	4.21
10	9.786	33.326	9.785	25.681	0.232	1.67	4.23
20	8.624	33.426	8.622	25.945	0.453	1.12	4.34
30	8.241	33.587	8.238	26.129	0.650	0.74	4.43
40	8.105	33.766	8.101	26.290	0.828	0.62	4.43
50	7.817	33.857	7.812	26.404	0.998	0.44	4.51
60	7.601	33.919	7.595	26.484	1.156	0.21	4.55
70	7.472	33.936	7.466	26.516	1.309	0.18	4.56
80	7.357	33.950	7.350	26.543	1.460	0.19	4.56
90	7.108	33.966	7.100	26.591	1.608	0.19	4.37
100	7.029	33.973	7.020	26.607	1.752	0.21	3.98
108	7.031	33.973	7.021	26.607	1.867	0.21	3.94

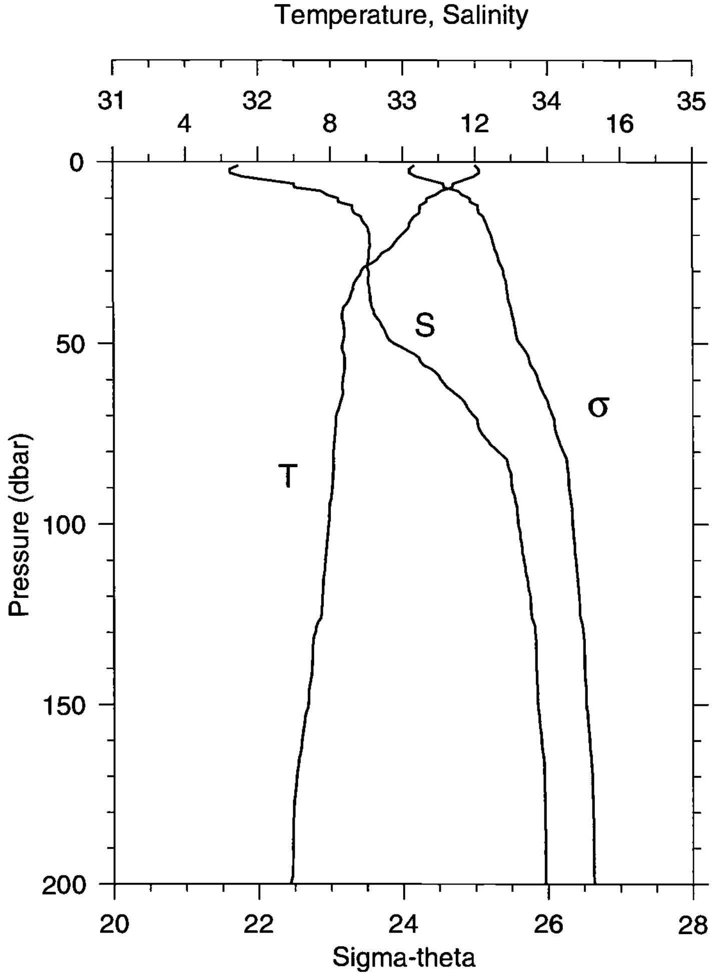
Station 19

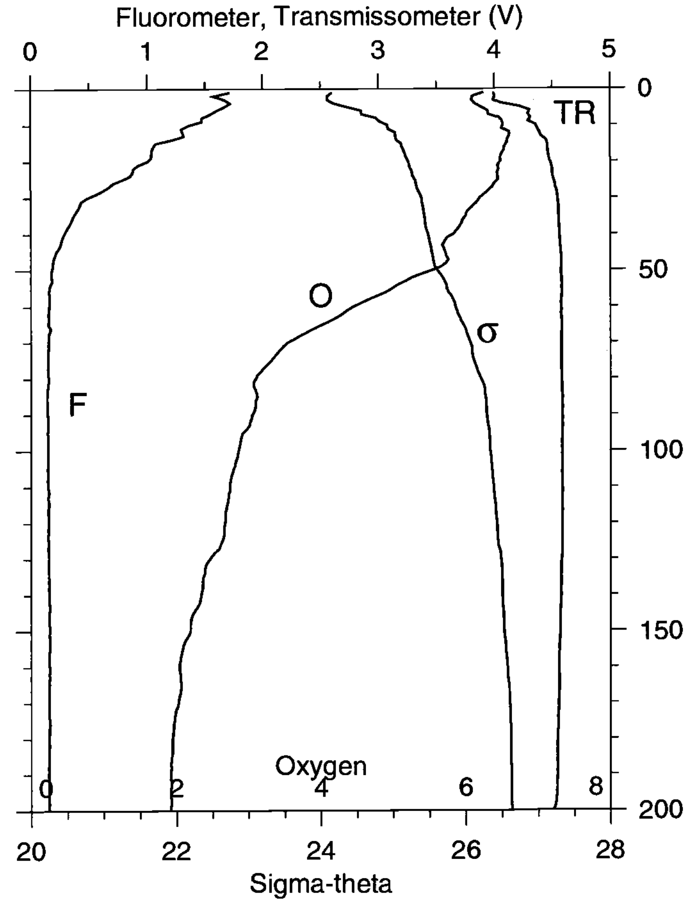


STA NO 19 LAT: 43 52.0 N LONG: 124 12.6 W
26 JUL 1999 0459 GMT DEPTH 52

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	8.774	33.781	8.774	26.200	0.036	3.88	3.96
10	8.771	33.782	8.770	26.200	0.181	4.74	3.96
20	8.245	33.800	8.243	26.296	0.360	2.57	4.27
30	7.713	33.858	7.710	26.419	0.523	0.93	4.27
40	7.680	33.865	7.676	26.430	0.683	0.58	4.36
45	7.618	33.879	7.614	26.450	0.762	0.48	4.35

Station 20

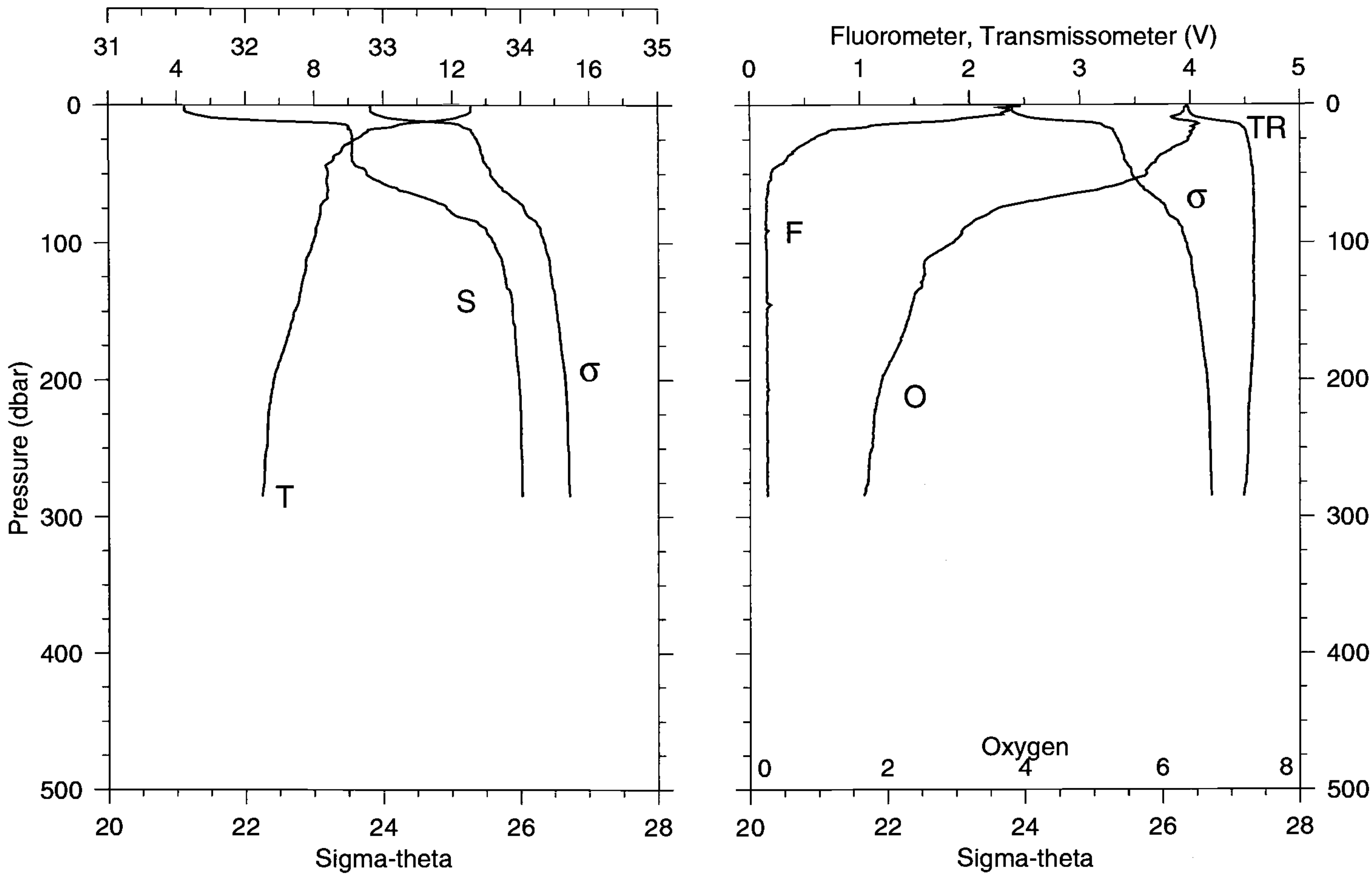




STA NO 20 LAT: 44 39.1 N LONG: 124 36.5 W
26 JUL 1999 1851 GMT DEPTH 210

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	11.996	31.867	11.996	24.158	0.037	1.72	3.99
10	10.676	32.553	10.675	24.928	0.350	1.36	4.36
20	9.968	32.772	9.966	25.219	0.637	1.00	4.48
30	8.860	32.764	8.857	25.390	0.904	0.48	4.54
40	8.347	32.783	8.343	25.483	1.158	0.28	4.56
50	8.317	32.936	8.312	25.607	1.403	0.18	4.57
60	8.328	33.260	8.322	25.860	1.627	0.16	4.57
70	8.144	33.485	8.137	26.064	1.832	0.15	4.57
80	8.063	33.657	8.055	26.211	2.021	0.15	4.58
90	8.028	33.750	8.019	26.290	2.197	0.14	4.59
100	7.937	33.792	7.927	26.336	2.368	0.15	4.58
110	7.838	33.832	7.827	26.383	2.535	0.14	4.58
120	7.760	33.877	7.749	26.429	2.698	0.15	4.58
130	7.562	33.910	7.549	26.483	2.857	0.15	4.58
140	7.472	33.918	7.459	26.503	3.012	0.15	4.57
150	7.368	33.928	7.354	26.526	3.165	0.16	4.56
175	7.001	33.976	6.985	26.614	3.534	0.16	4.55
200	6.873	33.984	6.855	26.638	3.892	0.16	4.51

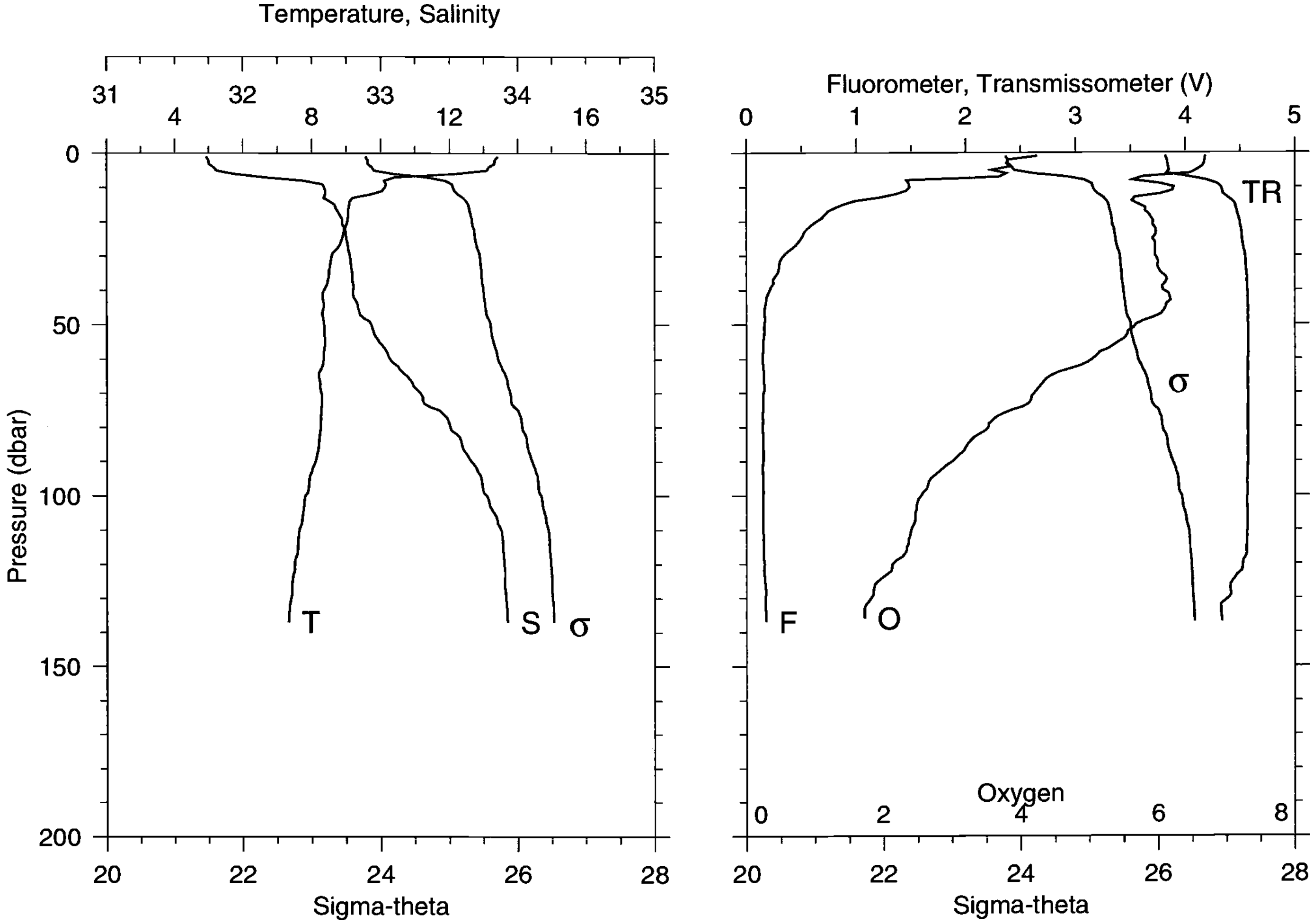
Station 21



STA NO 21 LAT: 44 39.1 N LONG: 124 39.1 W
27 JUL 1999 1052 GMT DEPTH 294

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	12.552	31.556	12.552	23.813	0.041	2.46	3.97
10	11.978	31.870	11.977	24.164	0.401	1.93	4.10
20	9.492	32.770	9.490	25.295	0.696	0.70	4.51
30	8.834	32.771	8.831	25.399	0.958	0.45	4.54
40	8.536	32.772	8.532	25.446	1.213	0.33	4.55
50	8.389	32.879	8.384	25.552	1.460	0.19	4.57
60	8.389	33.096	8.382	25.722	1.697	0.16	4.58
70	8.253	33.381	8.246	25.966	1.914	0.16	4.58
80	8.160	33.520	8.152	26.089	2.111	0.15	4.58
90	8.035	33.747	8.026	26.286	2.292	0.14	4.58
100	7.949	33.803	7.939	26.343	2.464	0.14	4.59
110	7.793	33.851	7.783	26.404	2.631	0.15	4.58
120	7.740	33.874	7.729	26.429	2.792	0.15	4.58
130	7.629	33.891	7.617	26.459	2.952	0.15	4.58
140	7.558	33.932	7.545	26.501	3.108	0.15	4.58
150	7.406	33.935	7.392	26.525	3.262	0.15	4.58
175	7.138	33.962	7.122	26.584	3.636	0.15	4.57
200	6.812	33.985	6.794	26.647	3.996	0.15	4.55
225	6.660	33.998	6.640	26.678	4.346	0.15	4.53
250	6.607	34.001	6.585	26.688	4.692	0.15	4.53
275	6.542	34.006	6.517	26.701	5.036	0.16	4.51
285	6.478	34.010	6.453	26.712	5.172	0.16	4.49

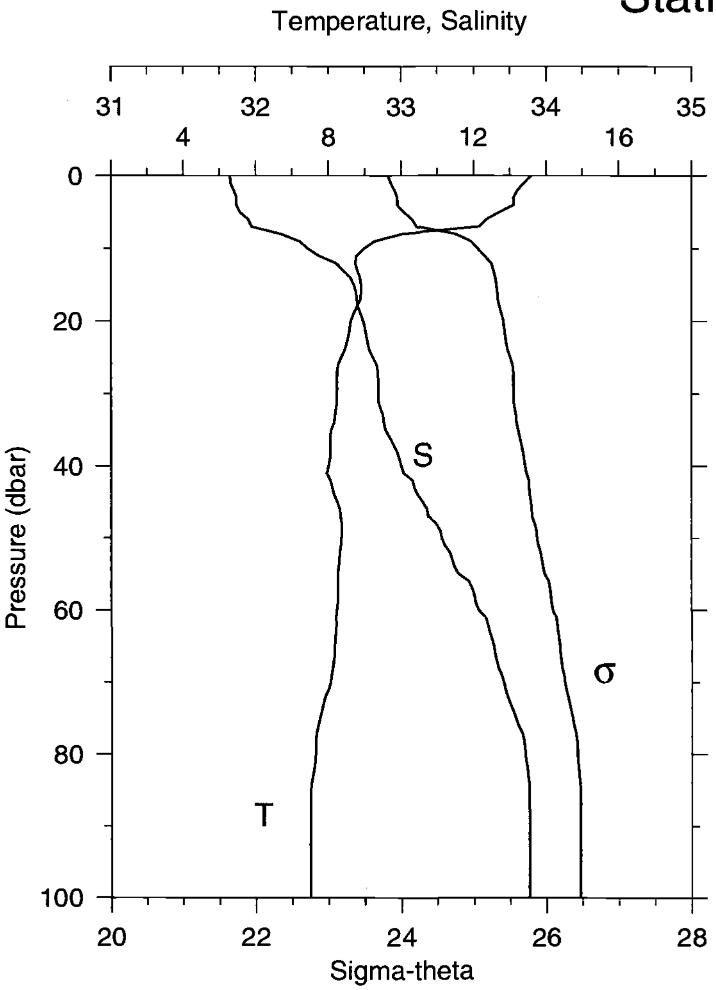
Station 22

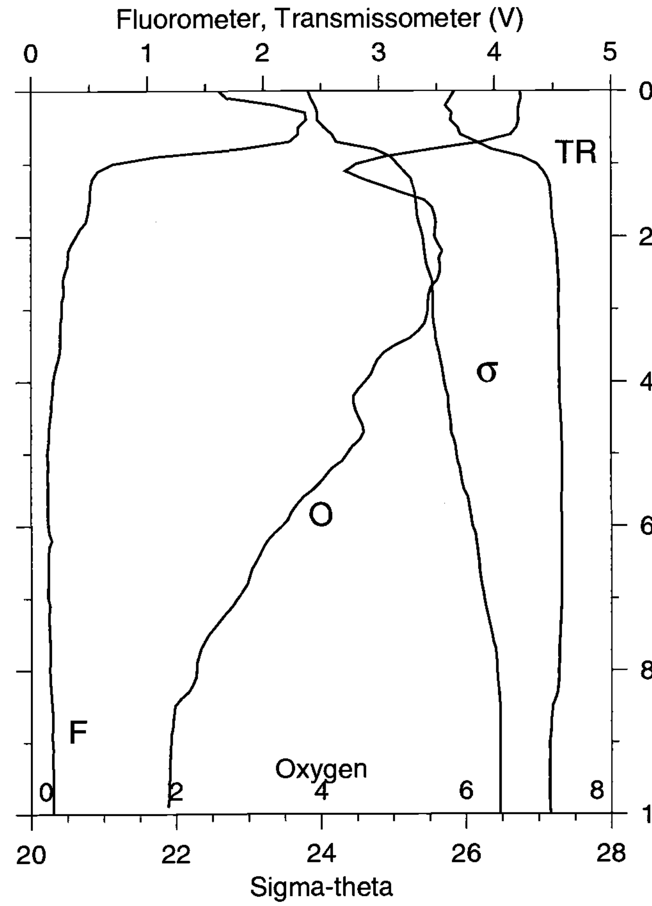


STA NO 22 LAT: 44 39.2 N LONG: 124 33.0 W
29 JUL 1999 0330 GMT DEPTH 142

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	13.414	31.731	13.414	23.781	0.041	2.65	3.82
10	10.117	32.591	10.116	25.052	0.367	1.49	4.32
20	9.030	32.720	9.028	25.329	0.640	0.64	4.50
30	8.573	32.777	8.570	25.444	0.899	0.34	4.55
40	8.345	32.799	8.342	25.496	1.149	0.21	4.57
50	8.355	32.934	8.350	25.600	1.394	0.16	4.57
60	8.337	33.068	8.331	25.708	1.628	0.15	4.57
70	8.281	33.290	8.274	25.890	1.847	0.15	4.57
80	8.252	33.505	8.244	26.064	2.050	0.14	4.57
90	8.101	33.661	8.092	26.209	2.238	0.15	4.57
100	7.802	33.776	7.792	26.343	2.413	0.15	4.56
110	7.635	33.879	7.625	26.448	2.577	0.15	4.56
120	7.499	33.900	7.488	26.484	2.734	0.16	4.52
130	7.393	33.913	7.381	26.510	2.889	0.17	4.40
137	7.321	33.926	7.308	26.530	2.996	0.18	4.33

Station 23

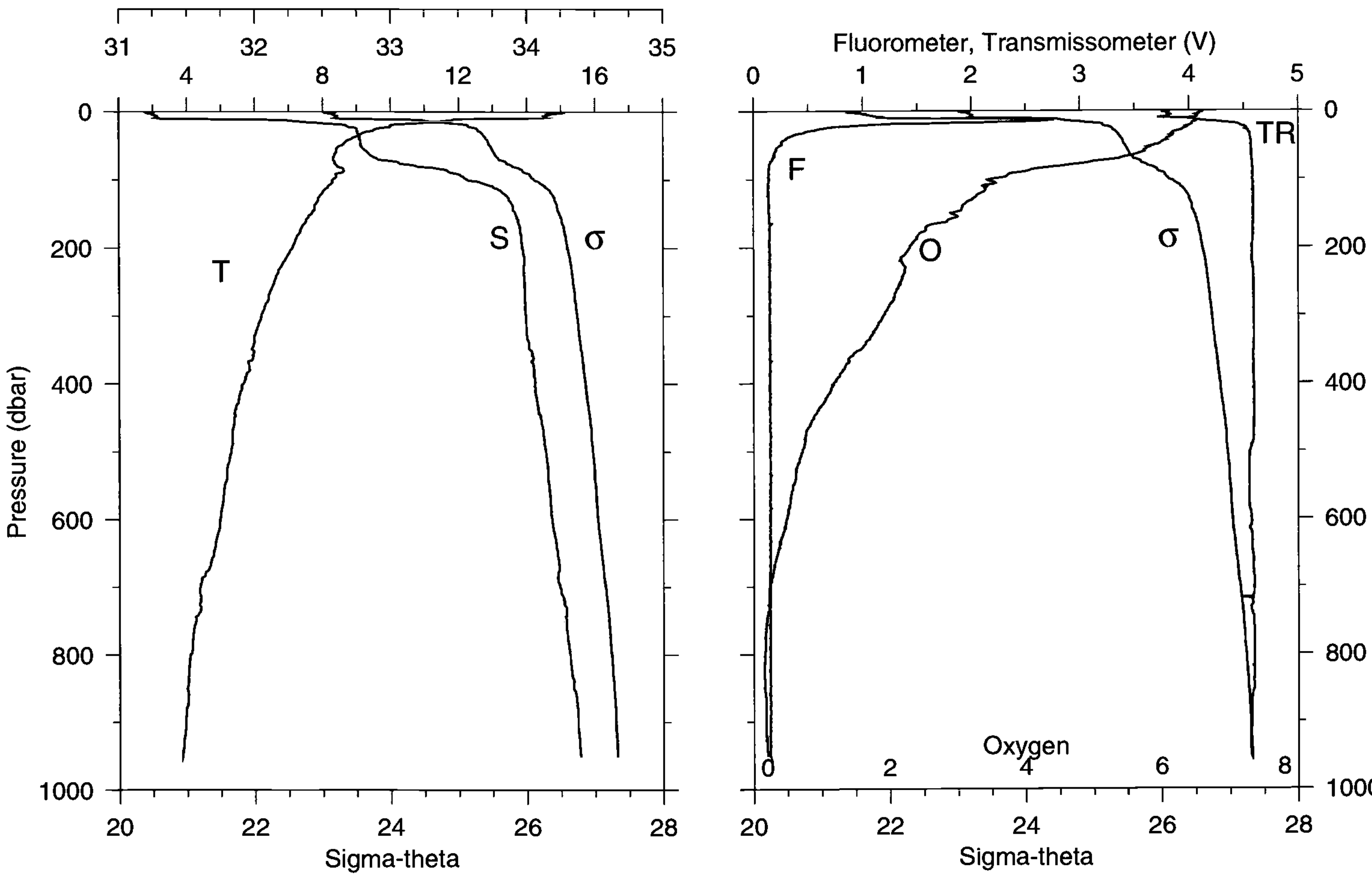




STA NO 23 LAT: 44 39.1 N LONG: 124 27.6 W
29 JUL 1999 1833 GMT DEPTH 104

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
0	13.587	31.823	13.587	23.818	0.000	1.62	3.65
10	8.984	32.360	8.983	25.054	0.369	0.70	4.36
20	8.611	32.740	8.608	25.409	0.636	0.38	4.52
30	8.230	32.843	8.227	25.547	0.885	0.26	4.55
40	8.000	33.001	7.996	25.705	1.122	0.19	4.55
50	8.353	33.279	8.348	25.871	1.342	0.14	4.58
60	8.233	33.534	8.227	26.090	1.544	0.15	4.57
70	8.048	33.703	8.041	26.249	1.728	0.14	4.57
80	7.630	33.850	7.622	26.426	1.896	0.16	4.55
90	7.491	33.880	7.483	26.470	2.053	0.18	4.47
100	7.491	33.880	7.481	26.470	2.210	0.19	4.48

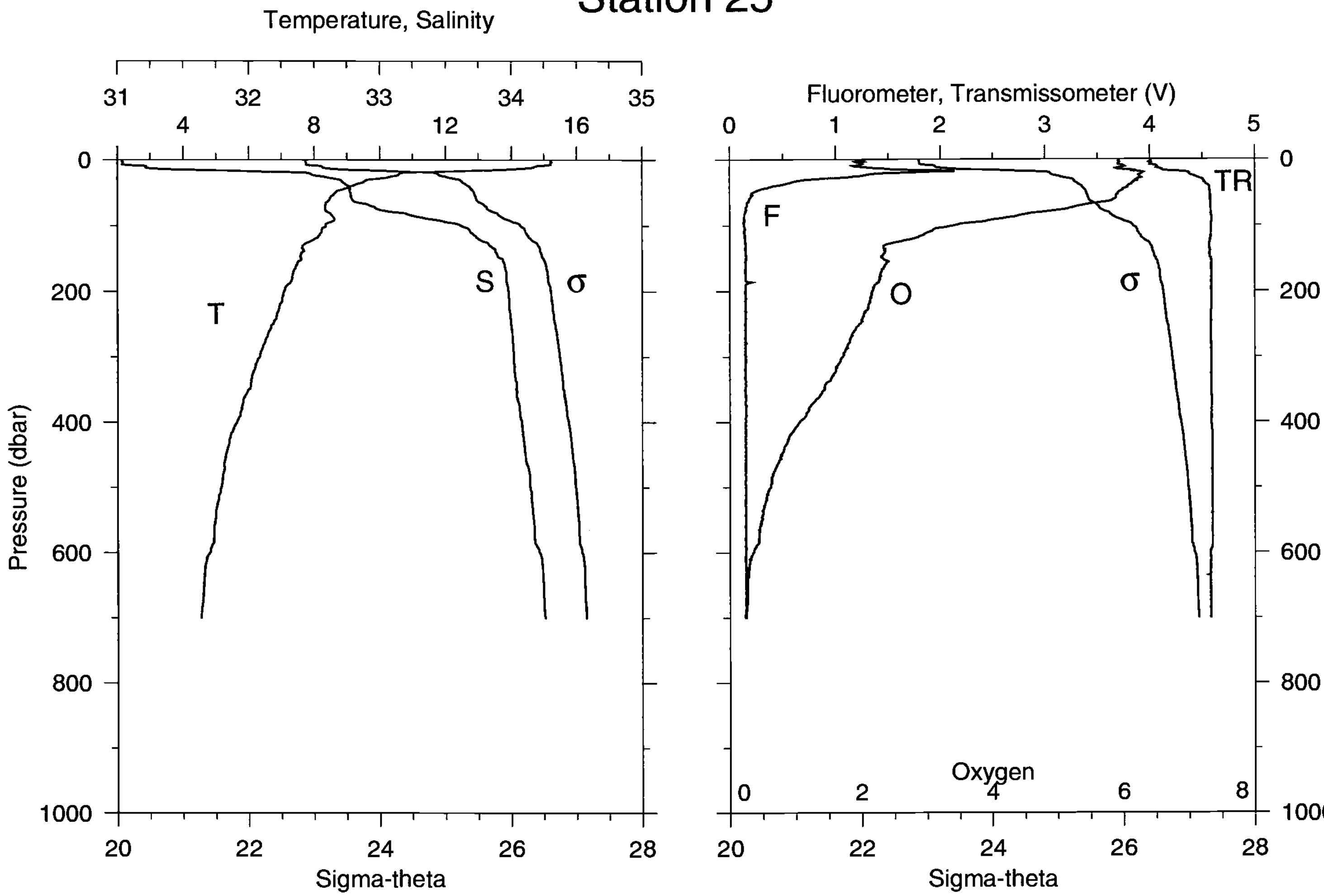
Station 24



STA NO 24 LAT: 44 39.1 N LONG: 125 0.1 W
30 JUL 1999 0538 GMT DEPTH 966

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
0	15.053	31.196	15.053	23.031	0.000	0.90	4.13
10	14.357	31.310	14.355	23.265	0.471	1.16	4.05
20	9.996	32.674	9.994	25.137	0.800	1.09	4.46
30	9.233	32.756	9.230	25.325	1.072	0.49	4.54
40	8.824	32.772	8.819	25.402	1.332	0.30	4.56
50	8.494	32.782	8.489	25.460	1.587	0.25	4.57
60	8.385	32.835	8.379	25.519	1.836	0.20	4.57
70	8.309	32.914	8.302	25.591	2.079	0.17	4.57
80	8.433	33.196	8.425	25.794	2.308	0.14	4.58
90	8.469	33.466	8.460	26.000	2.517	0.14	4.58
100	8.289	33.565	8.279	26.106	2.713	0.14	4.58
110	8.153	33.751	8.142	26.272	2.895	0.14	4.59
120	7.976	33.830	7.964	26.361	3.067	0.13	4.59
130	7.862	33.870	7.849	26.409	3.231	0.14	4.59
140	7.763	33.898	7.749	26.445	3.392	0.14	4.59
150	7.666	33.918	7.651	26.476	3.551	0.14	4.59
175	7.342	33.953	7.325	26.549	3.934	0.15	4.59
200	7.108	33.967	7.090	26.593	4.305	0.15	4.58
225	6.796	33.979	6.776	26.645	4.664	0.15	4.58
250	6.565	33.982	6.543	26.679	5.015	0.15	4.59
275	6.405	33.986	6.380	26.703	5.360	0.15	4.59
300	6.192	33.991	6.166	26.735	5.698	0.15	4.59
350	5.945	34.023	5.915	26.792	6.358	0.15	4.59
400	5.651	34.058	5.618	26.856	6.989	0.15	4.59
450	5.394	34.100	5.357	26.921	7.594	0.15	4.59
500	5.291	34.138	5.250	26.963	8.175	0.15	4.56
600	4.959	34.183	4.911	27.038	9.286	0.15	4.57
700	4.376	34.239	4.323	27.147	10.320	0.14	4.60
800	4.083	34.315	4.023	27.239	11.257	0.15	4.60
900	3.950	34.371	3.883	27.298	12.129	0.15	4.56
951	3.851	34.389	3.781	27.323	12.557	0.15	4.57

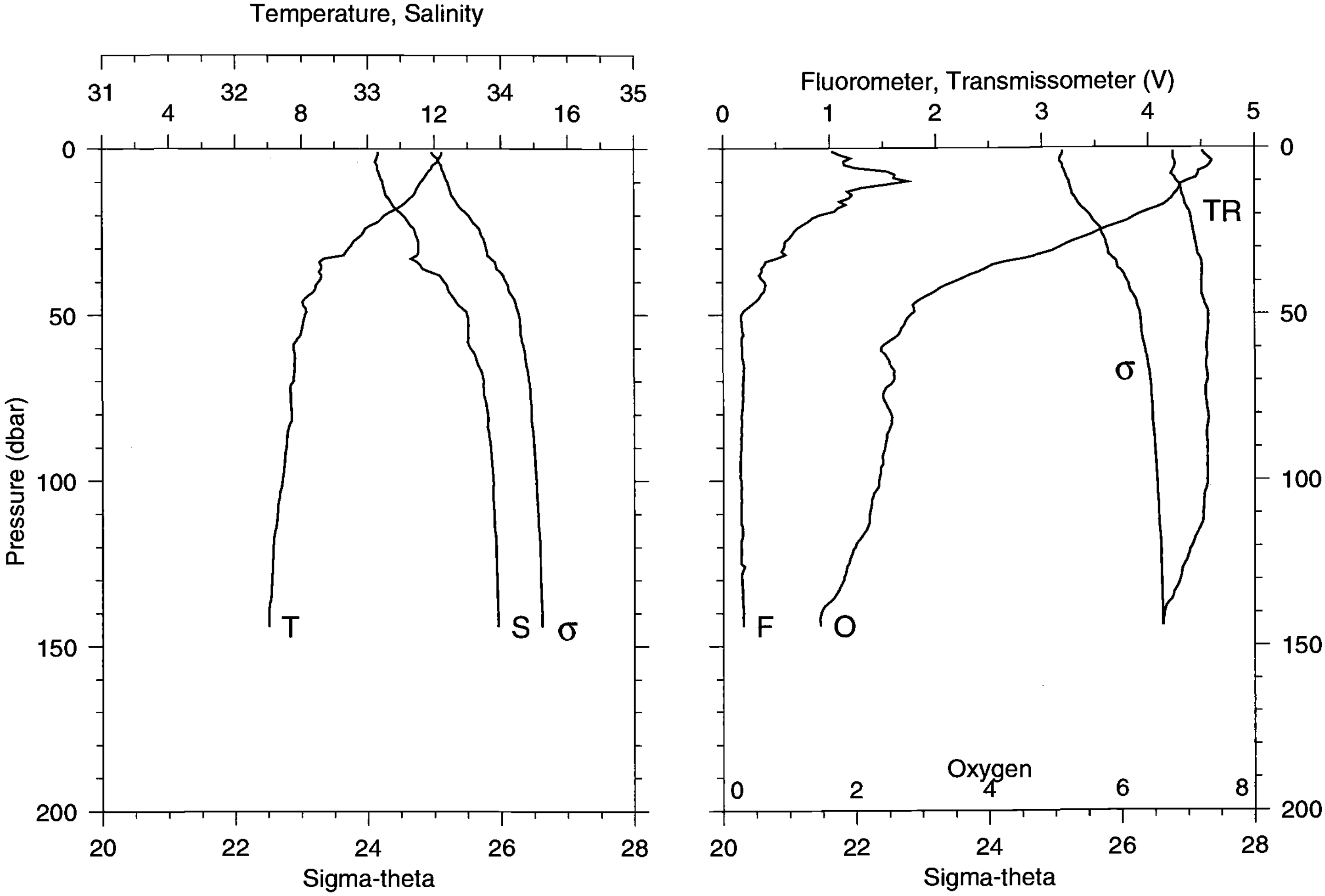
Station 25



STA NO 25 LAT: 44 39.1 N LONG: 125 7.1 W
30 JUL 1999 0653 GMT DEPTH 706

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	15.240	31.044	15.240	22.873	0.050	1.20	4.01
10	14.734	31.220	14.732	23.117	0.494	1.17	4.06
20	10.631	32.459	10.629	24.863	0.907	1.69	4.36
30	9.621	32.695	9.618	25.216	1.202	0.79	4.50
40	9.107	32.766	9.103	25.354	1.471	0.42	4.56
50	8.632	32.778	8.627	25.436	1.729	0.22	4.57
60	8.472	32.789	8.466	25.469	1.982	0.19	4.57
70	8.337	32.934	8.330	25.603	2.227	0.16	4.58
80	8.459	33.166	8.451	25.767	2.460	0.15	4.58
90	8.620	33.397	8.611	25.924	2.677	0.14	4.59
100	8.348	33.622	8.338	26.142	2.874	0.13	4.58
110	8.219	33.691	8.208	26.216	3.058	0.14	4.58
120	8.010	33.753	7.998	26.295	3.235	0.14	4.57
130	7.652	33.834	7.640	26.411	3.403	0.15	4.56
140	7.641	33.880	7.628	26.448	3.564	0.15	4.57
150	7.614	33.932	7.600	26.494	3.721	0.15	4.58
175	7.339	33.961	7.322	26.556	4.101	0.15	4.59
200	7.081	33.978	7.062	26.605	4.471	0.15	4.58
225	6.930	33.984	6.909	26.631	4.832	0.15	4.59
250	6.735	33.996	6.713	26.667	5.187	0.14	4.58
275	6.508	34.010	6.484	26.708	5.532	0.15	4.58
300	6.324	34.016	6.297	26.738	5.870	0.15	4.59
350	5.984	34.036	5.954	26.797	6.526	0.14	4.59
400	5.635	34.078	5.601	26.874	7.153	0.15	4.59
450	5.295	34.104	5.259	26.935	7.747	0.15	4.60
500	5.149	34.142	5.108	26.982	8.318	0.15	4.59
600	4.800	34.216	4.753	27.082	9.406	0.15	4.57
700	4.540	34.256	4.486	27.143	10.409	0.15	4.58
698	4.541	34.256	4.487	27.143	10.389	0.15	4.58

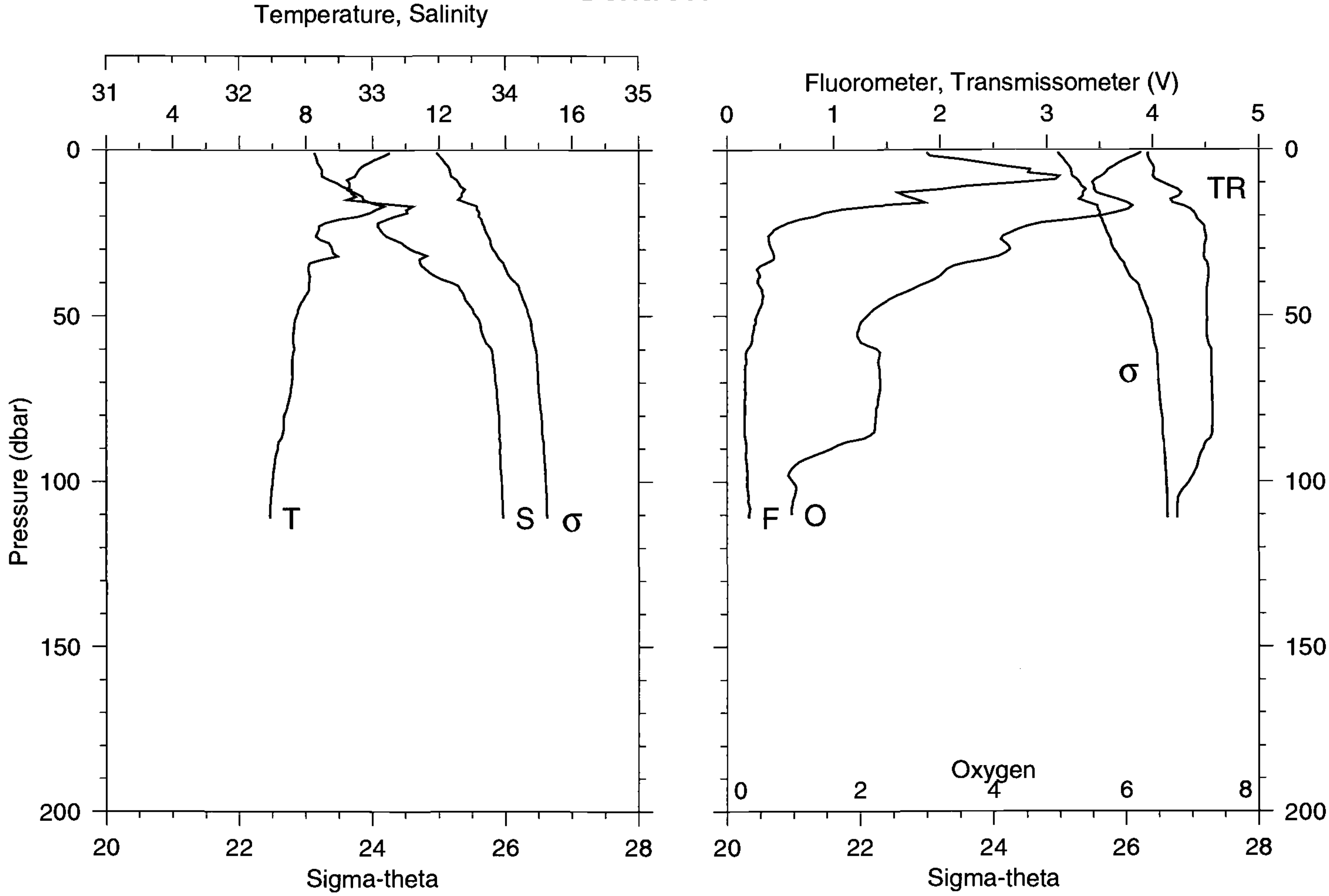
Station 26



STA NO 26 LAT: 44 0.6 N LONG: 124 36.0 W
30 JUL 1999 1824 GMT DEPTH 149

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	11.909	33.079	11.909	25.115	0.028	1.02	4.23
10	11.592	33.114	11.591	25.201	0.284	1.74	4.26
20	10.505	33.267	10.503	25.514	0.549	0.92	4.40
30	9.424	33.381	9.420	25.784	0.780	0.58	4.46
40	8.507	33.575	8.503	26.080	0.987	0.39	4.50
50	8.111	33.748	8.106	26.275	1.170	0.18	4.56
60	7.761	33.774	7.755	26.347	1.342	0.18	4.55
70	7.774	33.874	7.768	26.423	1.506	0.19	4.56
80	7.701	33.901	7.693	26.456	1.665	0.18	4.56
90	7.541	33.922	7.533	26.495	1.821	0.17	4.55
100	7.425	33.942	7.415	26.528	1.974	0.17	4.55
110	7.273	33.947	7.262	26.553	2.124	0.17	4.51
120	7.144	33.963	7.133	26.584	2.272	0.17	4.41
130	7.103	33.969	7.091	26.594	2.418	0.18	4.30
140	7.015	33.976	7.002	26.612	2.562	0.19	4.15
144	7.011	33.977	6.998	26.613	2.620	0.19	4.13

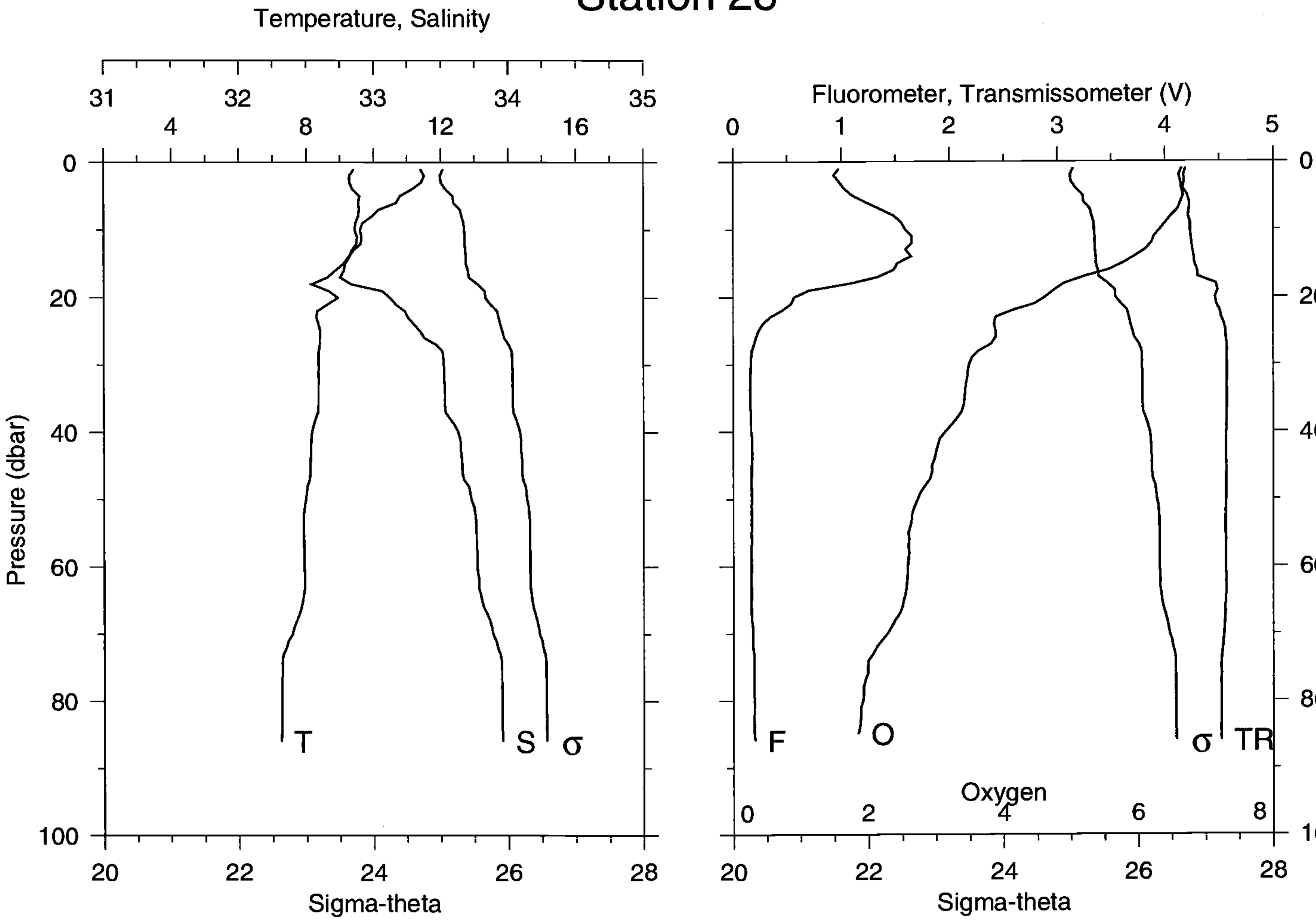
Station 27



STA NO 27 LAT: 44 0.6 N LONG: 124 45.0 W
30 JUL 1999 1926 GMT DEPTH 119

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	10.528	32.563	10.528	24.961	0.030	1.87	3.96
10	9.312	32.735	9.311	25.297	0.284	2.70	4.10
20	9.581	33.170	9.579	25.593	0.538	0.83	4.41
30	8.798	33.290	8.795	25.811	0.765	0.42	4.49
40	8.107	33.597	8.103	26.157	0.968	0.29	4.52
50	7.720	33.778	7.716	26.356	1.143	0.28	4.51
60	7.661	33.895	7.655	26.457	1.305	0.19	4.55
70	7.591	33.925	7.584	26.490	1.460	0.17	4.56
80	7.354	33.952	7.346	26.546	1.612	0.17	4.57
90	7.163	33.959	7.155	26.577	1.760	0.18	4.48
100	7.015	33.972	7.006	26.608	1.905	0.19	4.35
110	6.934	33.981	6.924	26.626	2.048	0.21	4.24
111	6.929	33.982	6.919	26.628	2.062	0.21	4.23

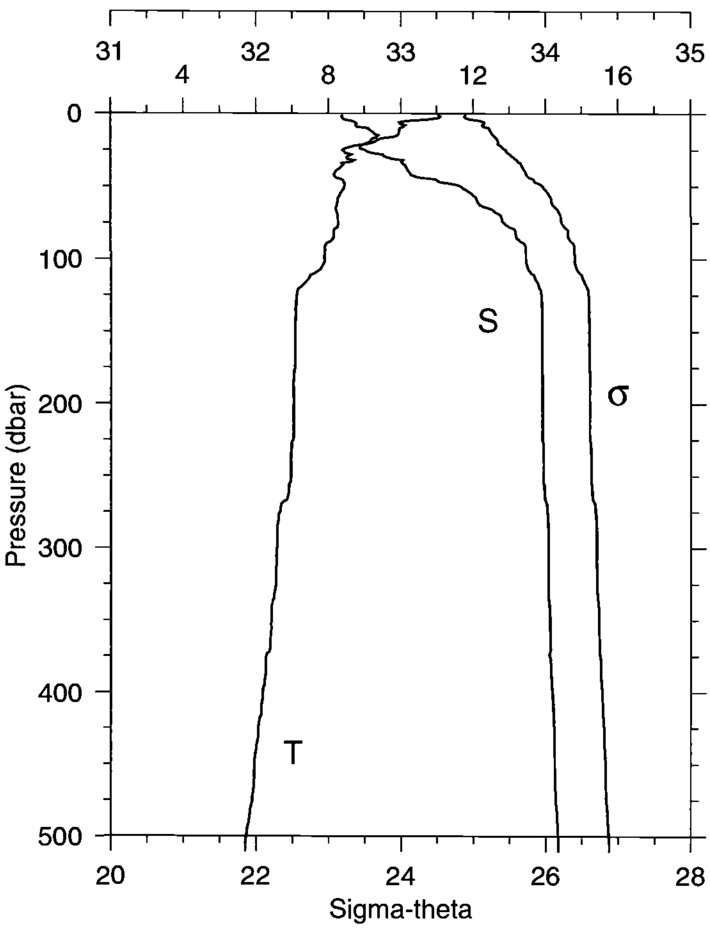
Station 28

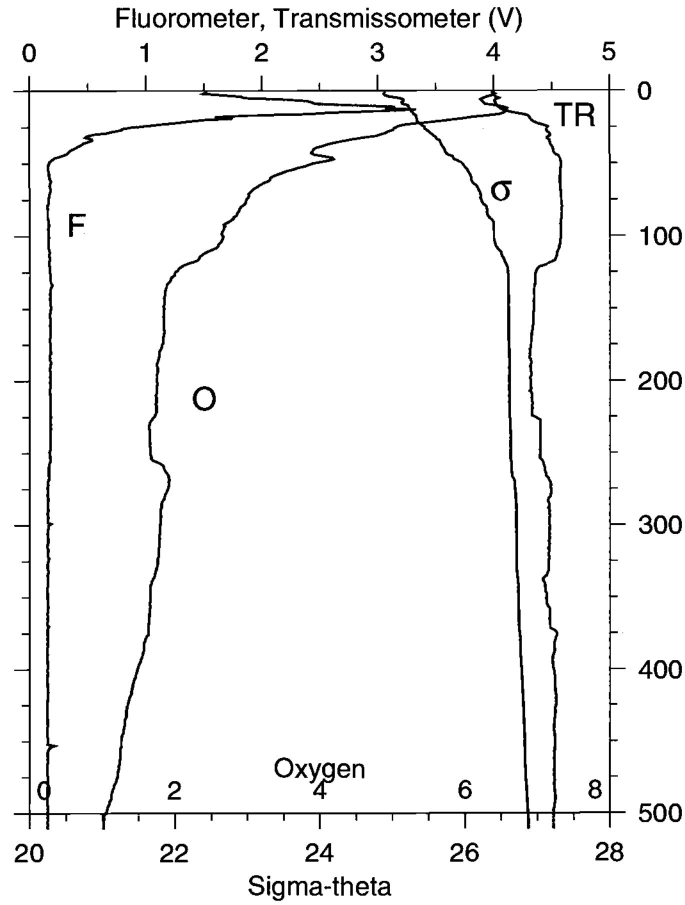


STA NO 28 LAT: 44 0.6 N LONG: 124 53.0 W
30 JUL 1999 2022 GMT DEPTH 93

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	11.402	32.853	11.402	25.032	0.029	0.98	4.19
10	9.603	32.860	9.602	25.347	0.280	1.59	4.23
20	8.938	33.124	8.936	25.660	0.534	0.57	4.47
30	8.359	33.522	8.356	26.060	0.742	0.16	4.57
40	8.166	33.630	8.162	26.174	0.934	0.17	4.57
50	7.981	33.725	7.976	26.276	1.114	0.17	4.56
60	7.928	33.768	7.922	26.318	1.285	0.17	4.56
70	7.570	33.886	7.564	26.463	1.451	0.18	4.55
80	7.269	33.953	7.261	26.558	1.600	0.20	4.52
86	7.240	33.957	7.232	26.566	1.689	0.20	4.52

Station 29

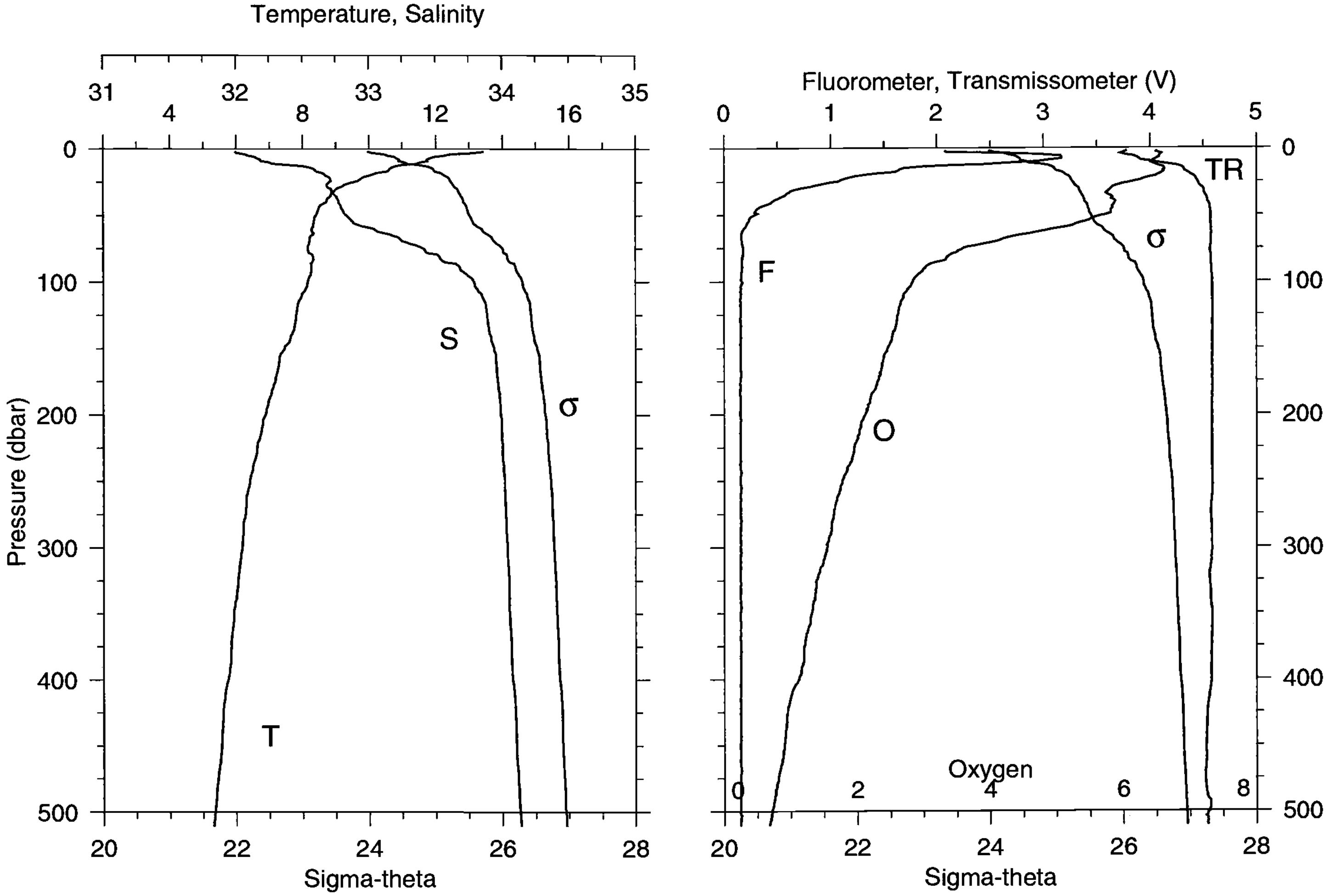




STA NO 29 LAT: 44 0.6 N LONG: 125 0.1 W
30 JUL 1999 2111 GMT DEPTH 952

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
1	11.028	32.600	11.028	24.902	0.030	1.53	4.00
10	9.965	32.773	9.964	25.219	0.291	2.79	4.03
20	9.220	32.774	9.218	25.342	0.559	1.50	4.32
30	8.505	32.902	8.501	25.553	0.812	0.55	4.49
40	8.192	33.058	8.188	25.722	1.046	0.37	4.51
50	8.446	33.418	8.441	25.967	1.263	0.17	4.57
60	8.253	33.529	8.247	26.083	1.461	0.17	4.57
70	8.262	33.692	8.254	26.209	1.648	0.17	4.58
80	8.159	33.787	8.151	26.299	1.827	0.15	4.58
90	7.916	33.855	7.907	26.389	1.997	0.16	4.58
100	7.882	33.862	7.872	26.399	2.161	0.16	4.57
110	7.592	33.900	7.582	26.471	2.322	0.17	4.55
120	7.189	33.955	7.178	26.571	2.474	0.17	4.43
130	7.102	33.970	7.090	26.595	2.619	0.18	4.36
140	7.083	33.972	7.070	26.600	2.764	0.17	4.34
150	7.080	33.972	7.066	26.600	2.910	0.18	4.34
175	7.065	33.973	7.049	26.603	3.272	0.18	4.32
200	7.036	33.976	7.018	26.610	3.635	0.18	4.31
225	7.023	33.977	7.003	26.613	3.997	0.18	4.36
250	6.962	33.983	6.939	26.626	4.358	0.17	4.40
275	6.657	34.009	6.632	26.688	4.712	0.16	4.49
300	6.573	34.017	6.546	26.705	5.056	0.16	4.48
350	6.418	34.029	6.387	26.736	5.739	0.15	4.45
400	6.175	34.045	6.140	26.780	6.406	0.15	4.51
450	5.951	34.062	5.912	26.823	7.053	0.16	4.52
500	5.721	34.084	5.679	26.869	7.685	0.15	4.51
511	5.697	34.087	5.653	26.874	7.820	0.16	4.51

Station 30

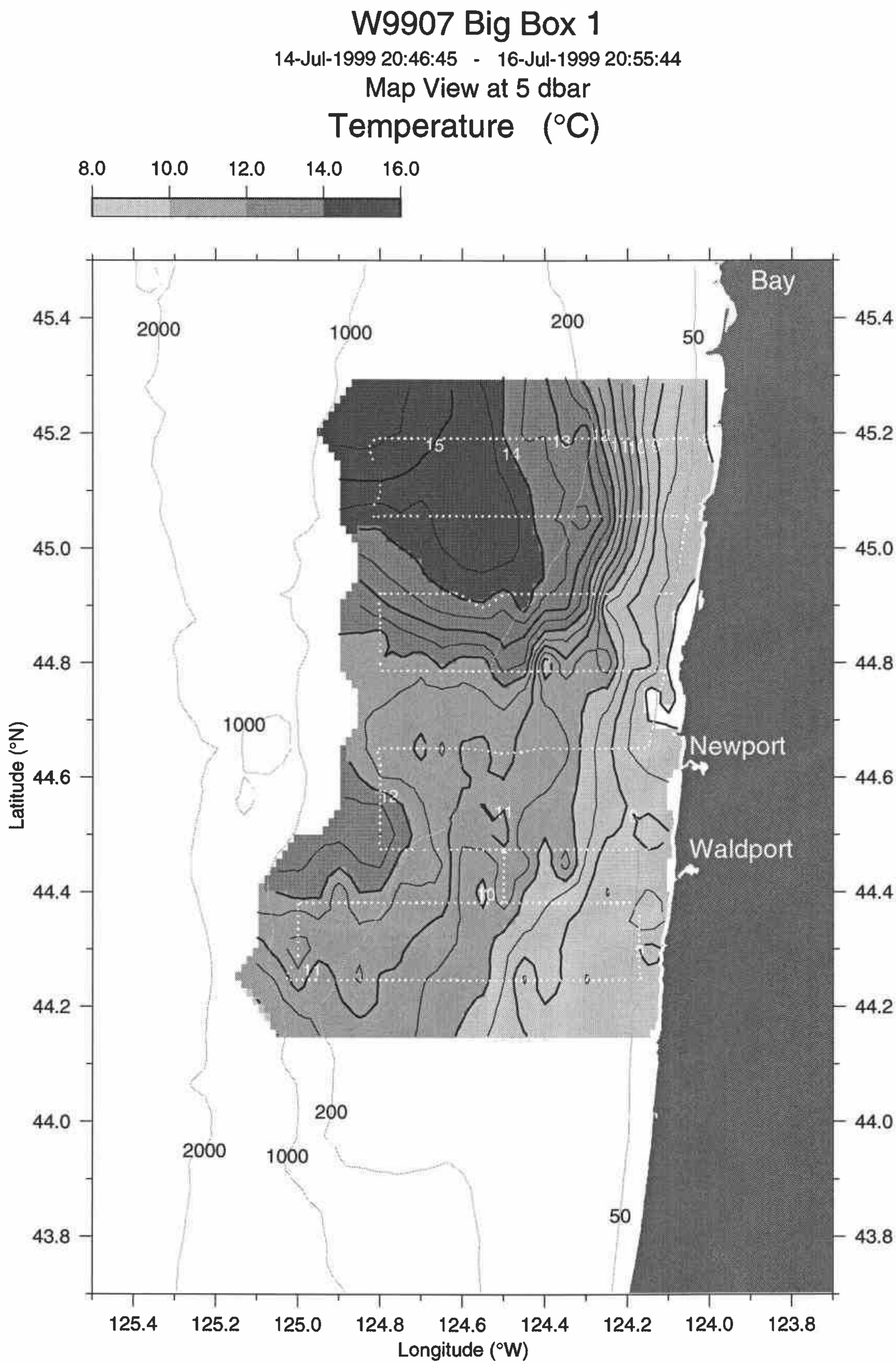


STA NO 30 LAT: 44 0.6 N LONG: 125 10.1 W
30 JUL 1999 2225 GMT DEPTH 1650

P (DB)	T (C)	S	POT T (C)	SIGMA THETA	GEO AN (J/KG)	FL (V)	TRN (V)
2	13.435	31.991	13.435	23.978	0.078	2.08	3.78
10	11.536	32.246	11.534	24.536	0.367	2.96	4.01
20	10.017	32.672	10.015	25.133	0.671	1.33	4.38
30	9.009	32.713	9.006	25.327	0.943	0.73	4.50
40	8.712	32.770	8.708	25.418	1.203	0.45	4.54
50	8.401	32.833	8.396	25.514	1.454	0.28	4.57
60	8.276	33.040	8.271	25.695	1.694	0.19	4.57
70	8.197	33.282	8.190	25.897	1.914	0.17	4.57
80	8.304	33.523	8.296	26.070	2.116	0.17	4.57
90	8.264	33.684	8.255	26.203	2.305	0.17	4.57
100	8.149	33.790	8.140	26.303	2.482	0.17	4.58
110	7.969	33.848	7.958	26.375	2.652	0.16	4.59
120	7.832	33.881	7.820	26.422	2.816	0.15	4.59
130	7.776	33.893	7.763	26.439	2.977	0.16	4.58
140	7.647	33.913	7.633	26.474	3.136	0.15	4.59
150	7.453	33.937	7.438	26.521	3.291	0.15	4.58
175	7.172	33.966	7.156	26.583	3.664	0.15	4.58
200	6.879	33.990	6.860	26.642	4.024	0.15	4.58
225	6.628	34.001	6.608	26.685	4.374	0.15	4.58
250	6.405	34.016	6.384	26.726	4.715	0.16	4.59
275	6.275	34.025	6.252	26.751	5.048	0.16	4.57
300	6.176	34.036	6.150	26.772	5.376	0.15	4.58
350	5.928	34.053	5.898	26.817	6.019	0.15	4.58
400	5.748	34.076	5.715	26.858	6.645	0.15	4.57
450	5.550	34.104	5.513	26.905	7.249	0.15	4.52
500	5.359	34.132	5.318	26.950	7.838	0.15	4.55
511	5.317	34.138	5.275	26.960	7.964	0.16	4.54

Big Box 1 Maps

Maps of Temperature, Salinity, and σ_t at Specified Depths

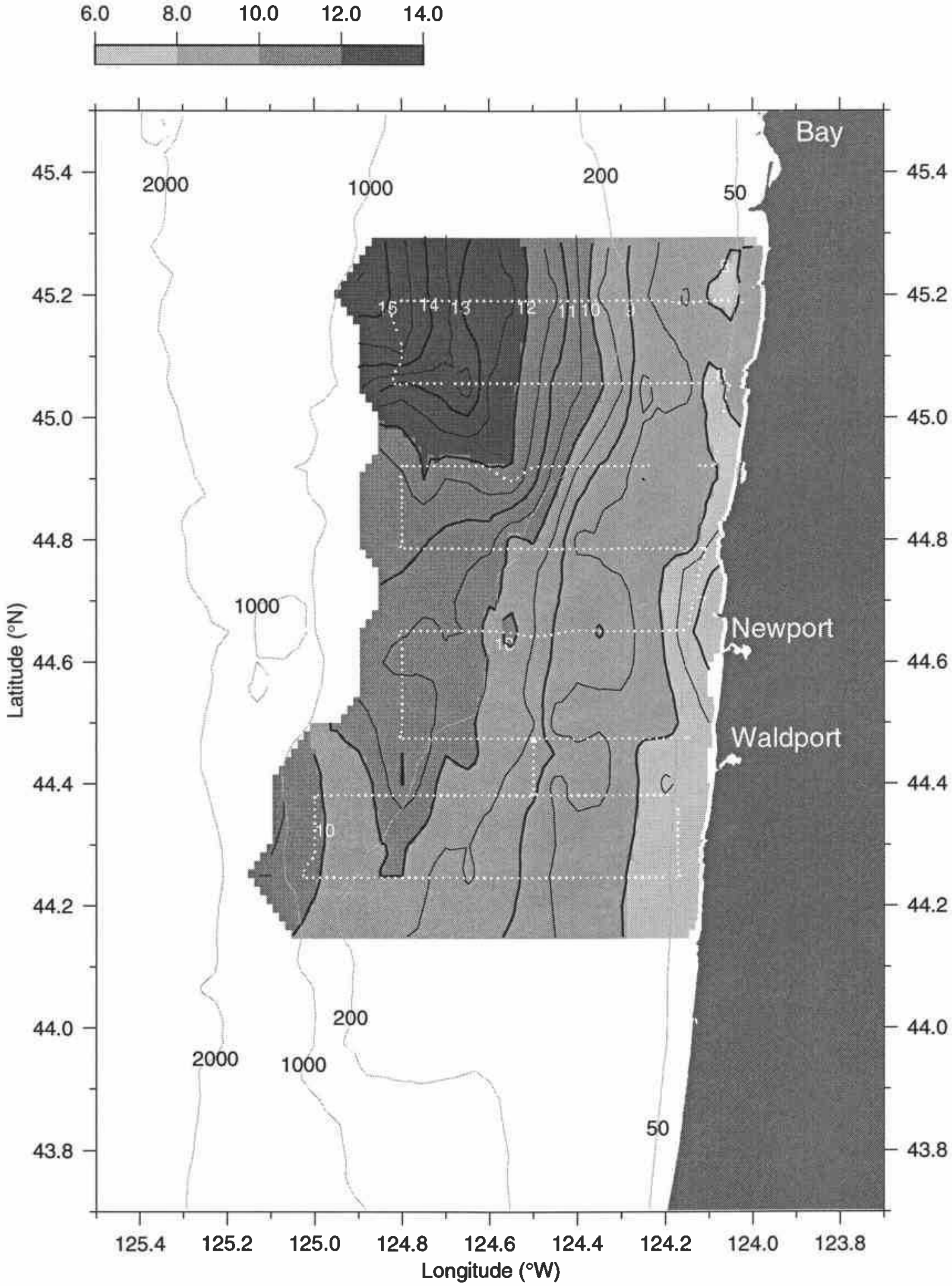

W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 5 dbar
Temperature (°C)
8.0
10.0
12.0
14.0
16.0
Bay
Newport
Waldport
2000
1000
200
50
15
14
13
12
11
10
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 15 dbar

Temperature (°C)

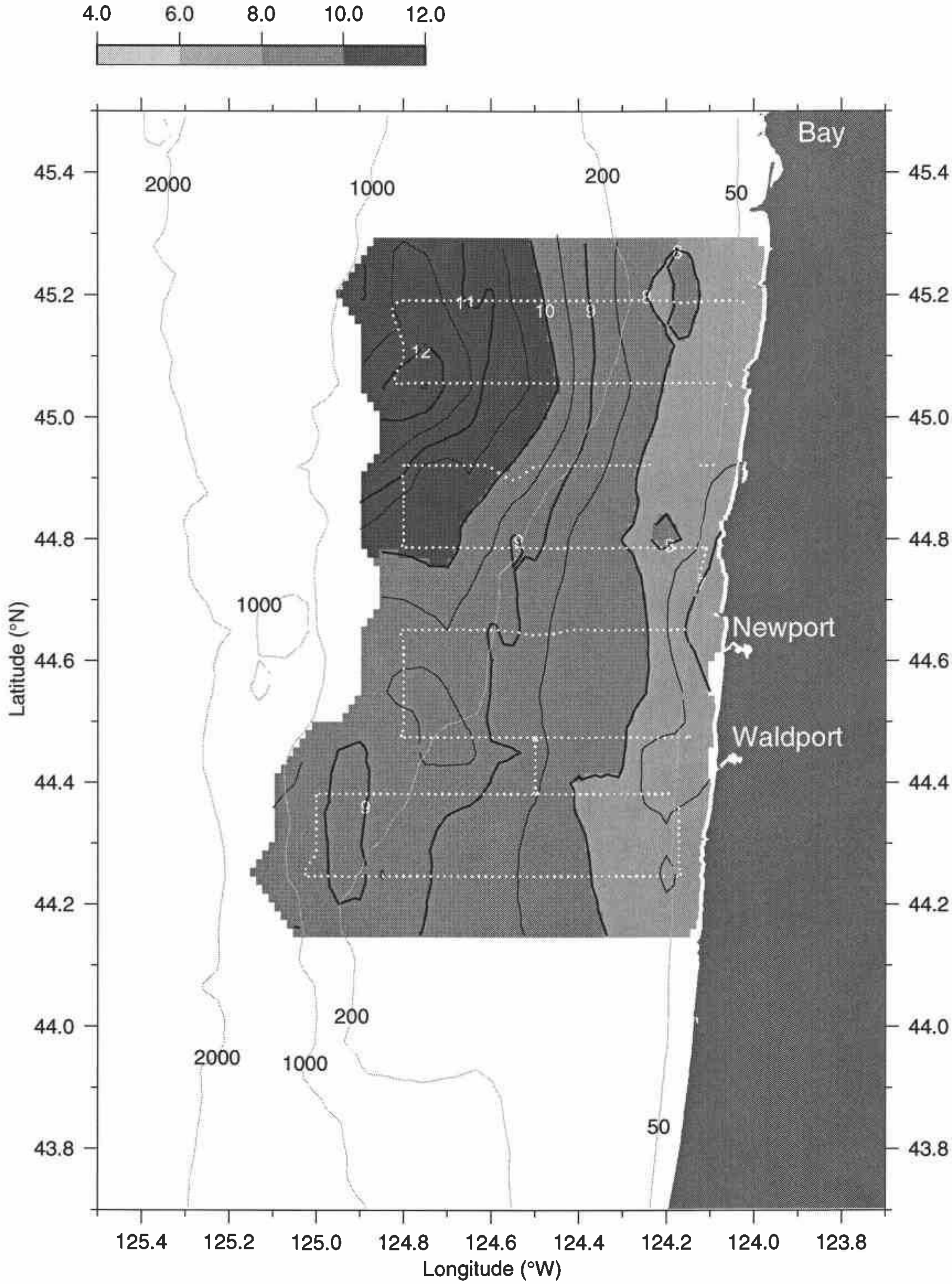


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 25 dbar

Temperature (°C)

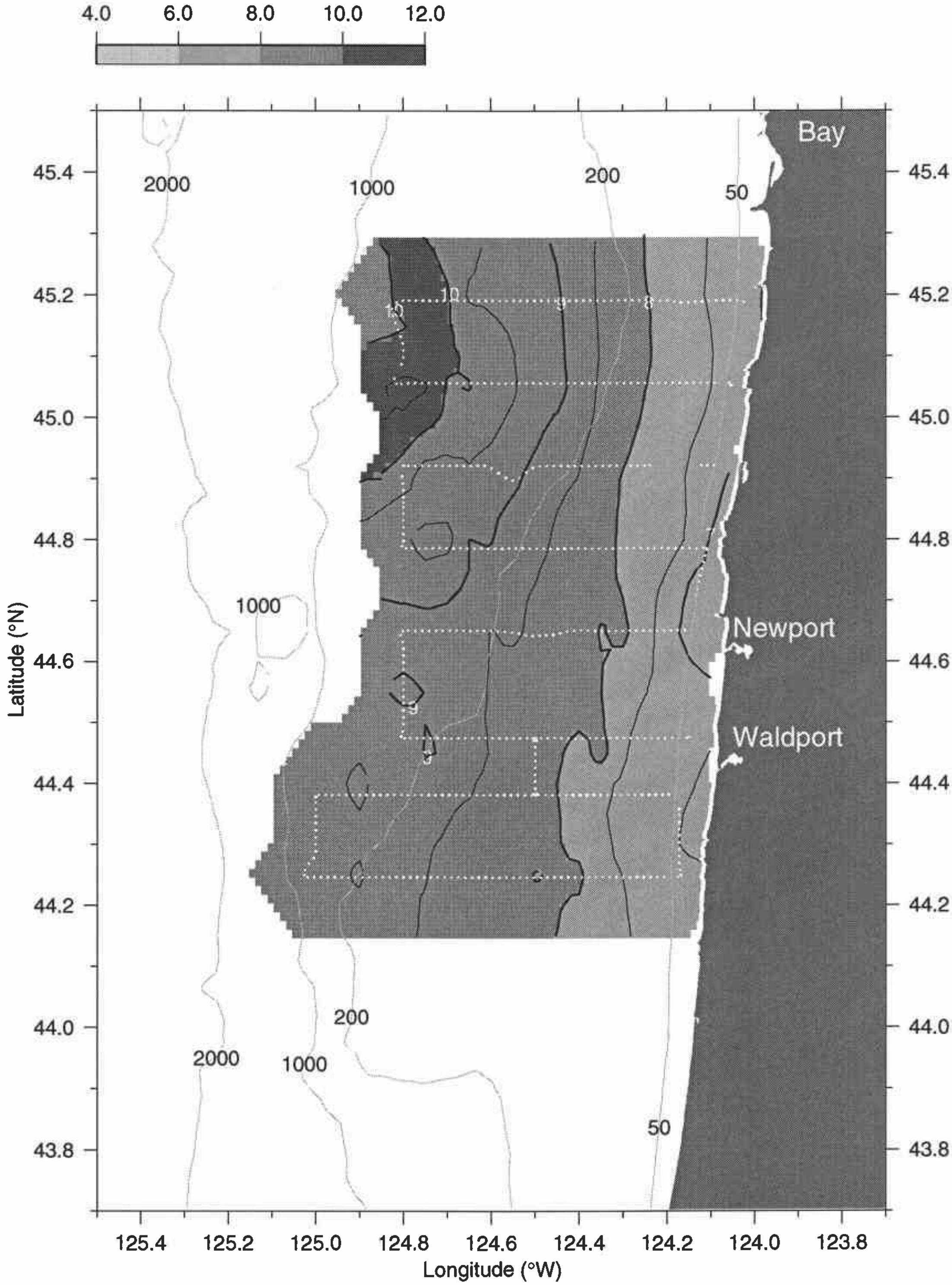


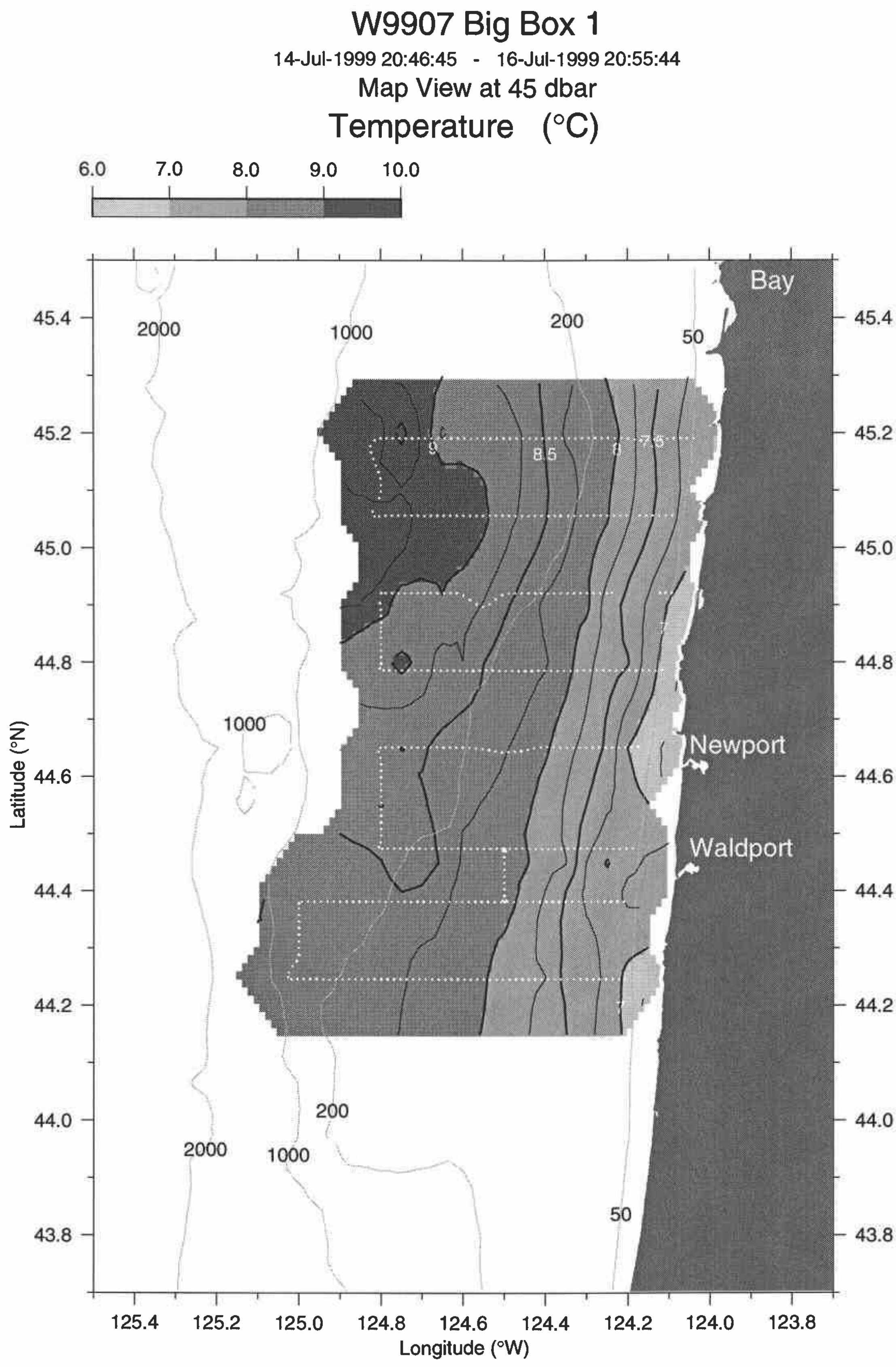
W9907 Big Box 1

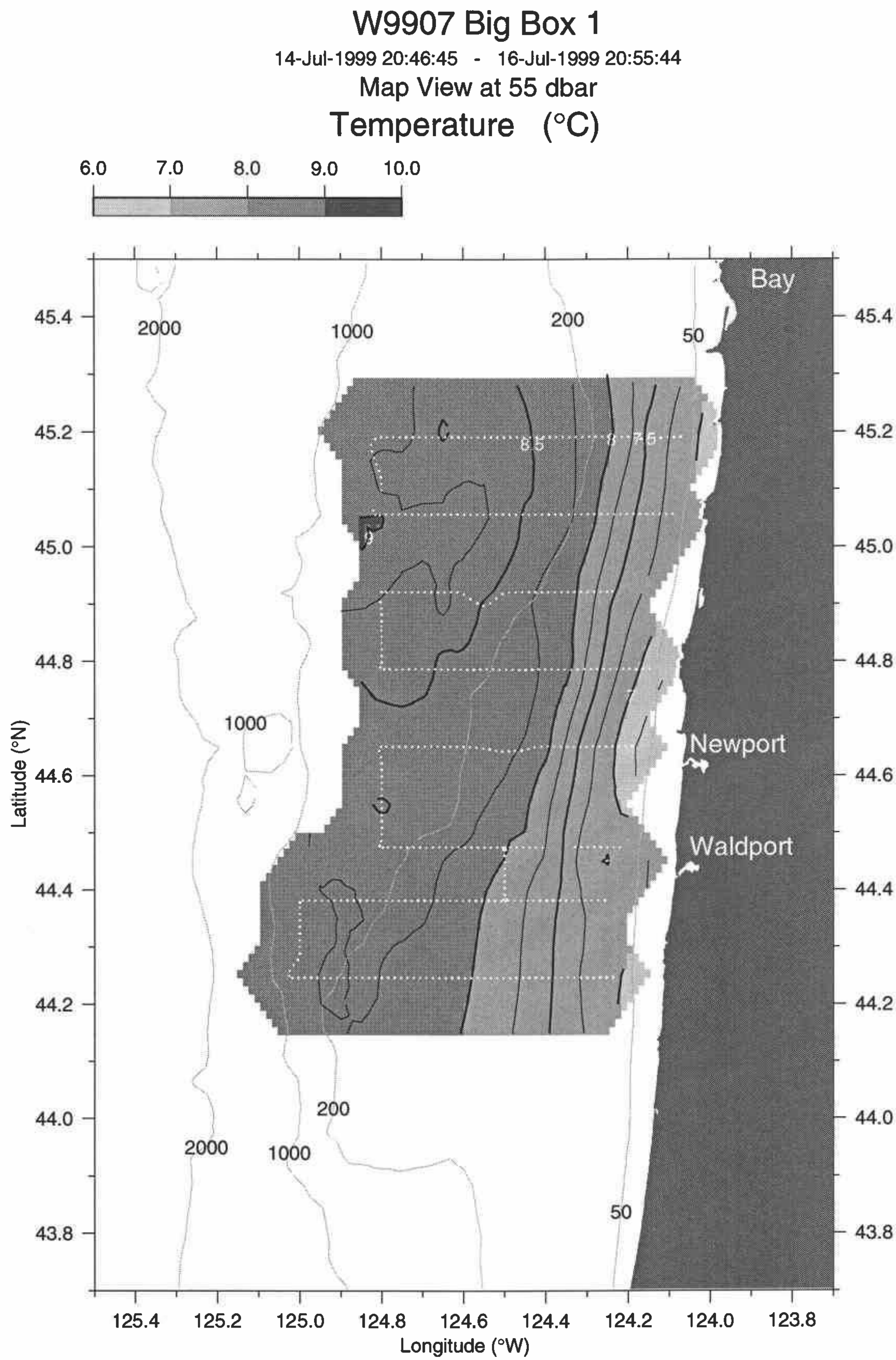
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

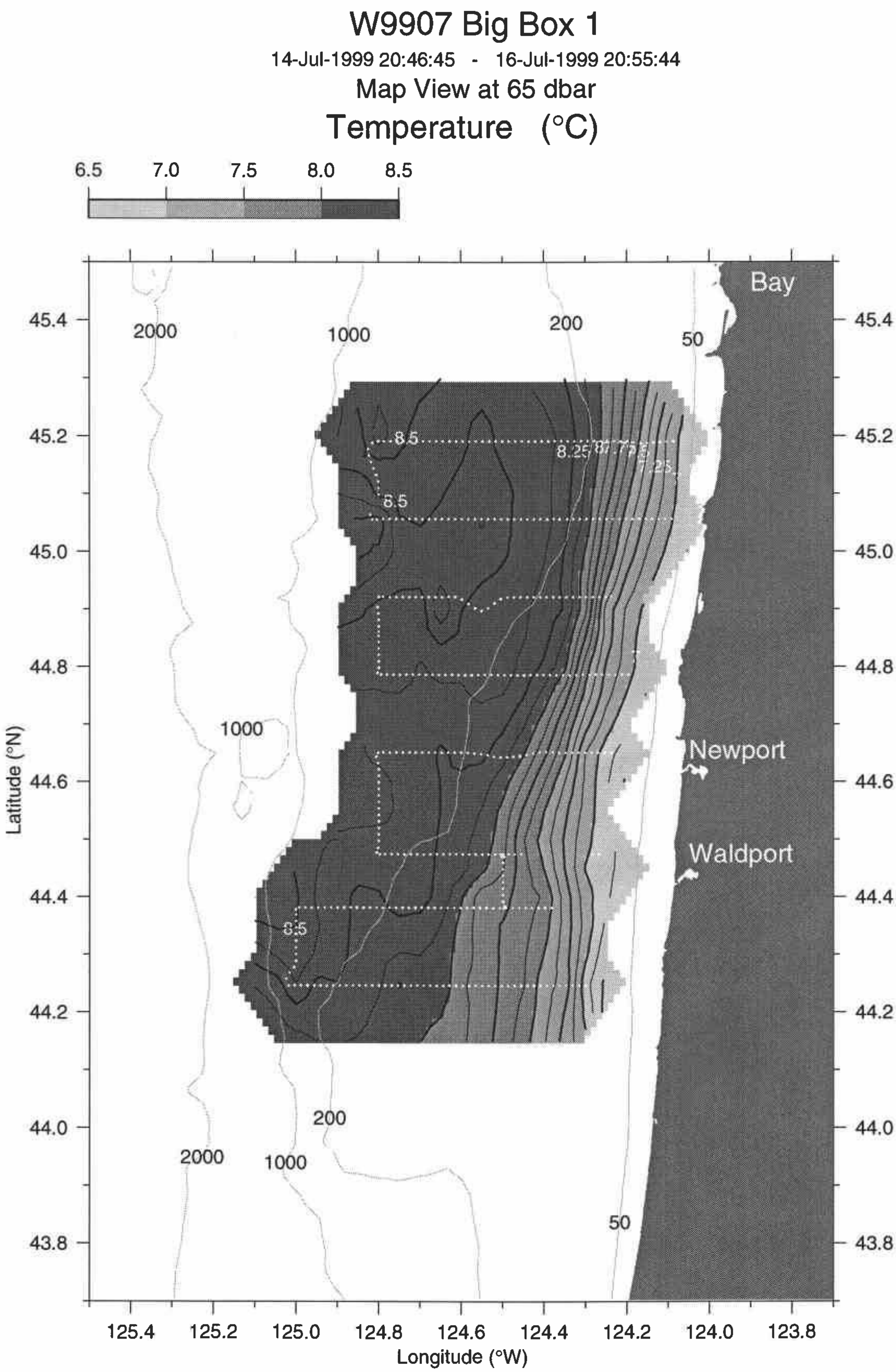
Map View at 35 dbar

Temperature (°C)




W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 45 dbar
Temperature (°C)
6.0
7.0
8.0
9.0
10.0
Bay
Newport
Waldport
2000
1000
200
50
9
8.5
8
7.5
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)


W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 55 dbar
Temperature (°C)
6.0
7.0
8.0
9.0
10.0
Bay
2000
1000
200
50
8.5
8
7.5
Newport
Waldport
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)



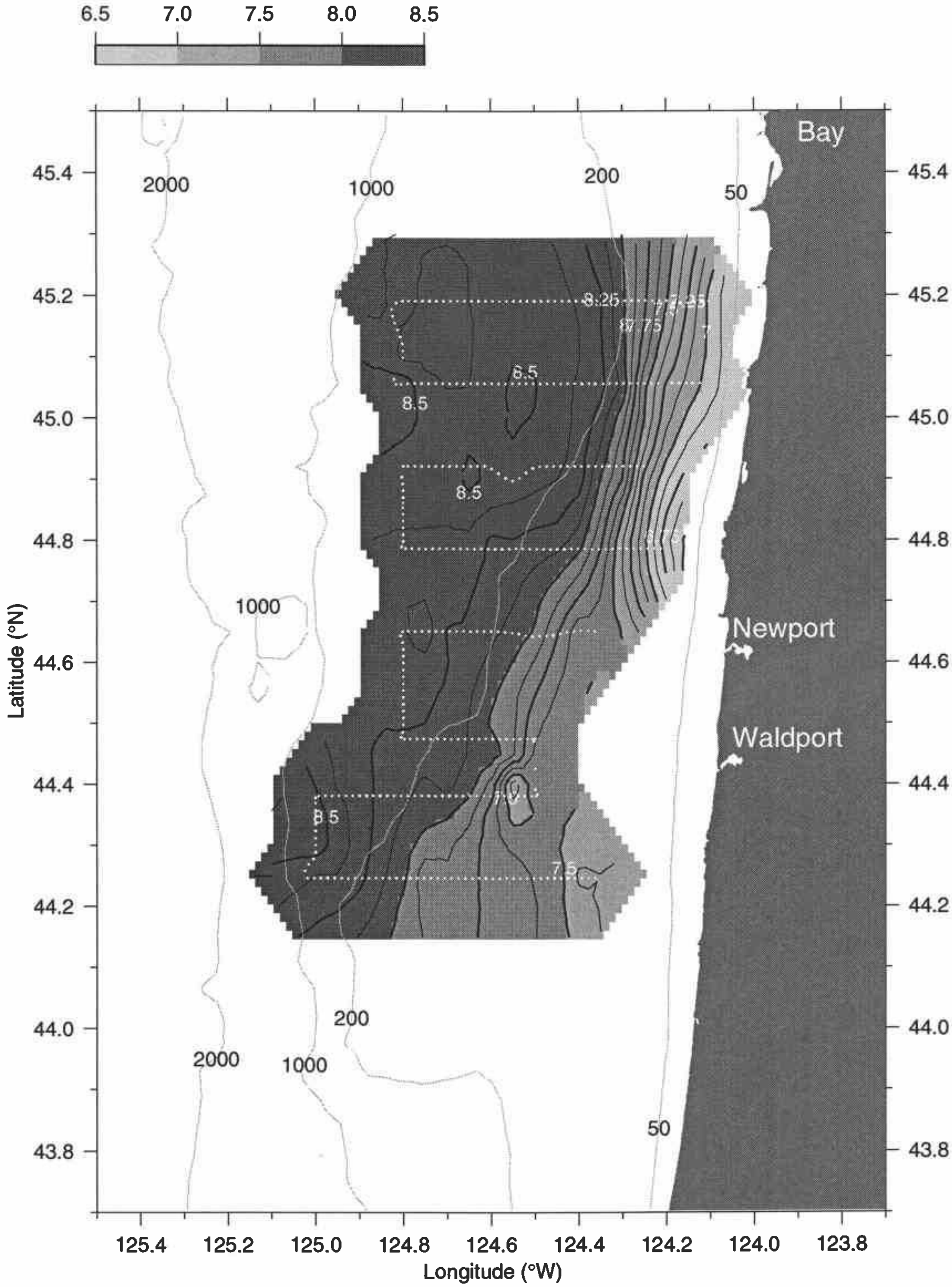
W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 65 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
Newport
Waldport
2000
1000
200
50
8.5
8.25
7.25
Latitude (°N)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Longitude (°W)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

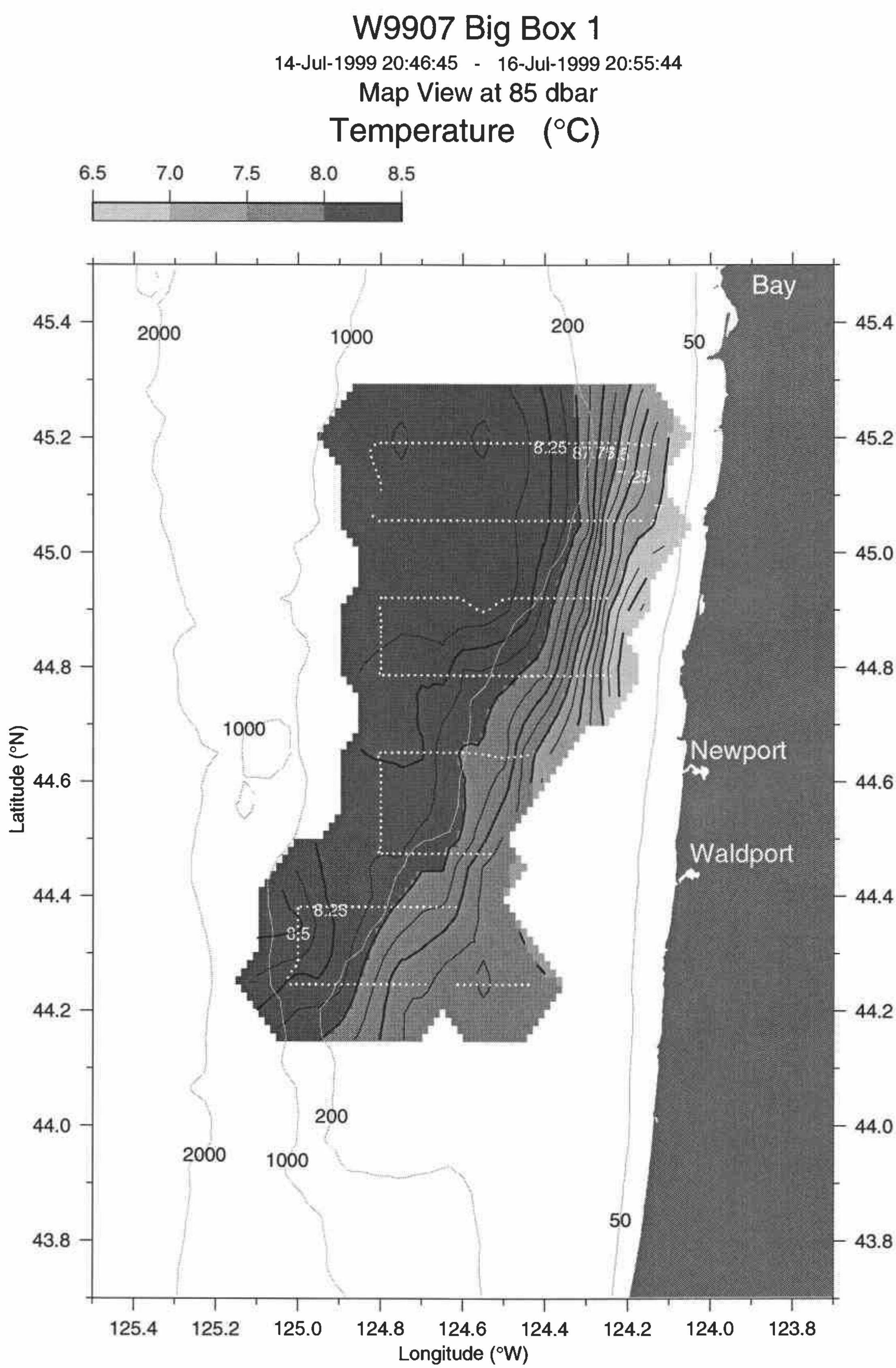
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 75 dbar

Temperature (°C)



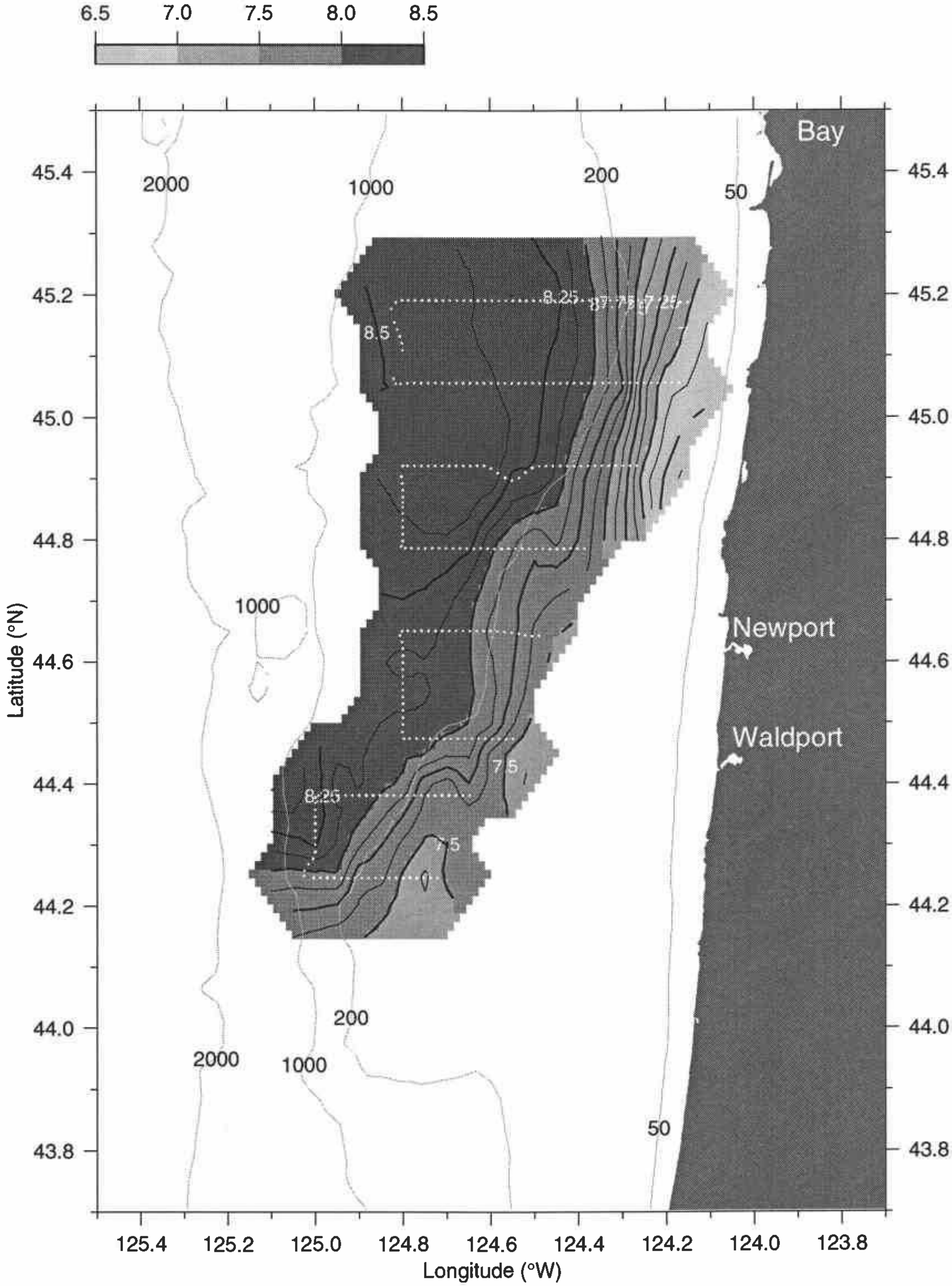

W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 85 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
Newport
Waldport
2000
1000
200
50
8.25
8.5
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

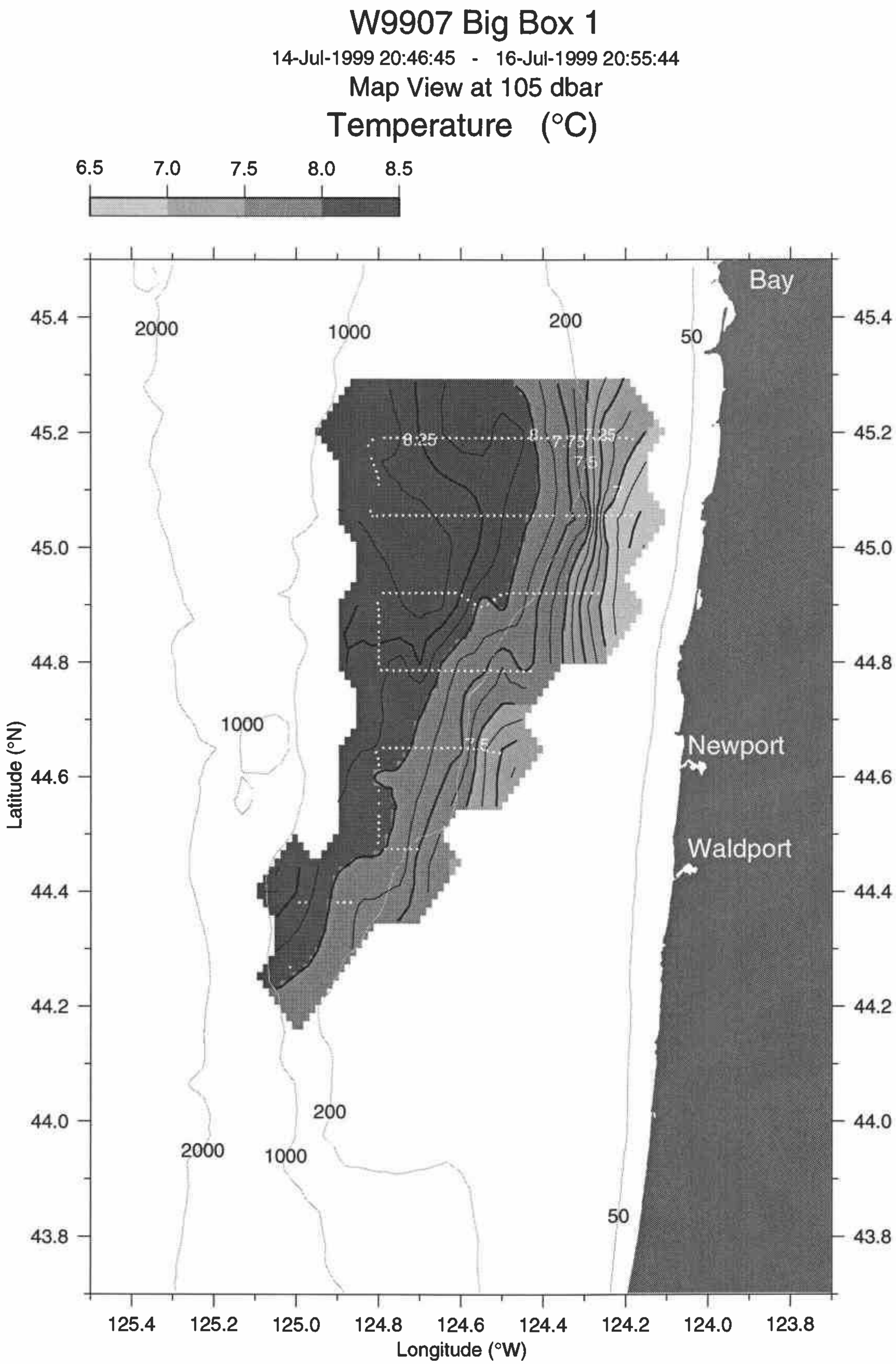
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 95 dbar

Temperature (°C)





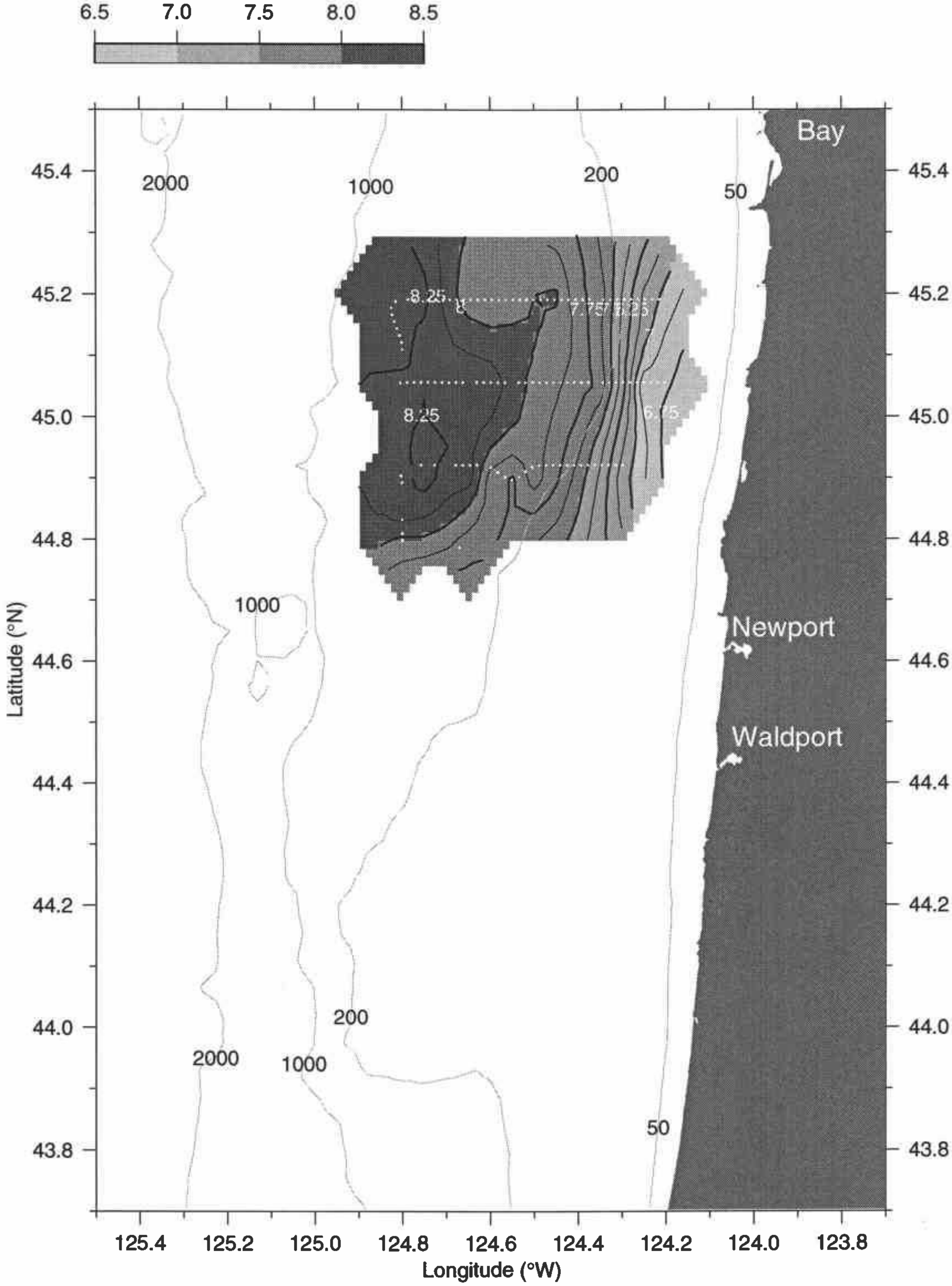
W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 105 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
2000
1000
200
50
8.25
8
7.75
7.25
7.5
7
Newport
Waldport
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

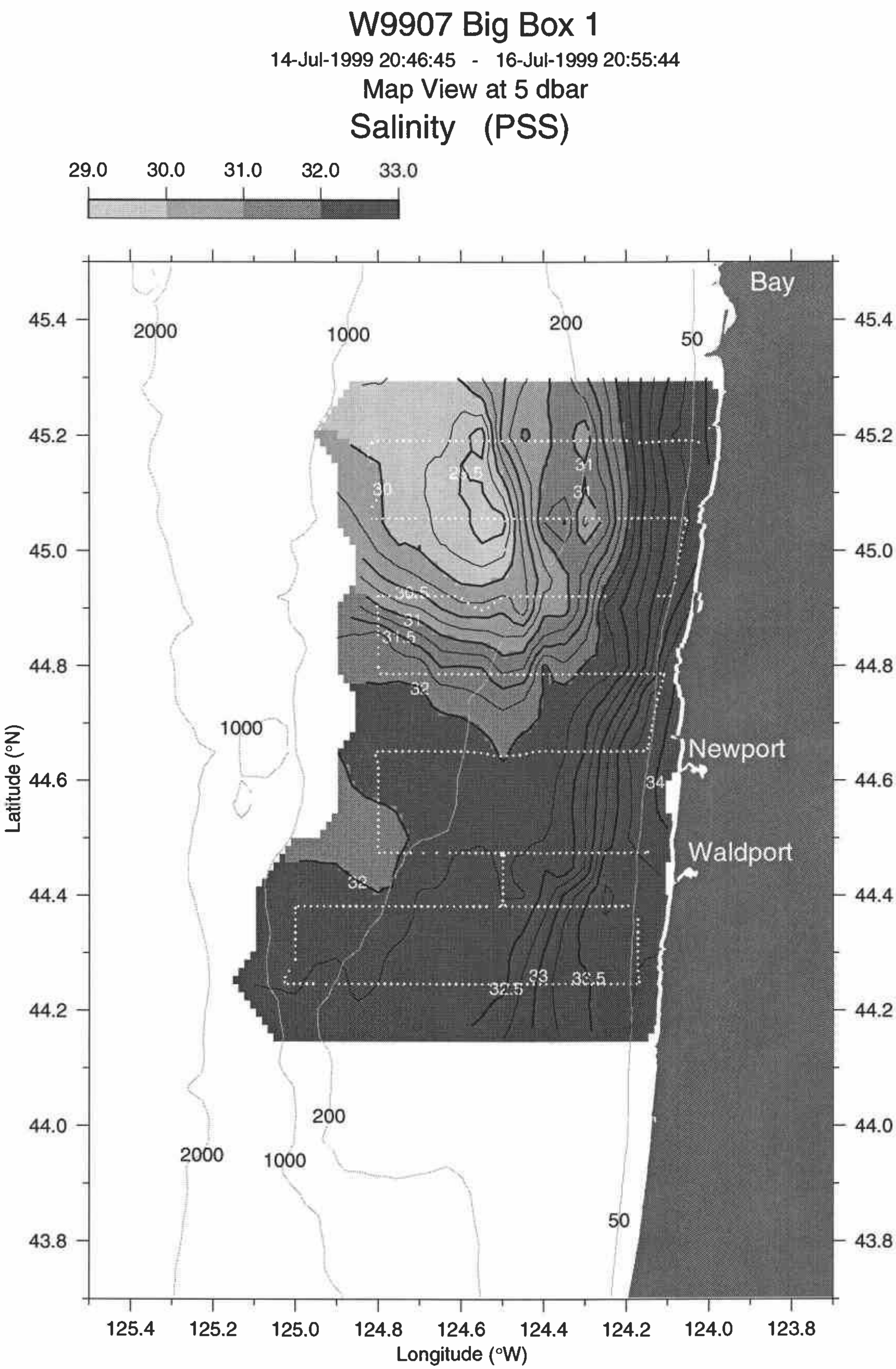
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 115 dbar

Temperature (°C)





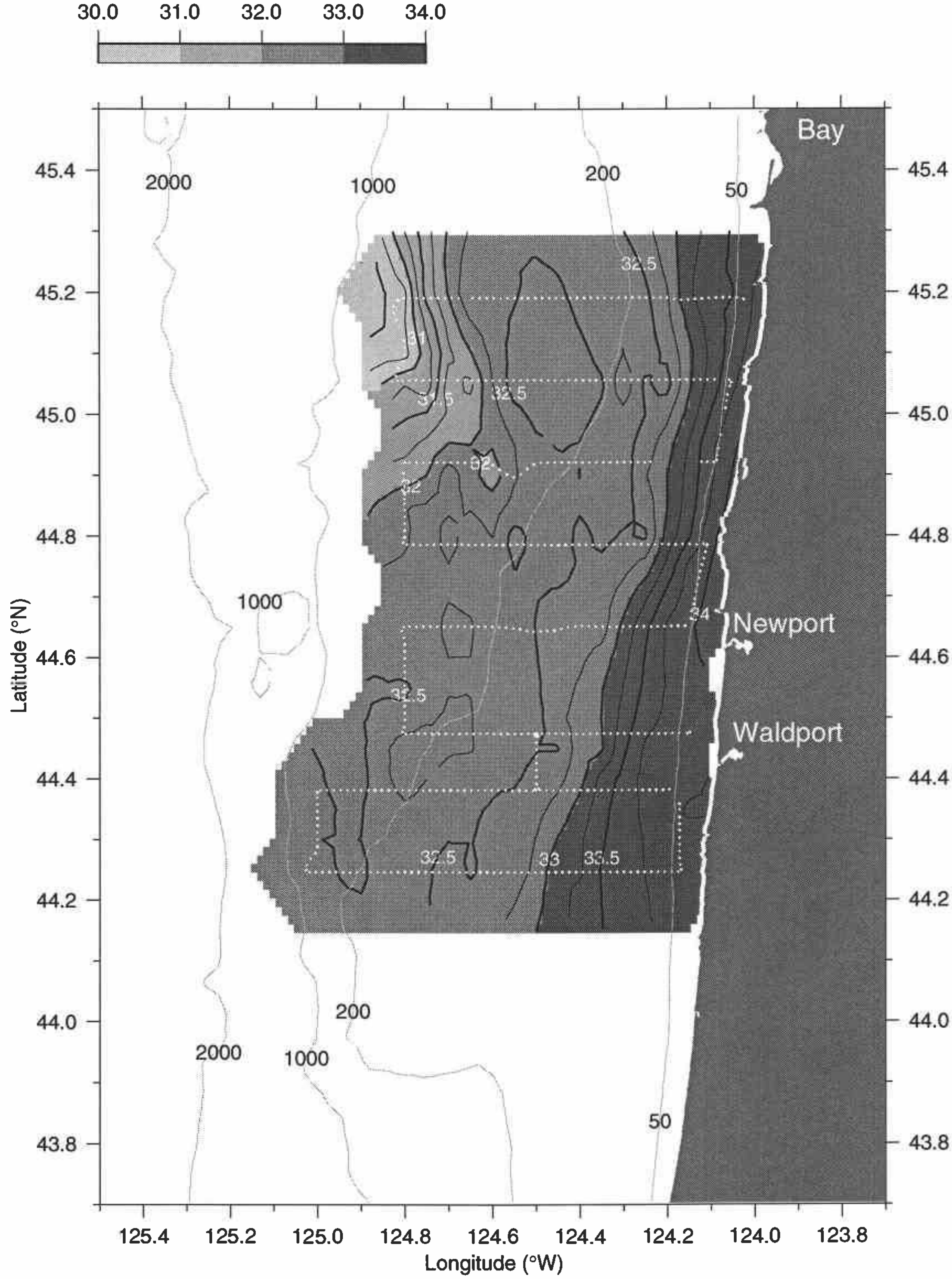
W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 5 dbar
Salinity (PSS)
29.0
30.0
31.0
32.0
33.0
Bay
Newport
Waldport
2000
1000
200
50
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 15 dbar

Salinity (PSS)

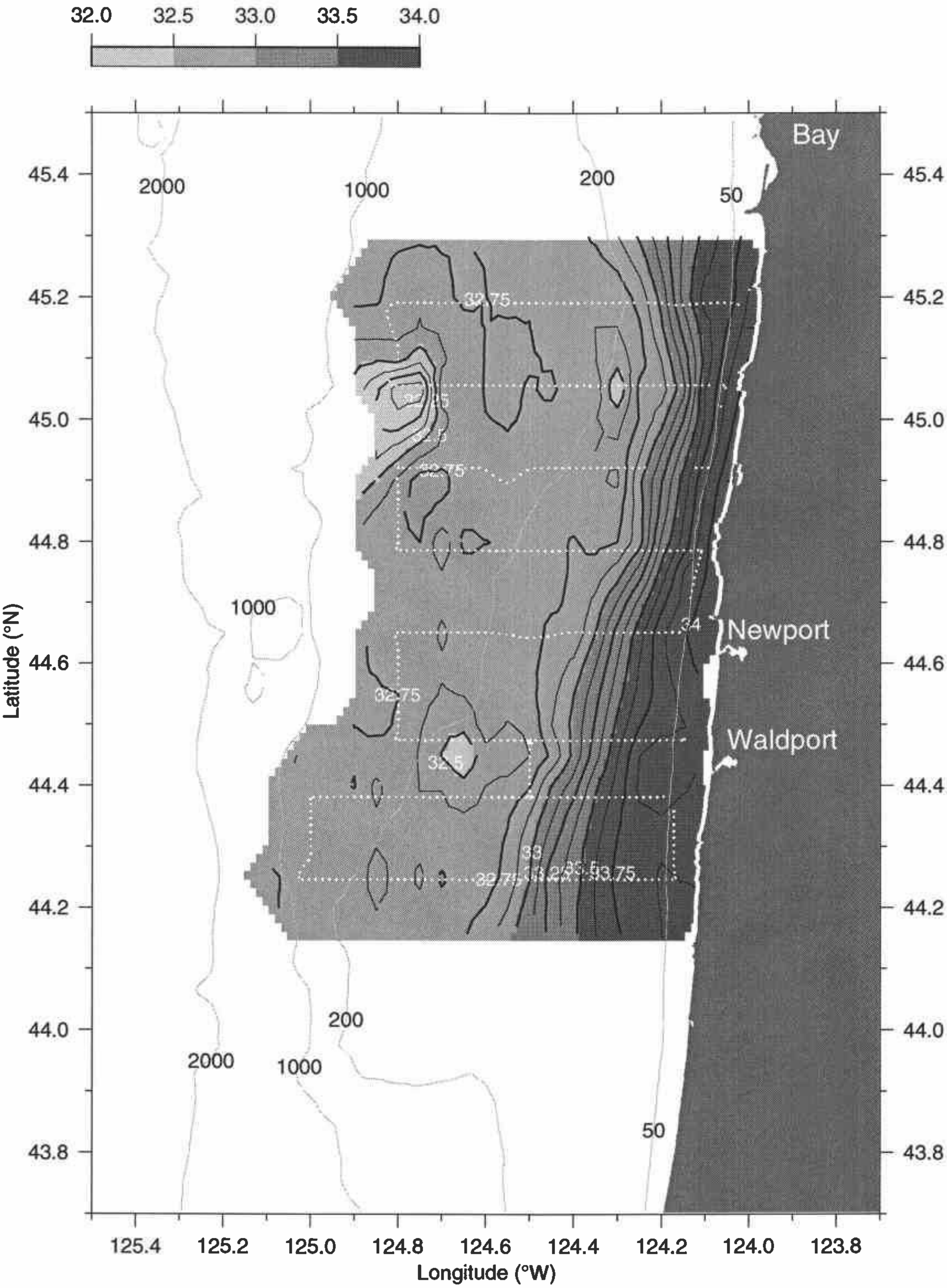


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 25 dbar

Salinity (PSS)

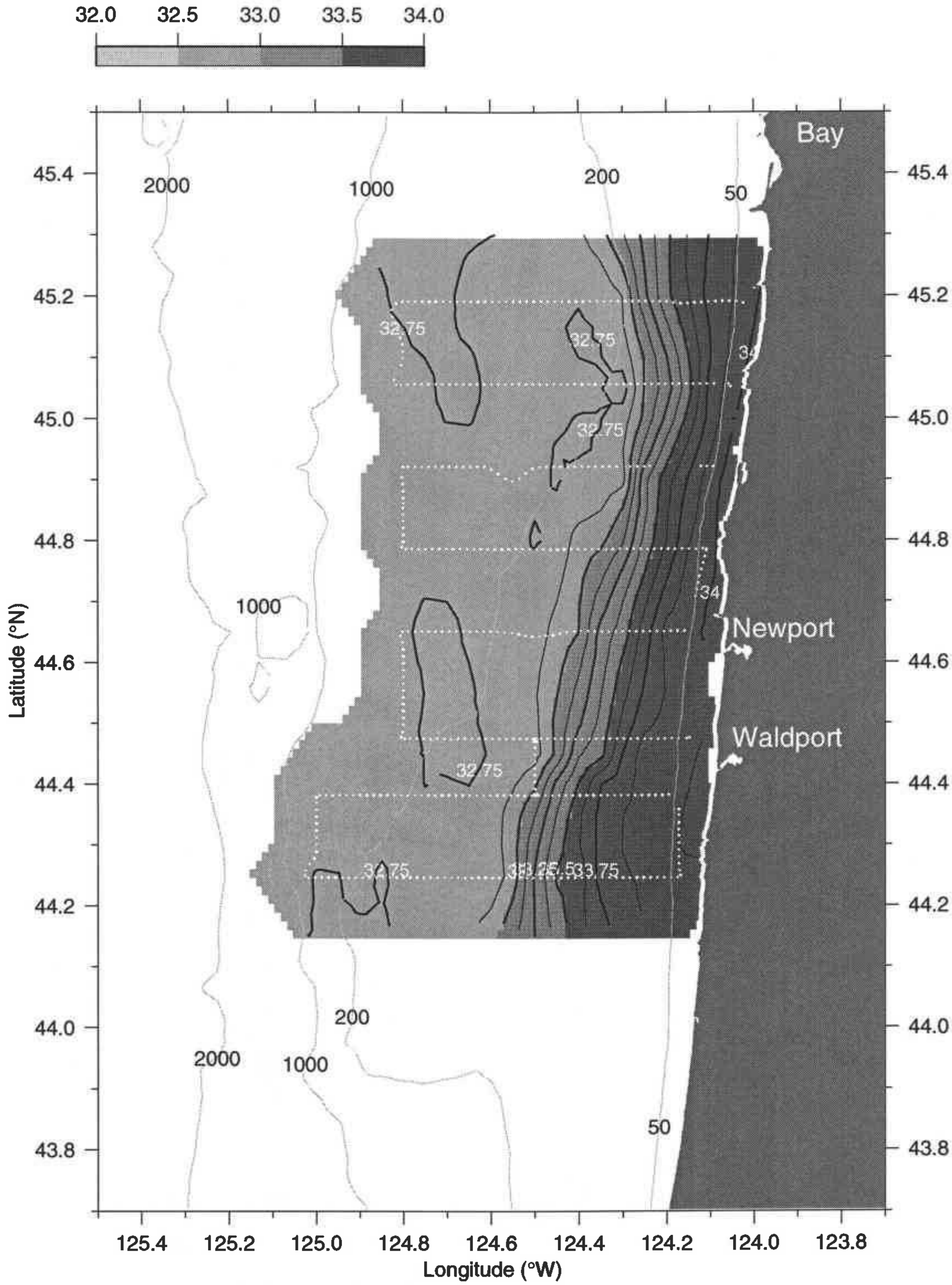


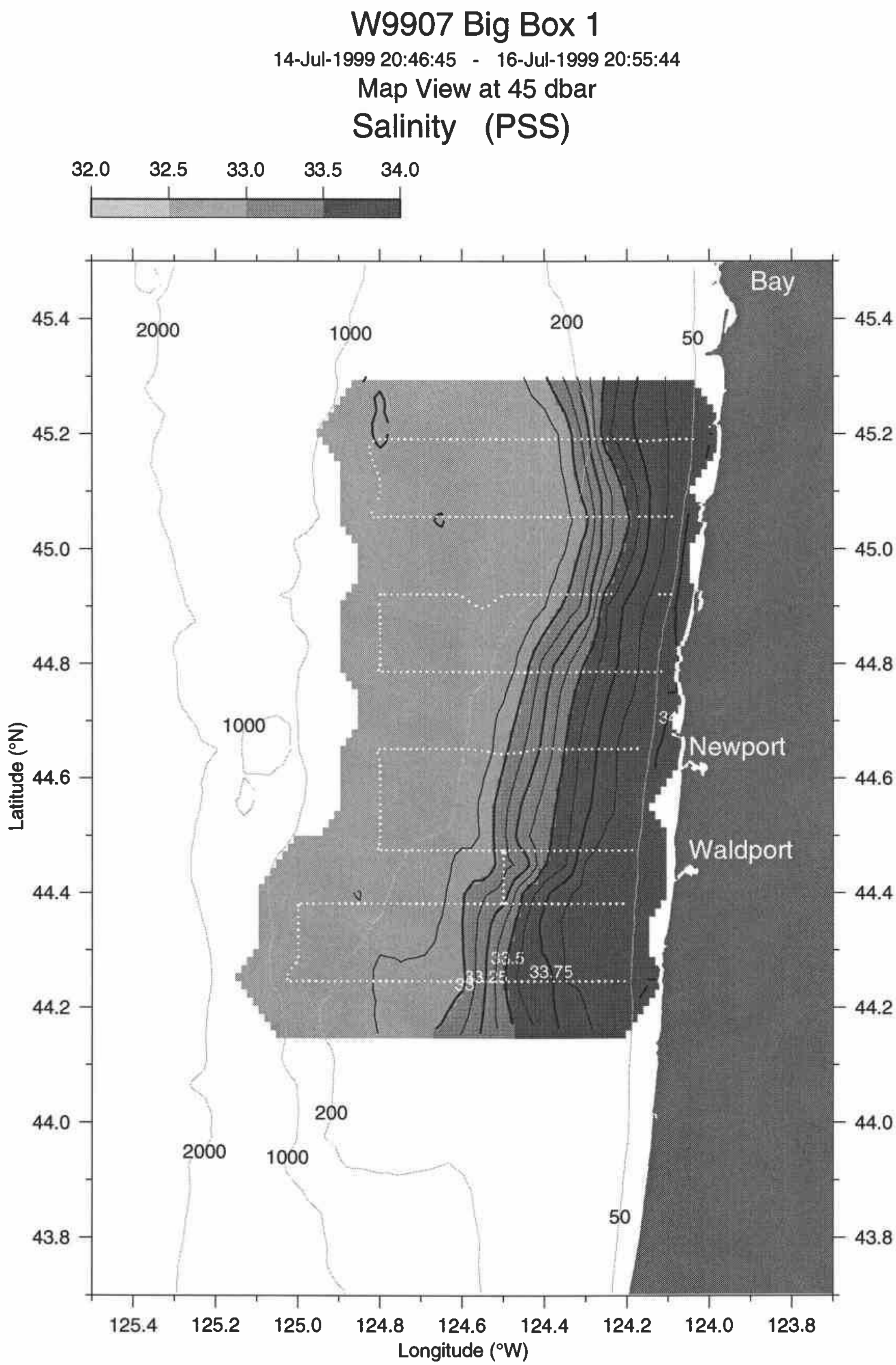
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 35 dbar

Salinity (PSS)



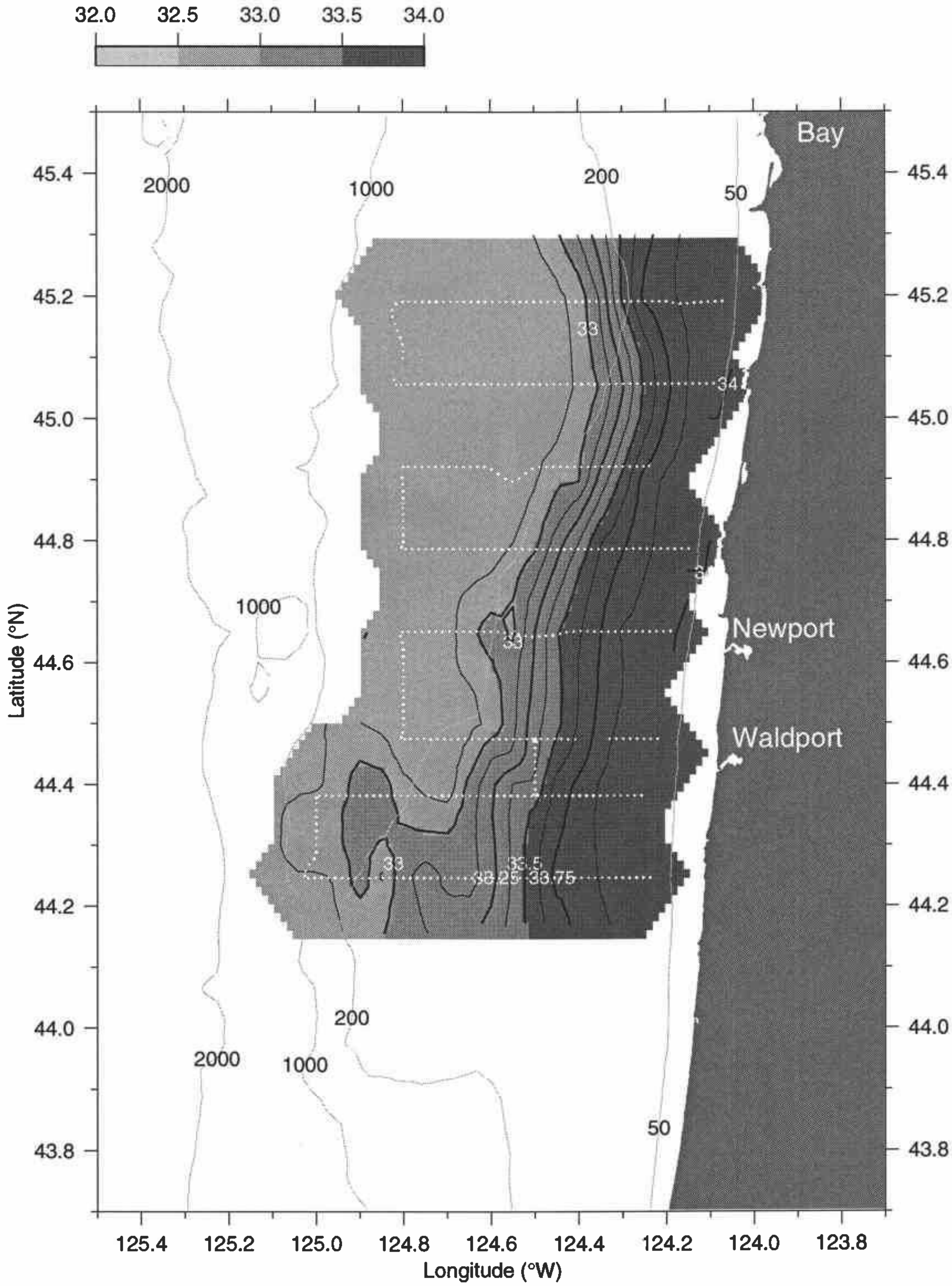

W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 45 dbar
Salinity (PSS)
32.0
32.5
33.0
33.5
34.0
Bay
Newport
Waldport
2000
1000
200
50
33.5
33.25
33.75
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Latitude (°N)
Longitude (°W)

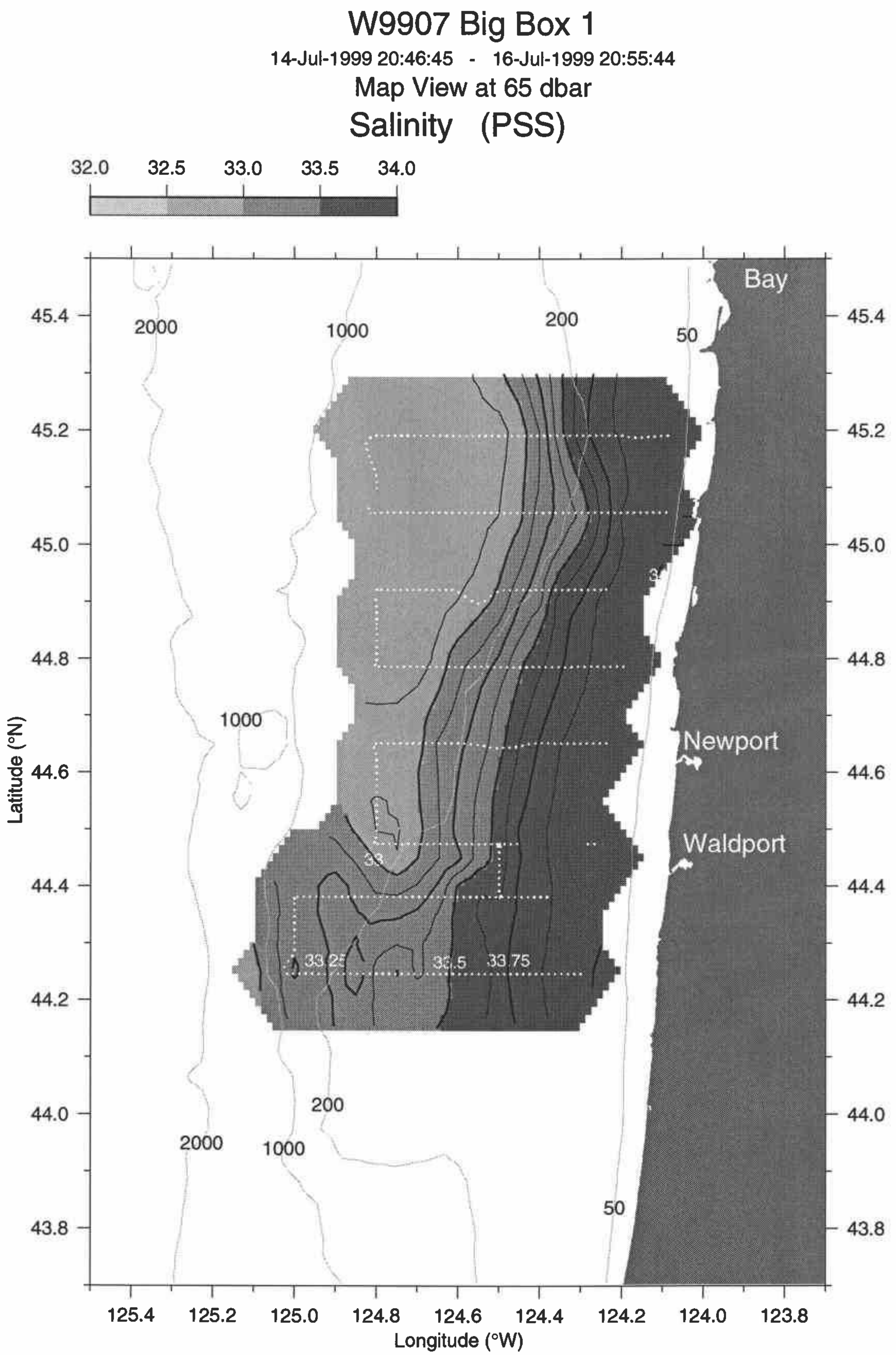
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 55 dbar

Salinity (PSS)



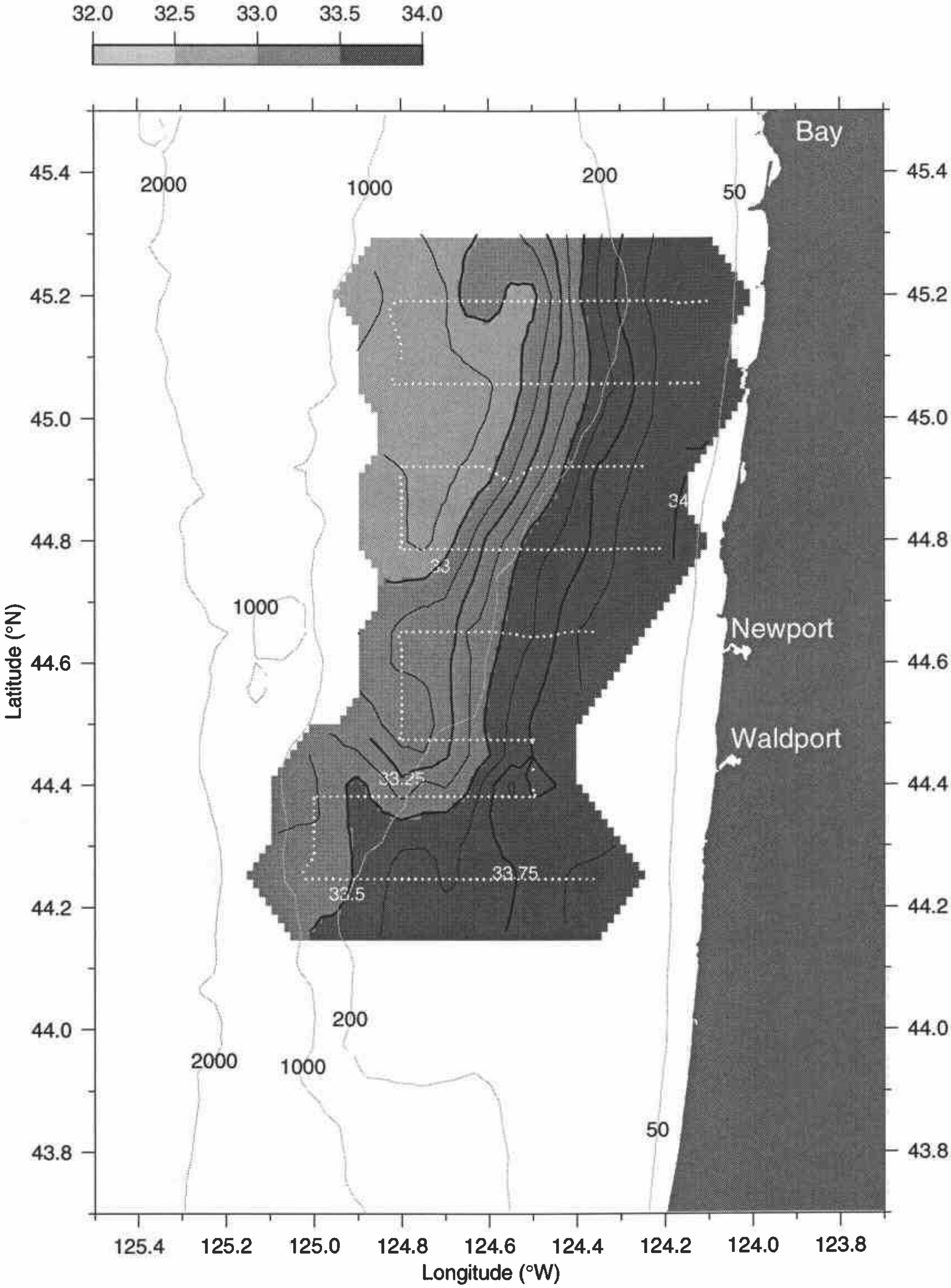

W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 65 dbar
Salinity (PSS)
32.0
32.5
33.0
33.5
34.0
Bay
Newport
Waldport
2000
1000
200
50
33
33.25
33.5
33.75
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

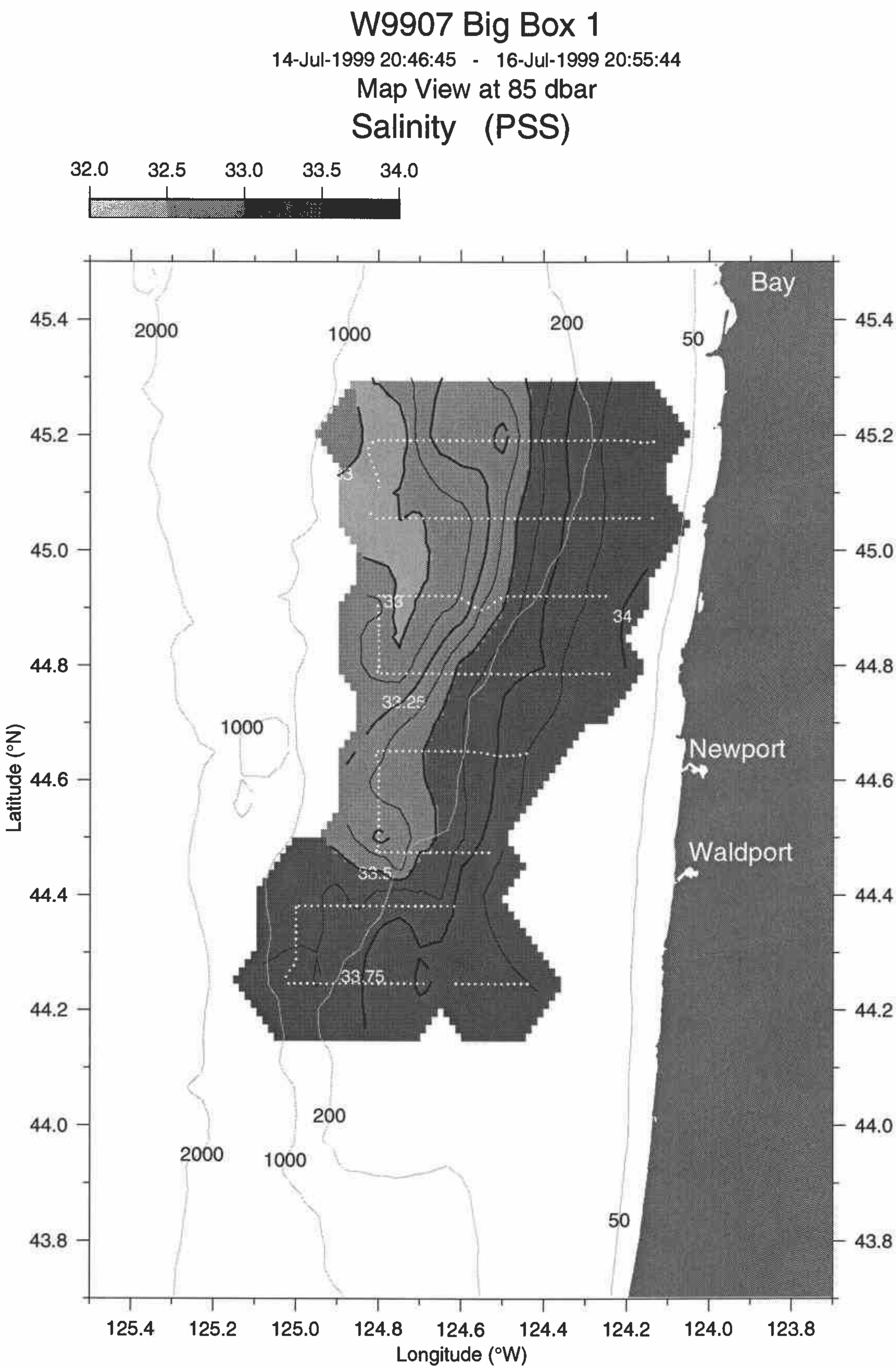
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 75 dbar

Salinity (PSS)



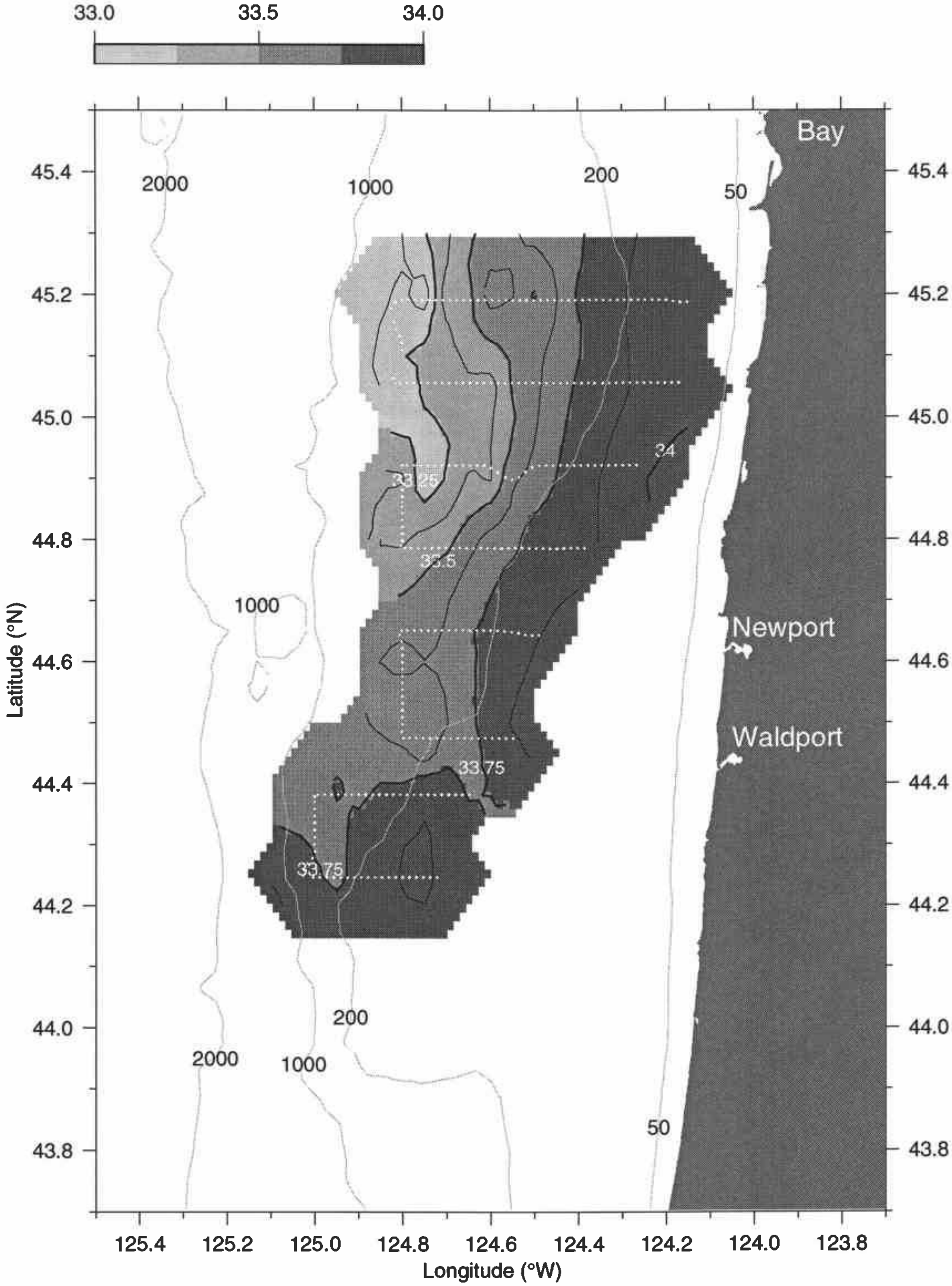

W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 85 dbar
Salinity (PSS)
32.0
32.5
33.0
33.5
34.0
Bay
2000
1000
200
50
33
34
33.25
33.5
33.75
1000
Newport
Waldport
200
2000
1000
50
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 95 dbar

Salinity (PSS)

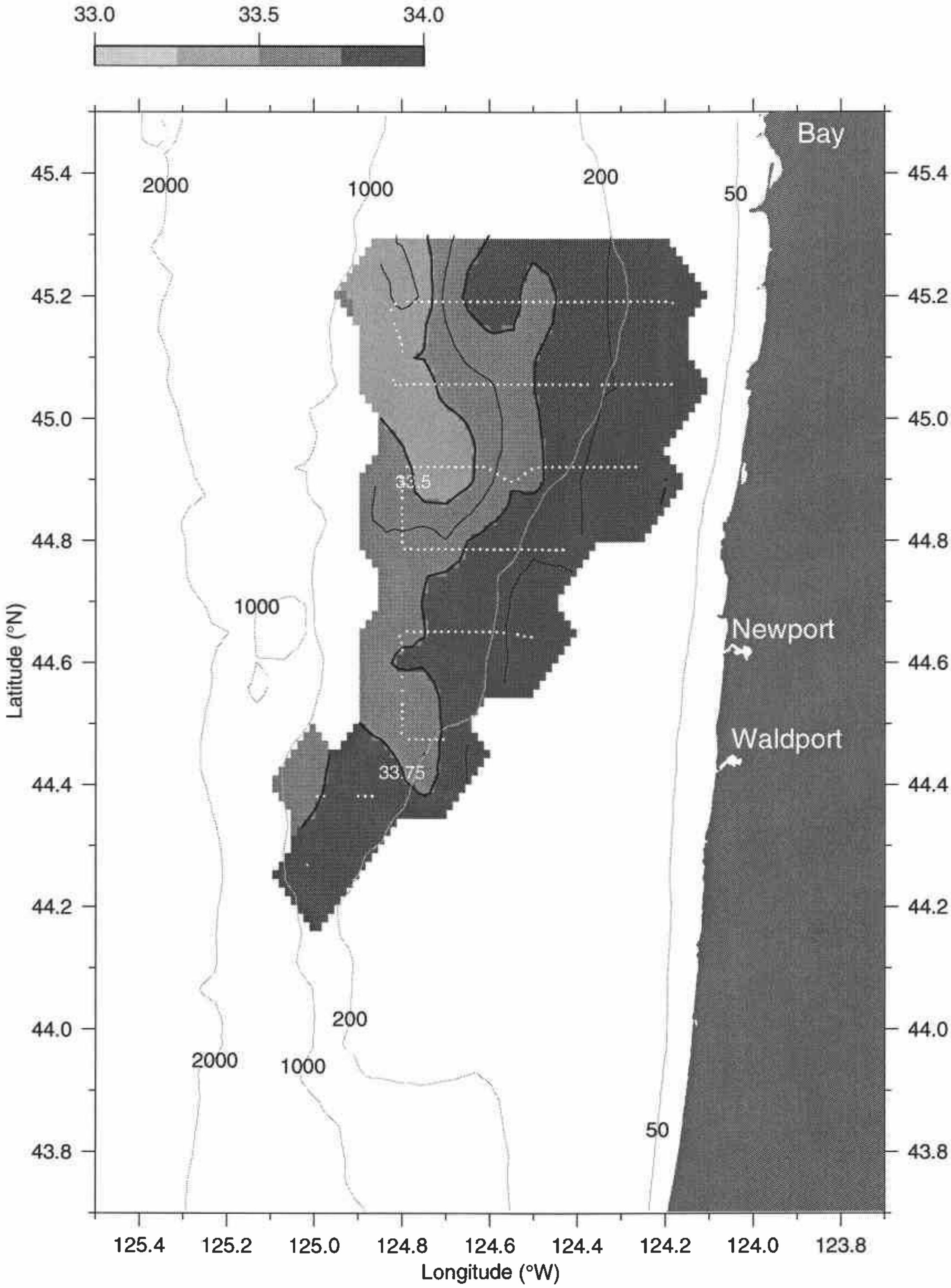


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 105 dbar

Salinity (PSS)

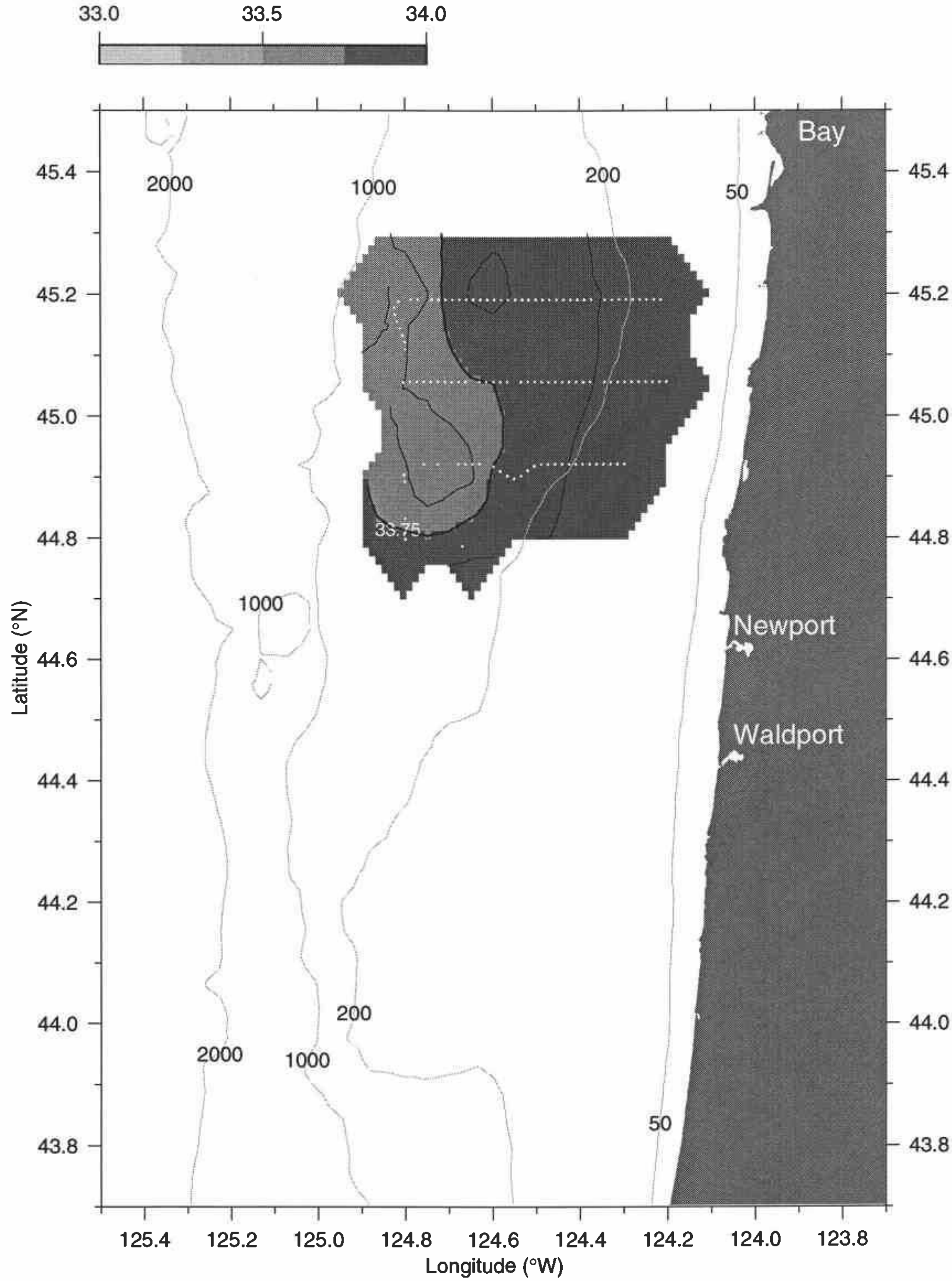


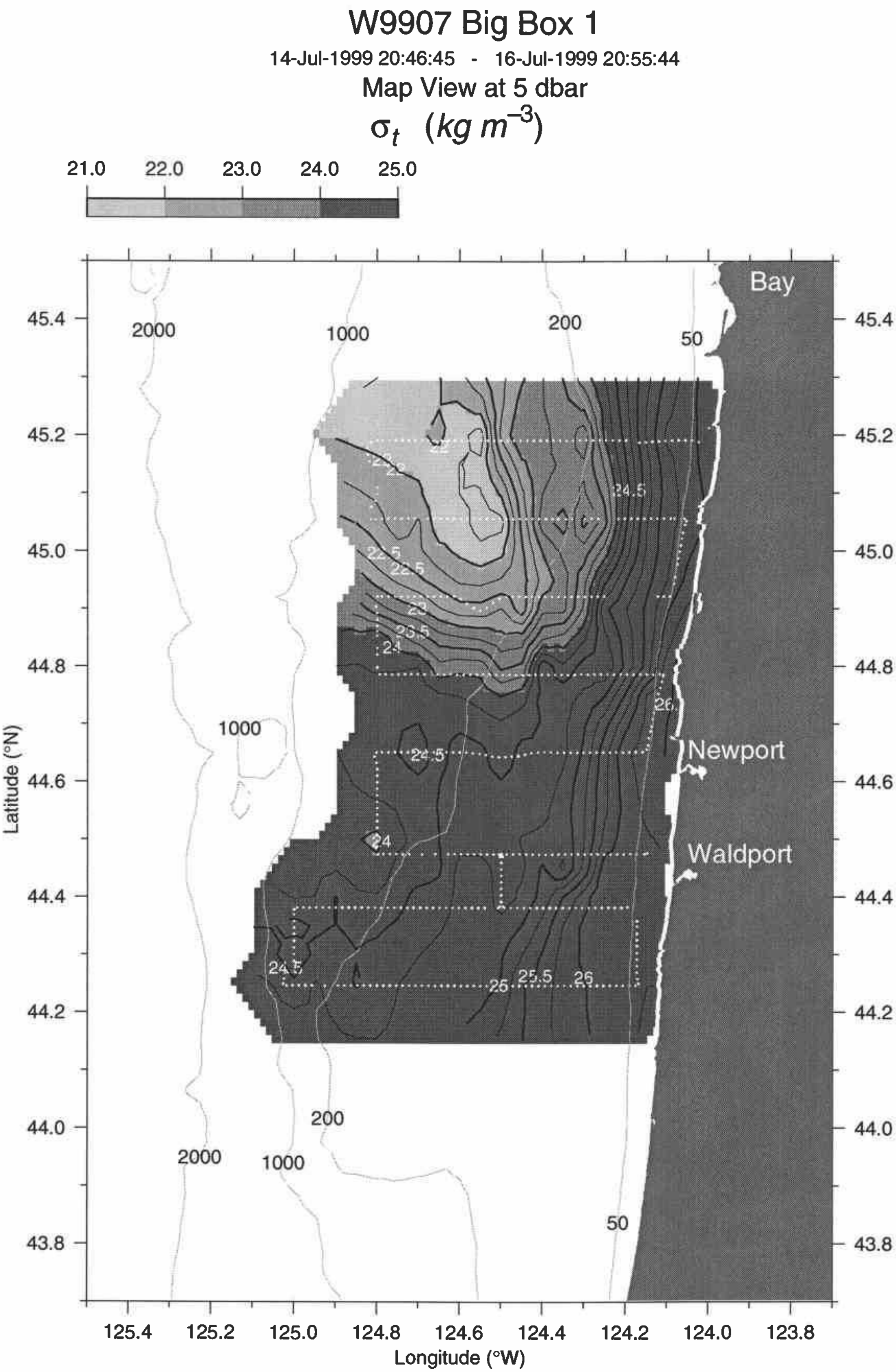
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

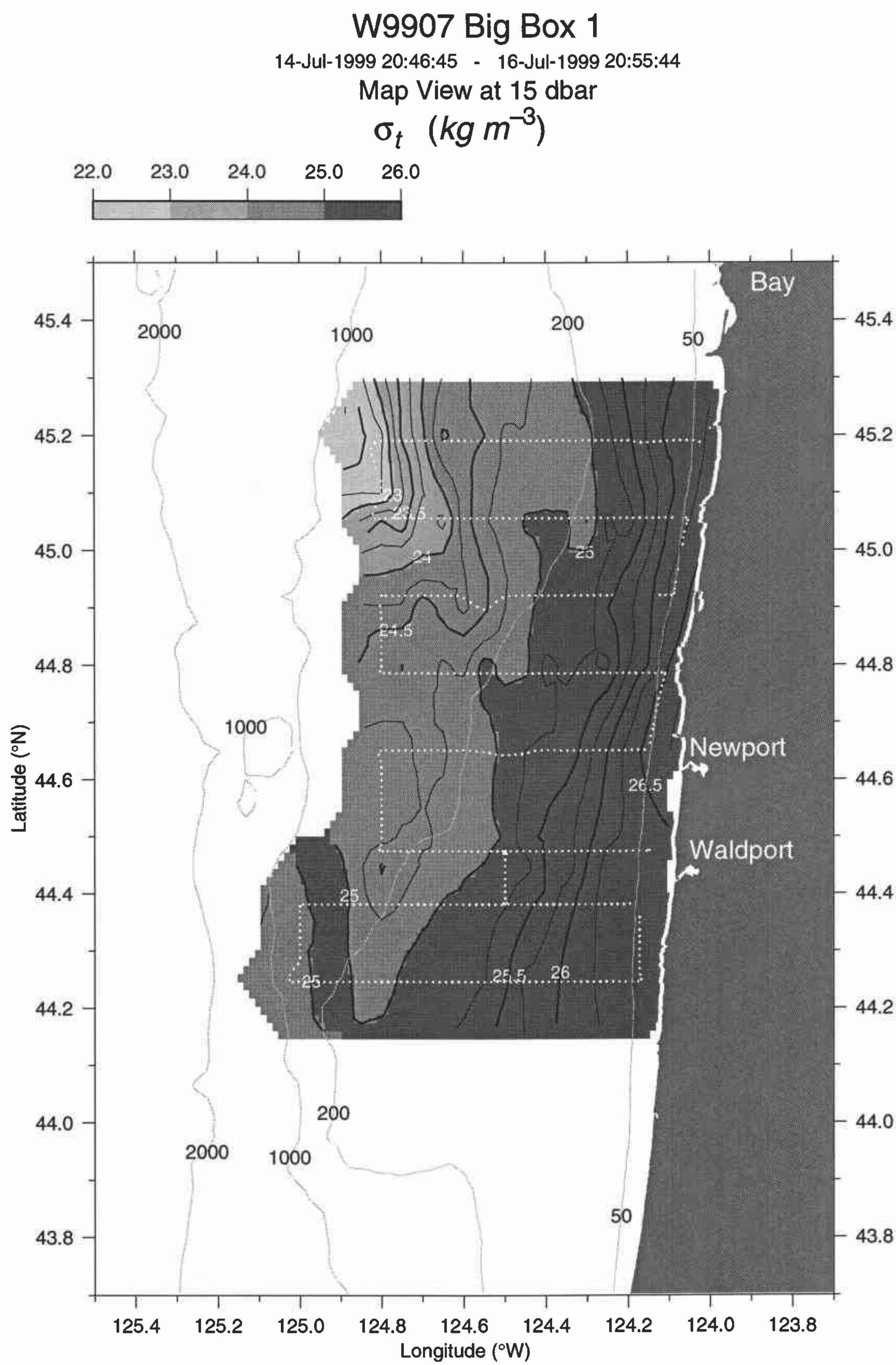
Map View at 115 dbar

Salinity (PSS)





W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 5 dbar
σ_t $(kg\ m^{-3})$
21.0
22.0
23.0
24.0
25.0
Bay
2000
1000
200
50
Newport
Waldport
1000
200
2000
1000
50
24.5
22.5
22.5
23
23.5
24
26
24.5
24
24.5
25
25.5
26
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)



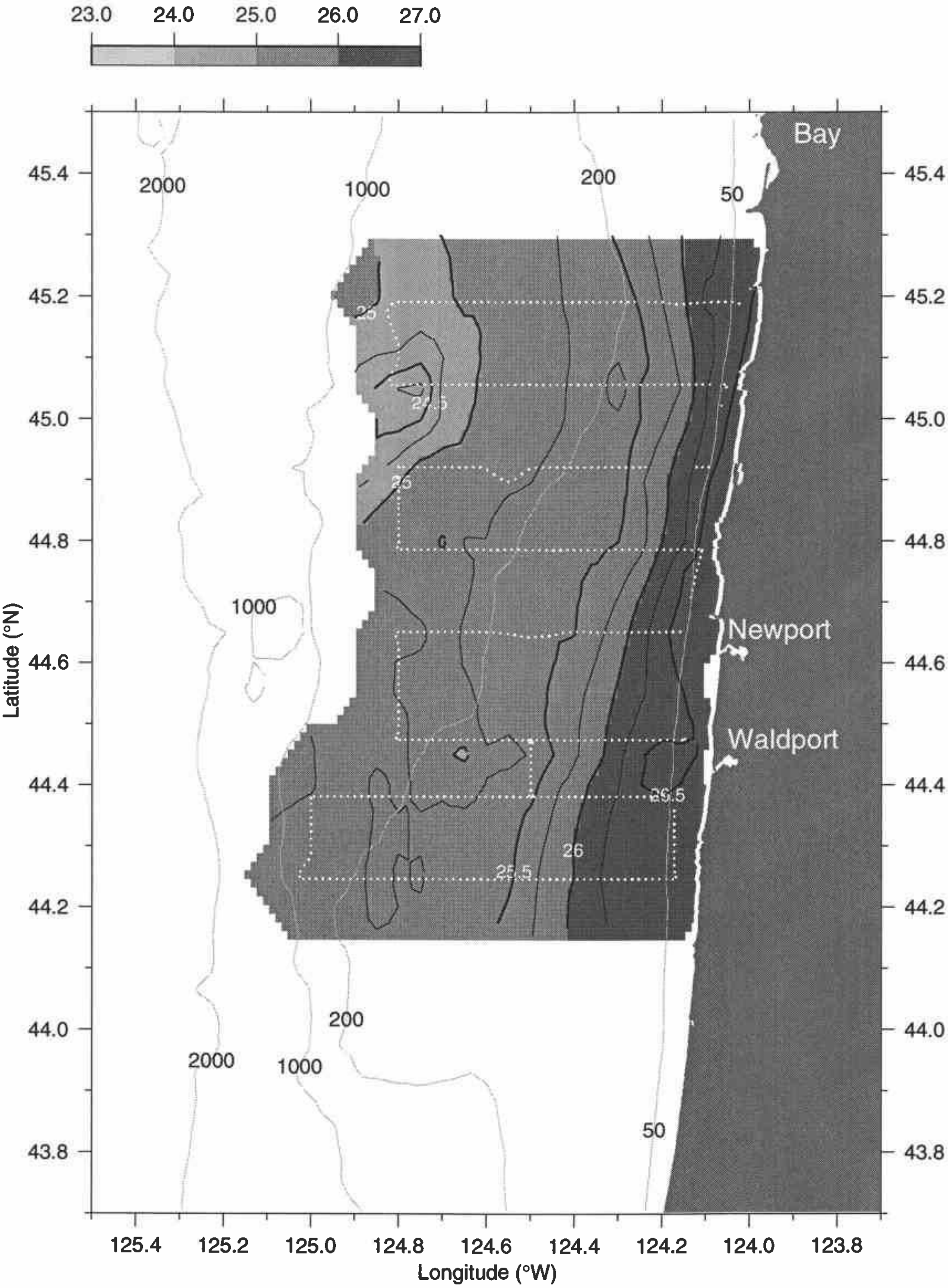
W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 15 dbar
σ_t $(kg\ m^{-3})$
22.0 23.0 24.0 25.0 26.0
Bay
Newport
Waldport
2000
1000
200
50
23
23.5
24
24.5
25
25.5
26
26.5
Latitude (°N)
45.4 45.2 45.0 44.8 44.6 44.4 44.2 44.0 43.8
Longitude (°W)
125.4 125.2 125.0 124.8 124.6 124.4 124.2 124.0 123.8

W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 25 dbar

σ_t $(kg\ m^{-3})$

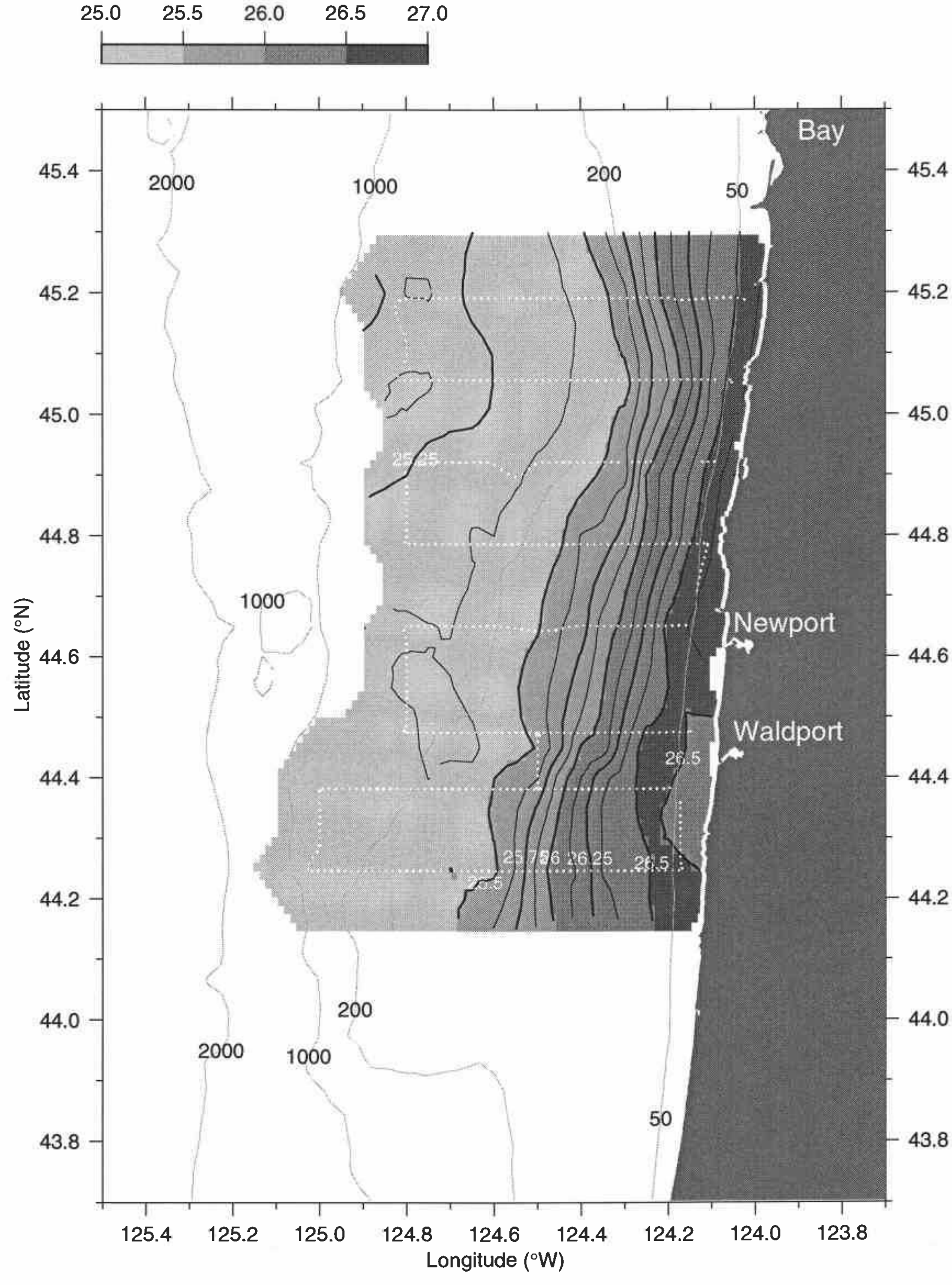


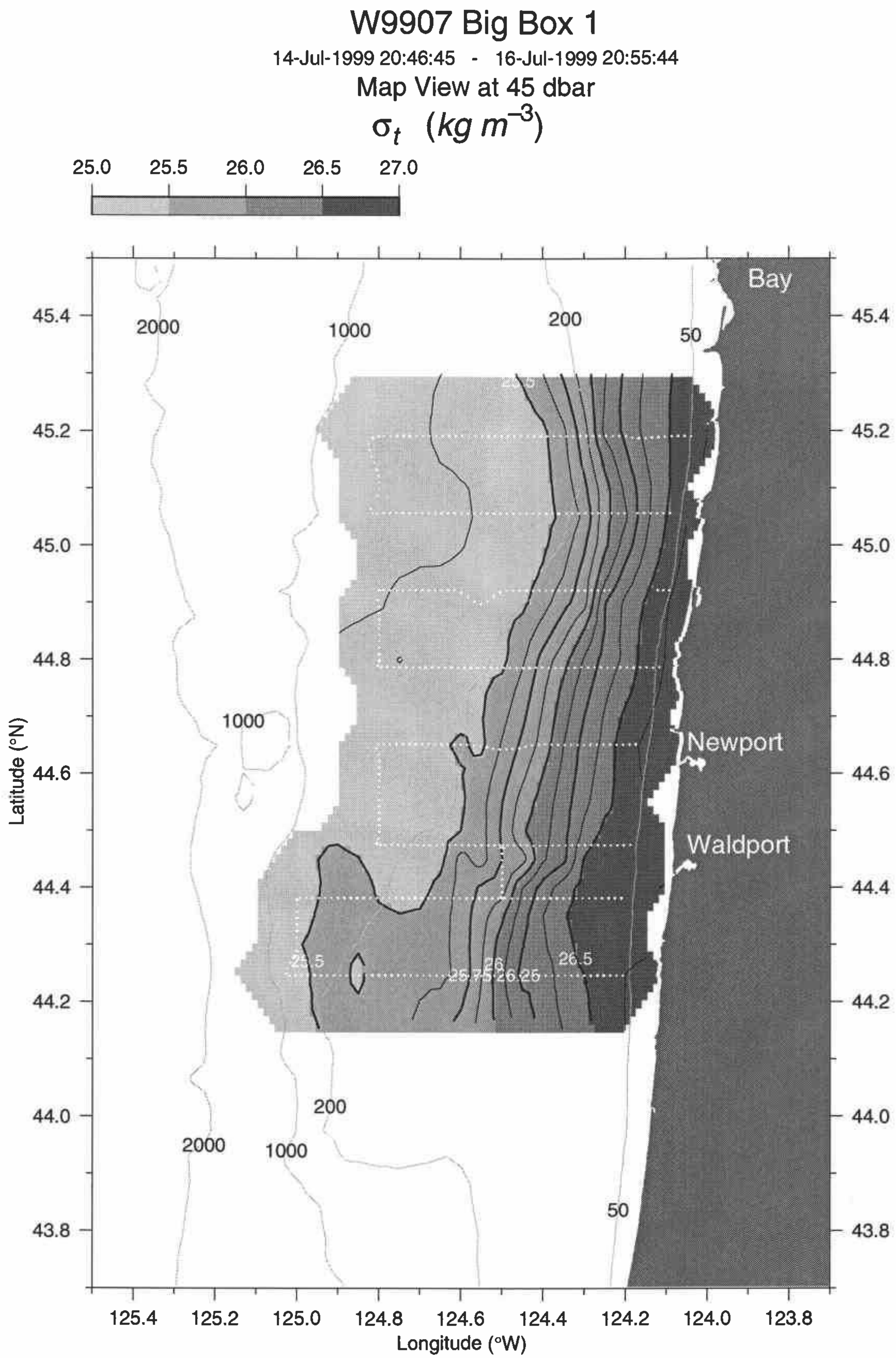
W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

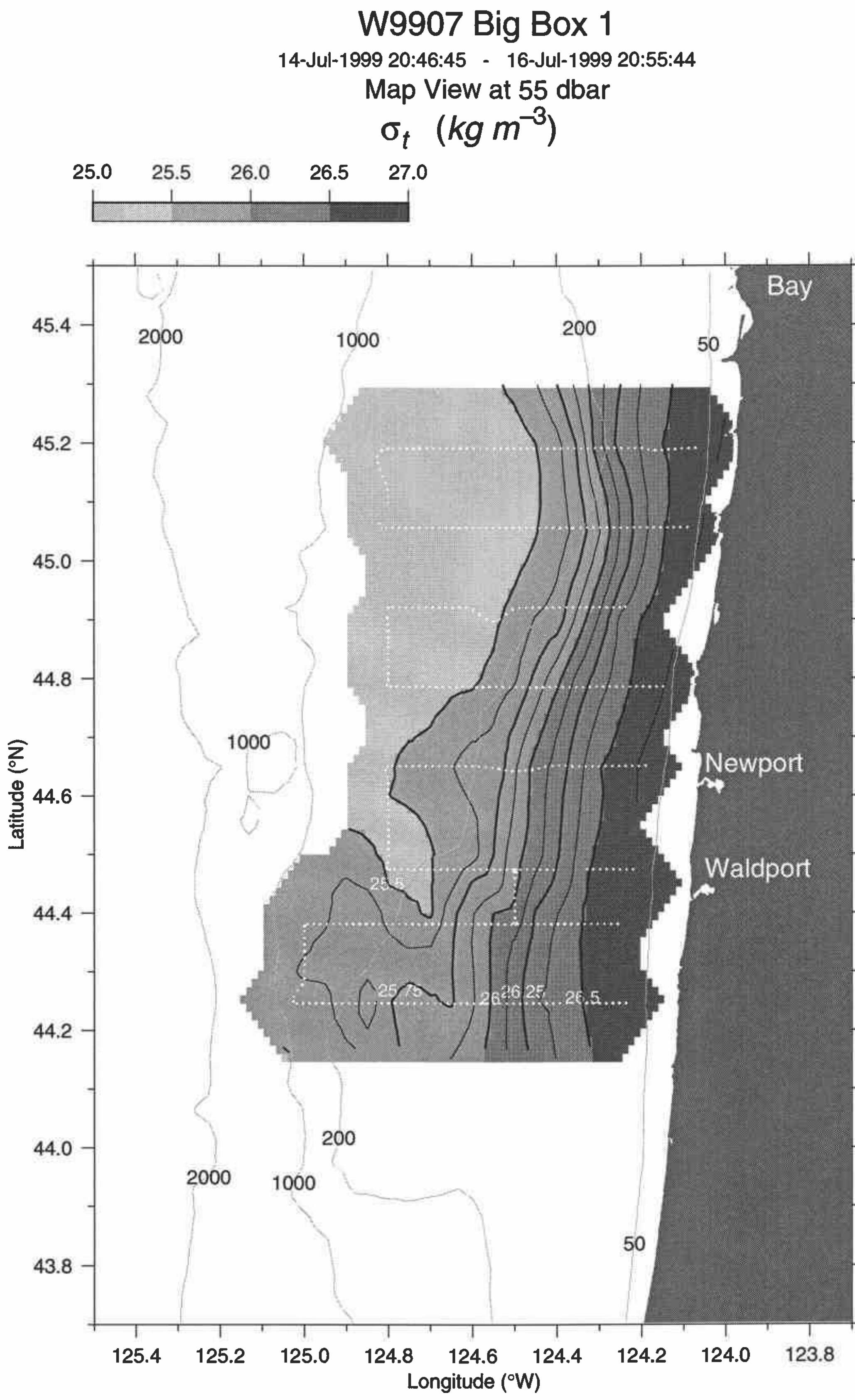
Map View at 35 dbar

σ_t $(kg\ m^{-3})$





W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 45 dbar
σt (kg m-3)
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
25.5
25.75
26
26.25
26.5
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

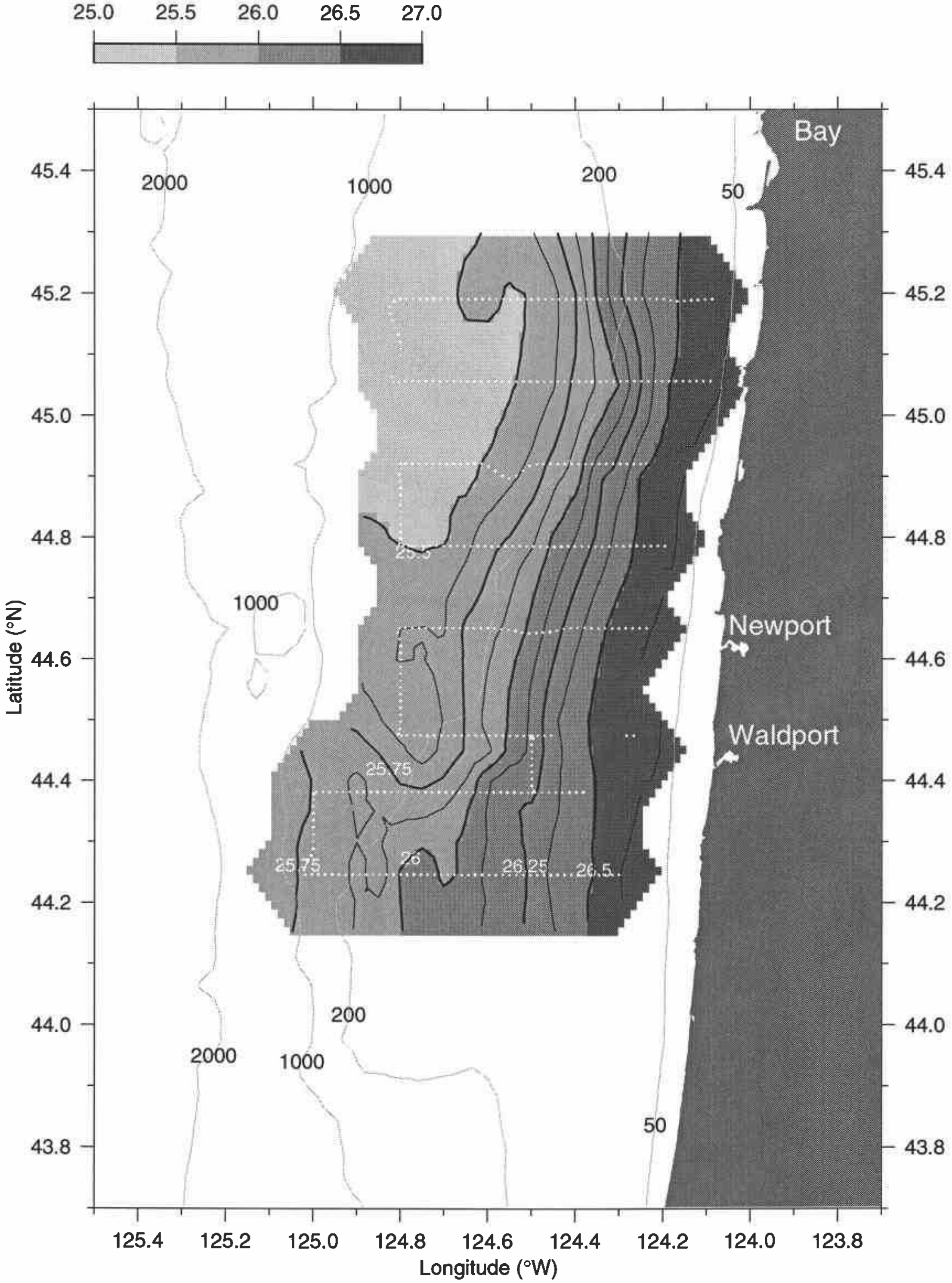

W9907 Big Box 1
14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44
Map View at 55 dbar
σt (kg m−3)
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
25.5
25.75
26
26.25
26.5
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 65 dbar

σ_t $(kg\ m^{-3})$

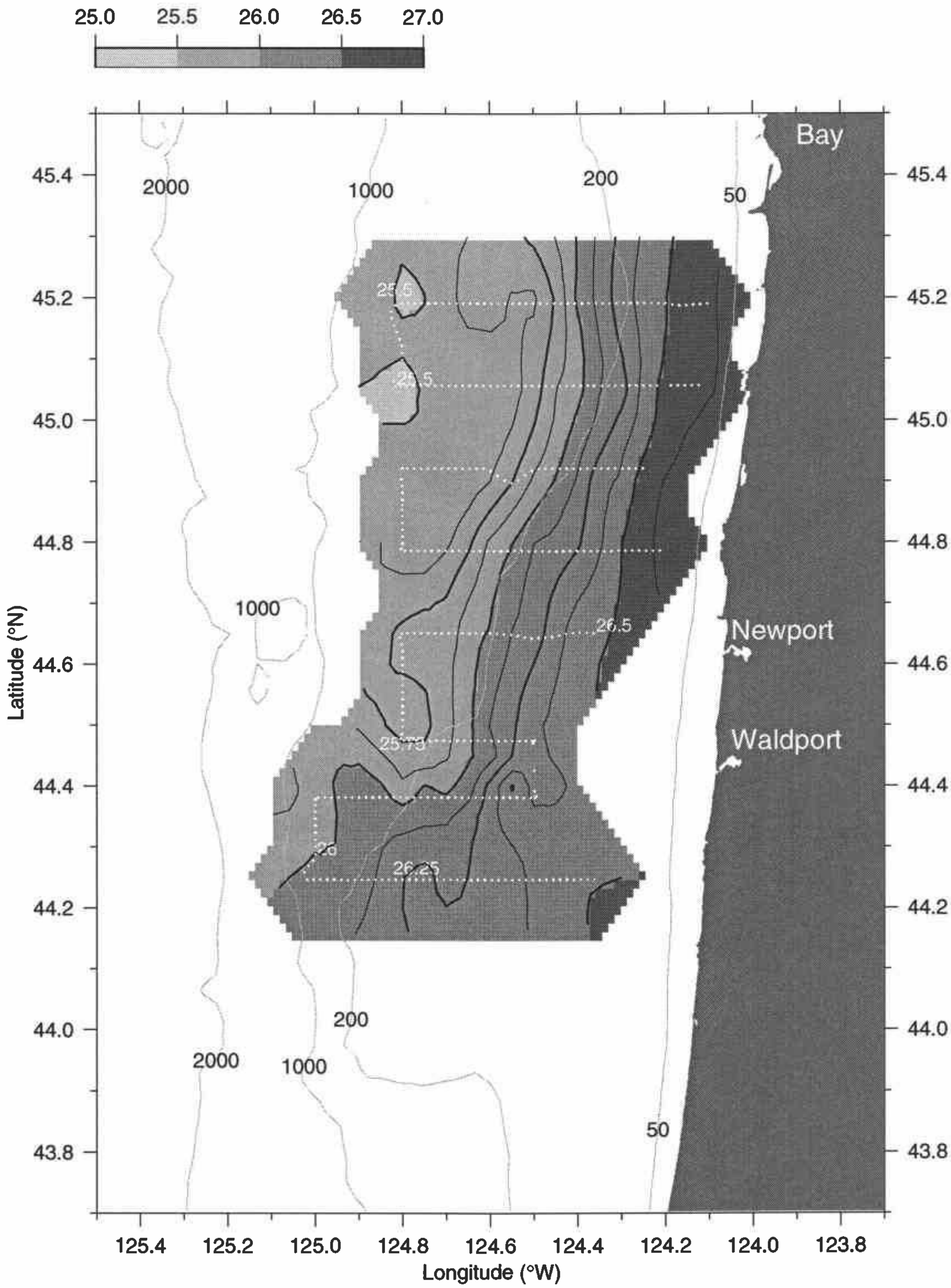


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 75 dbar

σ_t $(kg\ m^{-3})$

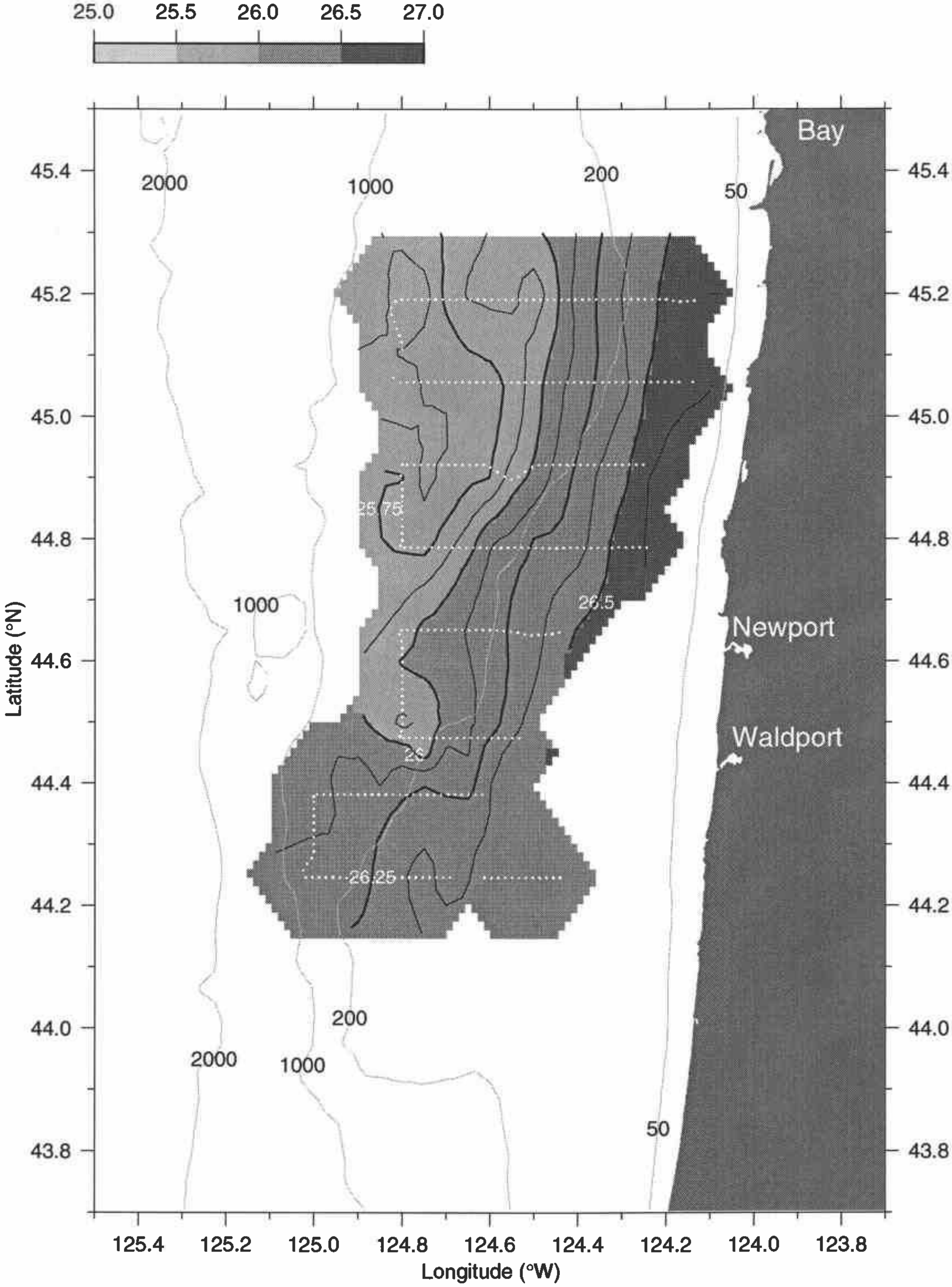


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 85 dbar

σ_t $(kg\ m^{-3})$

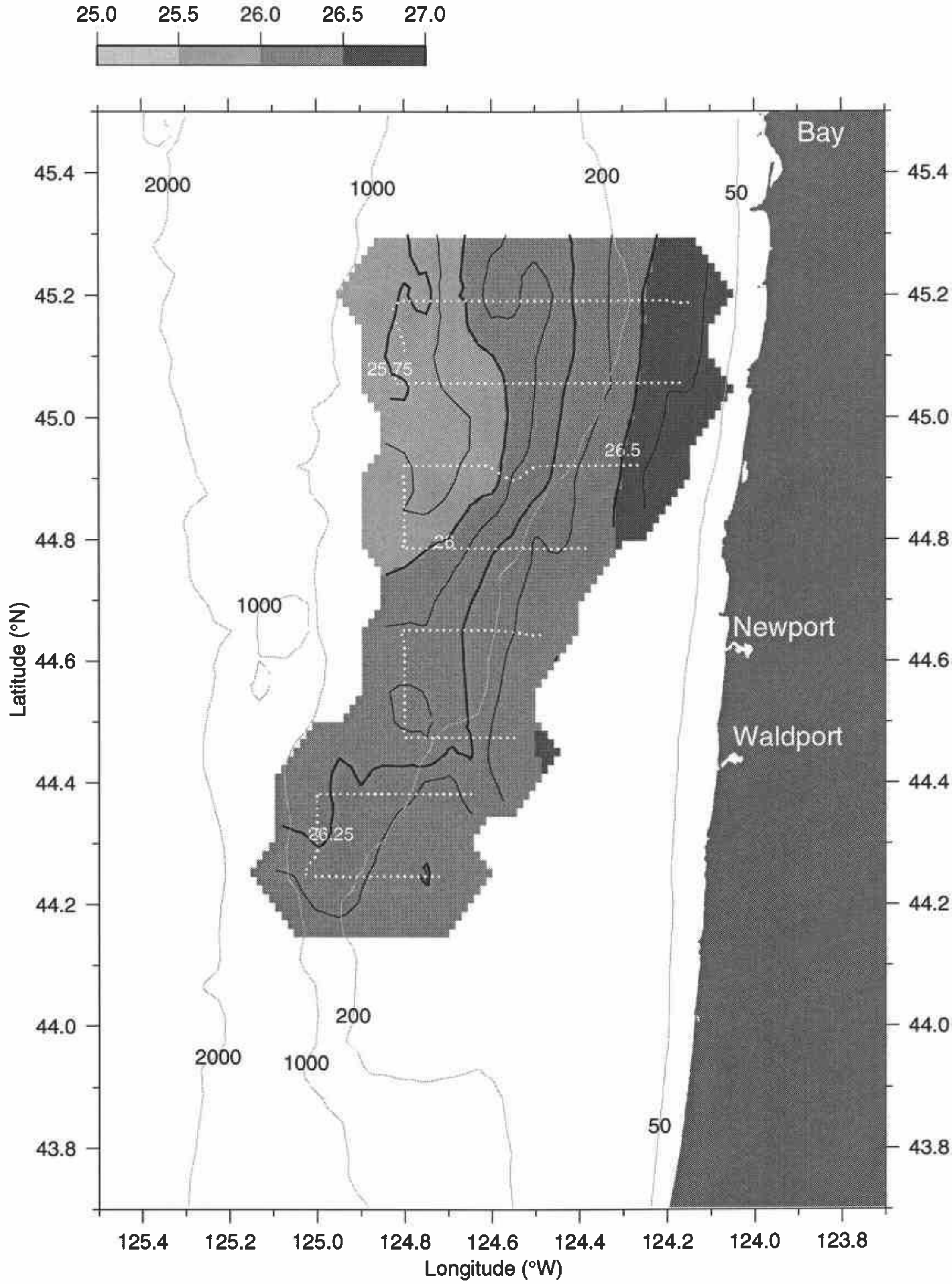


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 95 dbar

σ_t $(kg\ m^{-3})$

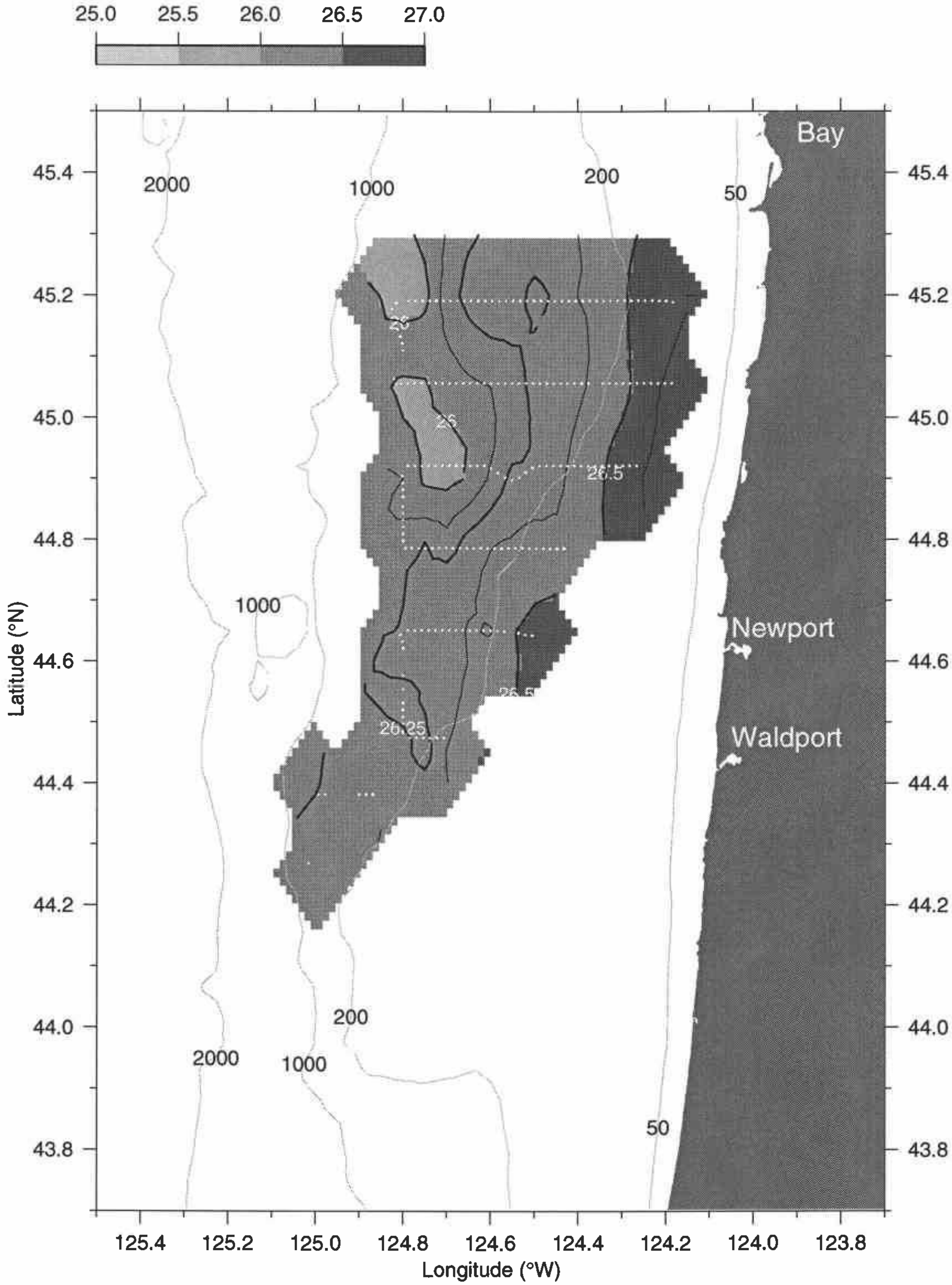


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 105 dbar

σ_t $(kg\ m^{-3})$

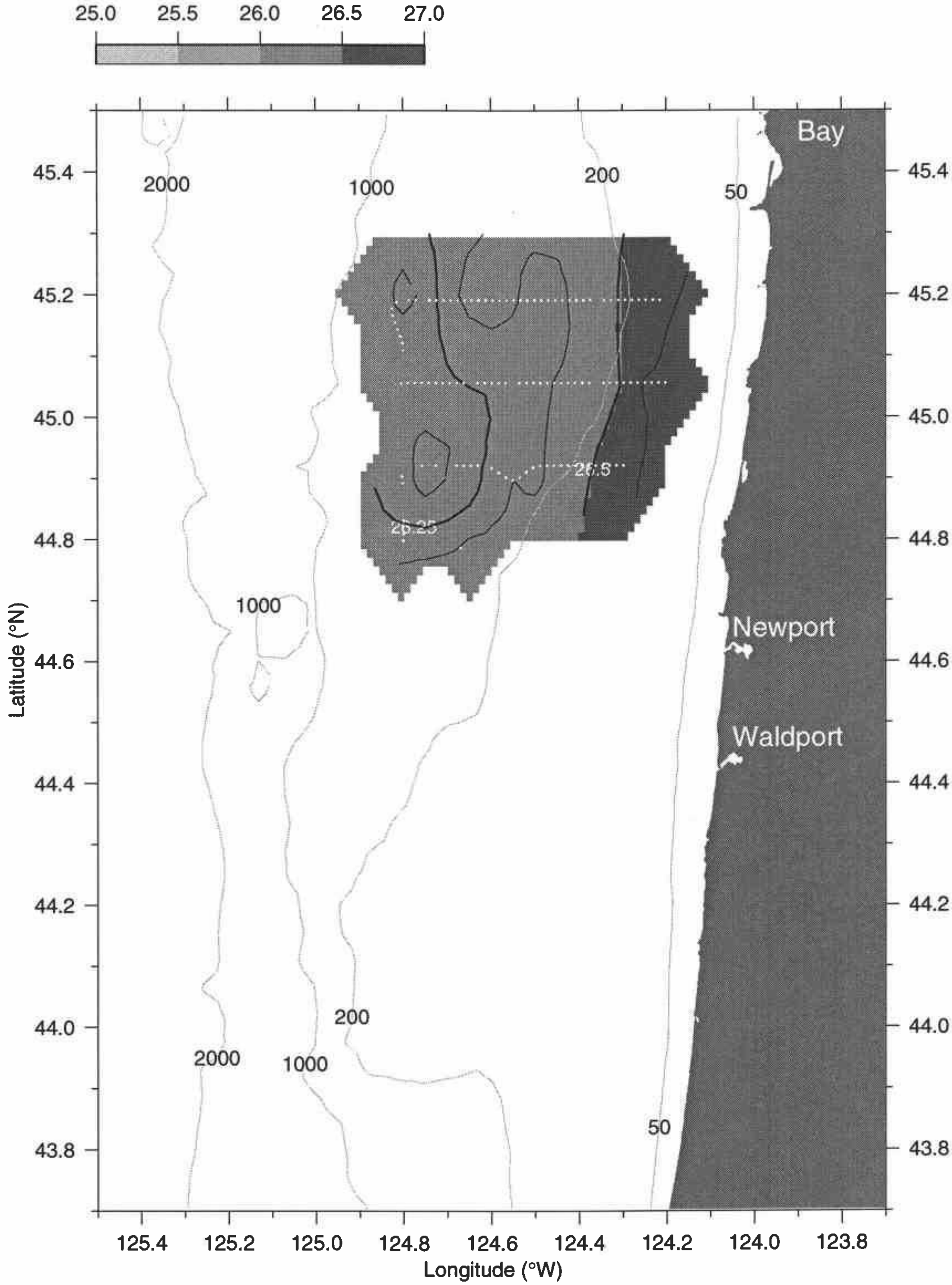


W9907 Big Box 1

14-Jul-1999 20:46:45 - 16-Jul-1999 20:55:44

Map View at 115 dbar

σ_t $(kg\ m^{-3})$



Small Box 1 Maps

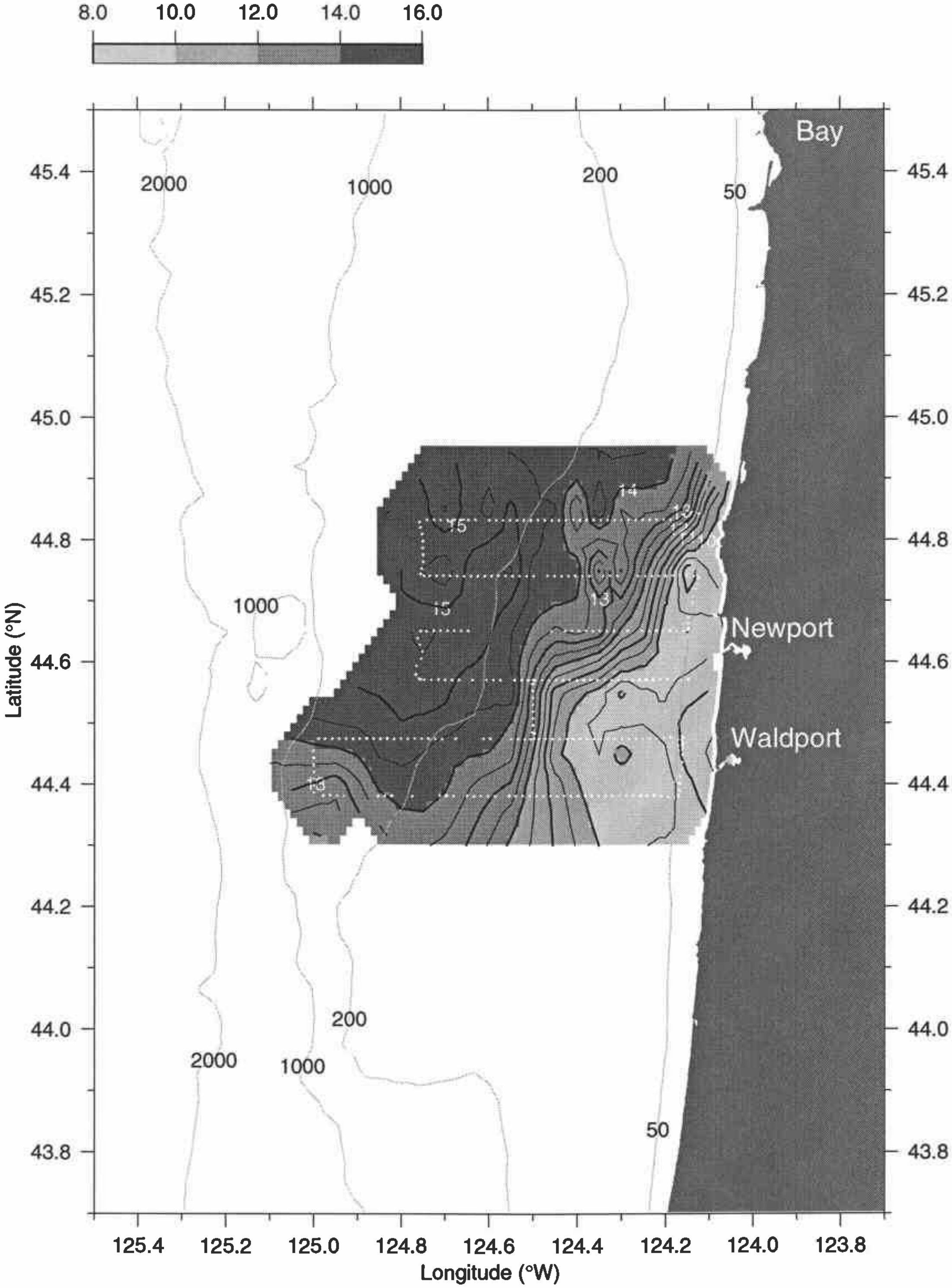
Maps of Temperature, Salinity, and σ_t at Specified Depths

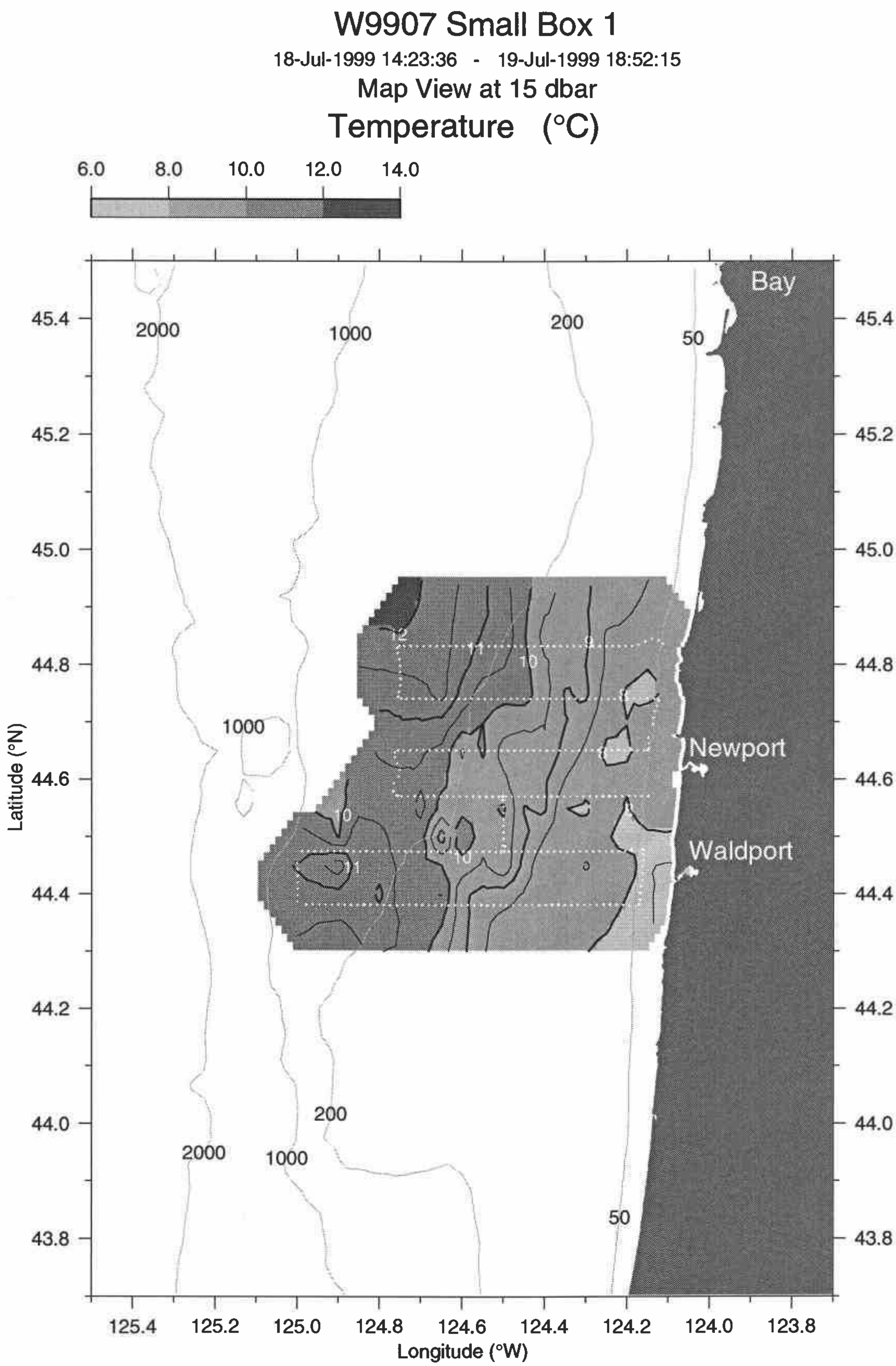
W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 5 dbar

Temperature (°C)



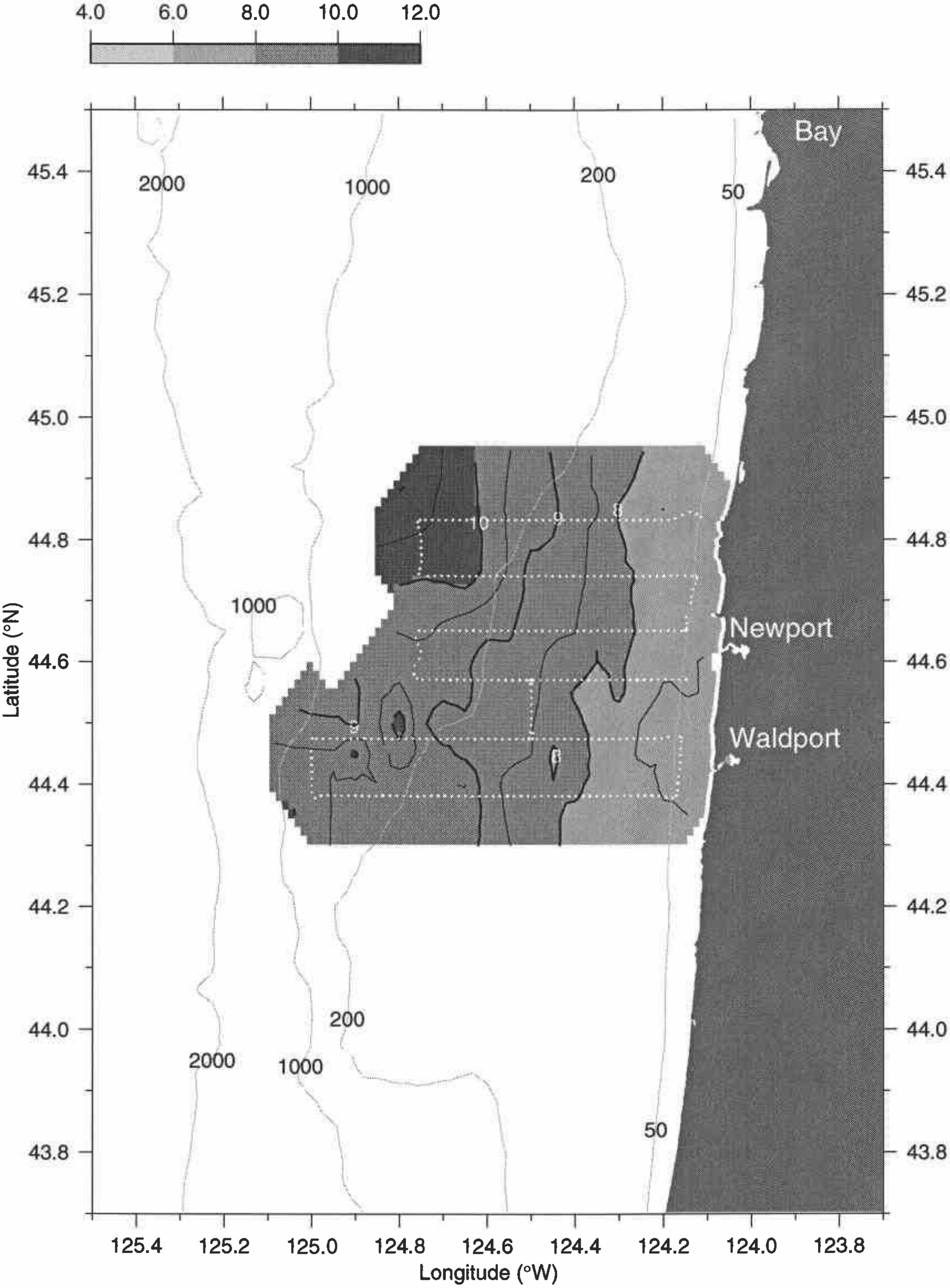

W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 15 dbar
Temperature (°C)
6.0
8.0
10.0
12.0
14.0
Bay
Newport
Waldport
2000
1000
200
50
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 25 dbar

Temperature (°C)

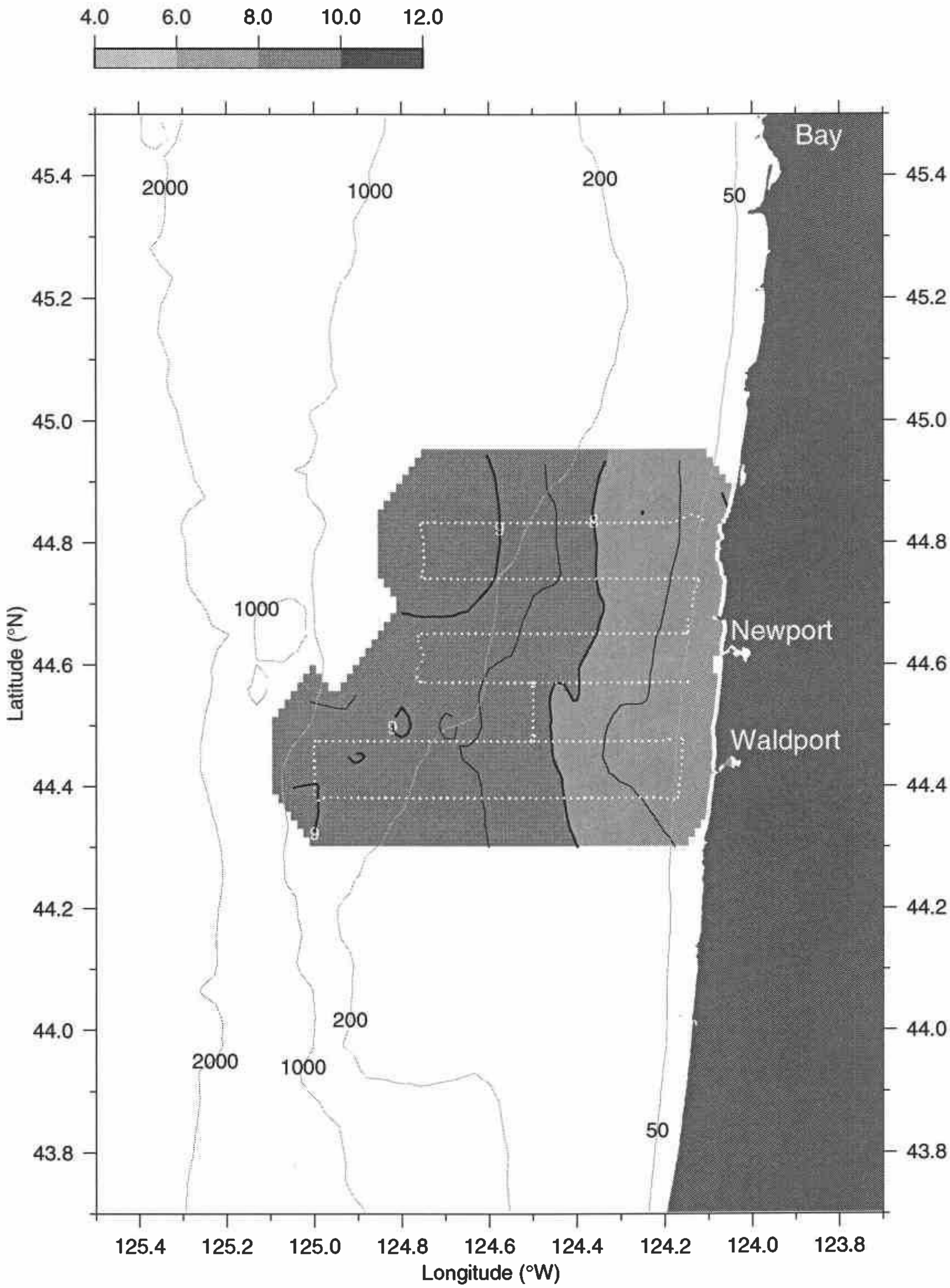


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 35 dbar

Temperature (°C)

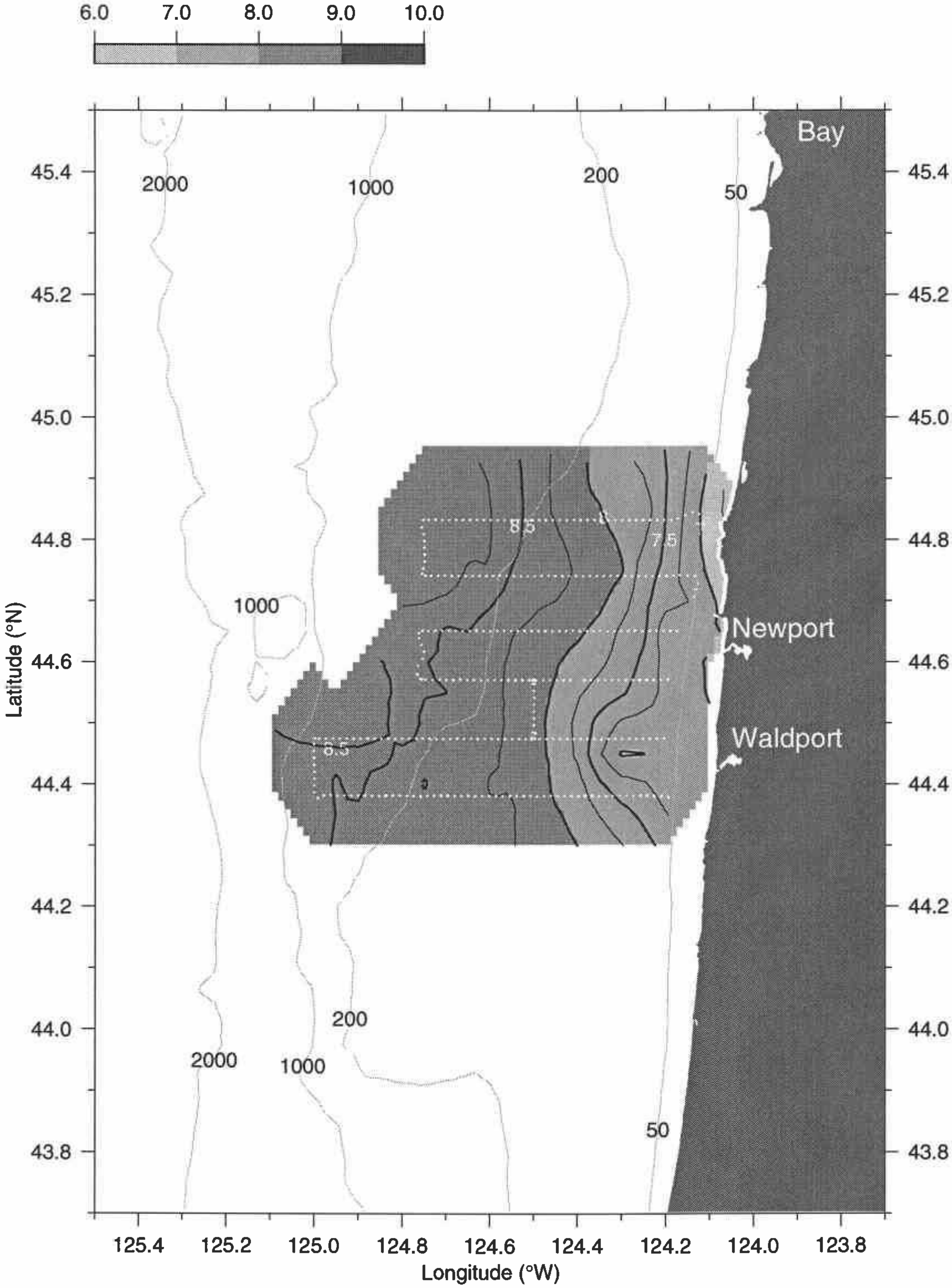


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 45 dbar

Temperature (°C)

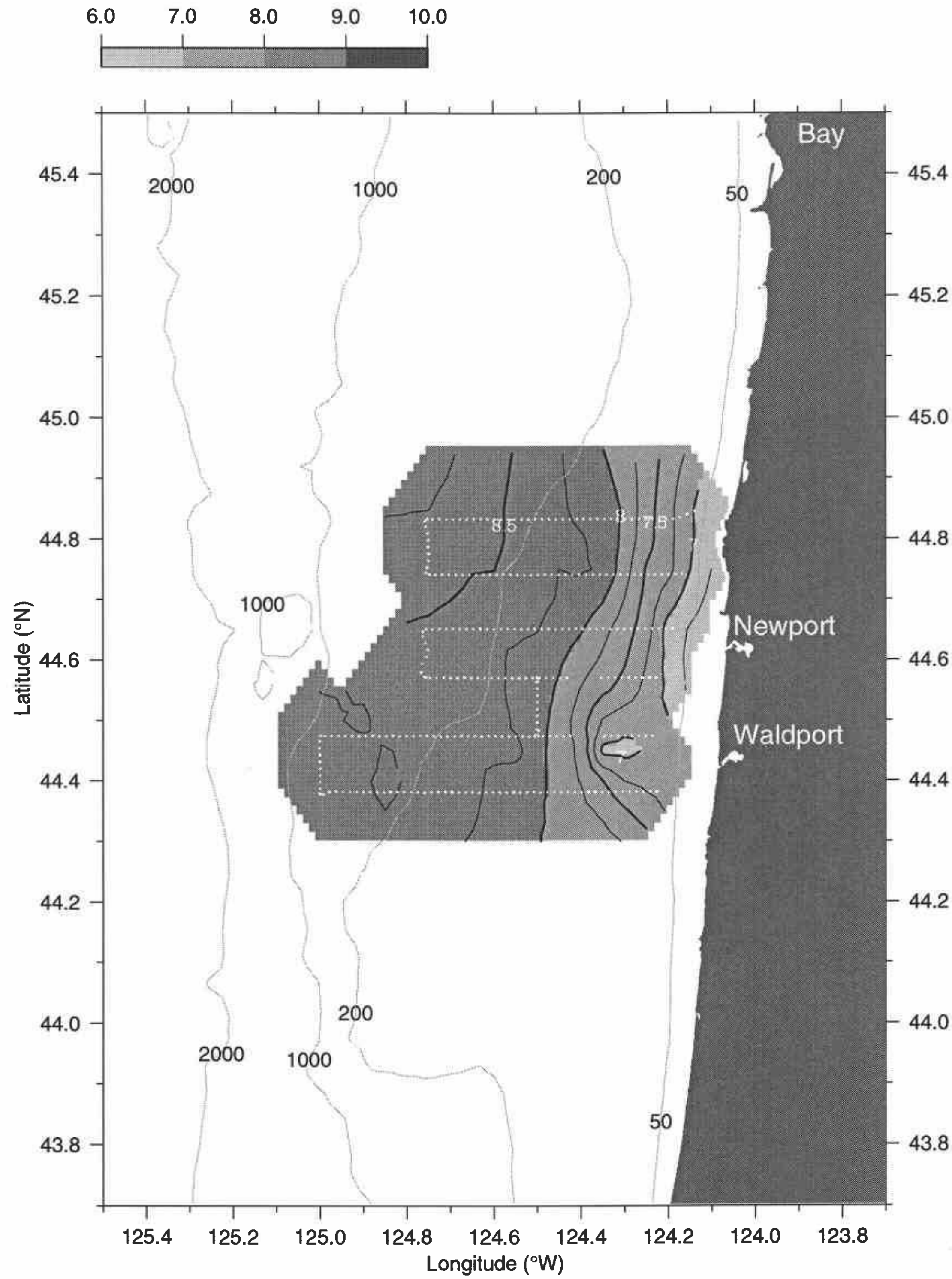


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 55 dbar

Temperature (°C)

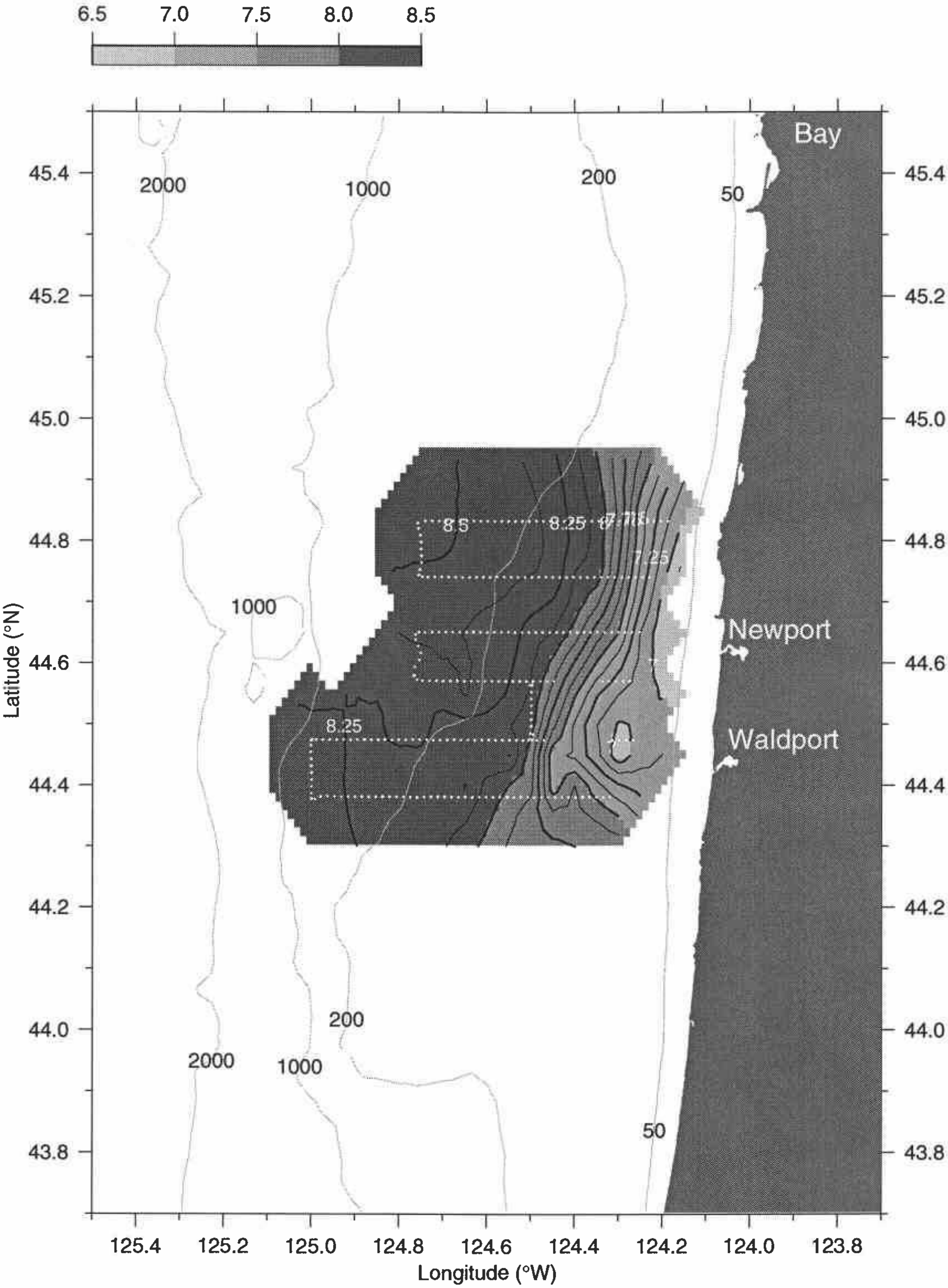


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 65 dbar

Temperature (°C)

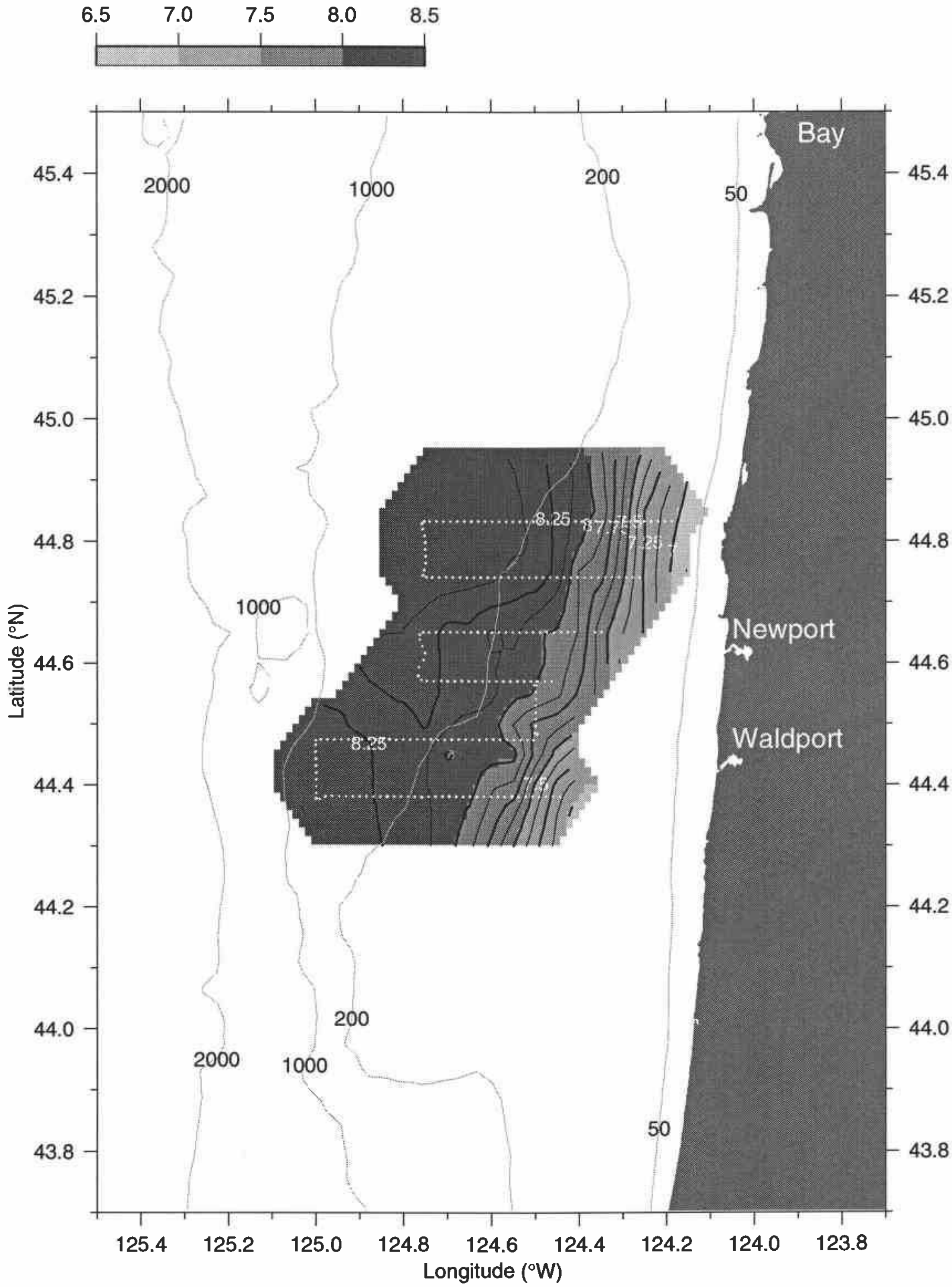


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 75 dbar

Temperature (°C)

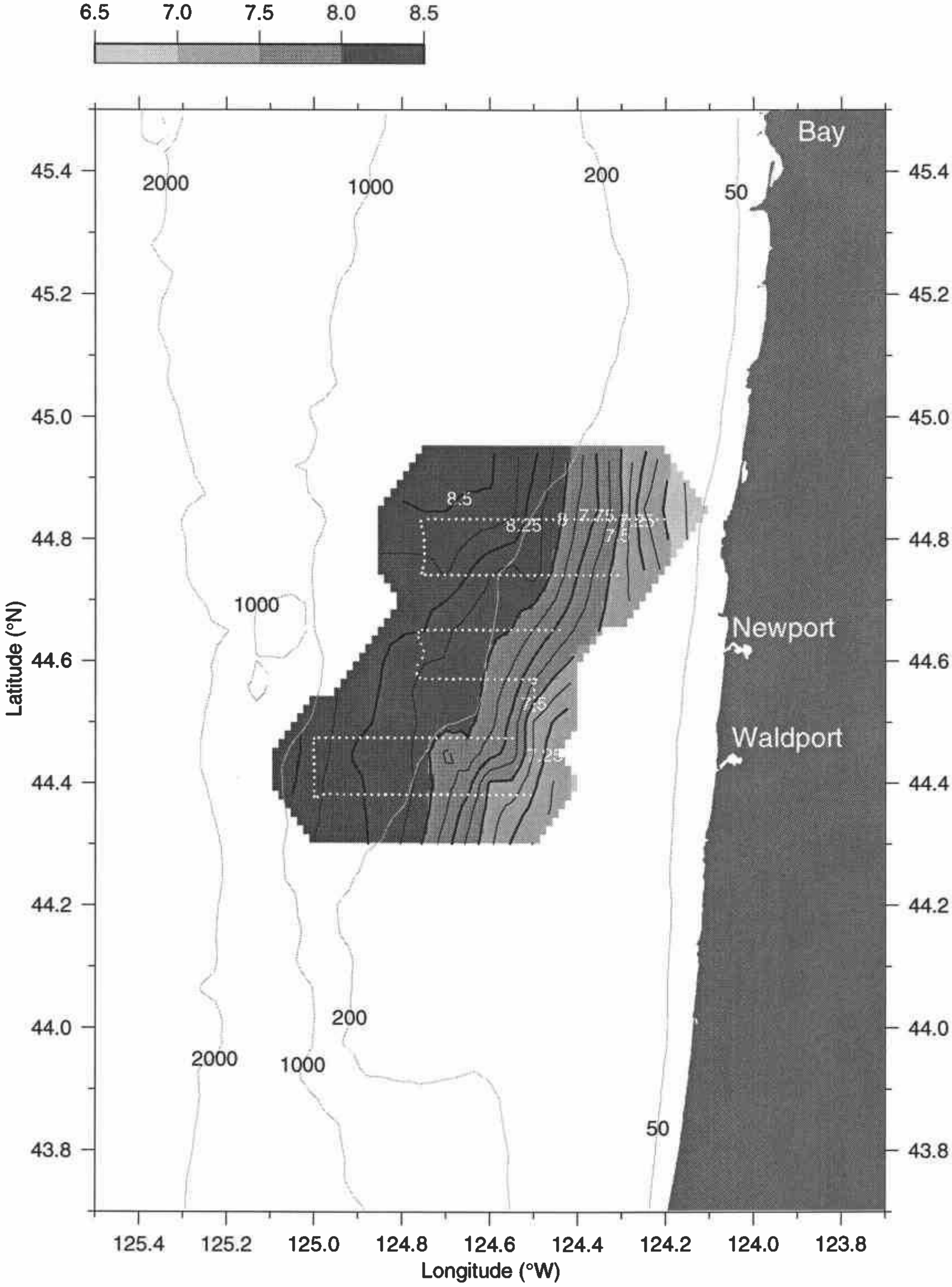


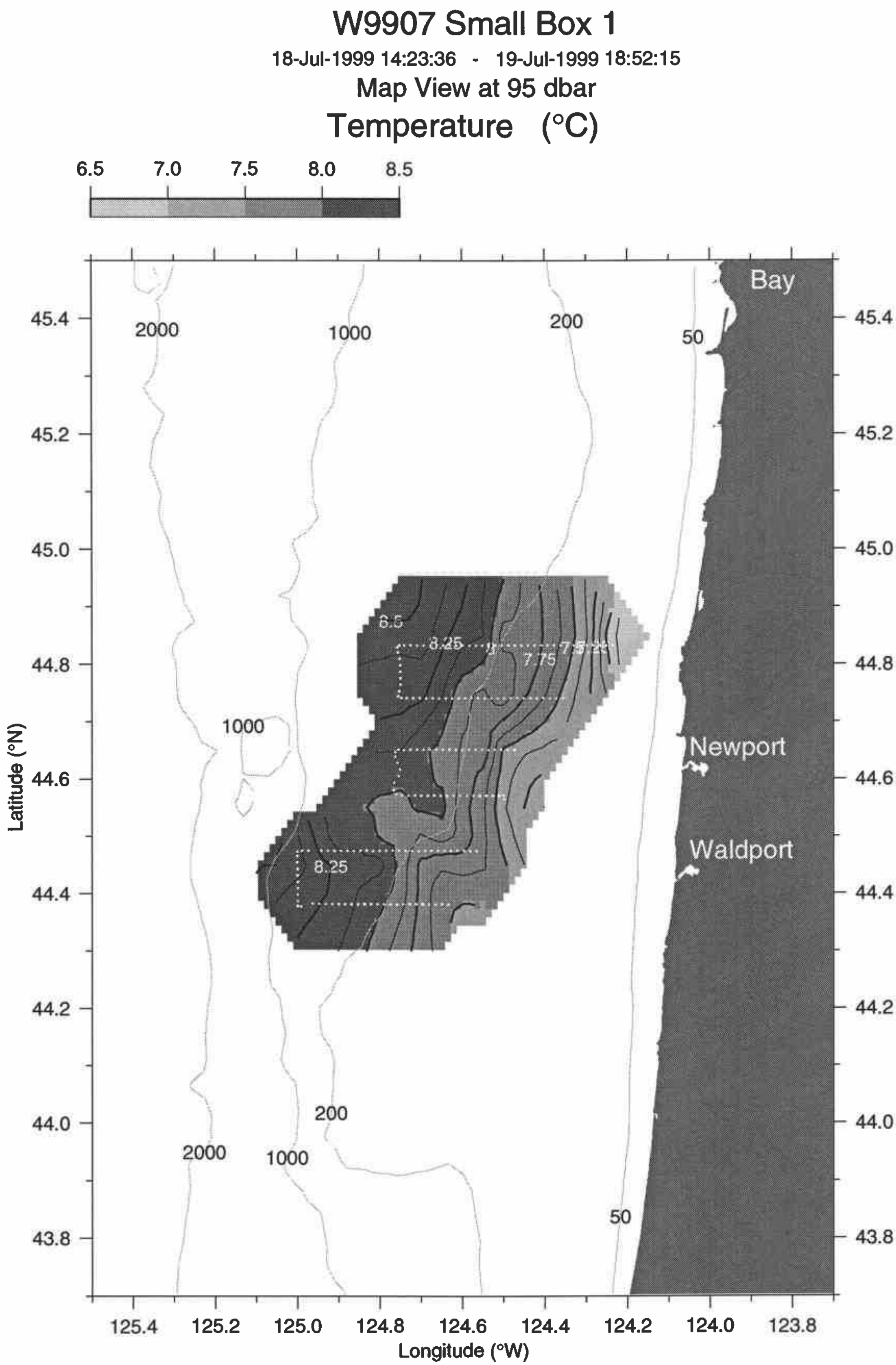
W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

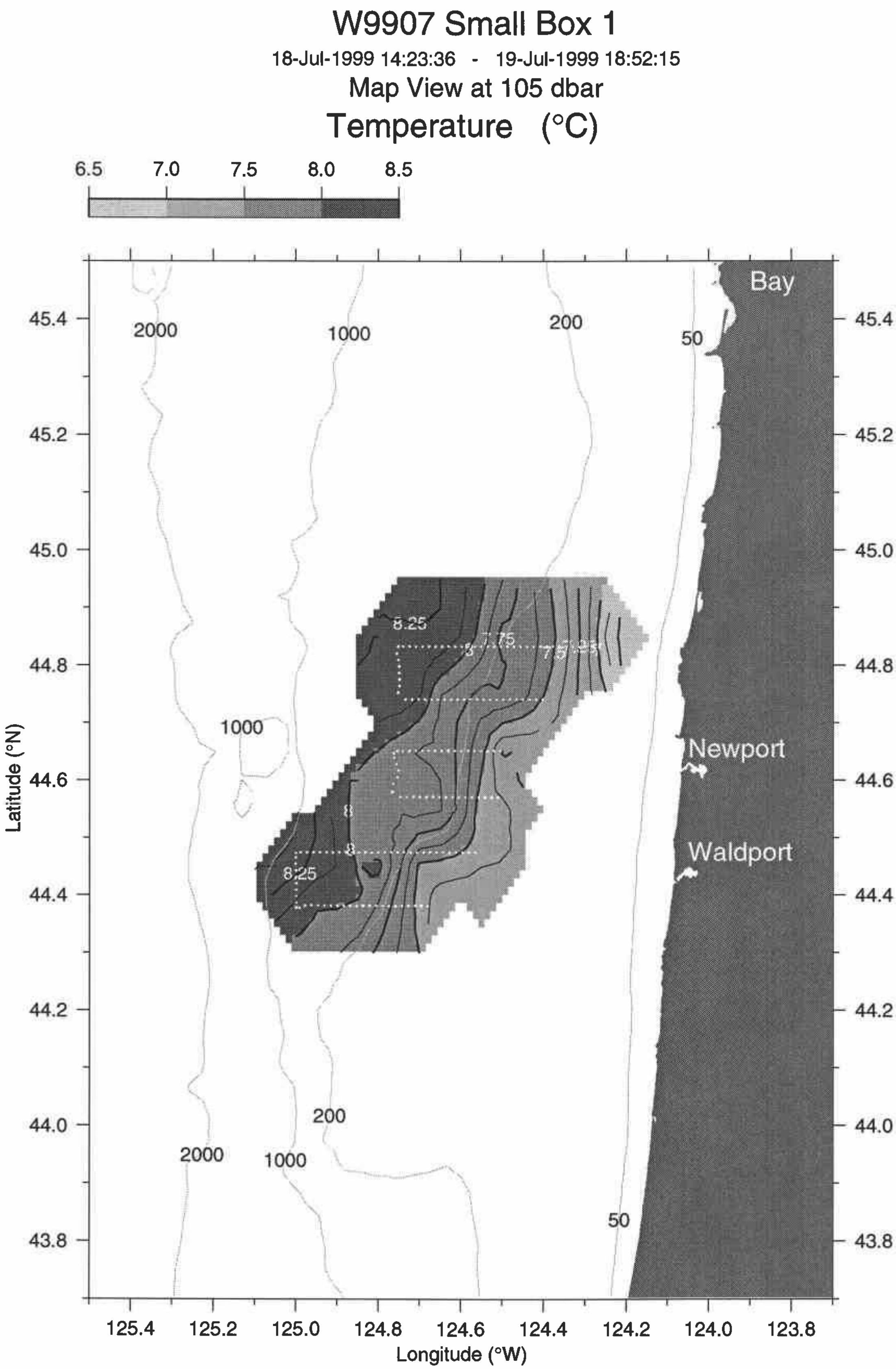
Map View at 85 dbar

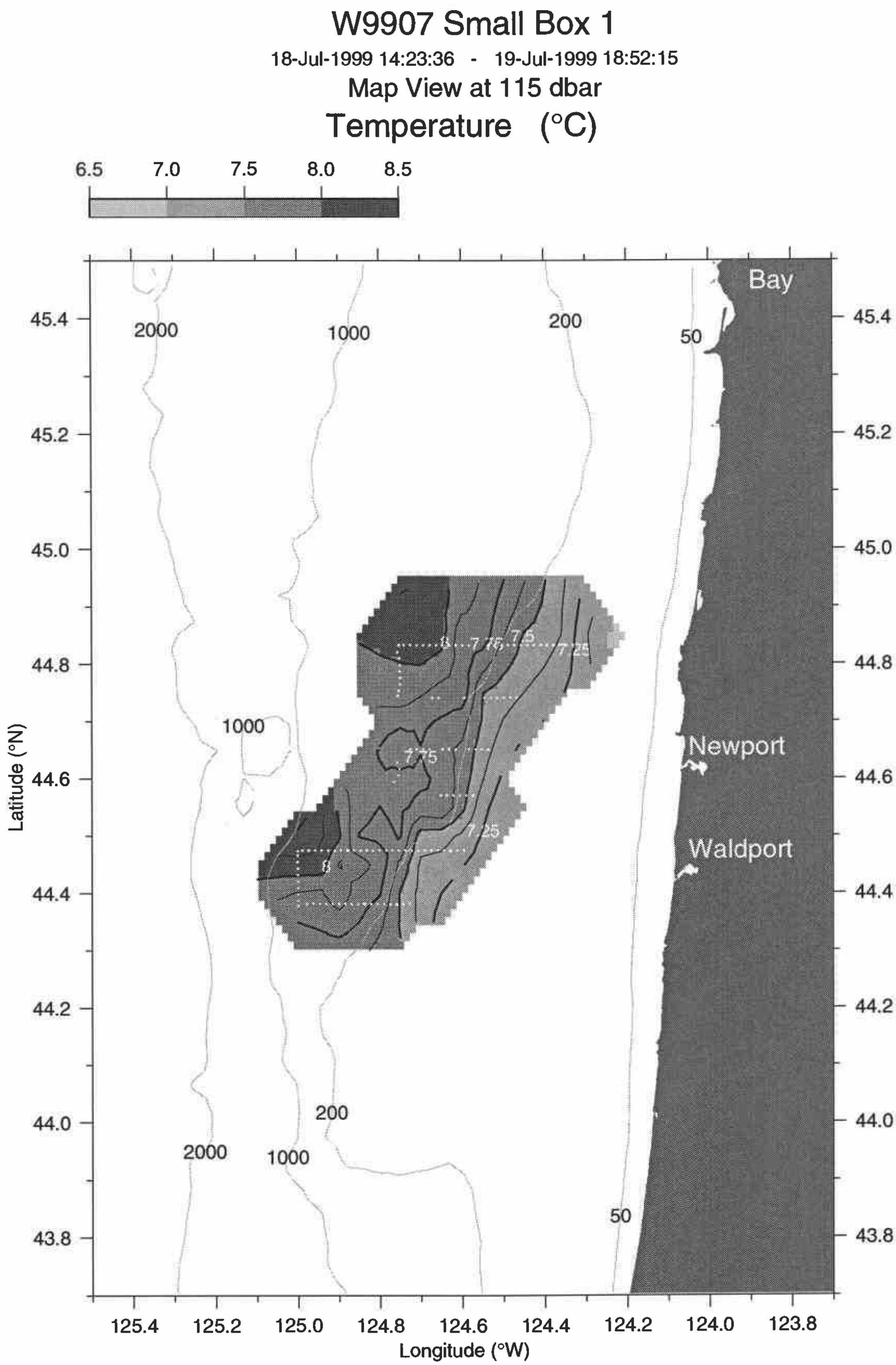
Temperature (°C)





W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 95 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
Newport
Waldport
2000
1000
200
50
8.25
7.75
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Latitude (°N)
Longitude (°W)


W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 105 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
Newport
Waldport
2000
1000
200
50
8.25
7.75
8
7.5
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8



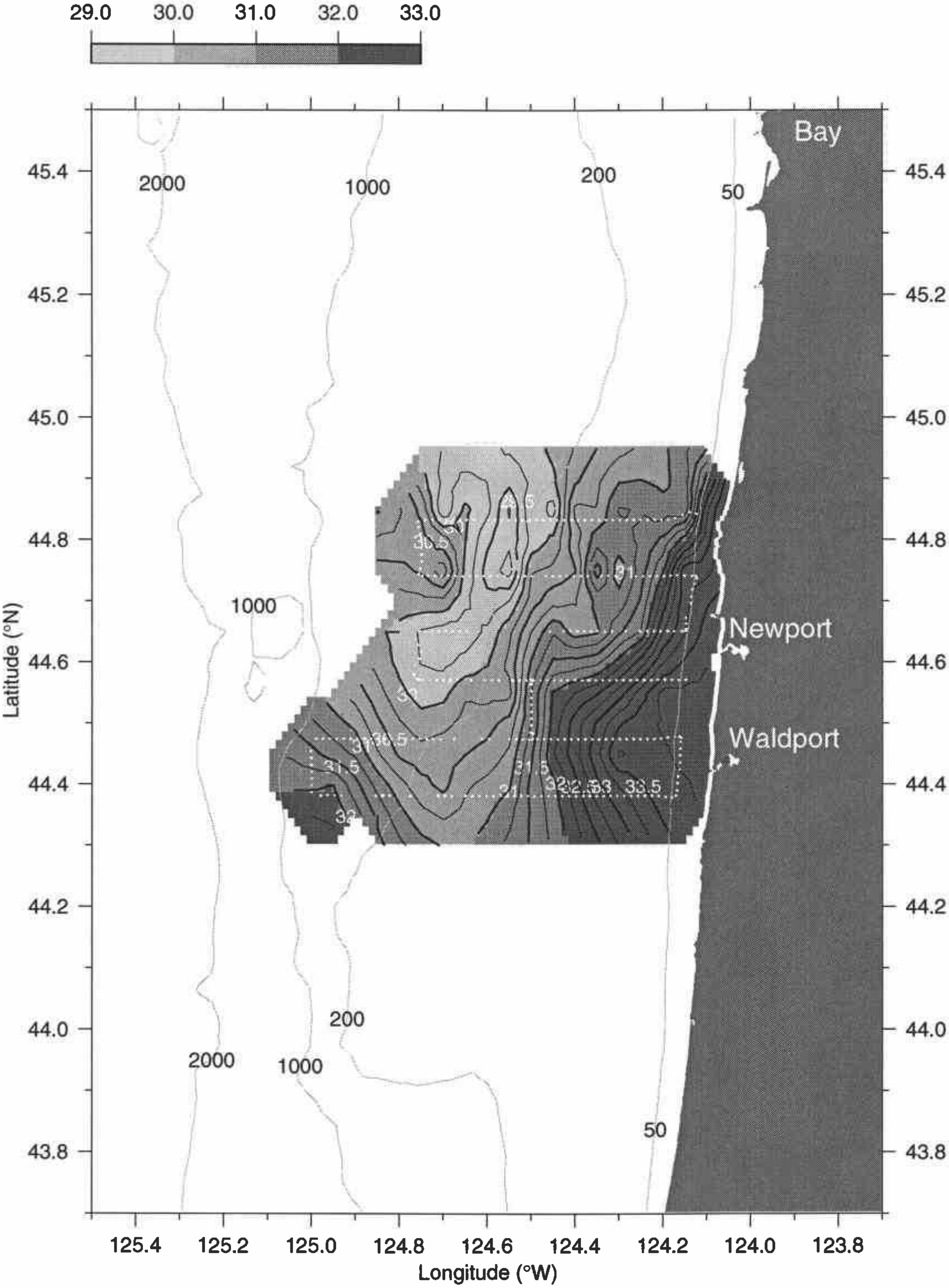
W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 115 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
Newport
Waldport
2000
1000
200
50
7.75
7.5
7.25
8
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 5 dbar

Salinity (PSS)

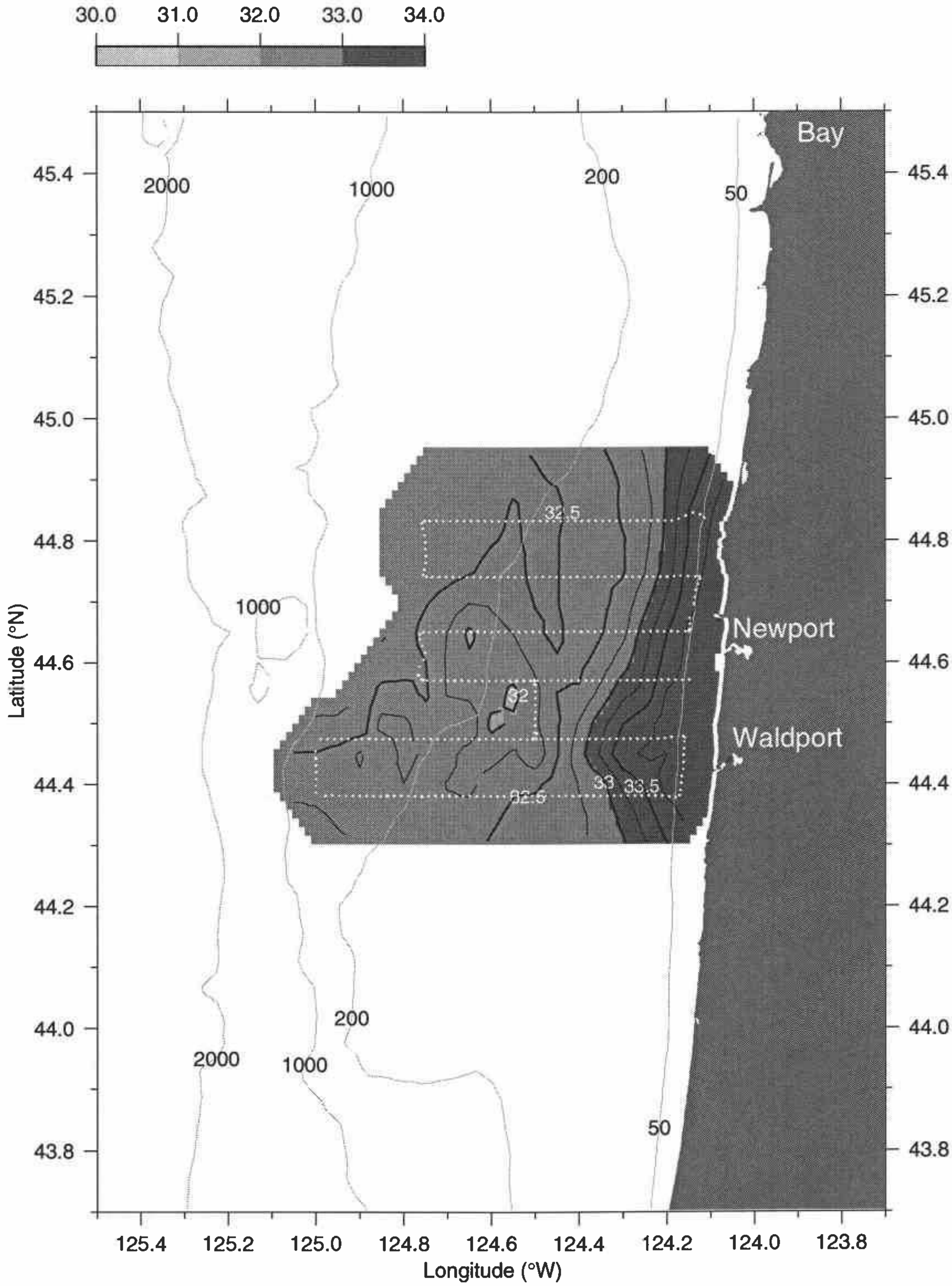


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 15 dbar

Salinity (PSS)

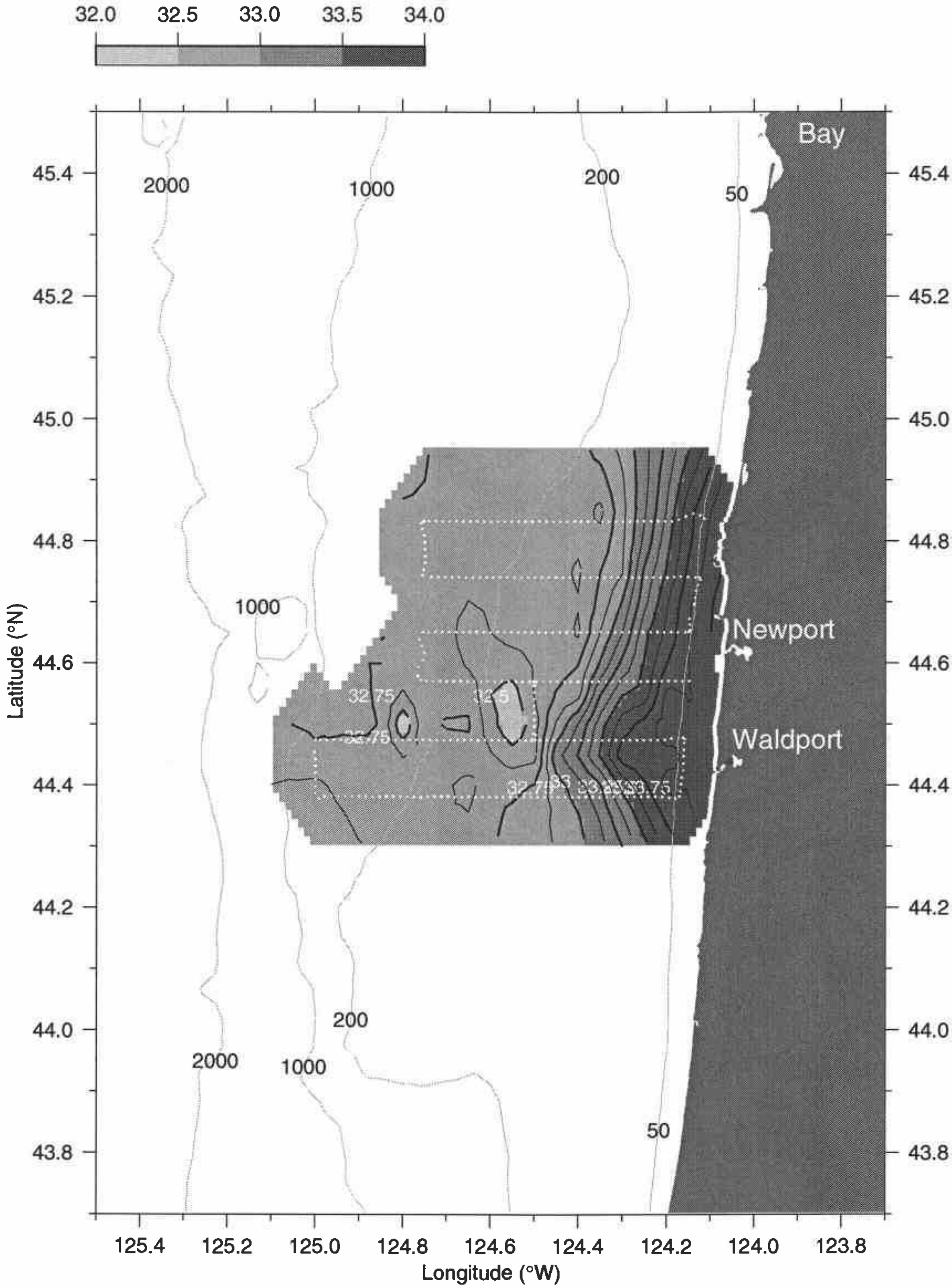


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 25 dbar

Salinity (PSS)

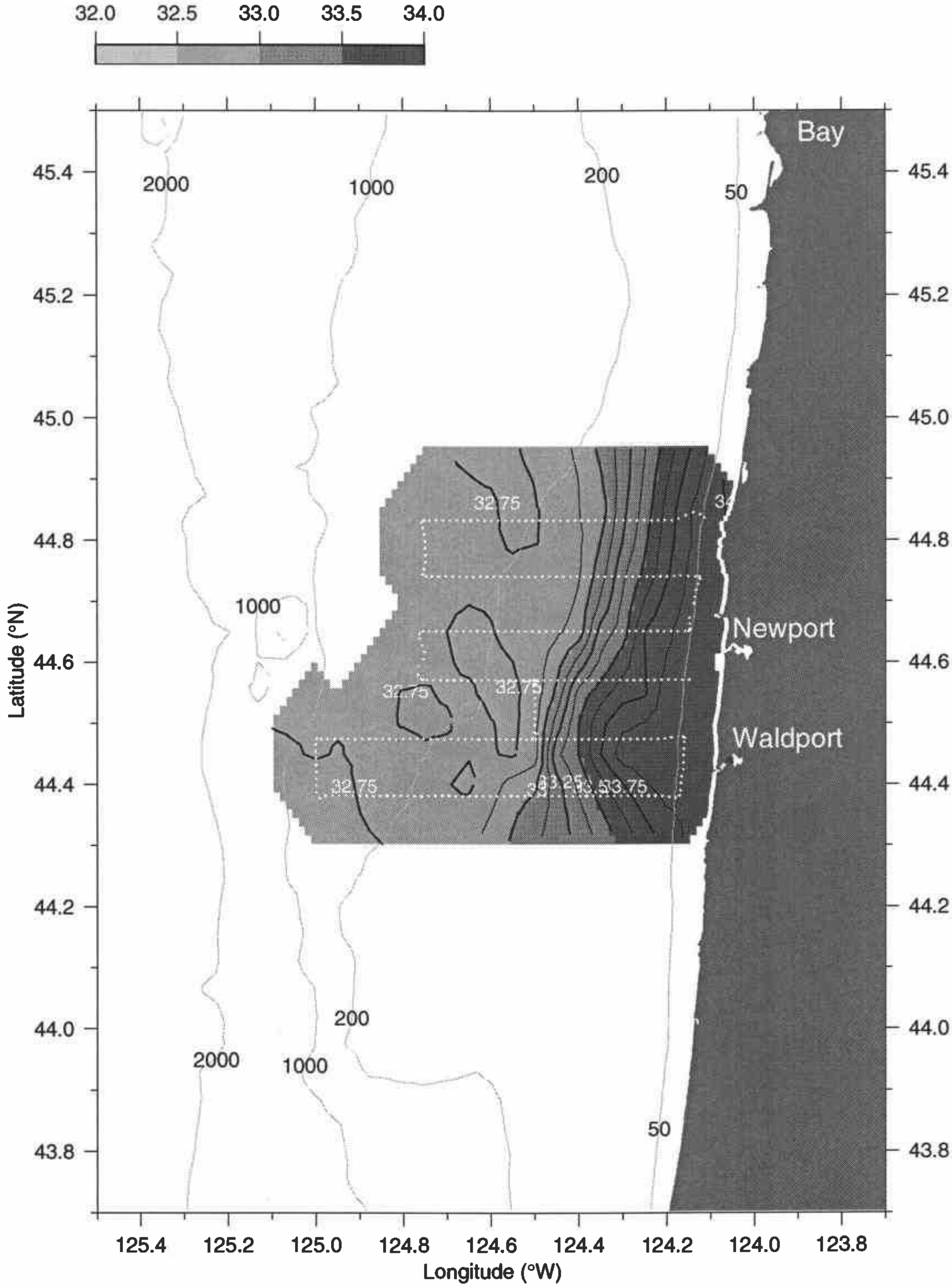


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 35 dbar

Salinity (PSS)

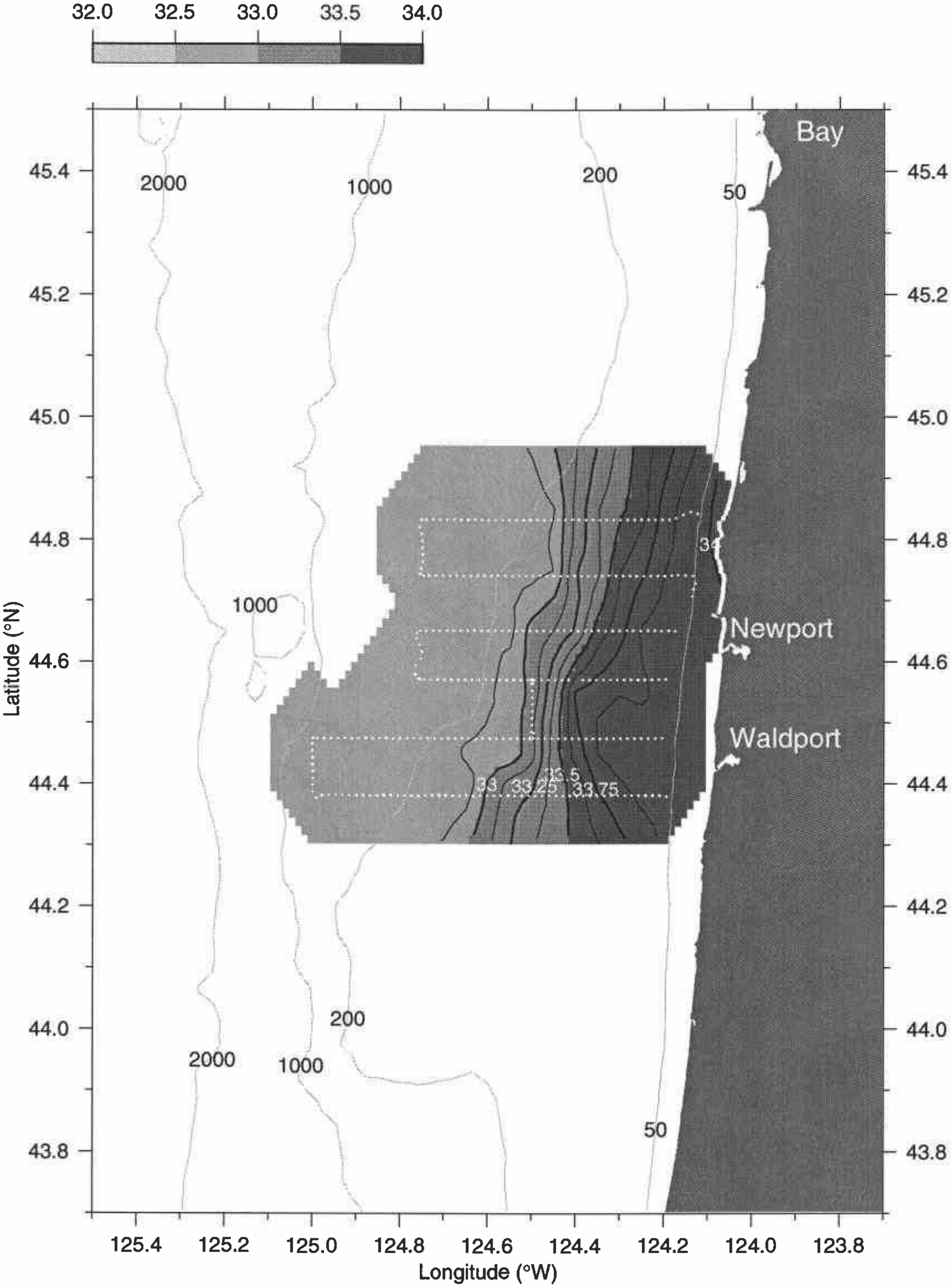


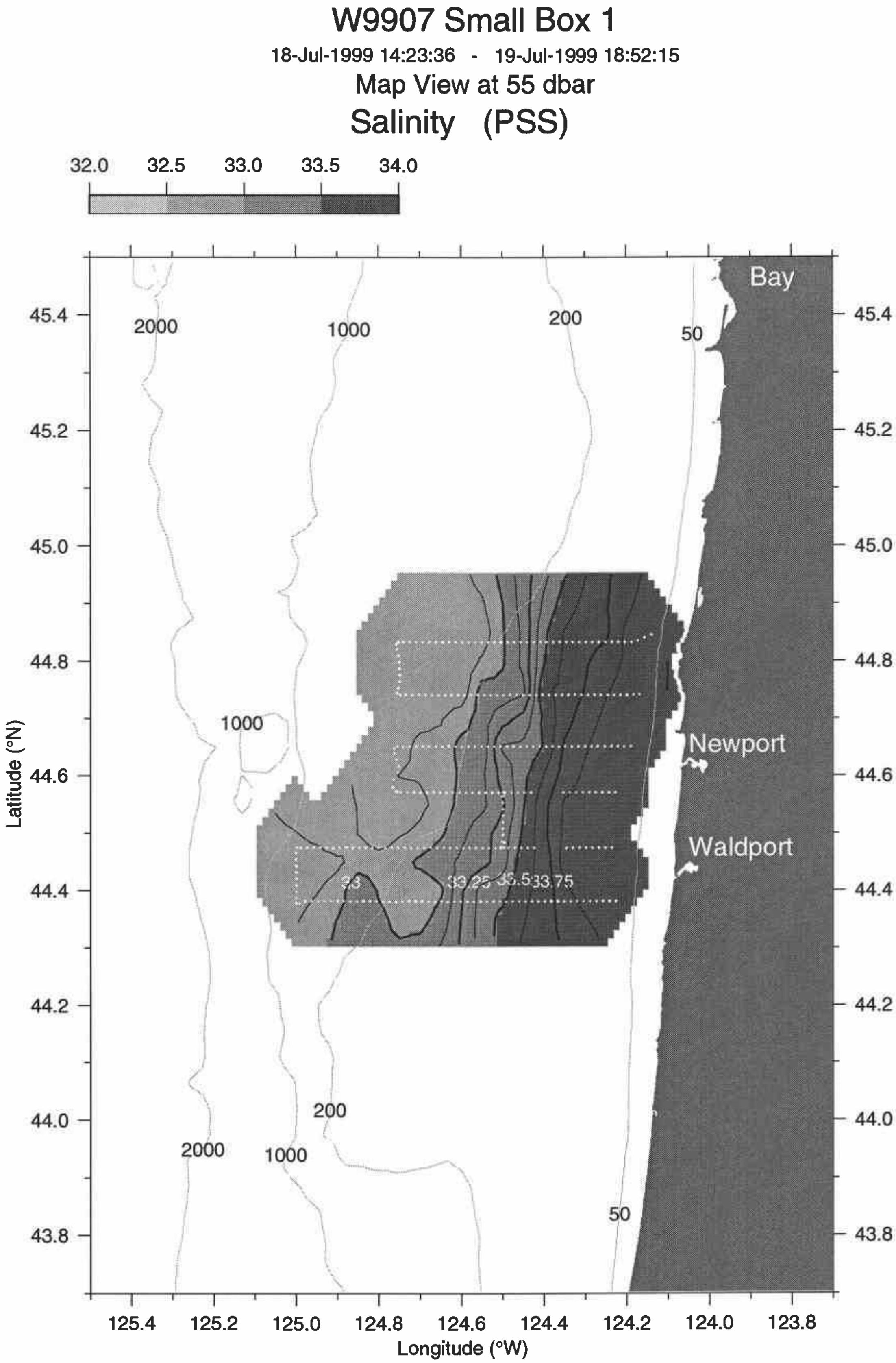
W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 45 dbar

Salinity (PSS)



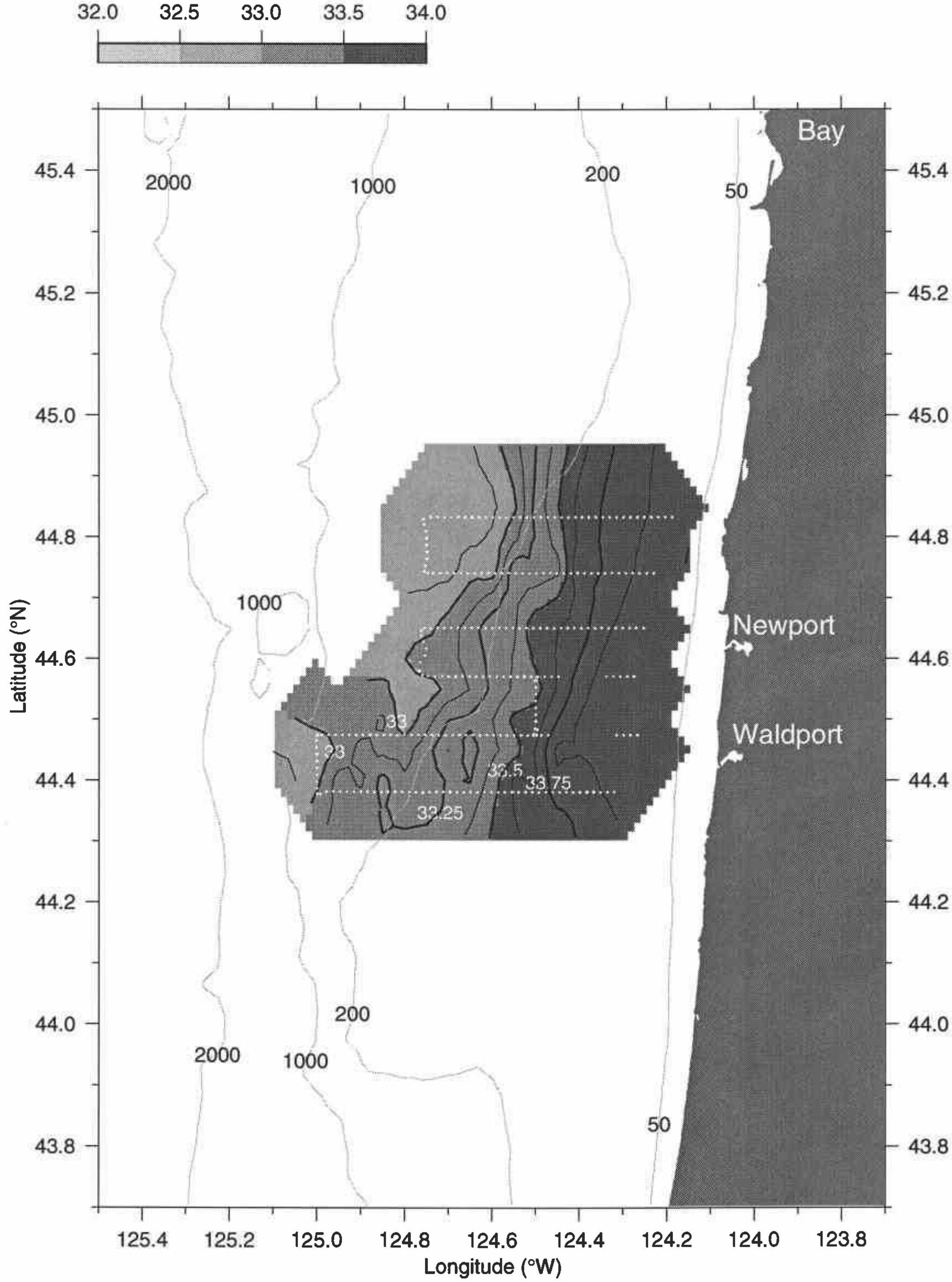

W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 55 dbar
Salinity (PSS)
32.0
32.5
33.0
33.5
34.0
Bay
Newport
Waldport
2000
1000
200
50
33
33.25
33.5
33.75
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 65 dbar

Salinity (PSS)

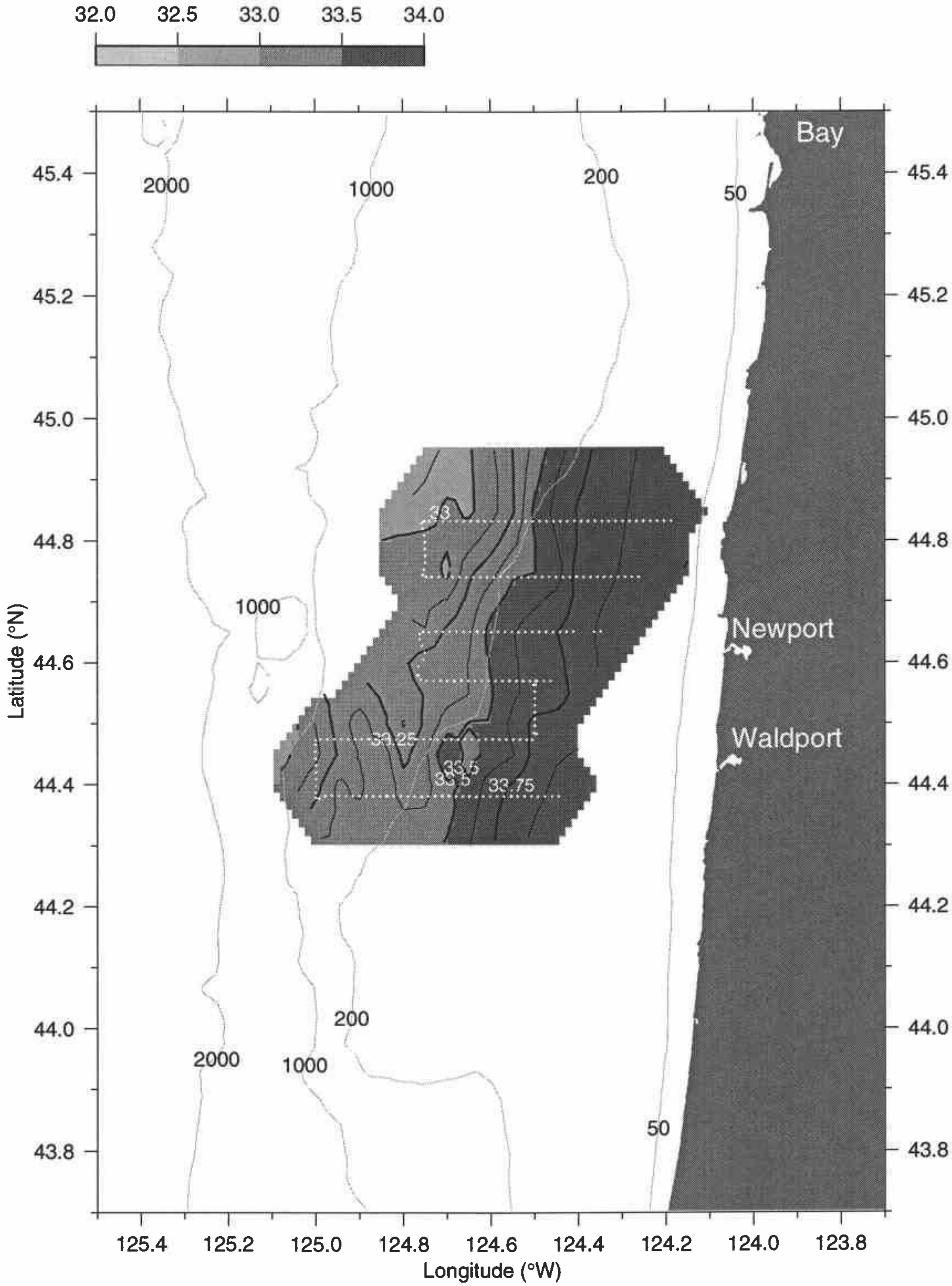


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 75 dbar

Salinity (PSS)

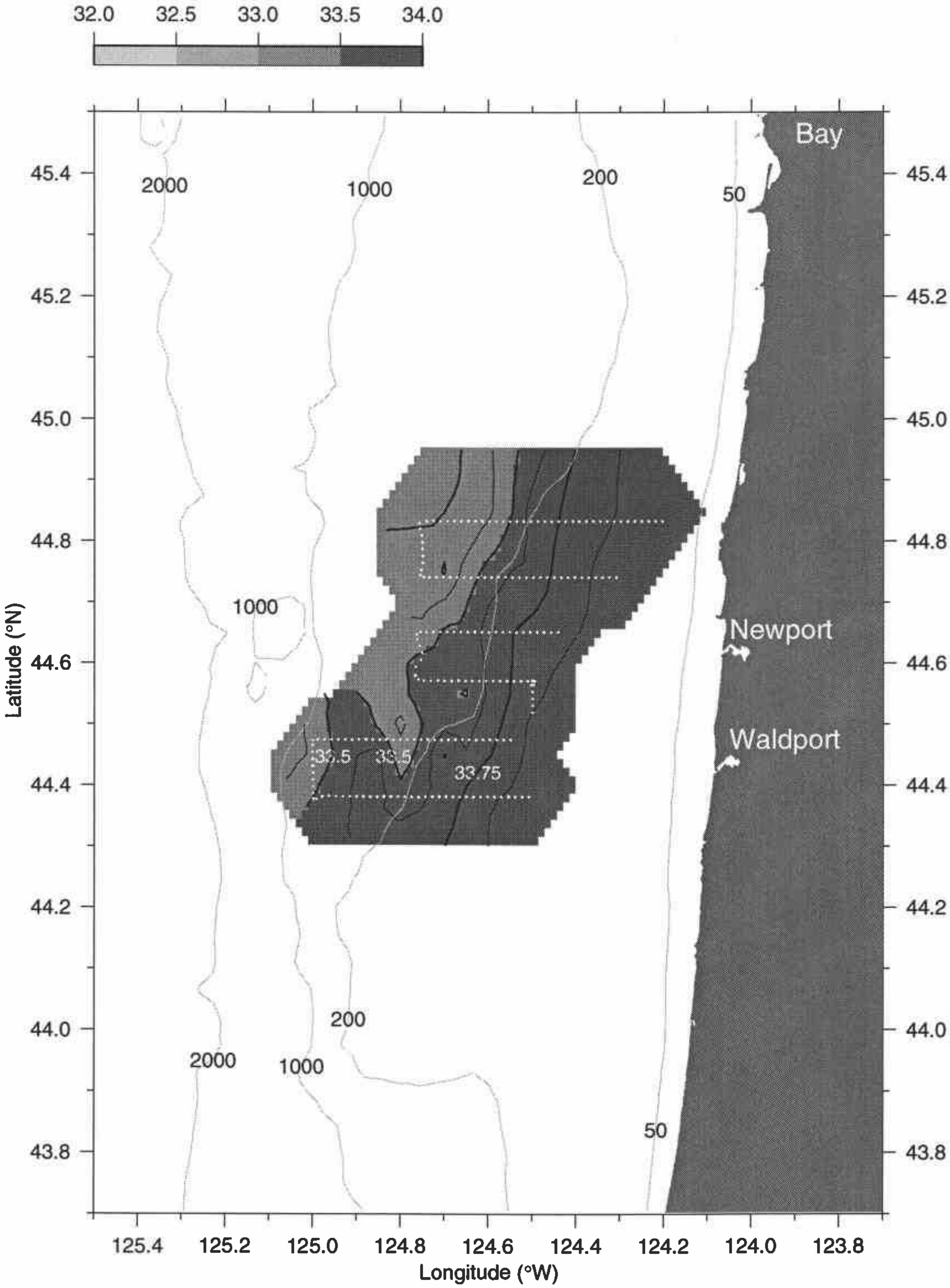


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 85 dbar

Salinity (PSS)

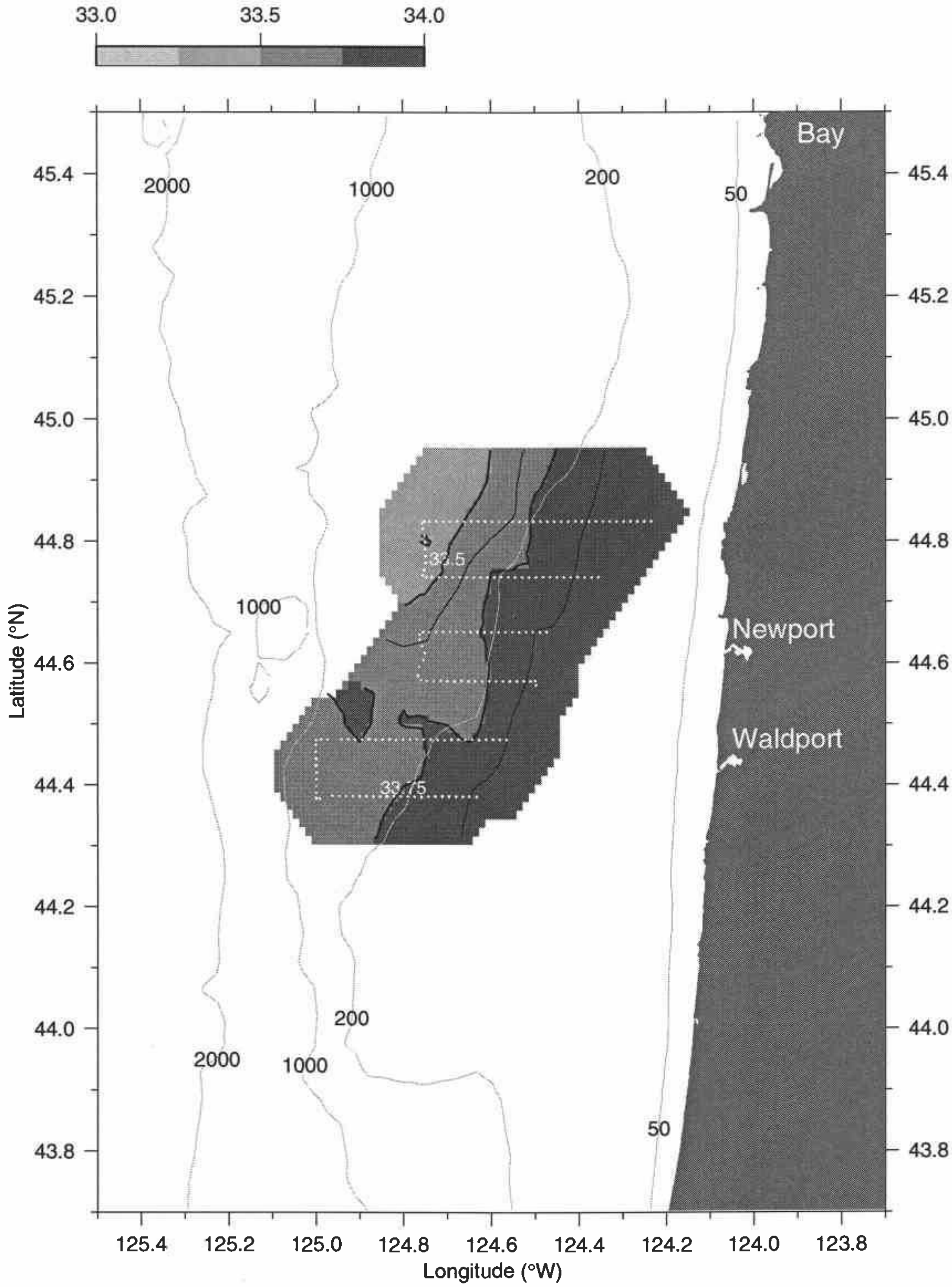


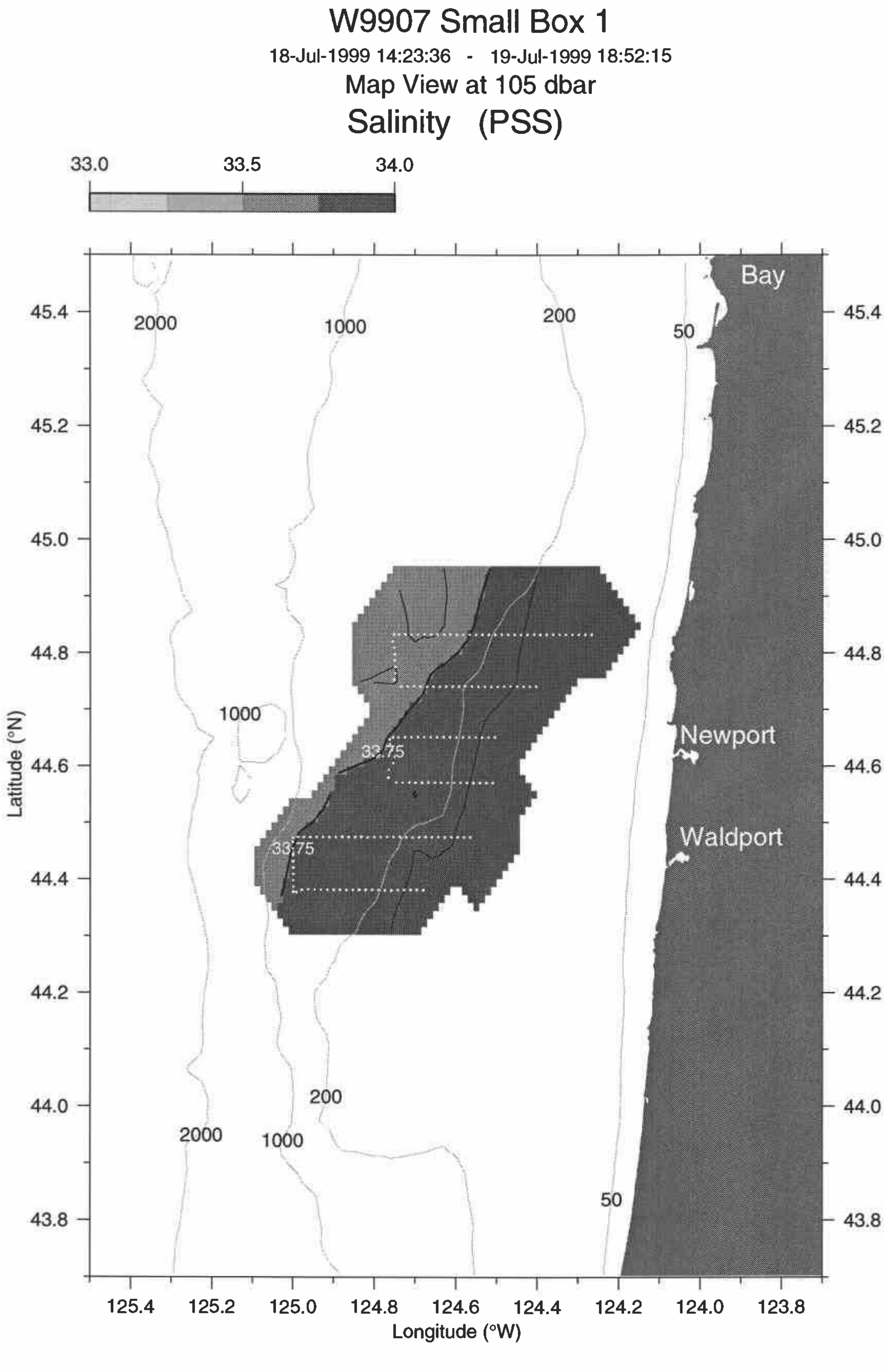
W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 95 dbar

Salinity (PSS)



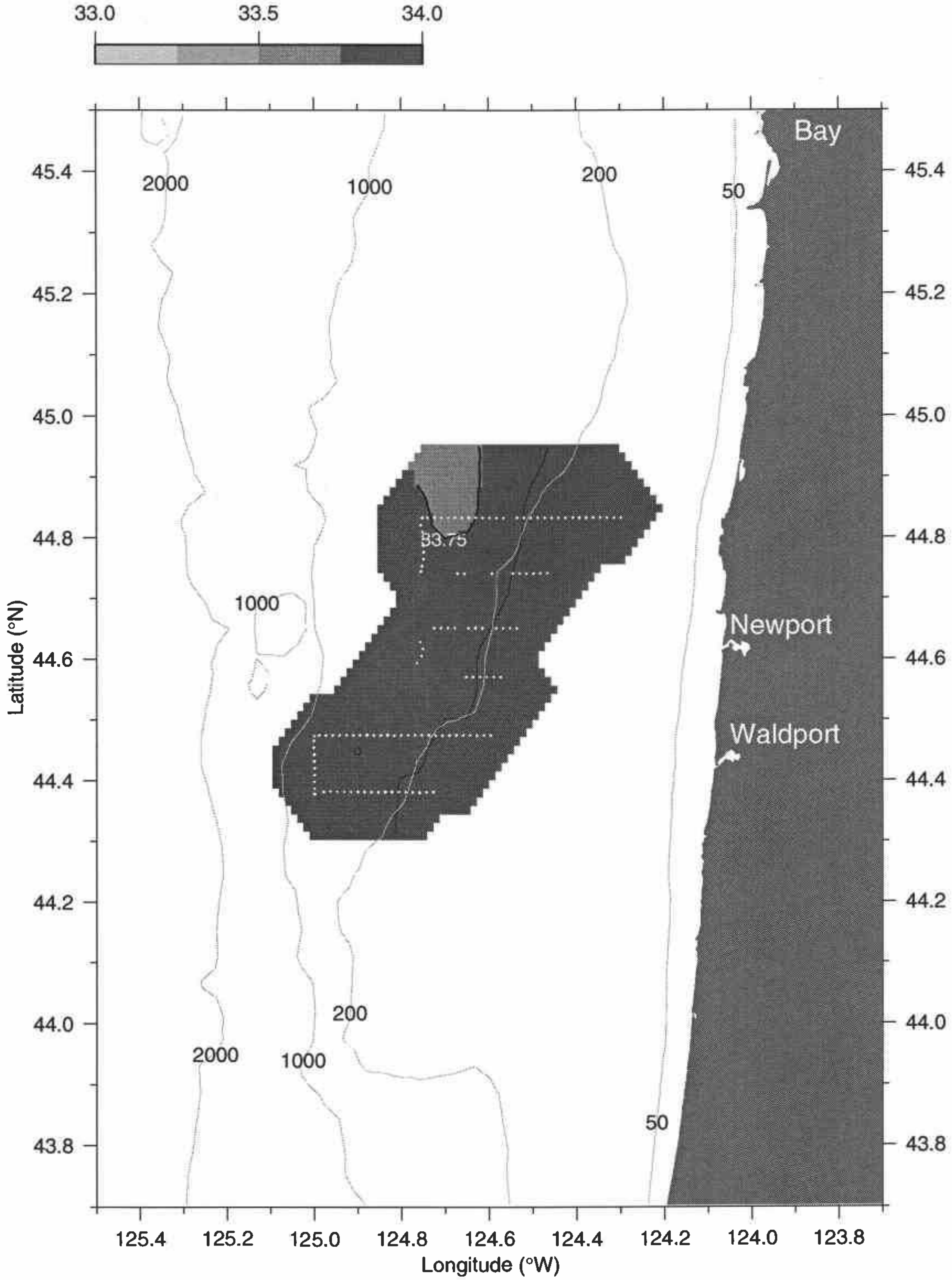

W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 105 dbar
Salinity (PSS)
33.0
33.5
34.0
Bay
Newport
Waldport
2000
1000
200
50
33.75
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 115 dbar

Salinity (PSS)

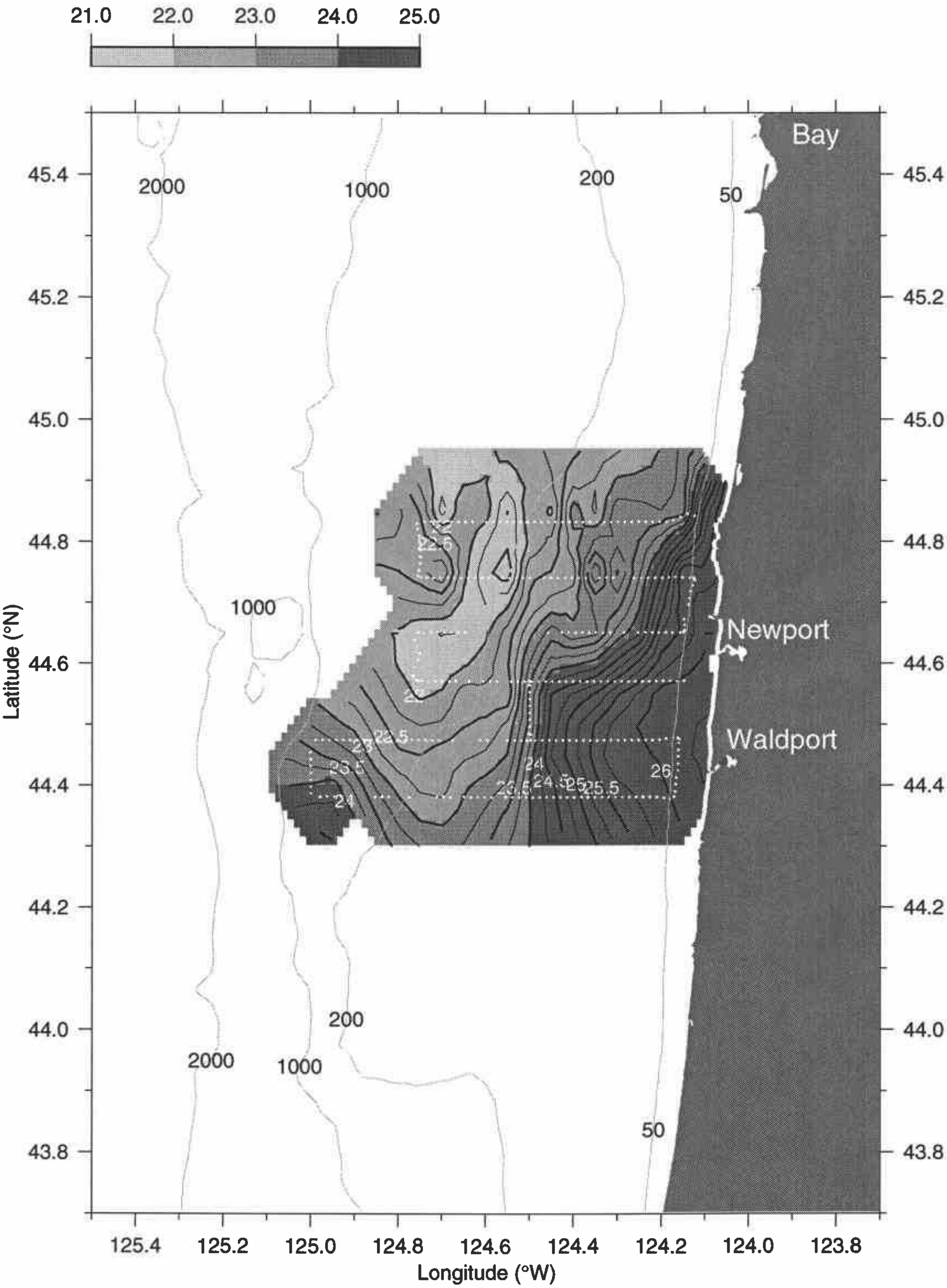


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 5 dbar

σ_t $(kg\ m^{-3})$

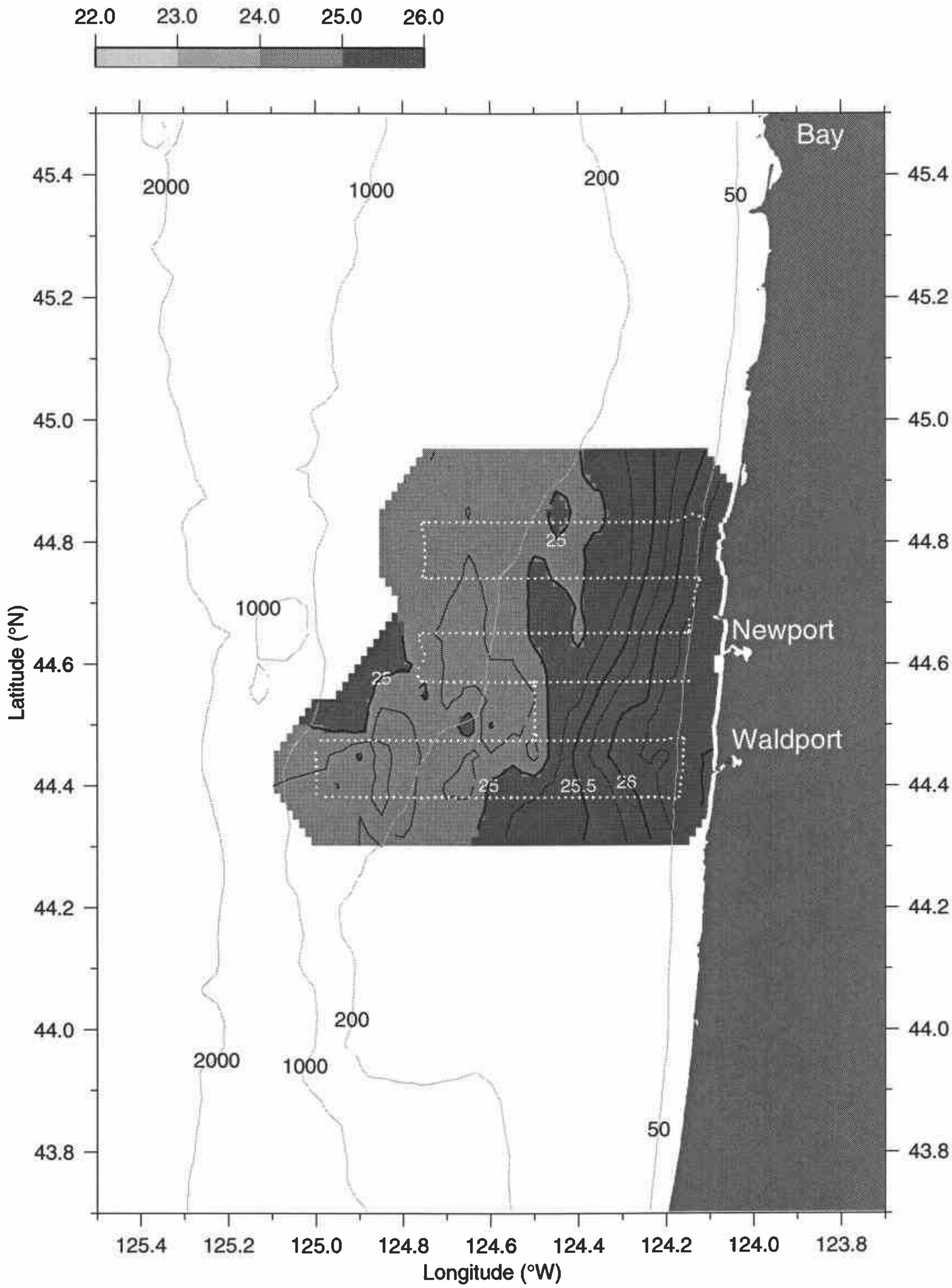


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 15 dbar

σ_t $(kg\ m^{-3})$

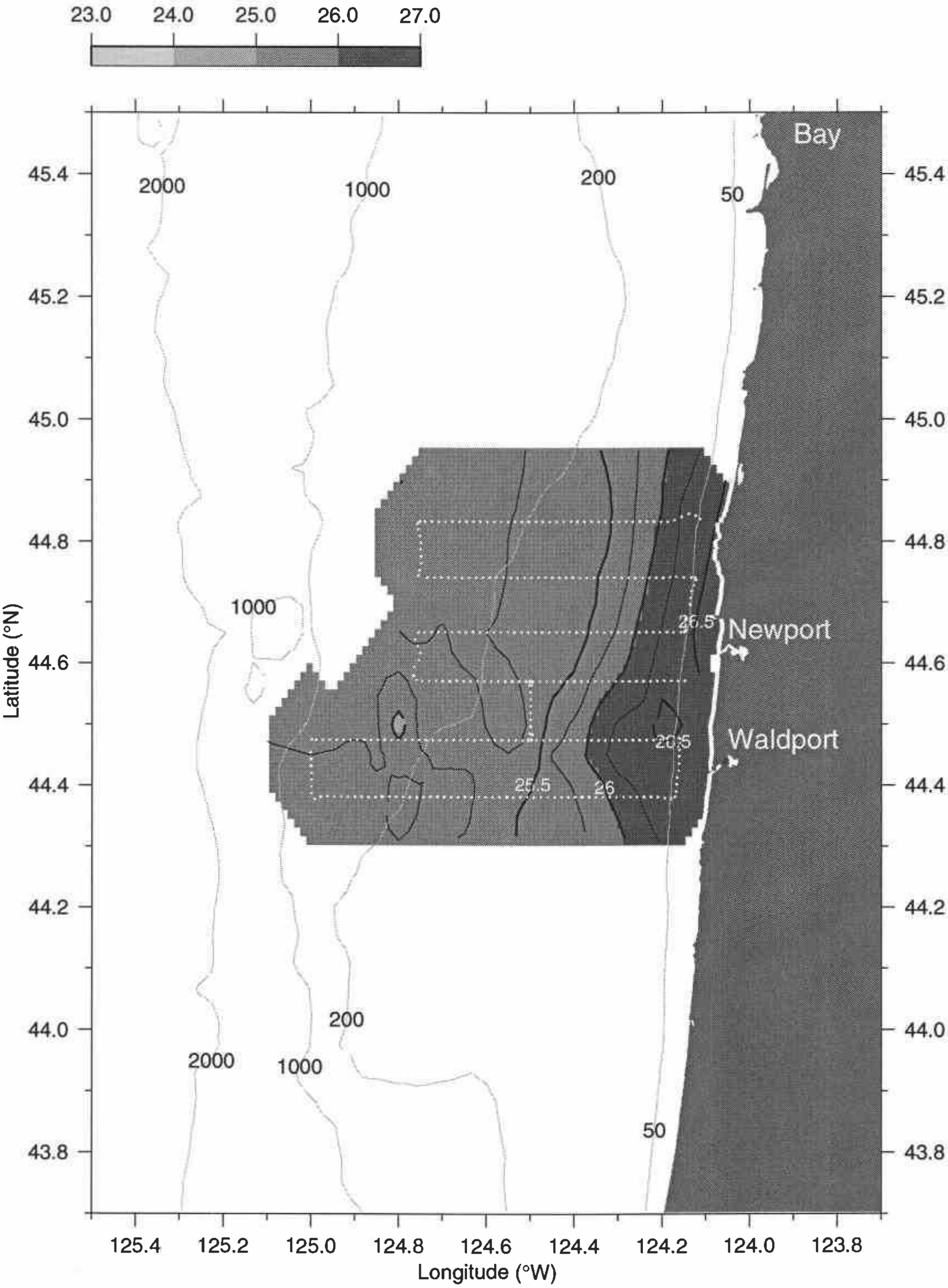


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 25 dbar

σ_t $(kg\ m^{-3})$

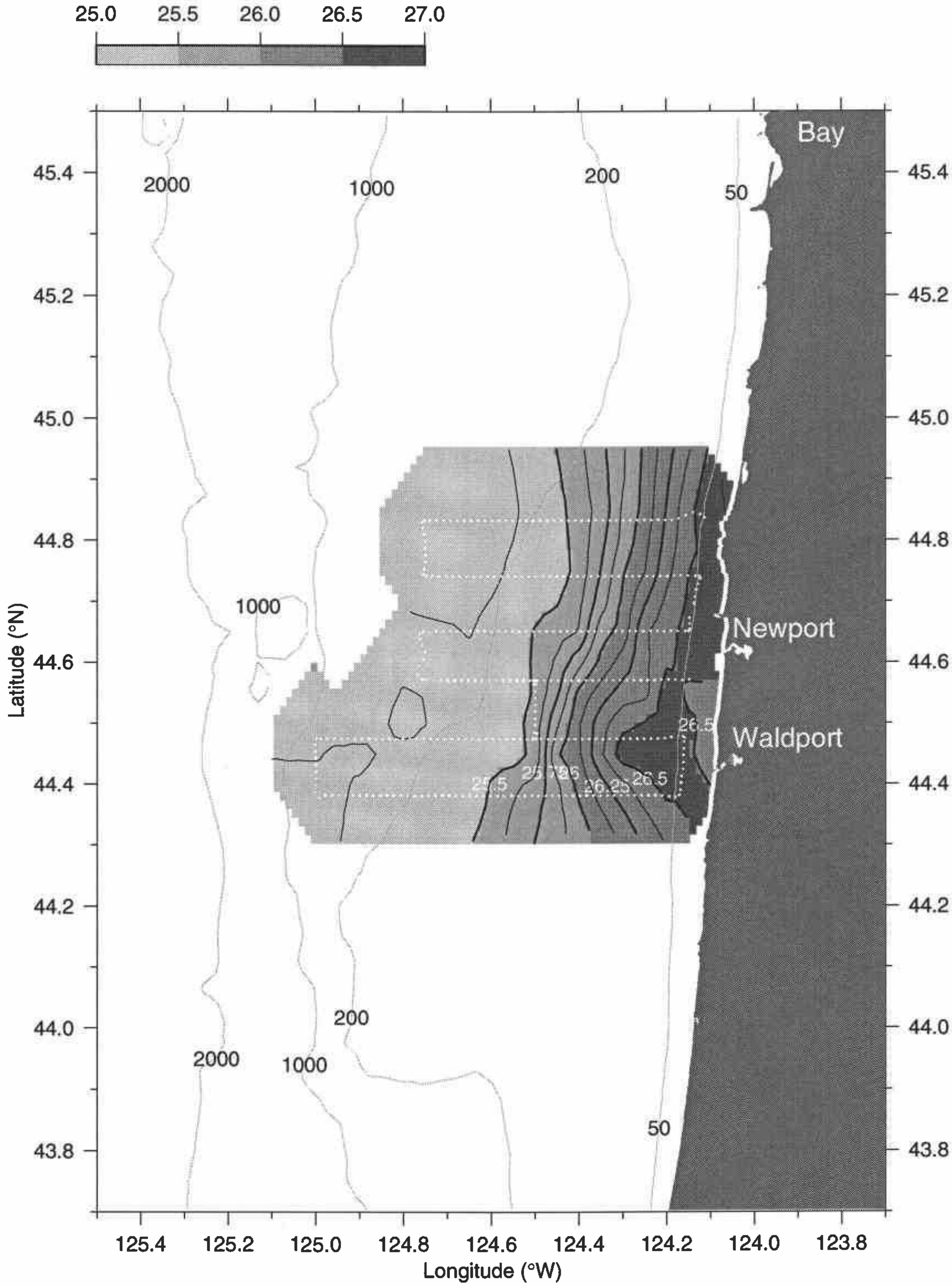


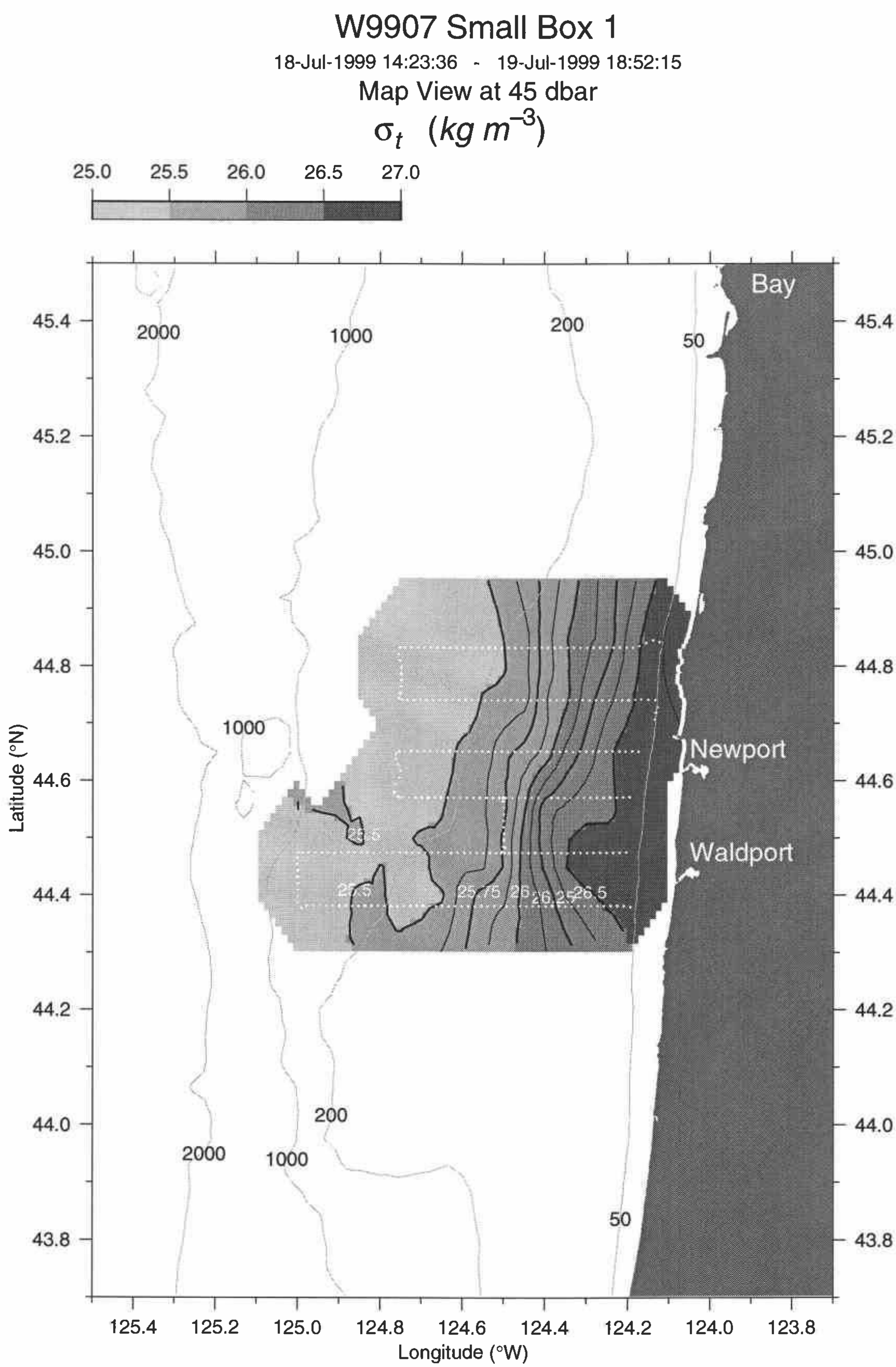
W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 35 dbar

σ_t $(kg\ m^{-3})$





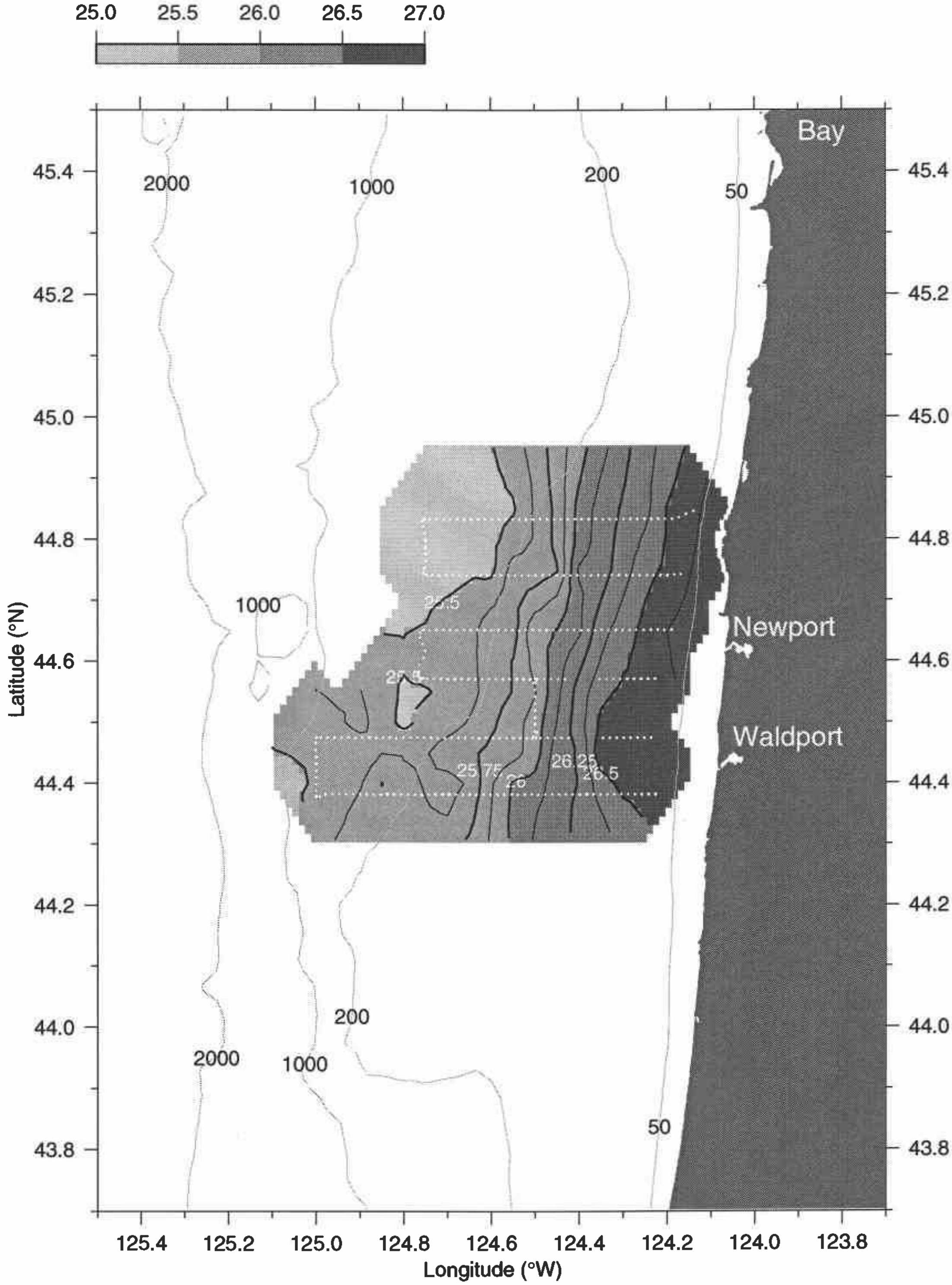
W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 45 dbar
σ_t $(kg\ m^{-3})$
25.0 25.5 26.0 26.5 27.0
Bay
Newport
Waldport
2000
1000
200
50
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4 125.2 125.0 124.8 124.6 124.4 124.2 124.0 123.8

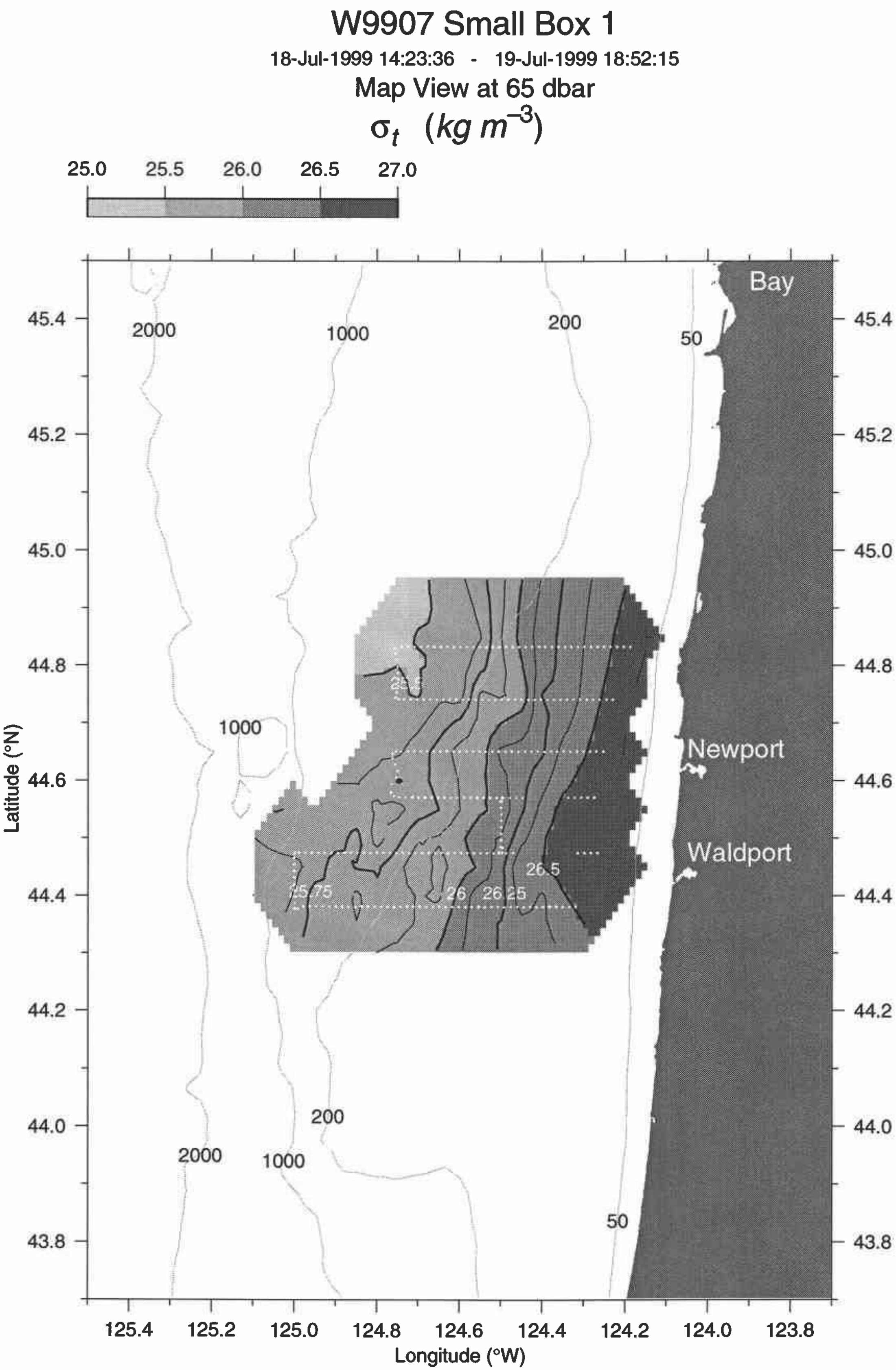
W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 55 dbar

σ_t $(kg\ m^{-3})$



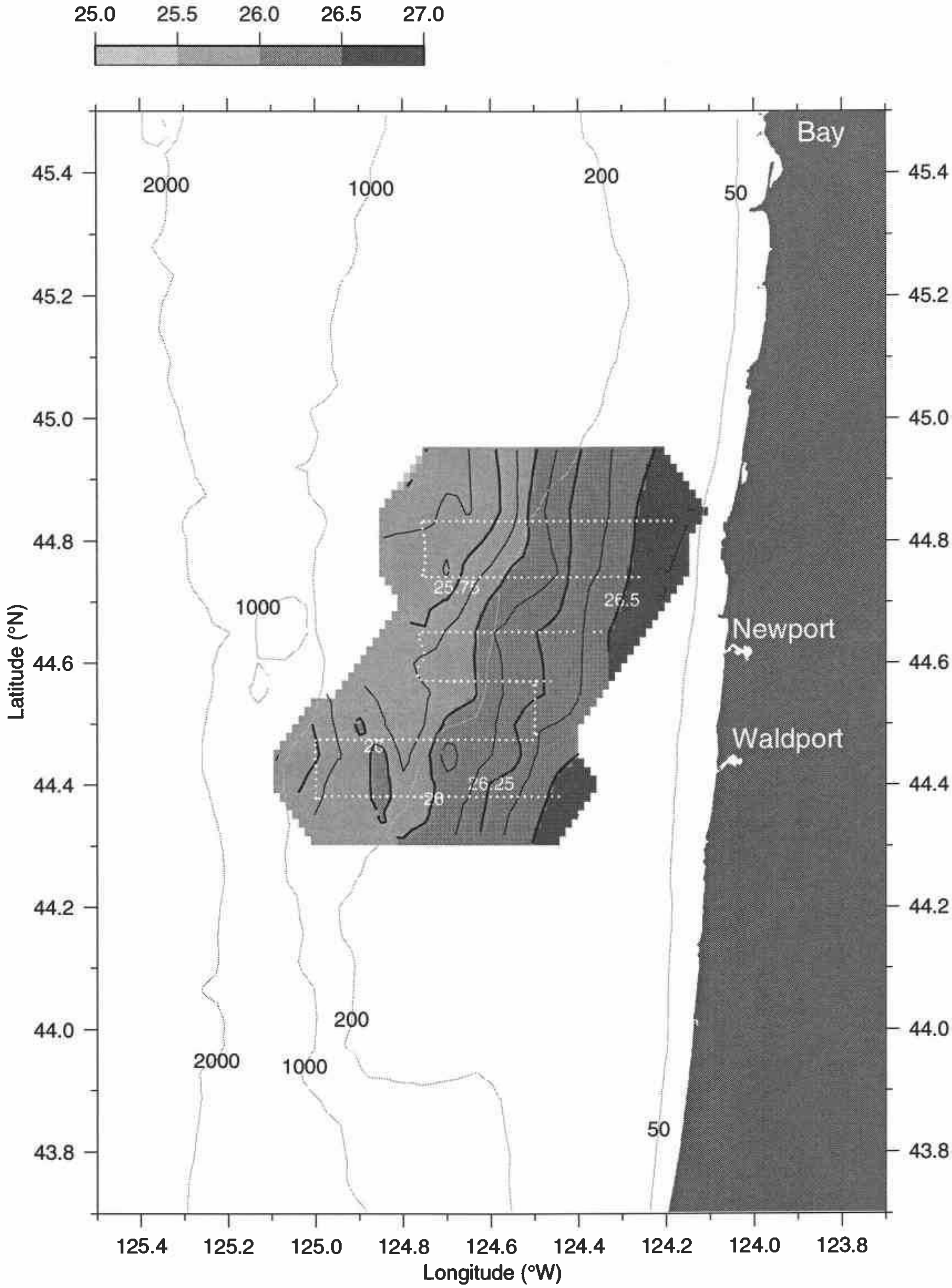

W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 65 dbar
σ_t $(kg\ m^{-3})$
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
25.5
25.75
26
26.25
26.5
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

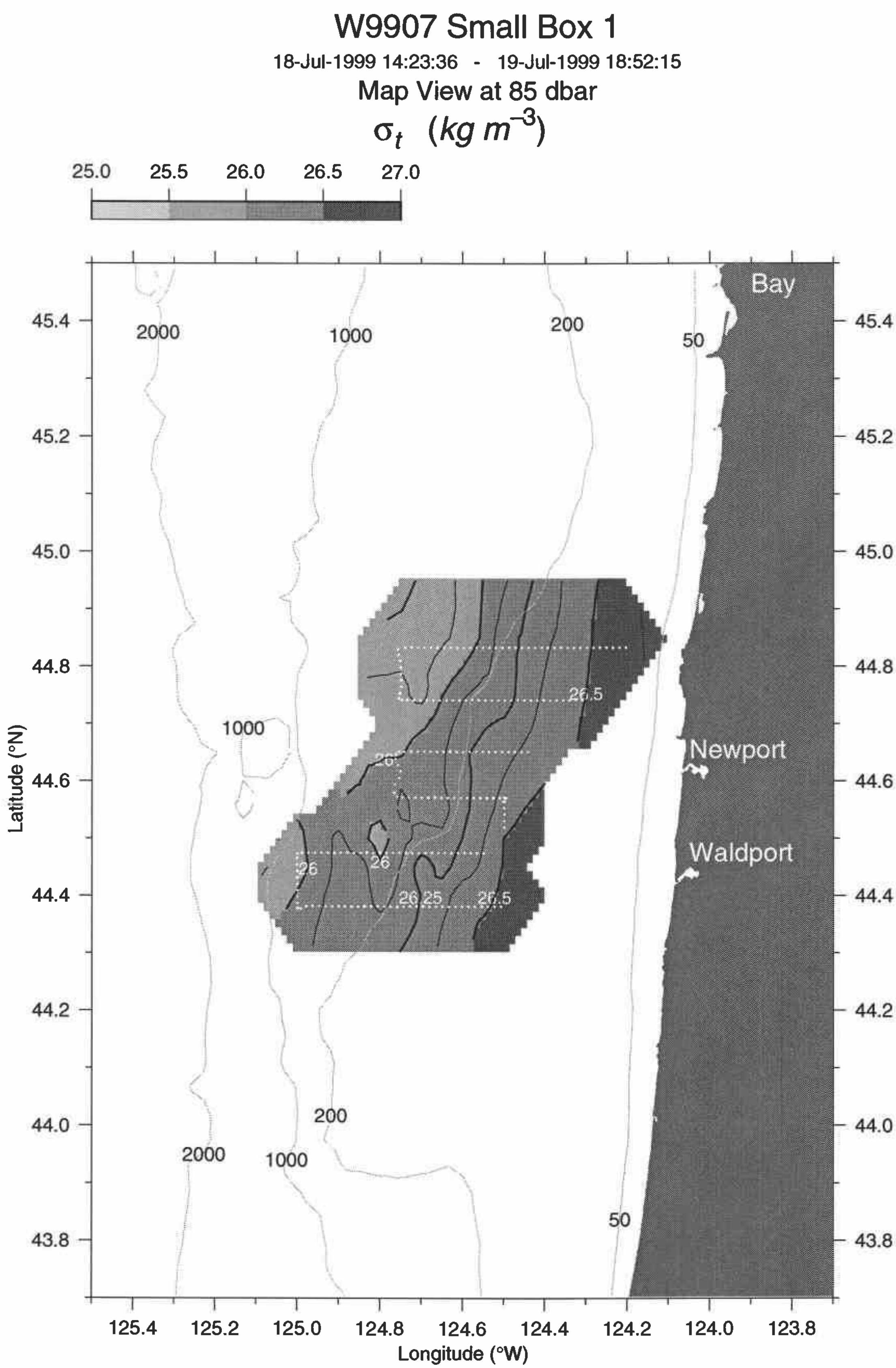
W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 75 dbar

σ_t $(kg\ m^{-3})$



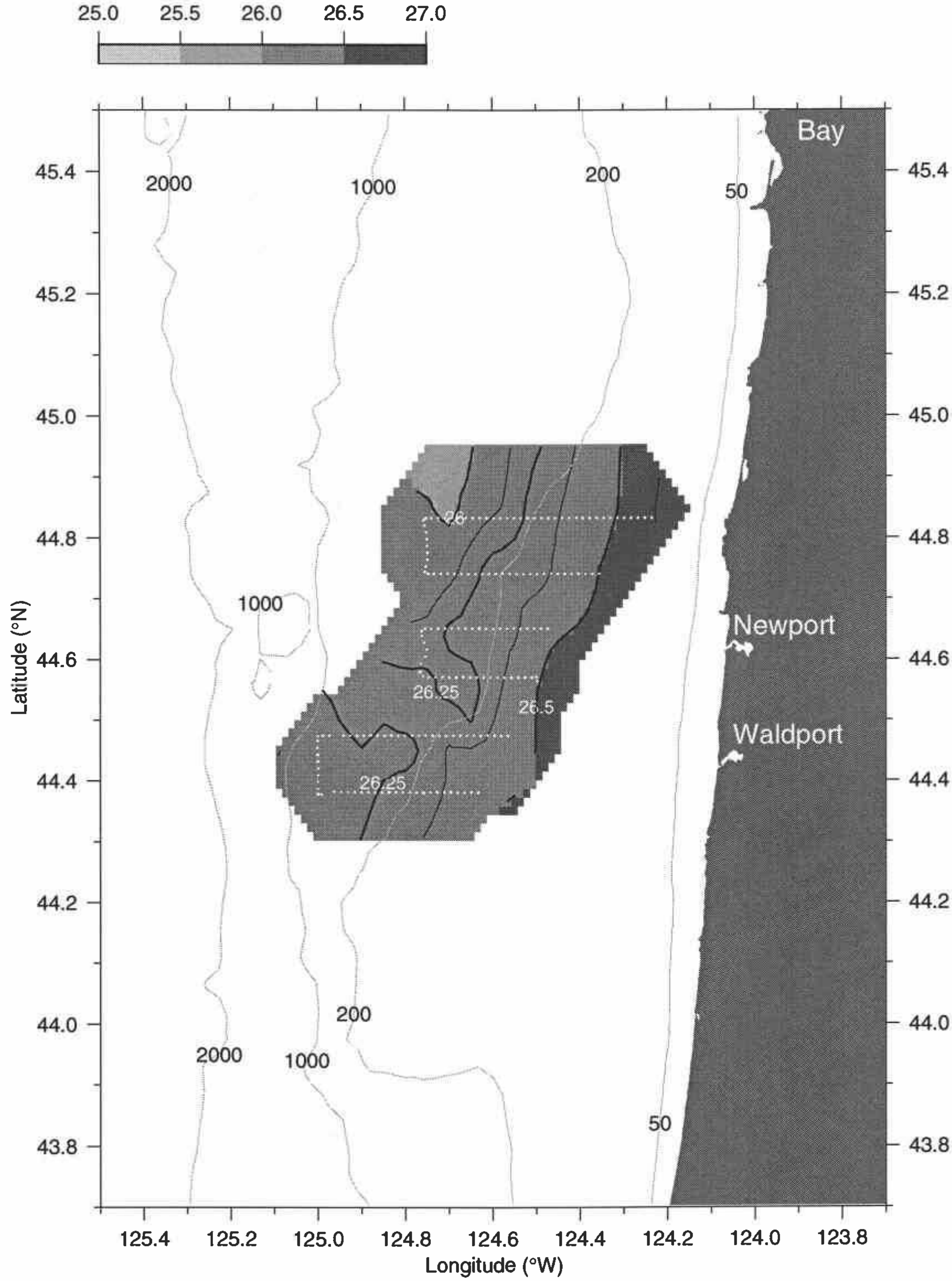

W9907 Small Box 1
18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15
Map View at 85 dbar
σ_t $(kg\ m^{-3})$
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
26.5
26
26.25
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 95 dbar

σ_t $(kg\ m^{-3})$

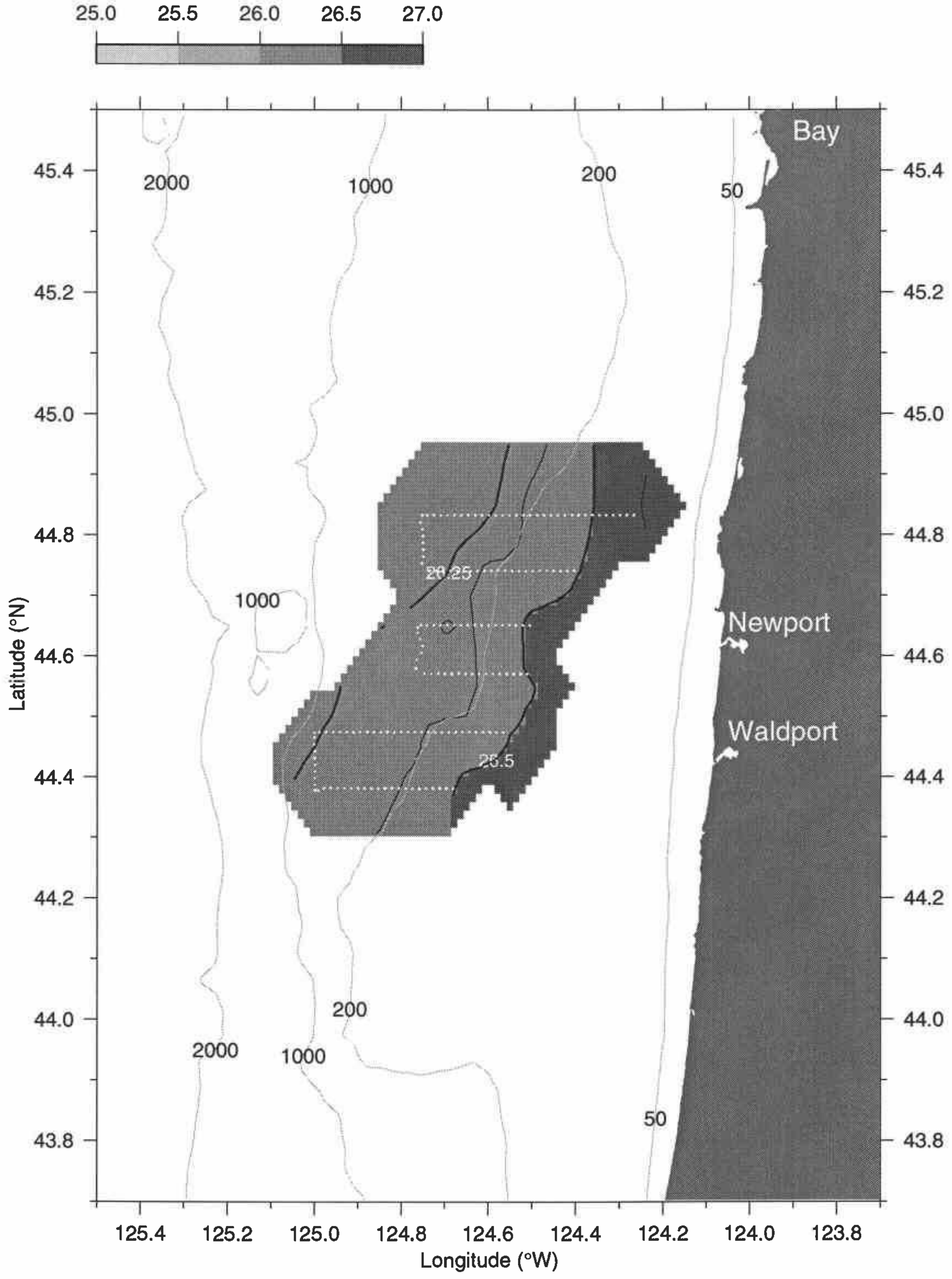


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 105 dbar

σ_t $(kg\ m^{-3})$

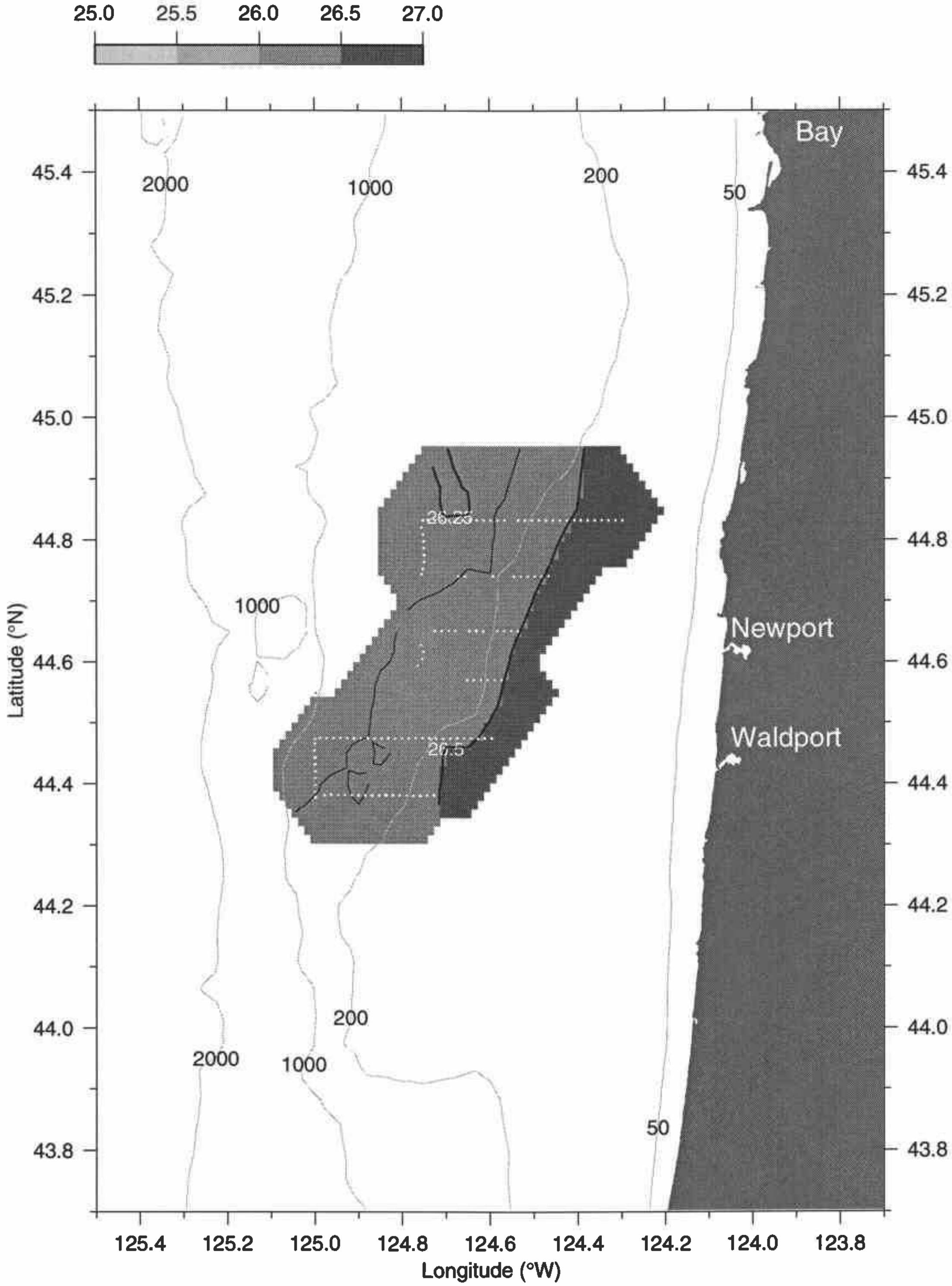


W9907 Small Box 1

18-Jul-1999 14:23:36 - 19-Jul-1999 18:52:15

Map View at 115 dbar

σ_t $(kg\ m^{-3})$



Small Box 2 Maps

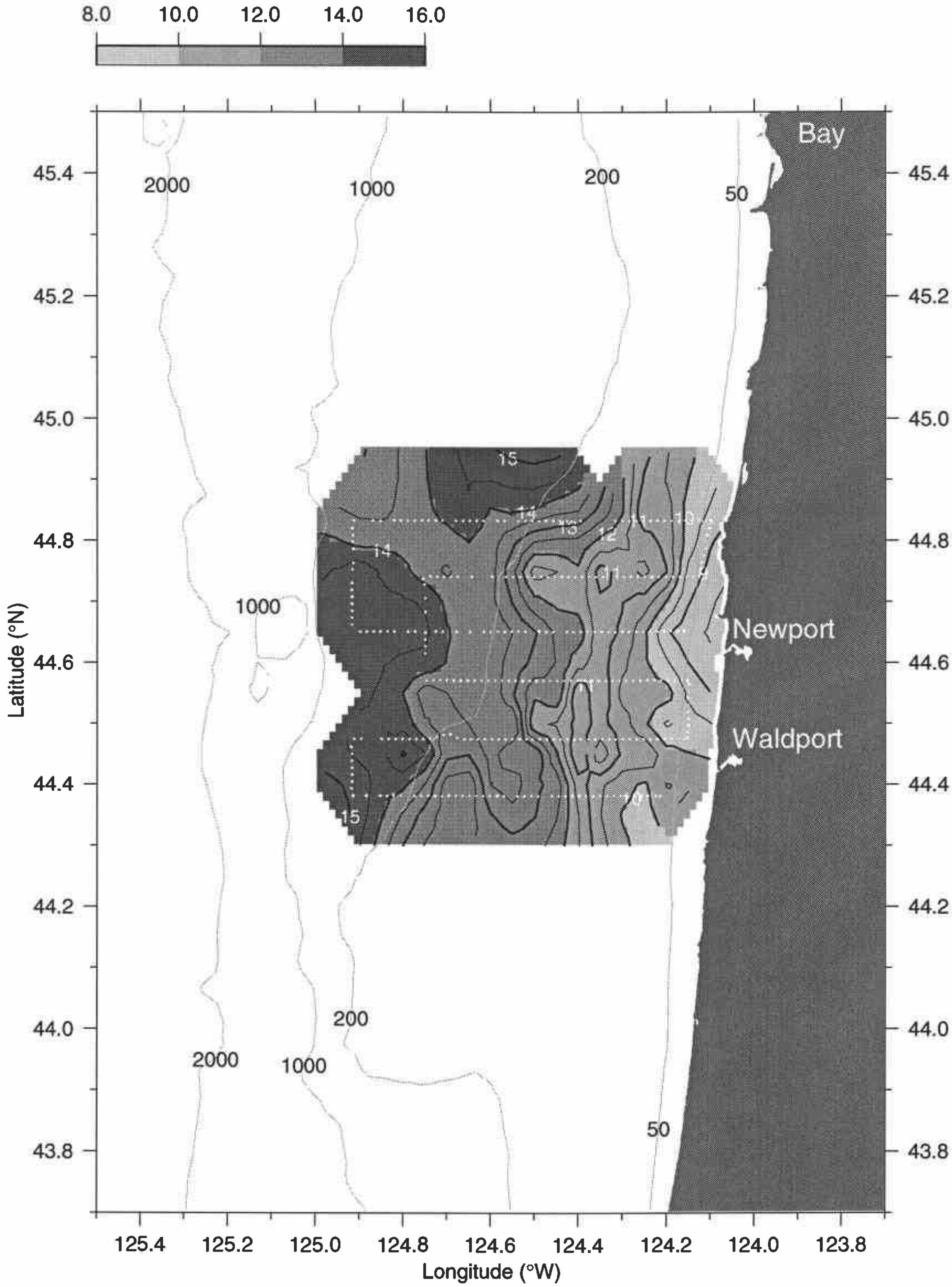
Maps of Temperature, Salinity, and σ_t at Specified Depths

W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 5 dbar

Temperature (°C)

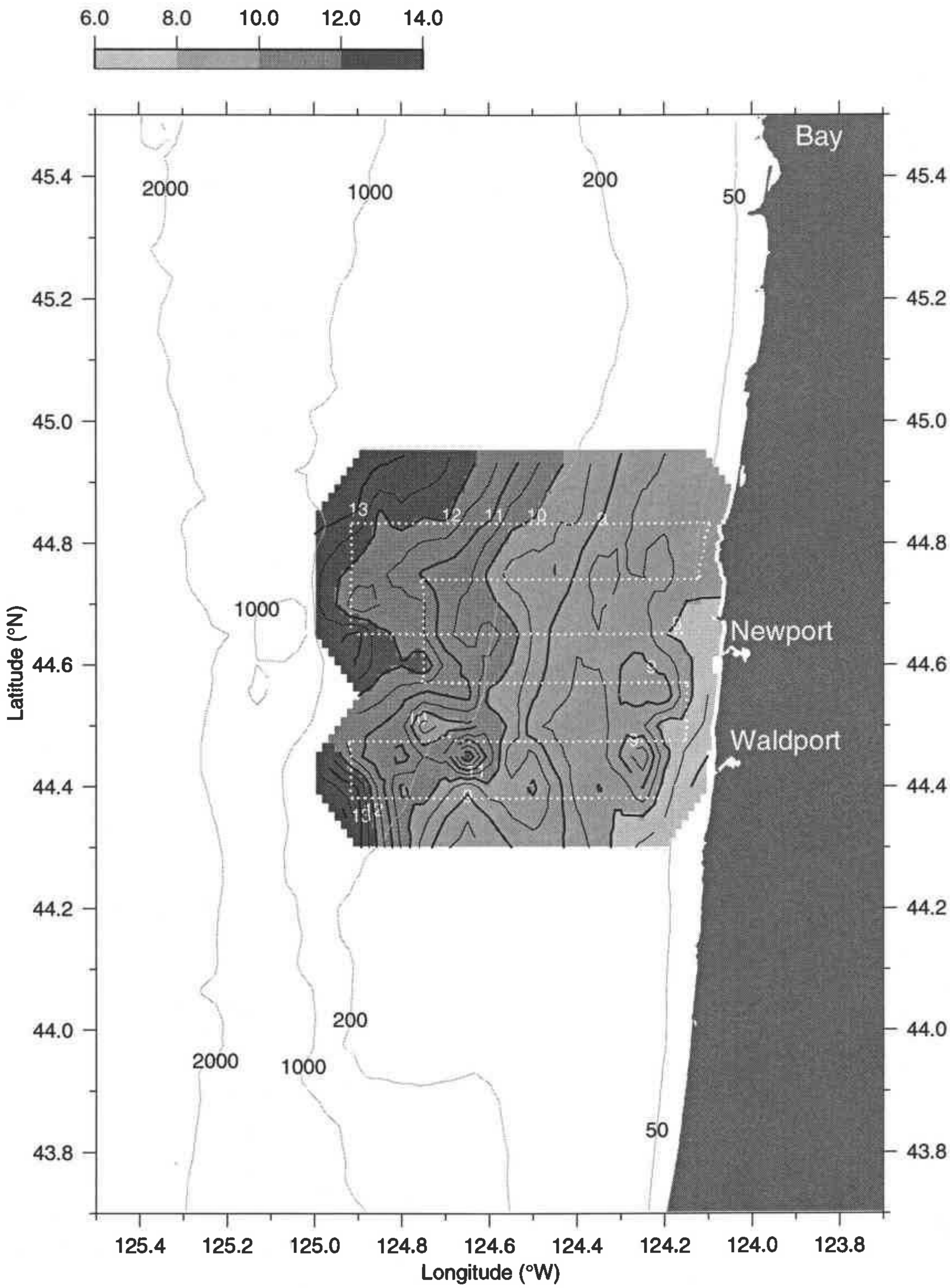


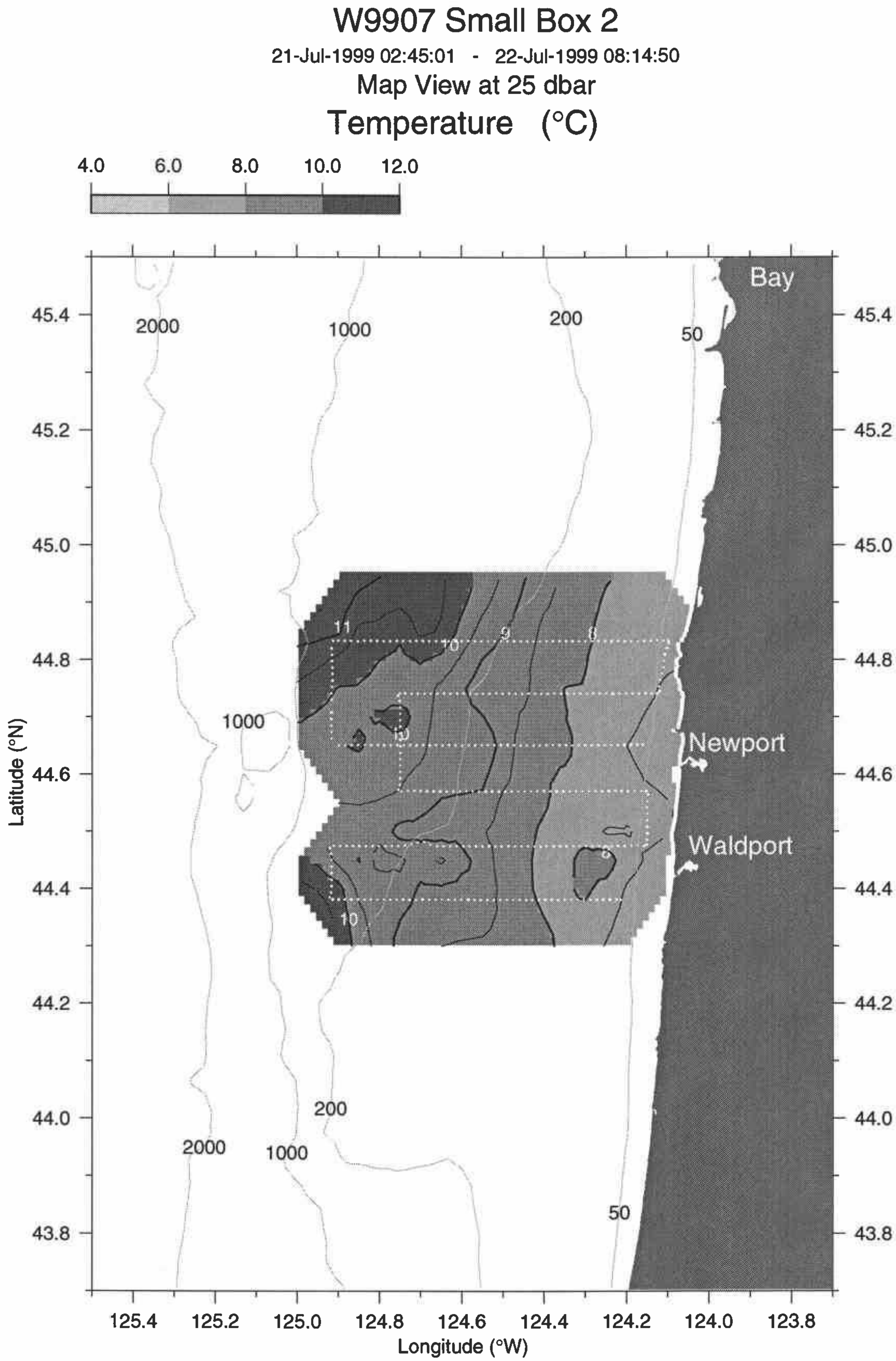
W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 15 dbar

Temperature (°C)



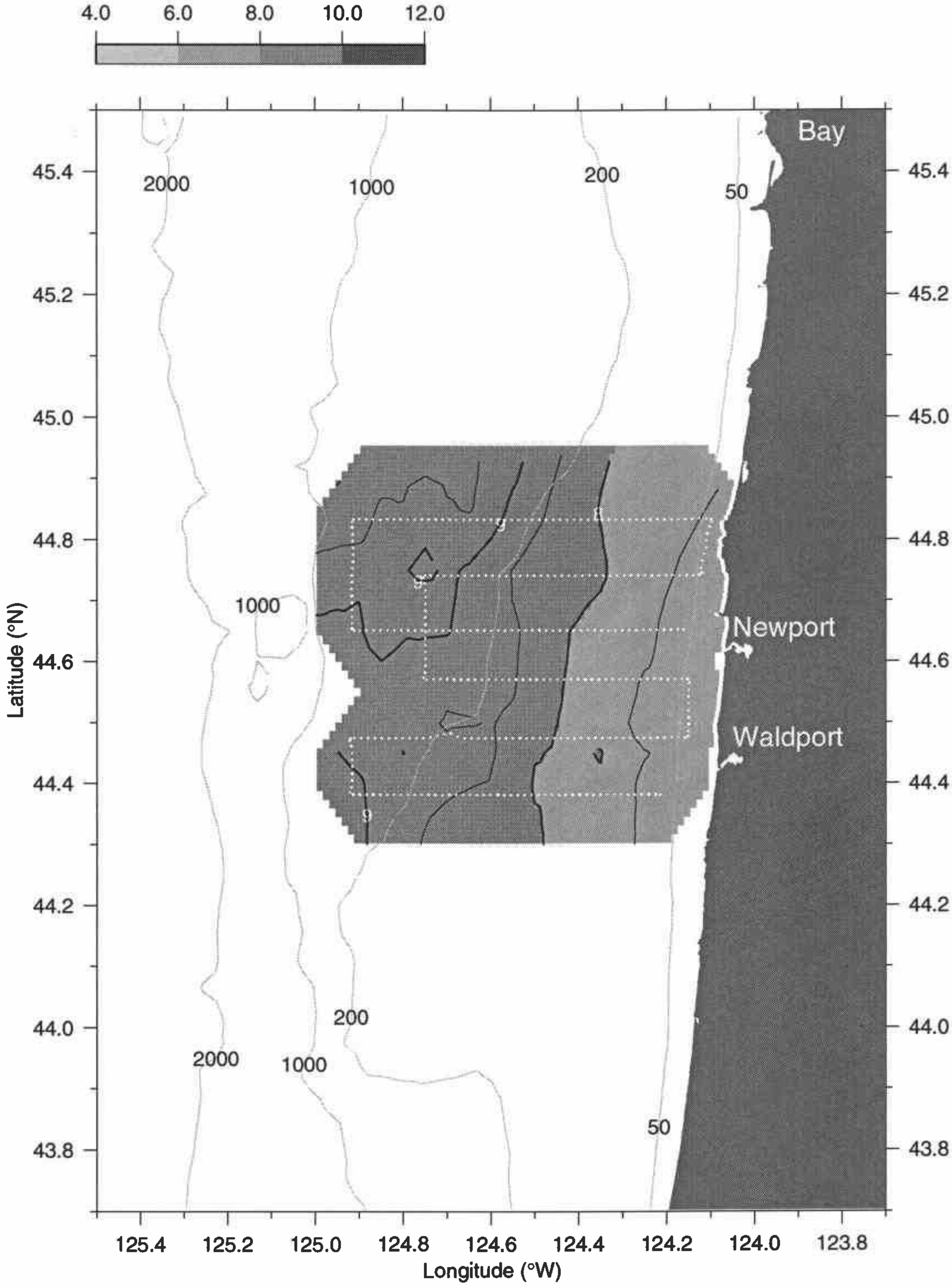

W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 25 dbar
Temperature (°C)
4.0
6.0
8.0
10.0
12.0
Bay
Newport
Waldport
2000
1000
200
50
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 35 dbar

Temperature (°C)

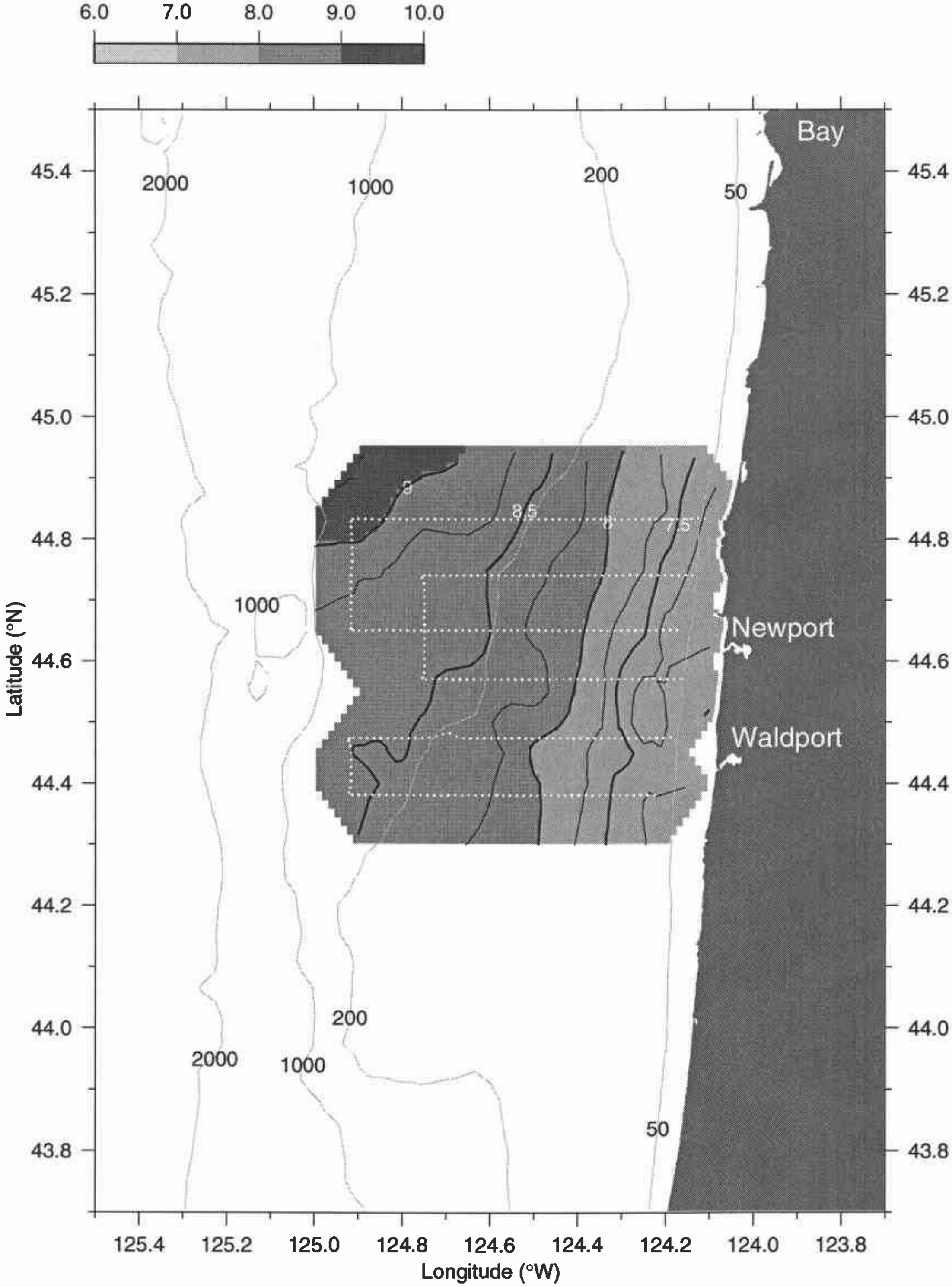


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 45 dbar

Temperature (°C)

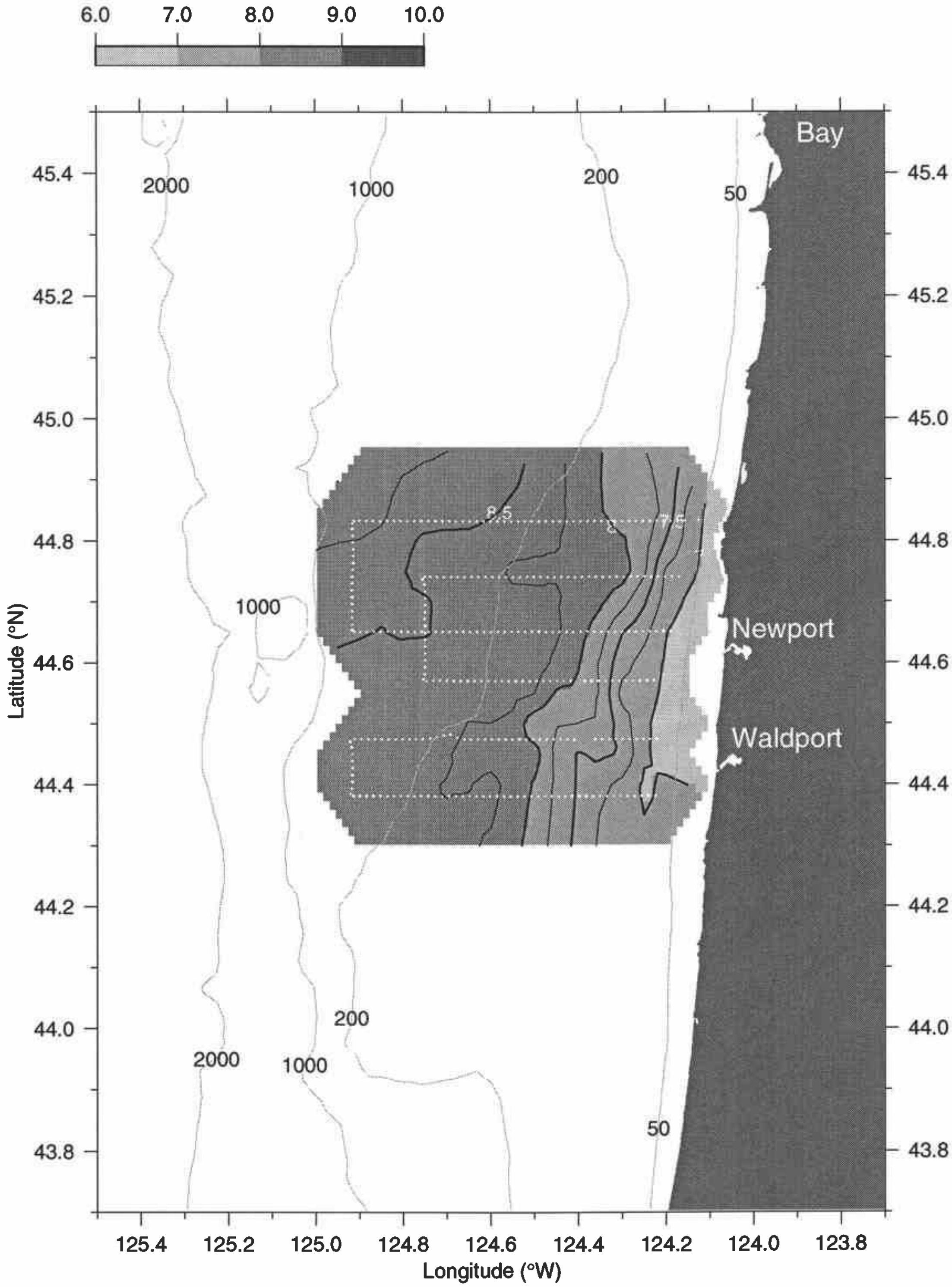


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 55 dbar

Temperature (°C)

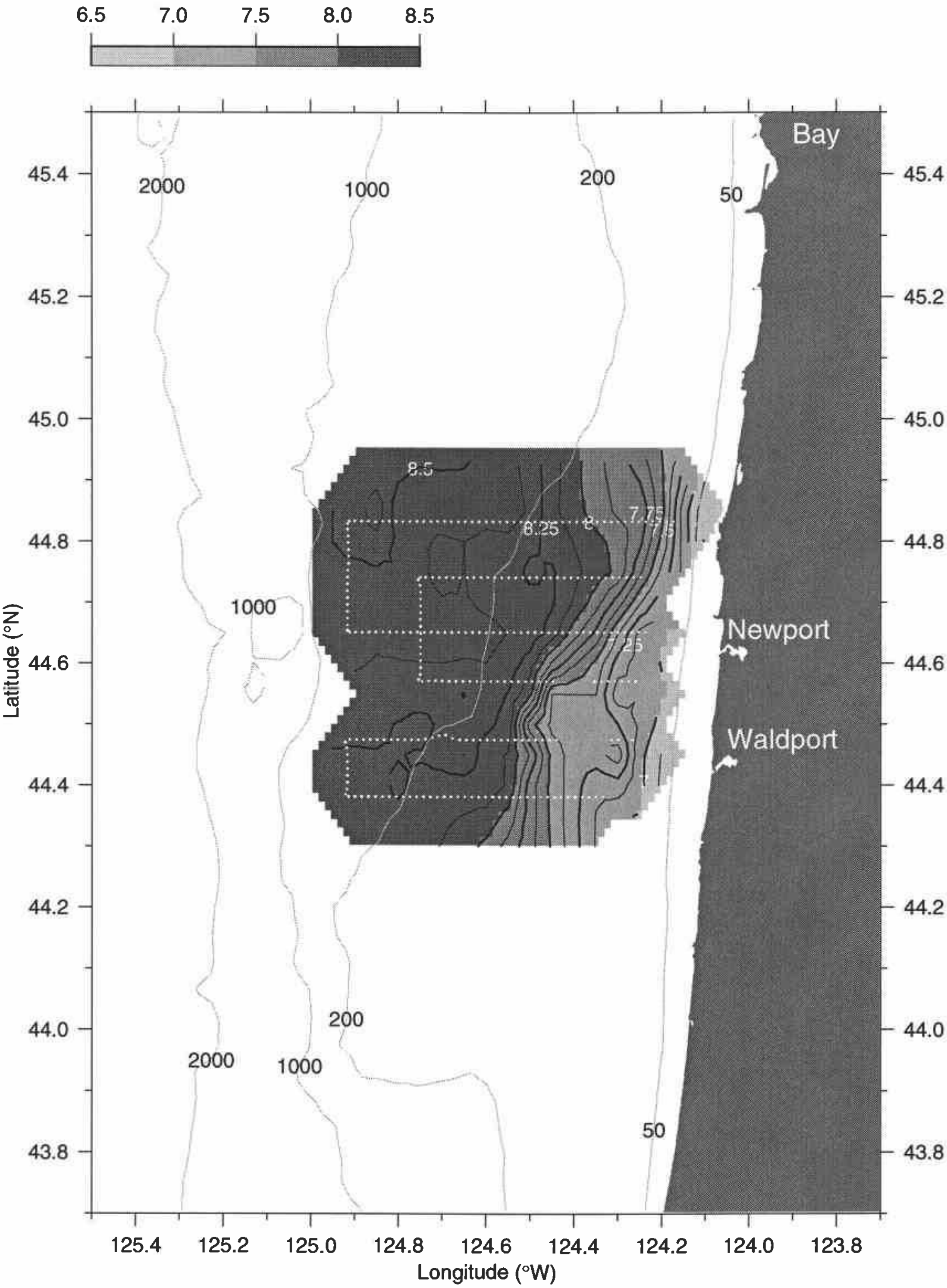


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 65 dbar

Temperature (°C)

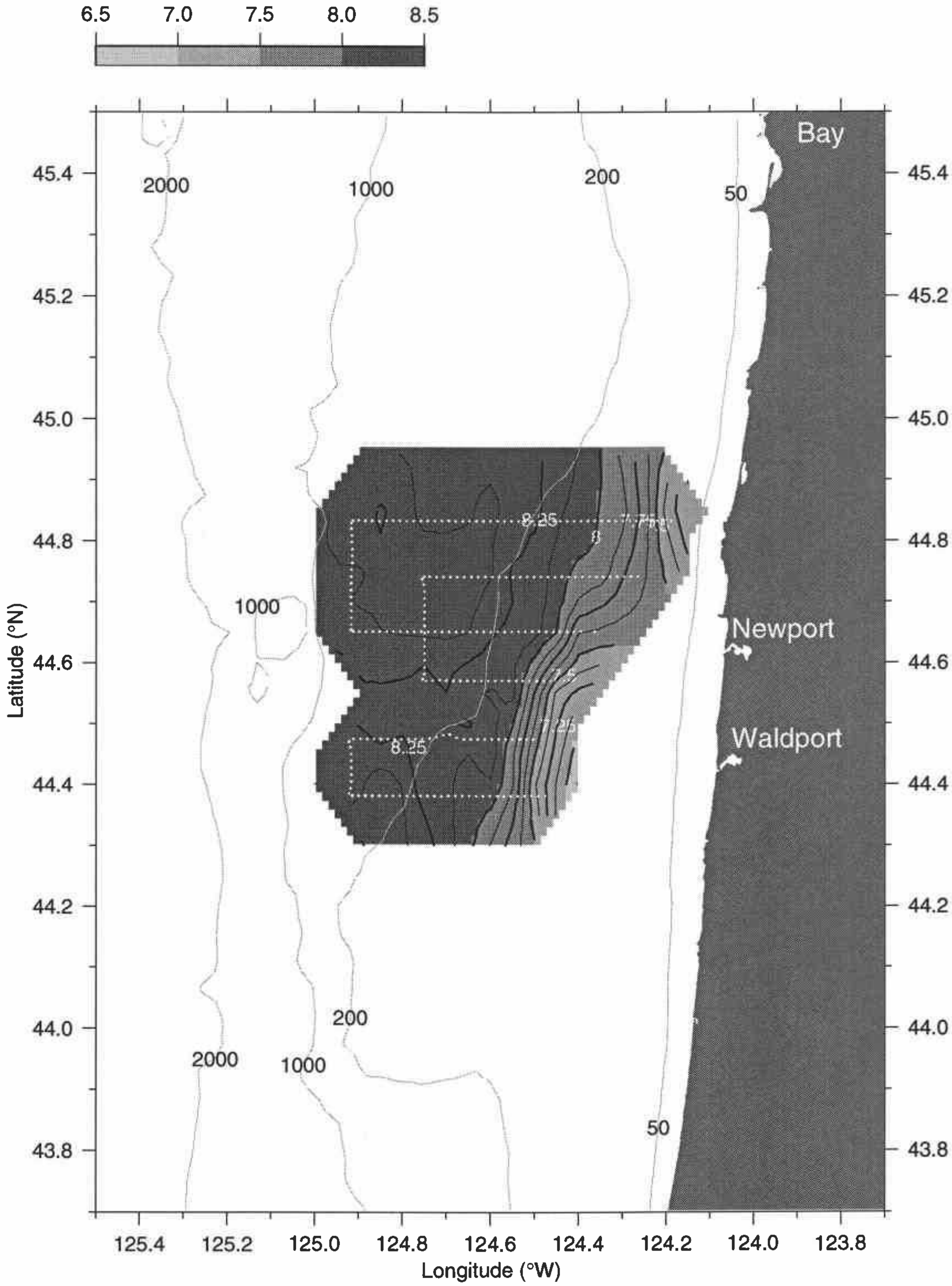


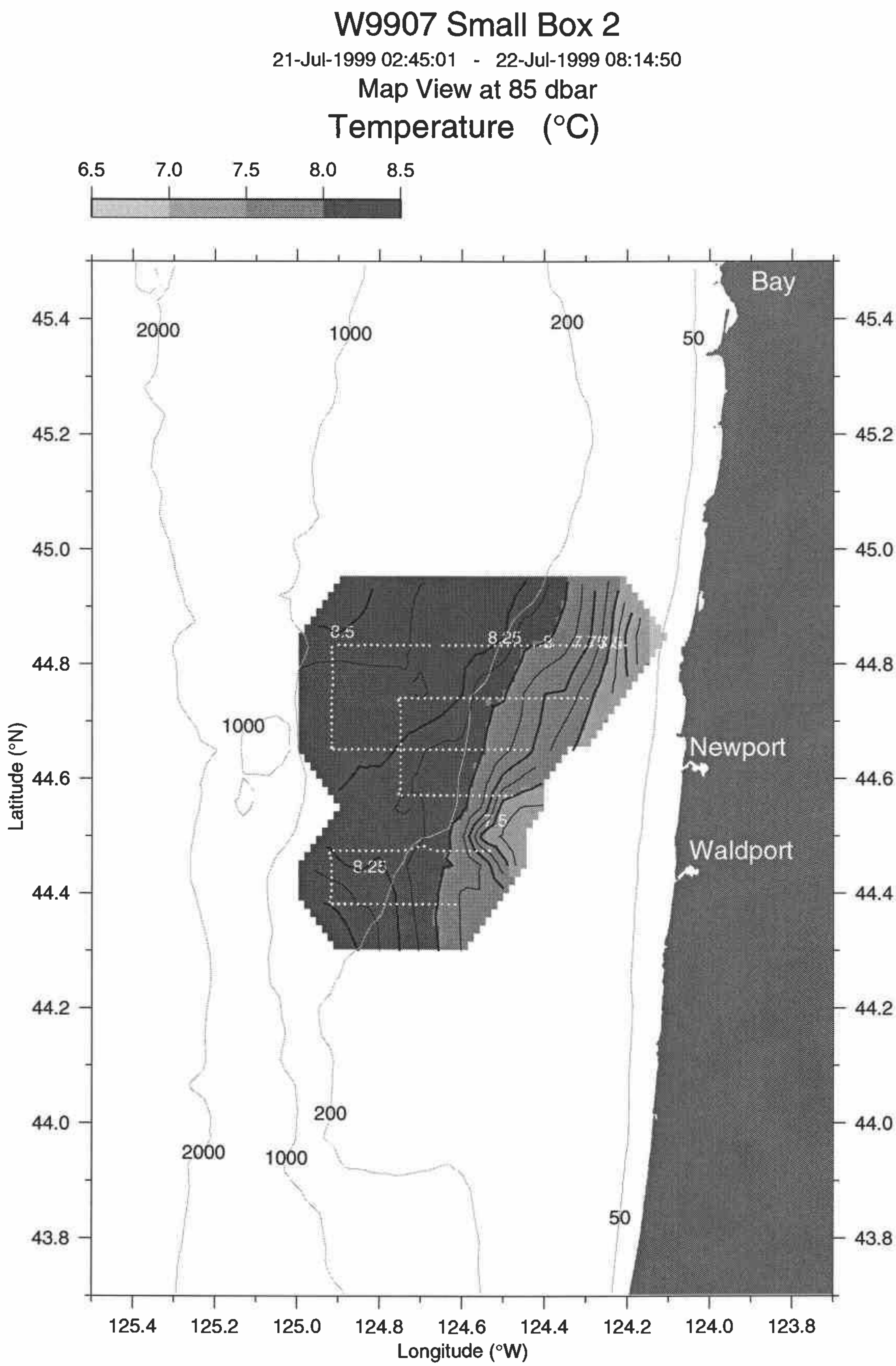
W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 75 dbar

Temperature (°C)



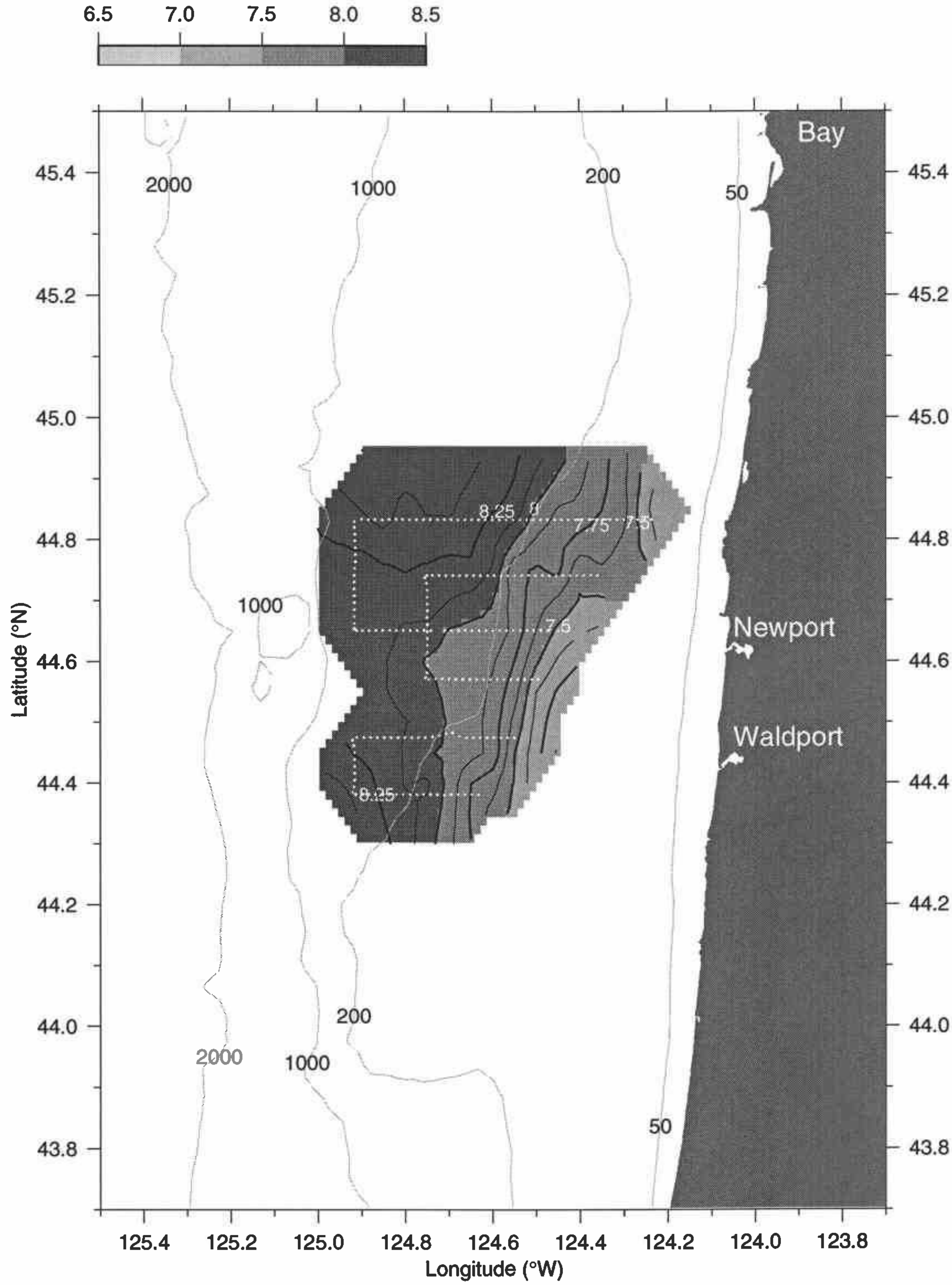

W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 85 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
Newport
Waldport
2000
1000
200
50
8.5
8.25
7.75
7.5
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 95 dbar

Temperature (°C)

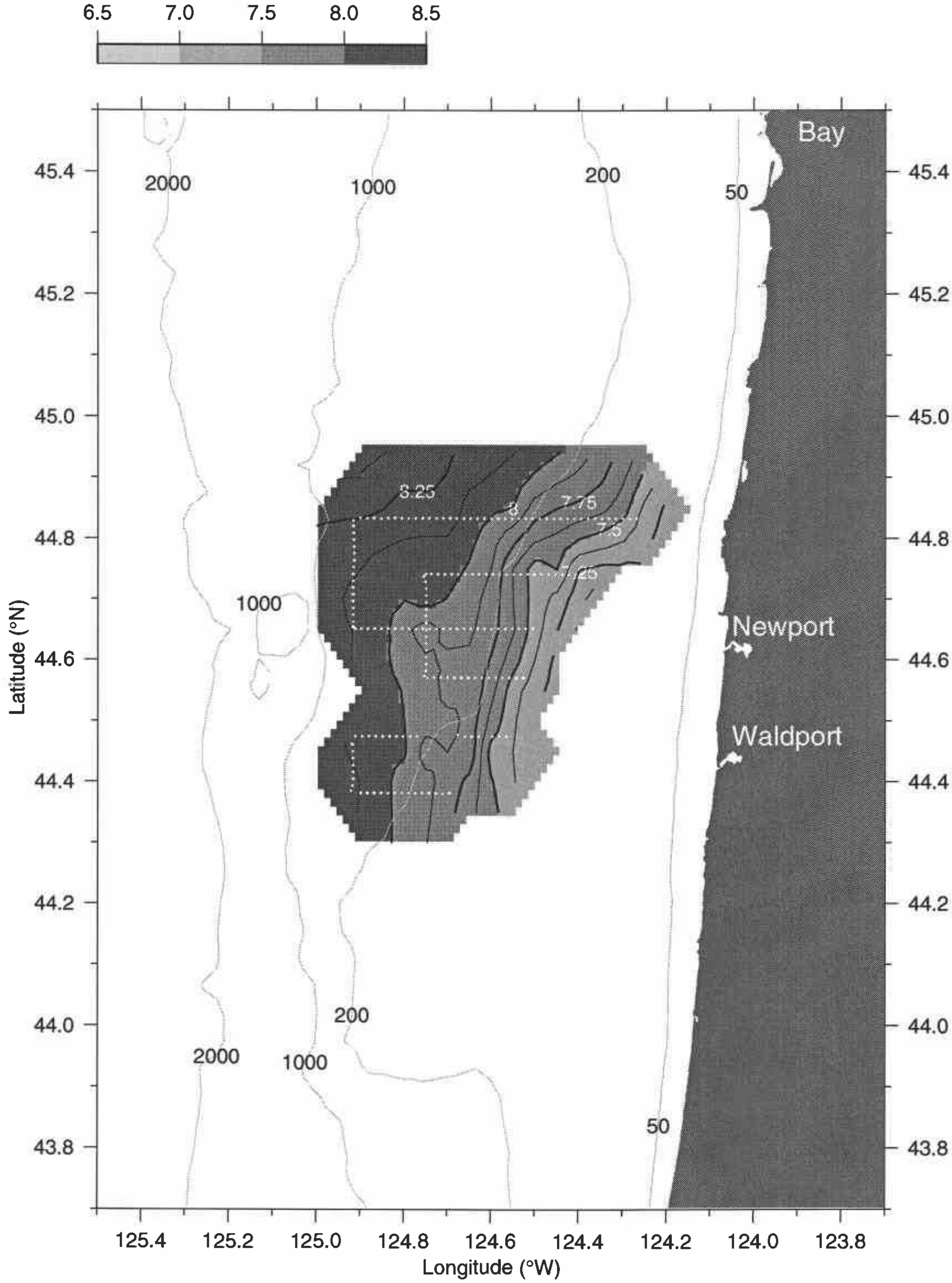


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 105 dbar

Temperature (°C)

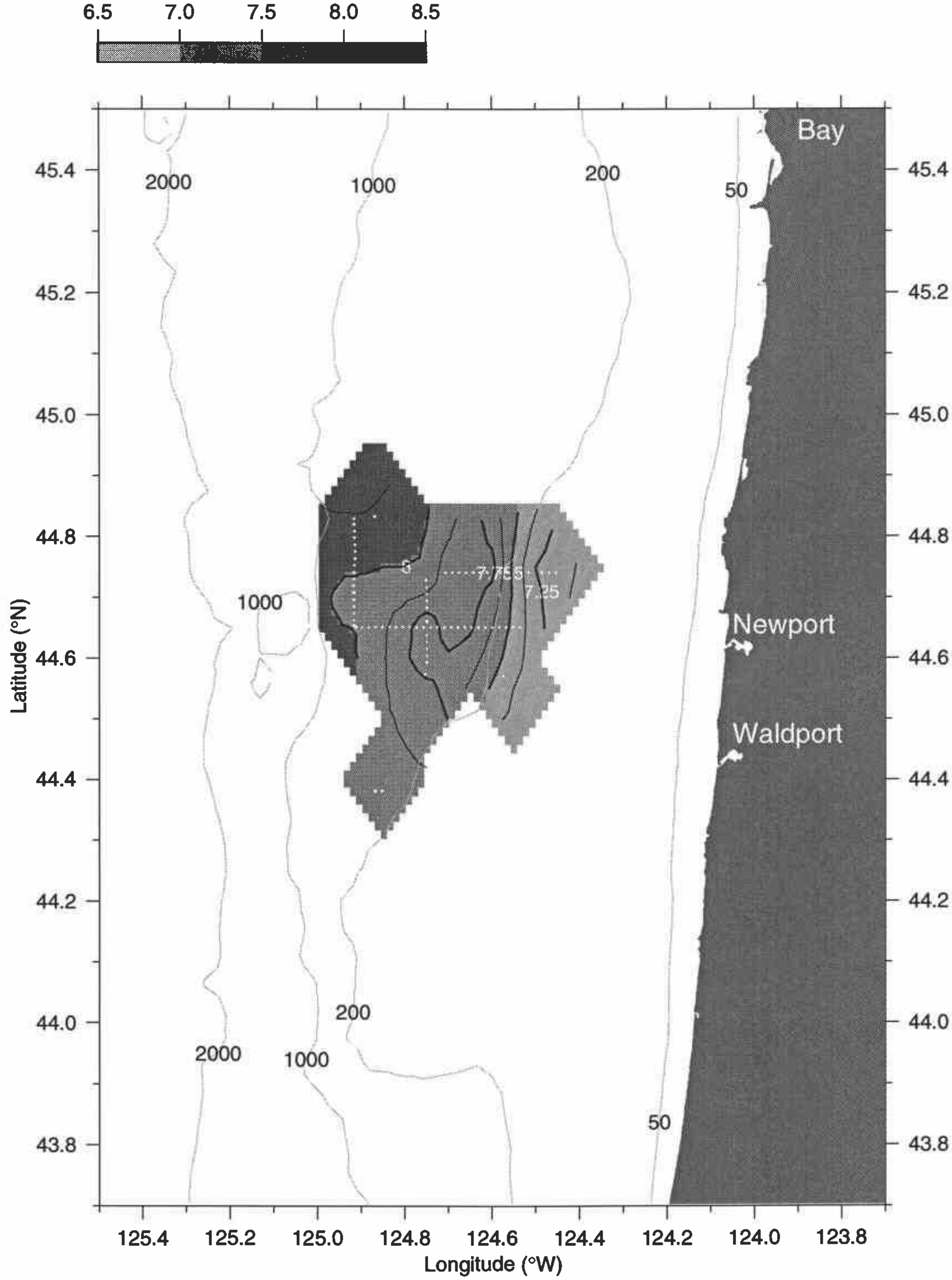


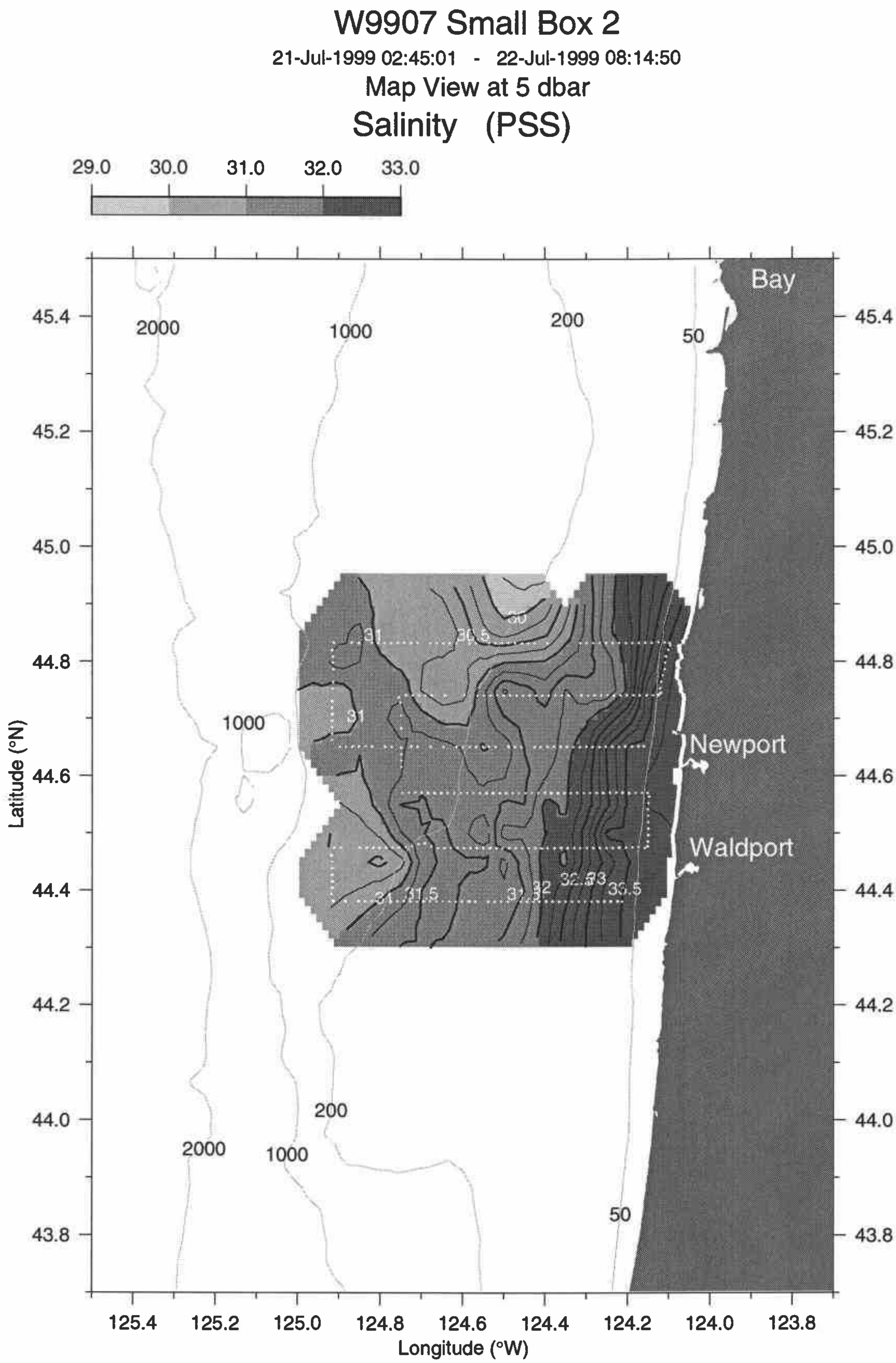
W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 115 dbar

Temperature (°C)



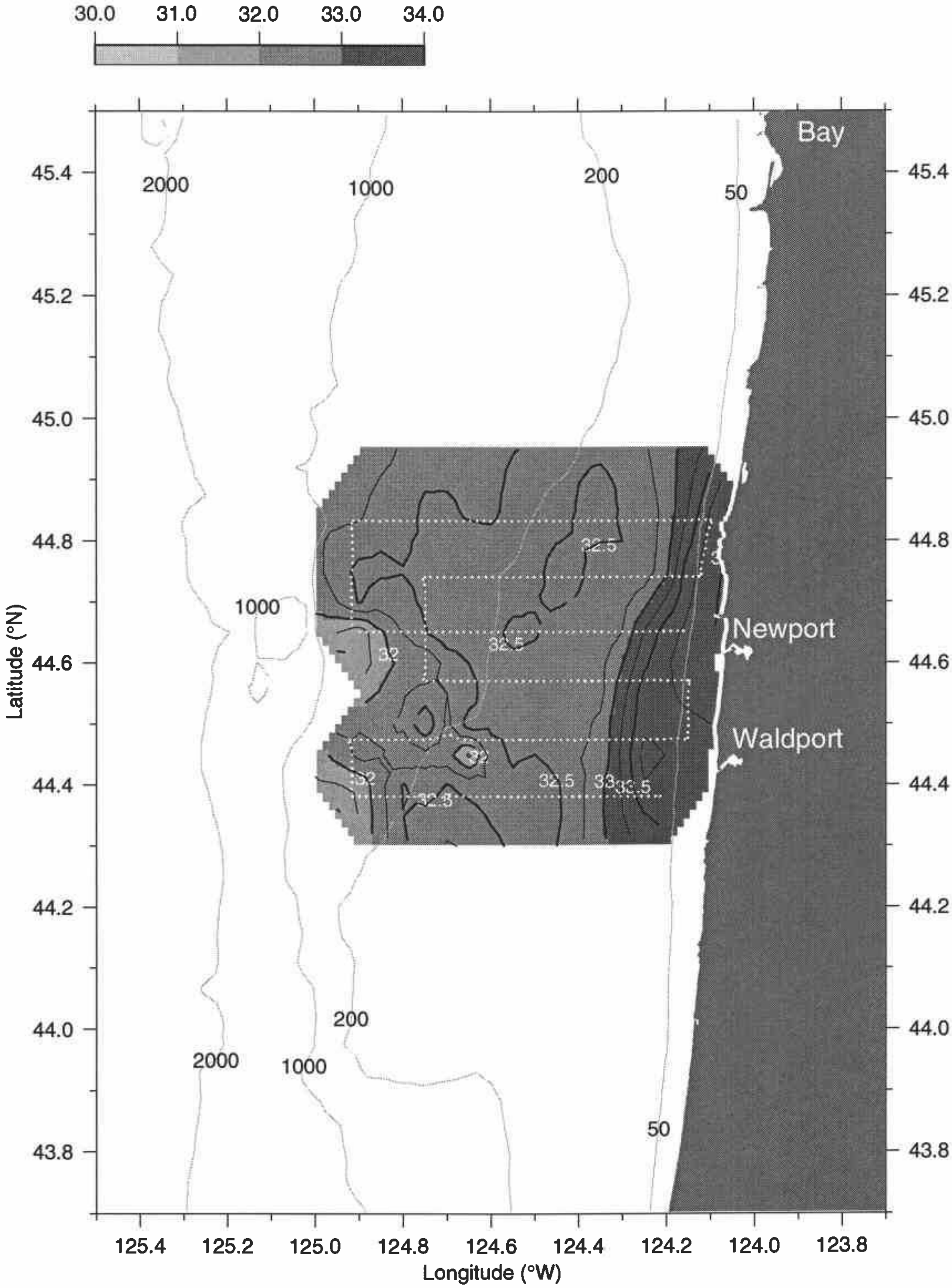

W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 5 dbar
Salinity (PSS)
29.0
30.0
31.0
32.0
33.0
Bay
Newport
Waldport
2000
1000
200
50
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 15 dbar

Salinity (PSS)

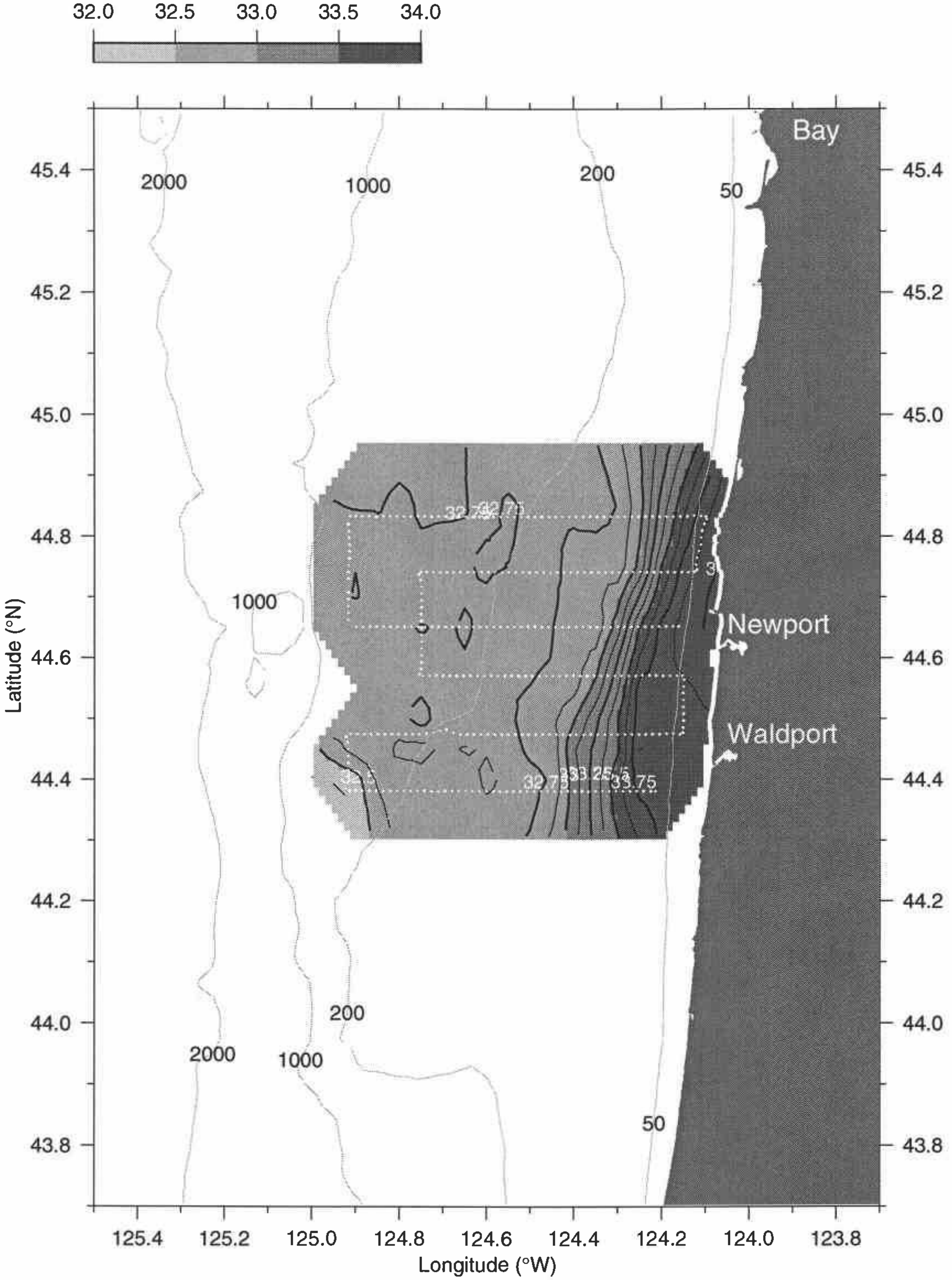


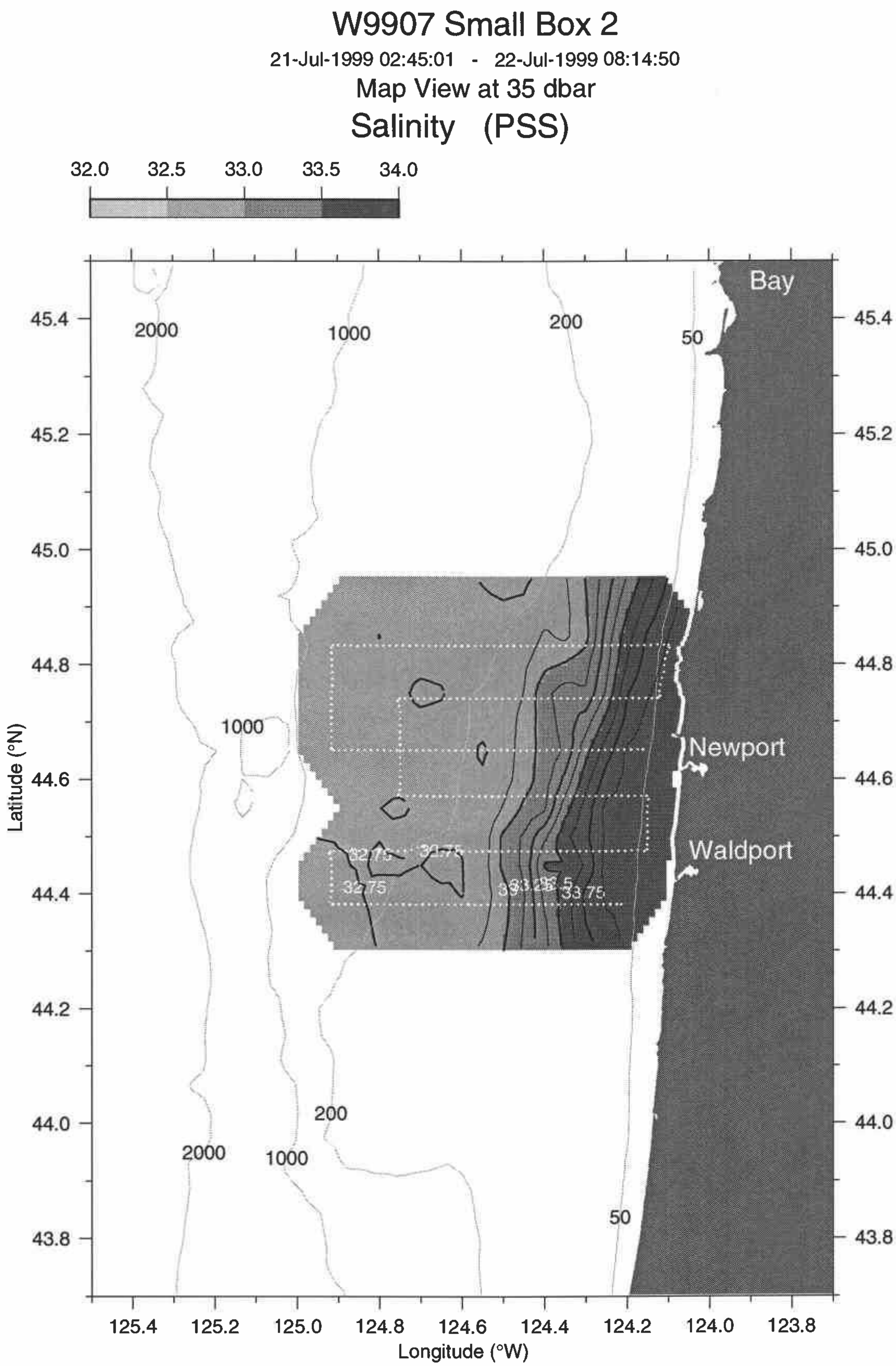
W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 25 dbar

Salinity (PSS)





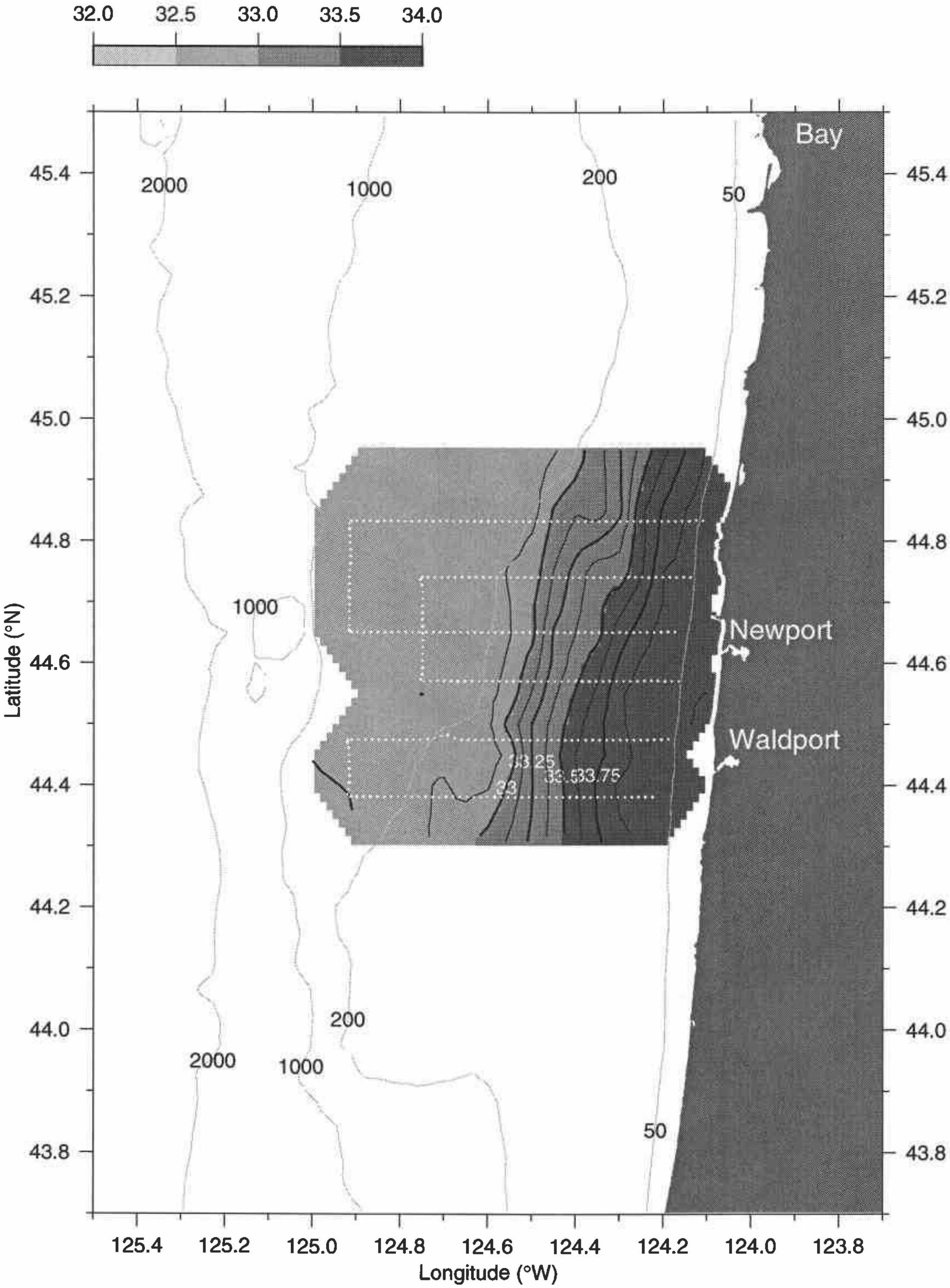
W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 35 dbar
Salinity (PSS)
32.0
32.5
33.0
33.5
34.0
Bay
Newport
Waldport
2000
1000
200
50
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 45 dbar

Salinity (PSS)

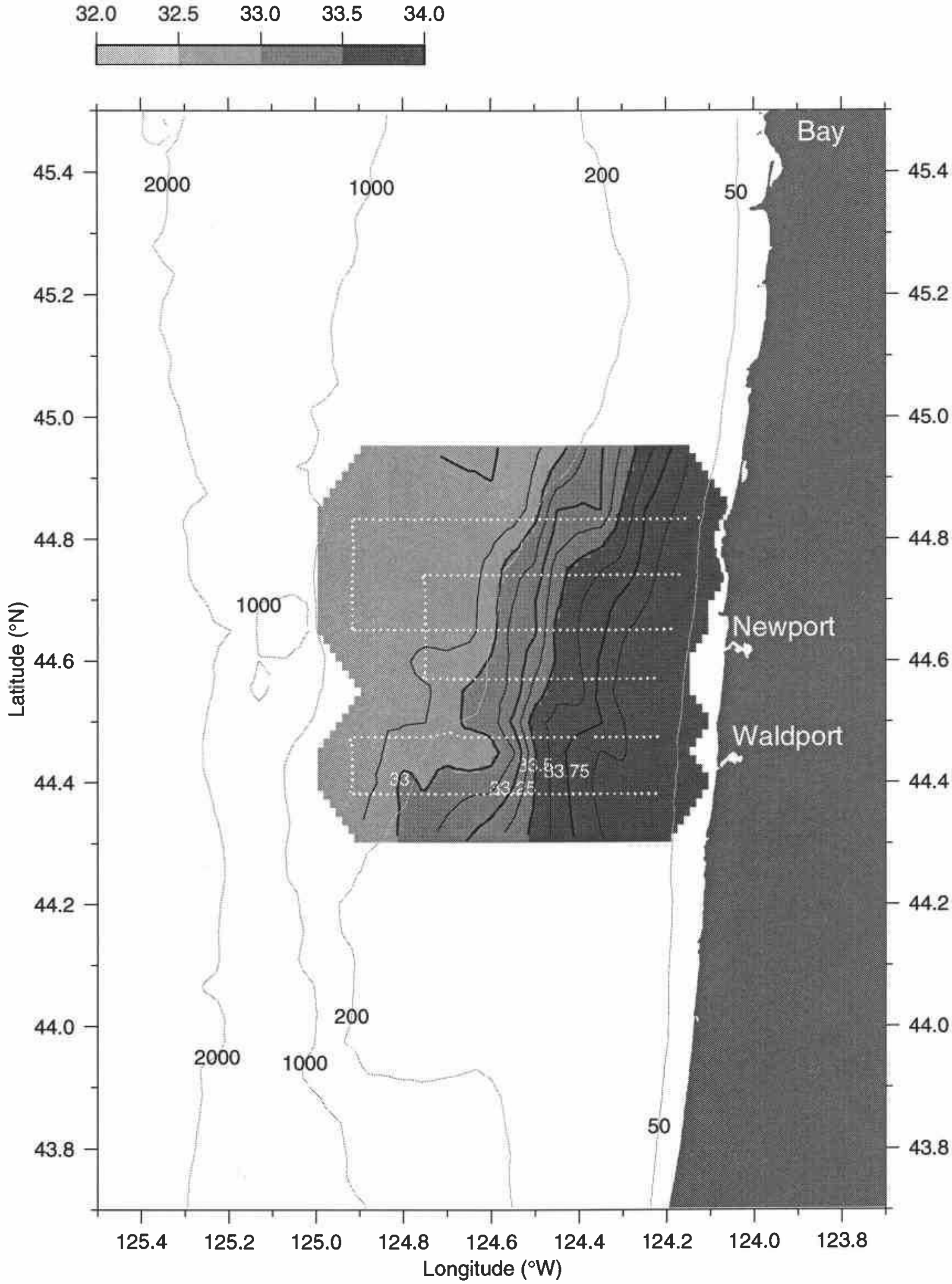


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 55 dbar

Salinity (PSS)

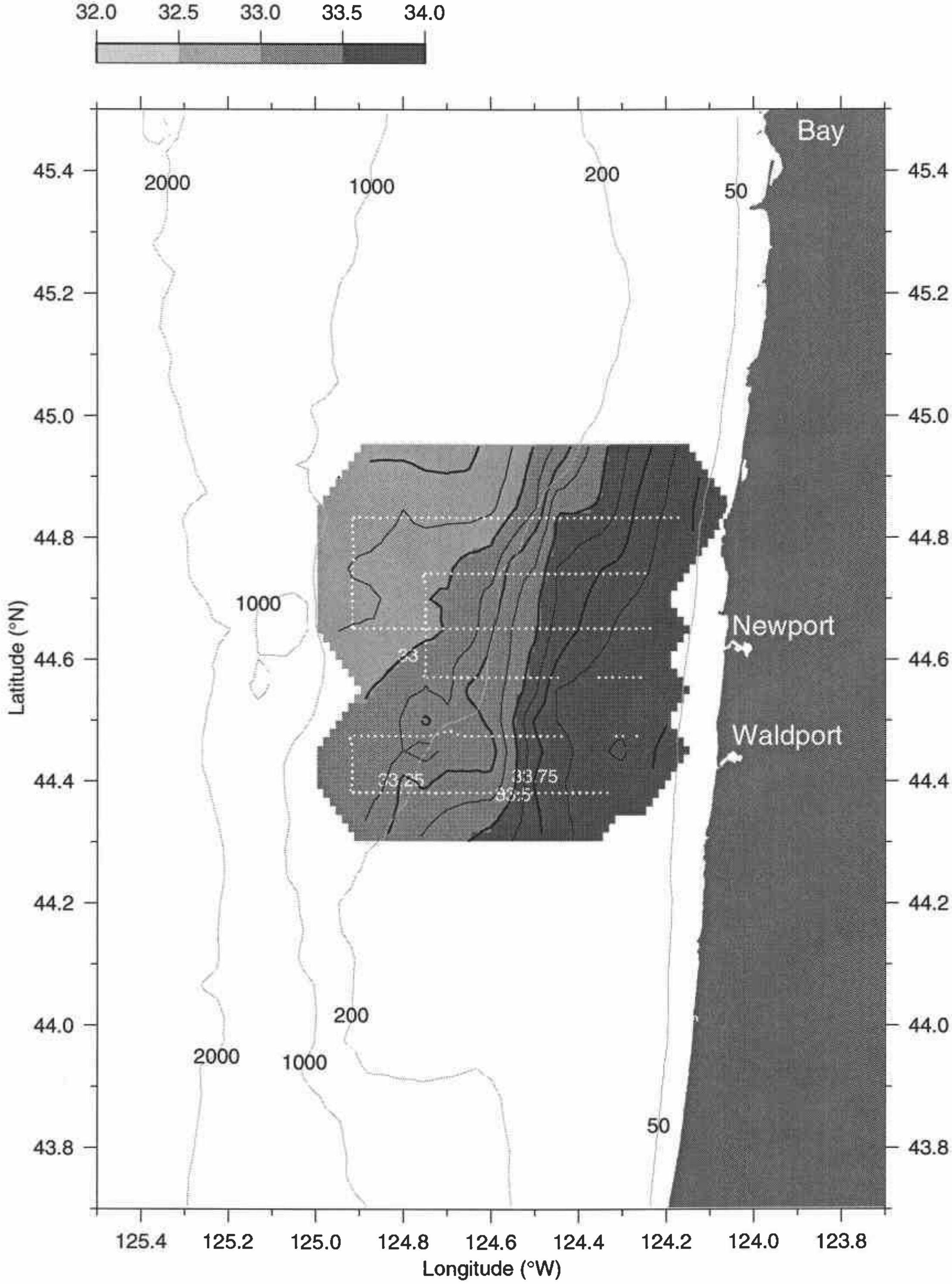


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 65 dbar

Salinity (PSS)

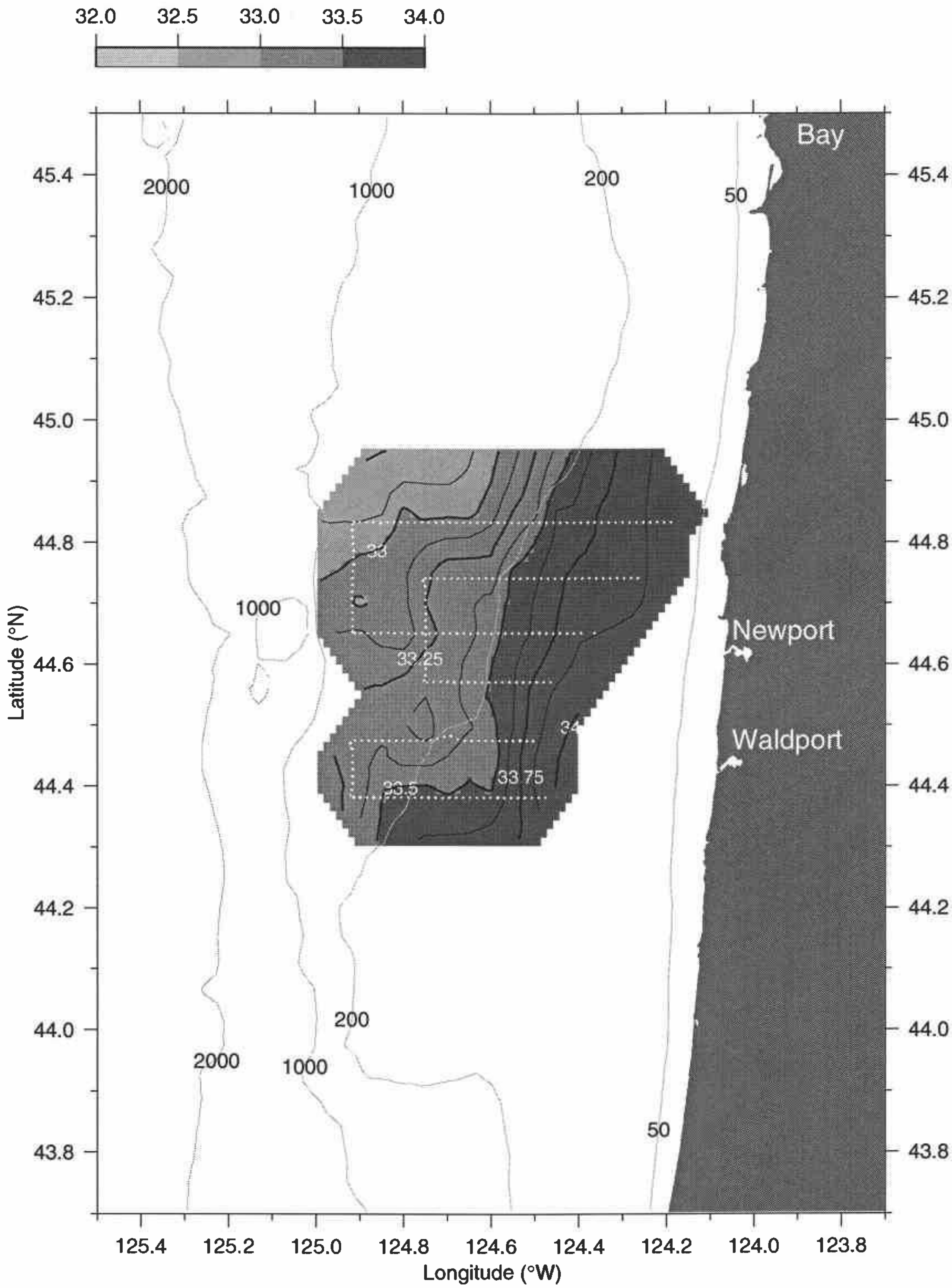


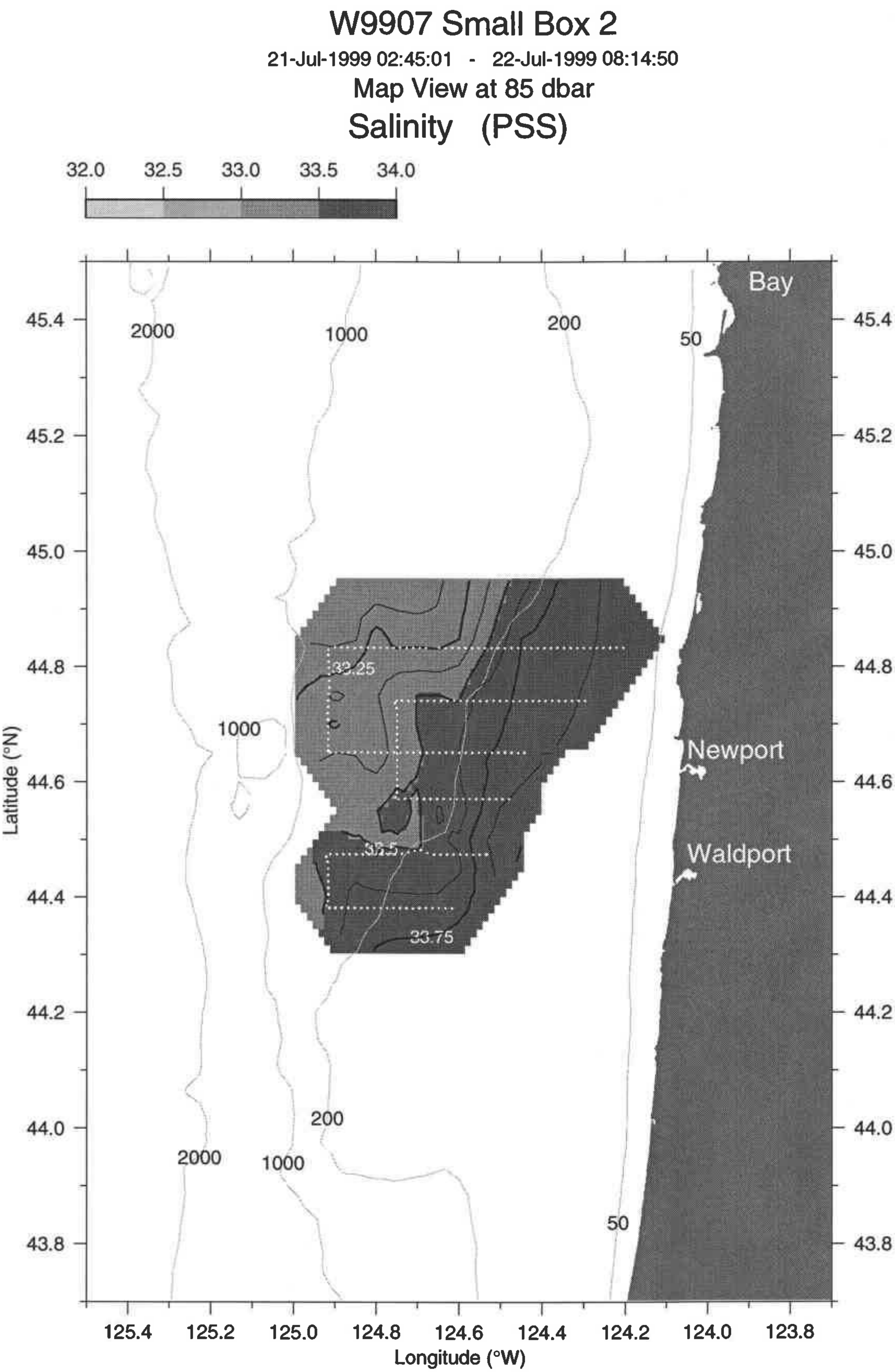
W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 75 dbar

Salinity (PSS)





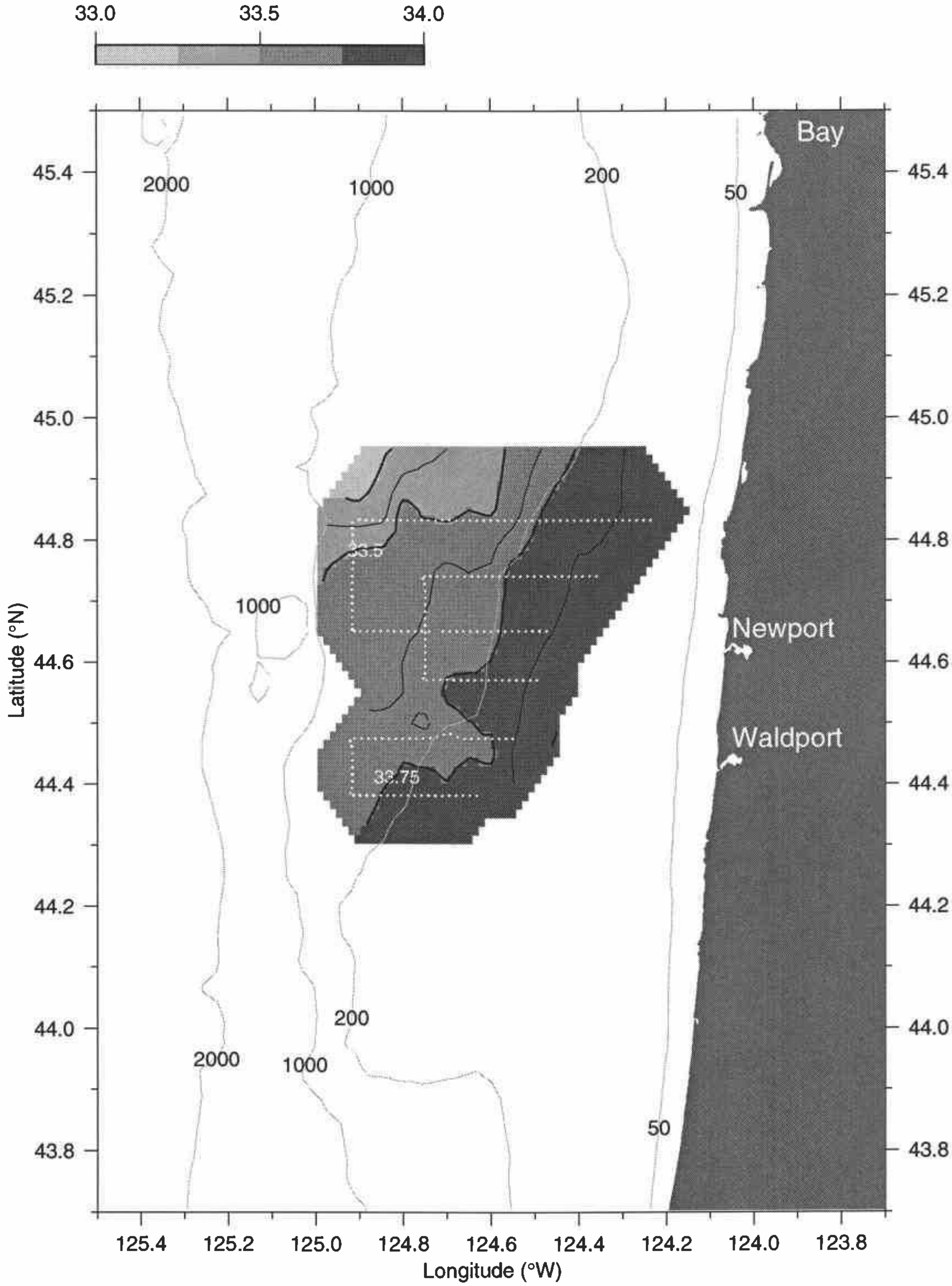
W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 85 dbar
Salinity (PSS)
32.0
32.5
33.0
33.5
34.0
Bay
Newport
Waldport
2000
1000
200
50
33.25
32.5
33.75
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 95 dbar

Salinity (PSS)

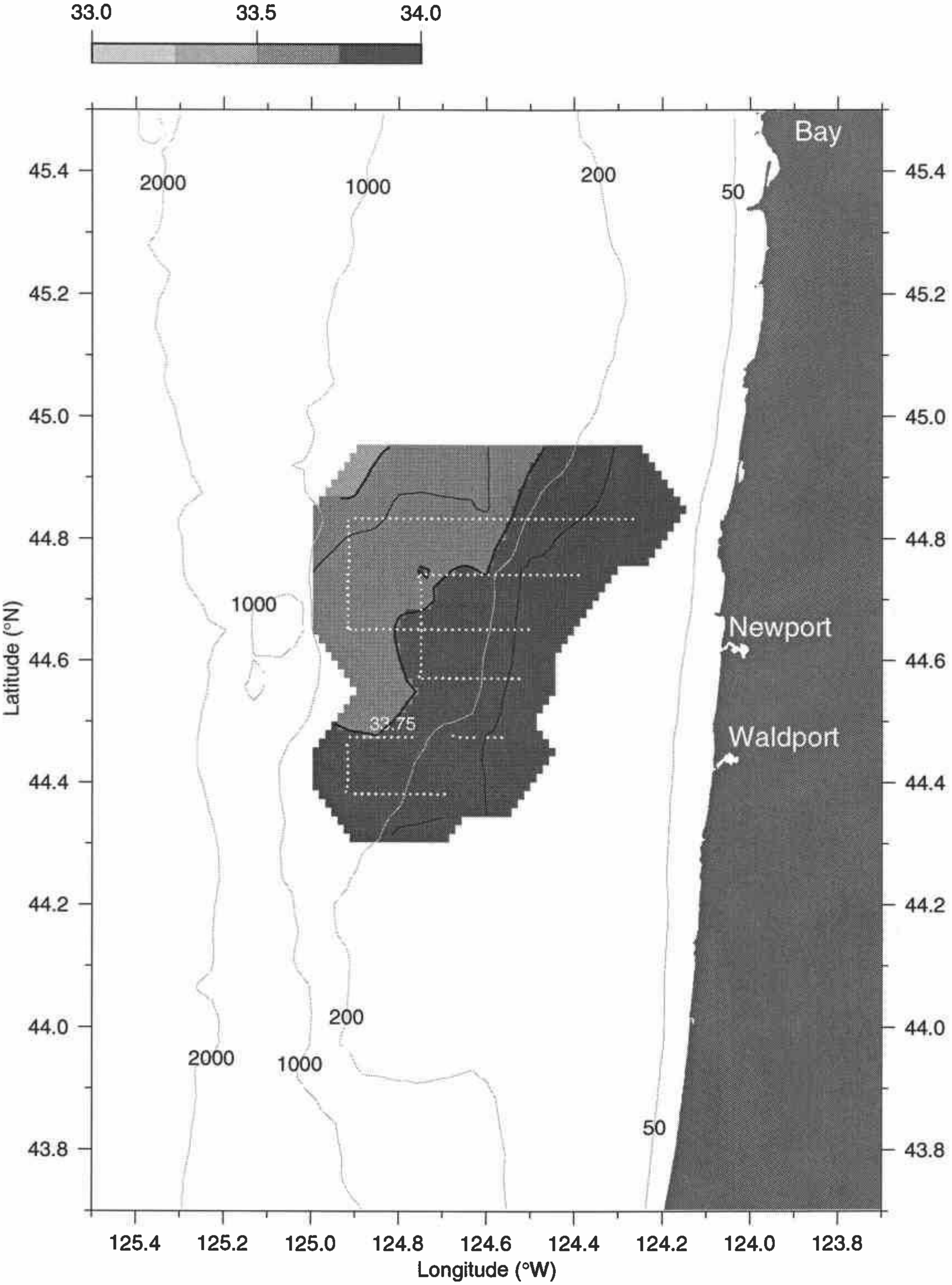


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 105 dbar

Salinity (PSS)

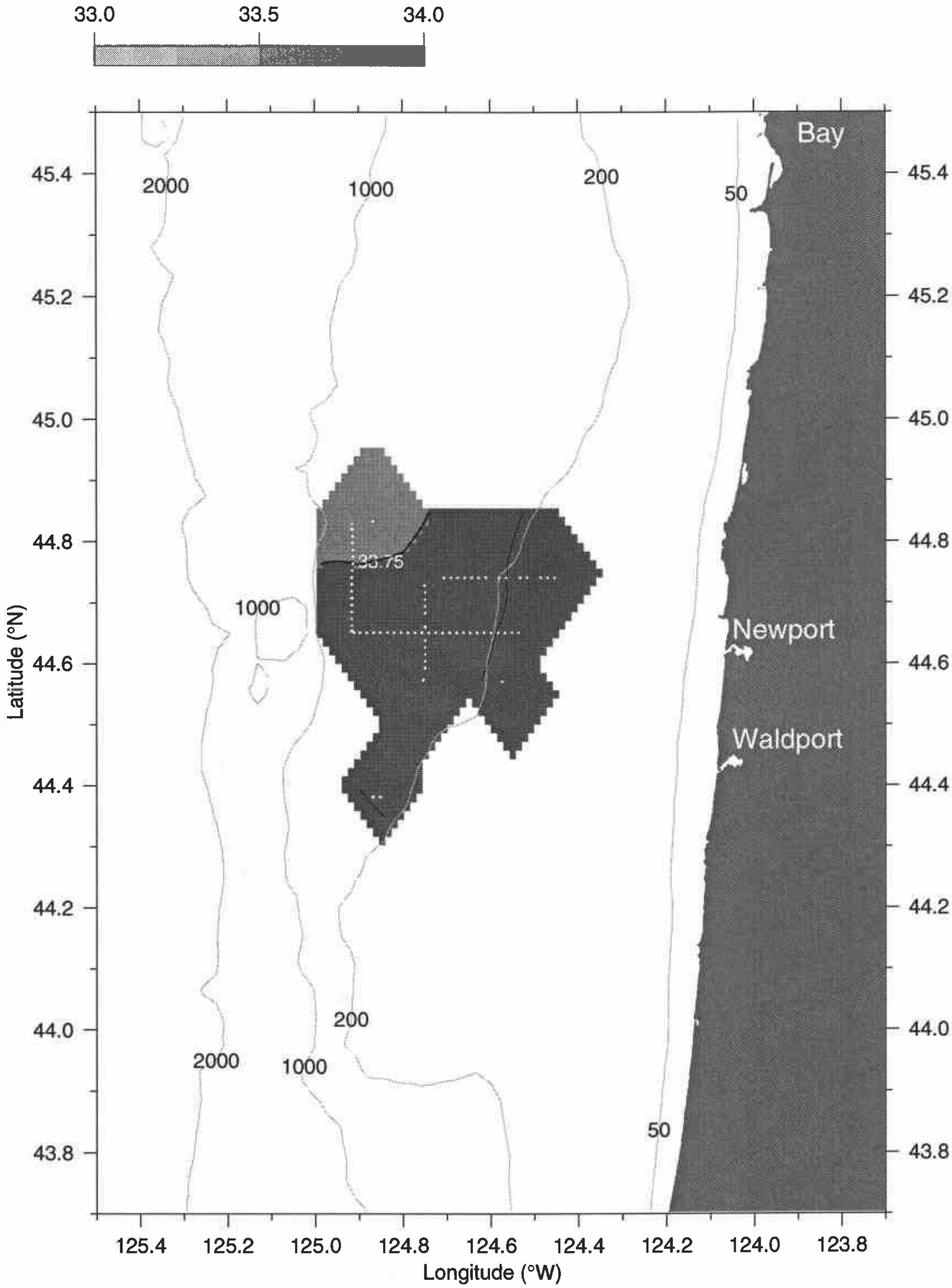


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 115 dbar

Salinity (PSS)

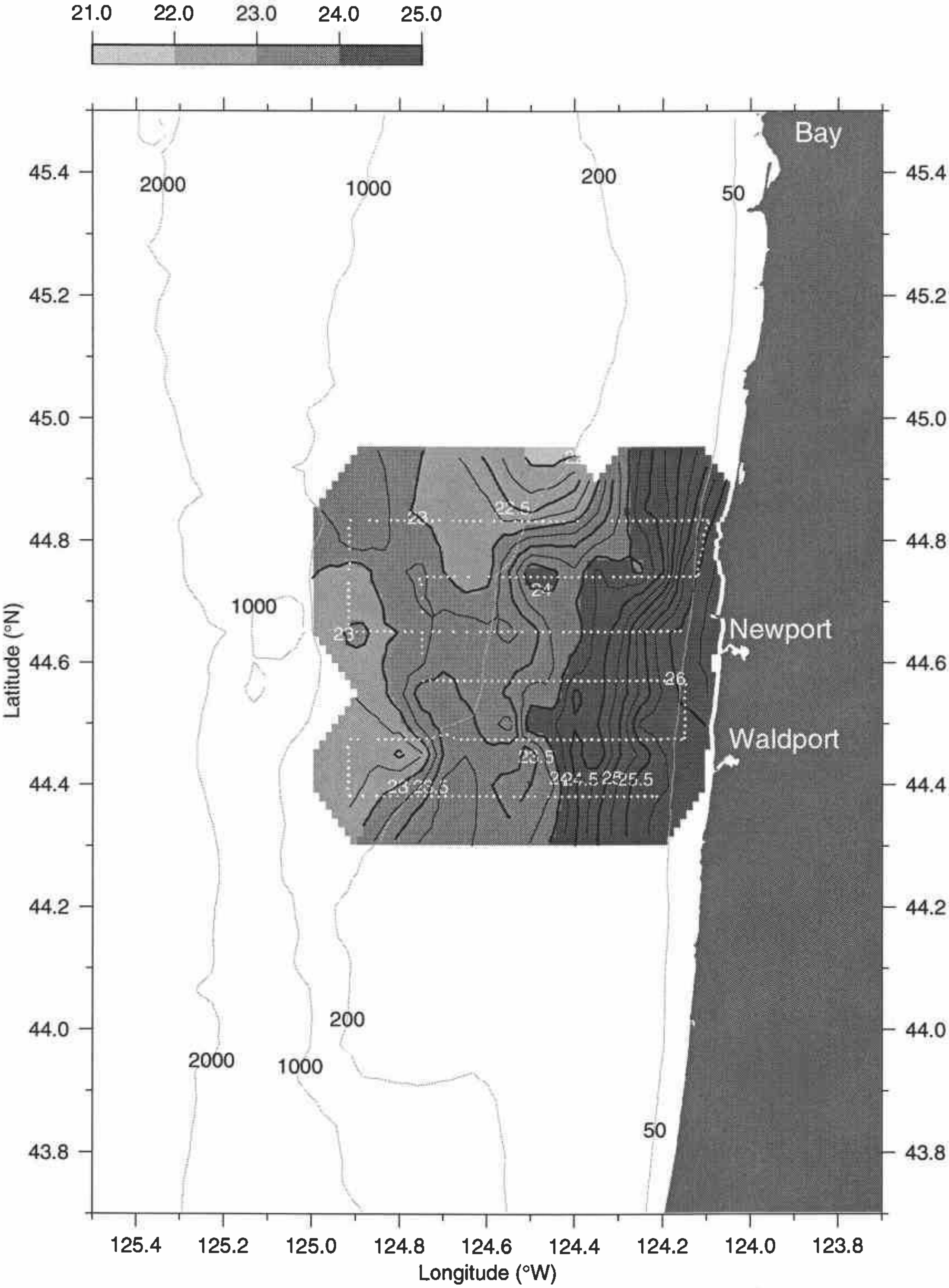


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 5 dbar

σ_t $(kg\ m^{-3})$

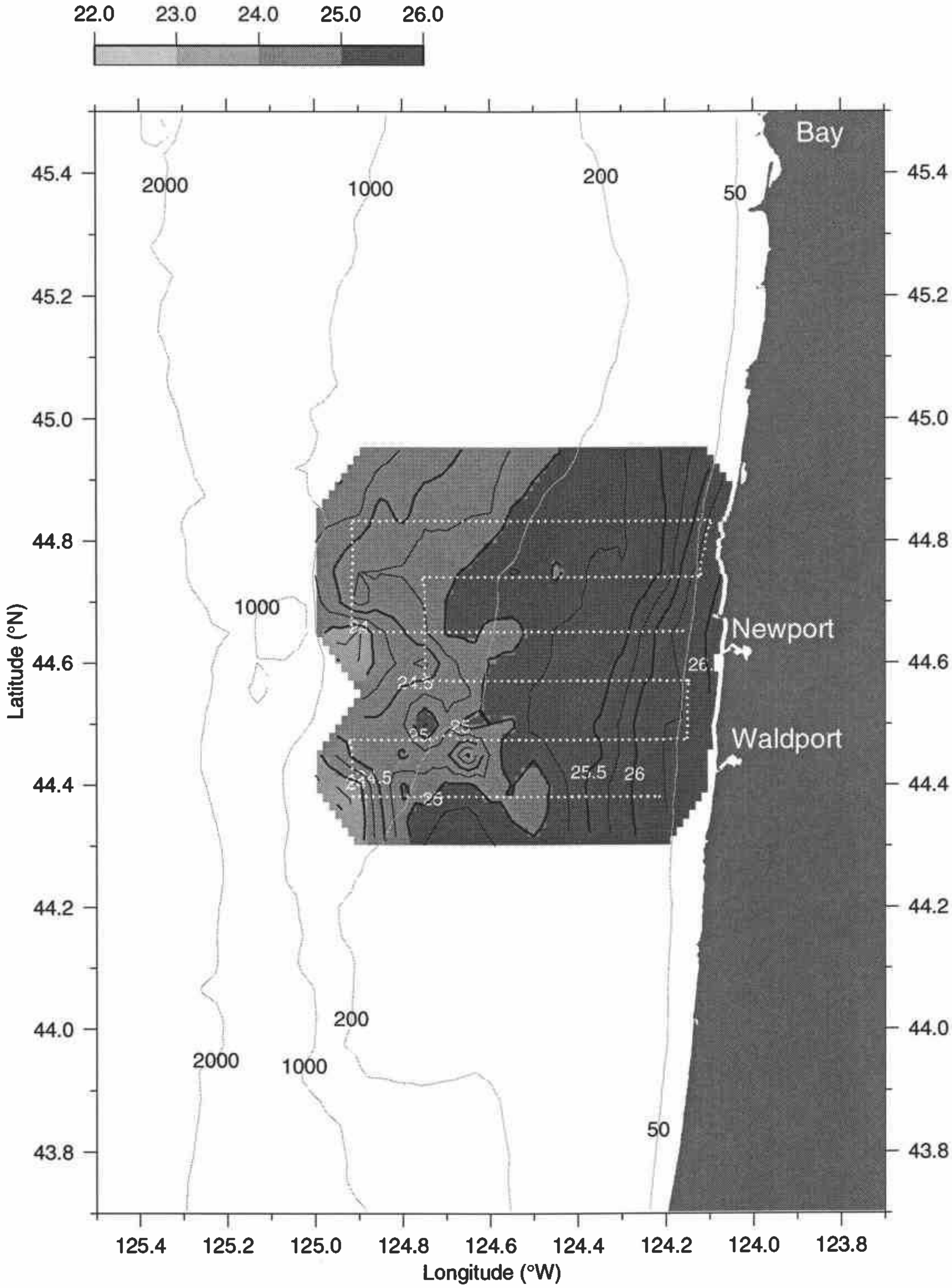


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 15 dbar

σ_t $(kg\ m^{-3})$

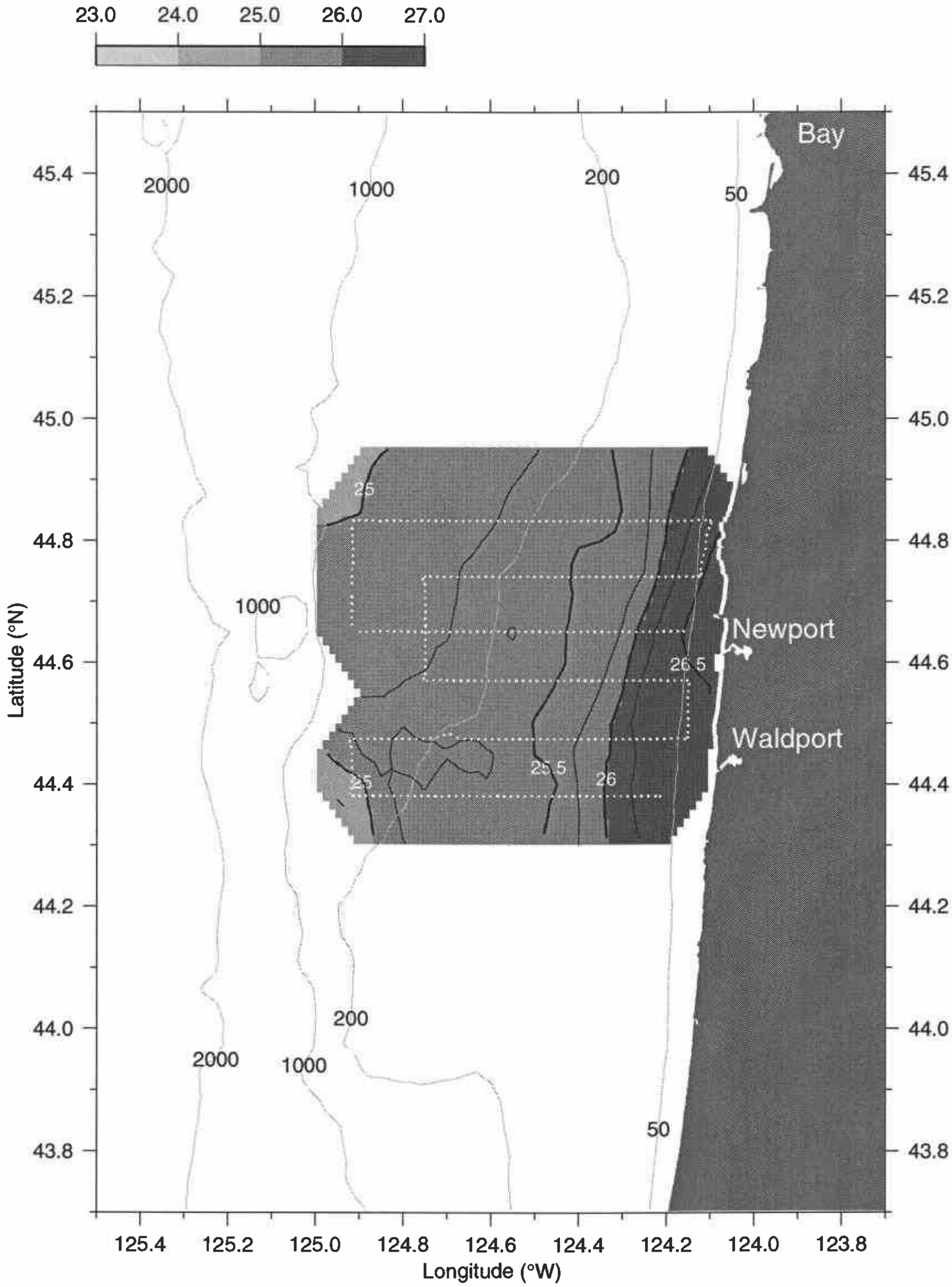


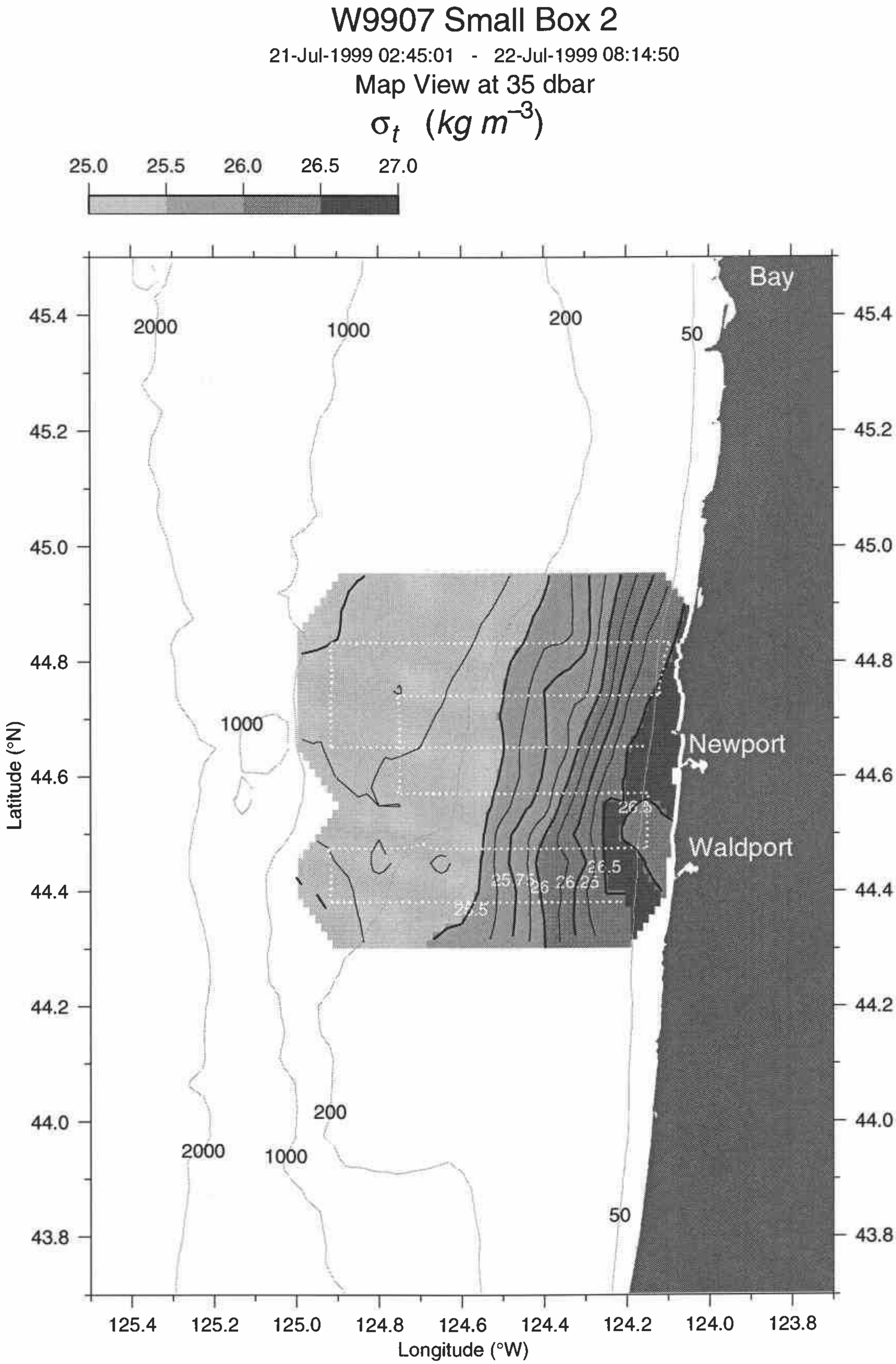
W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 25 dbar

σ_t $(kg\ m^{-3})$





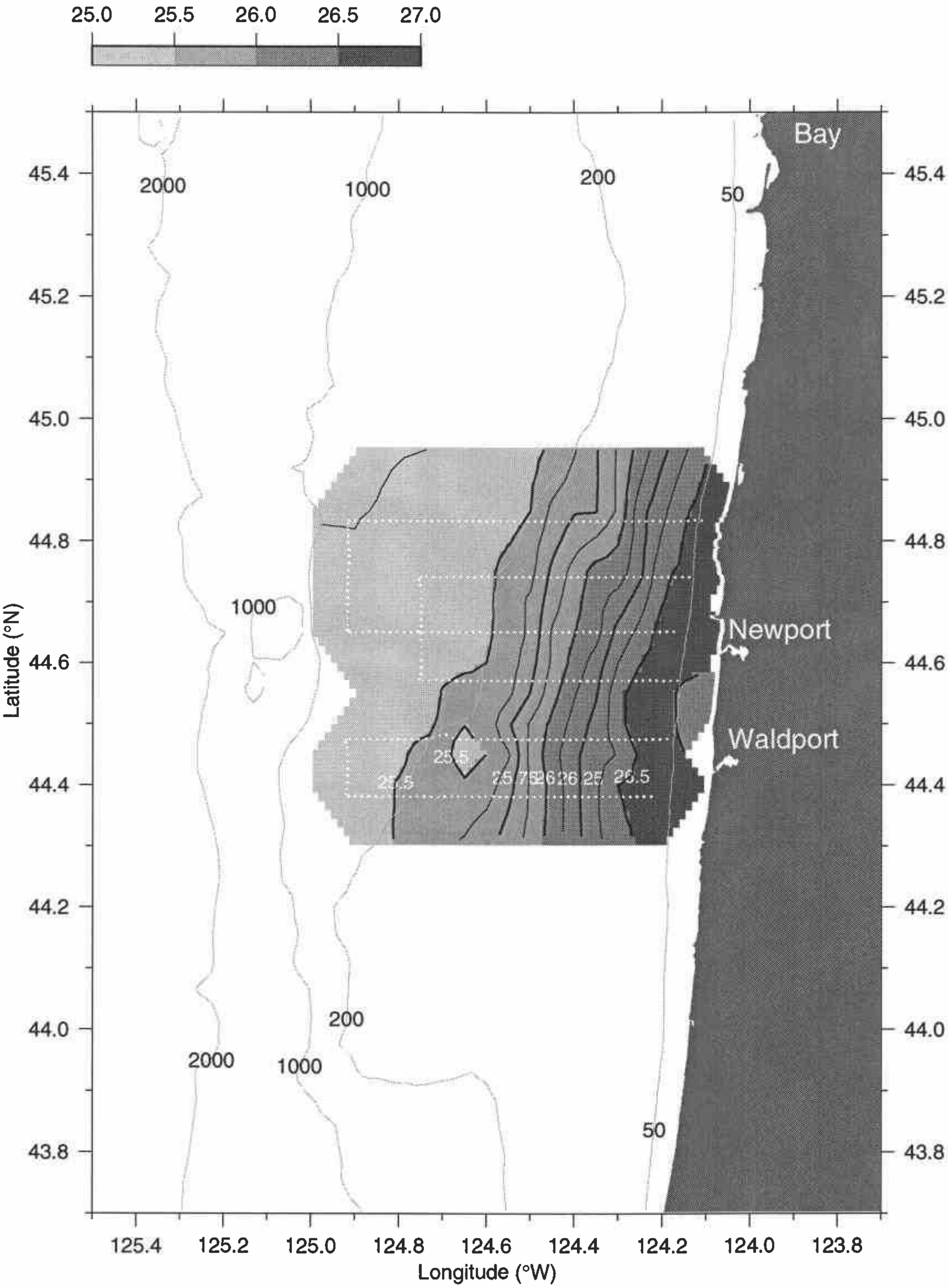
W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 35 dbar
σt (kg m-3)
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
25.5
25.75
26
26.25
26.5
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

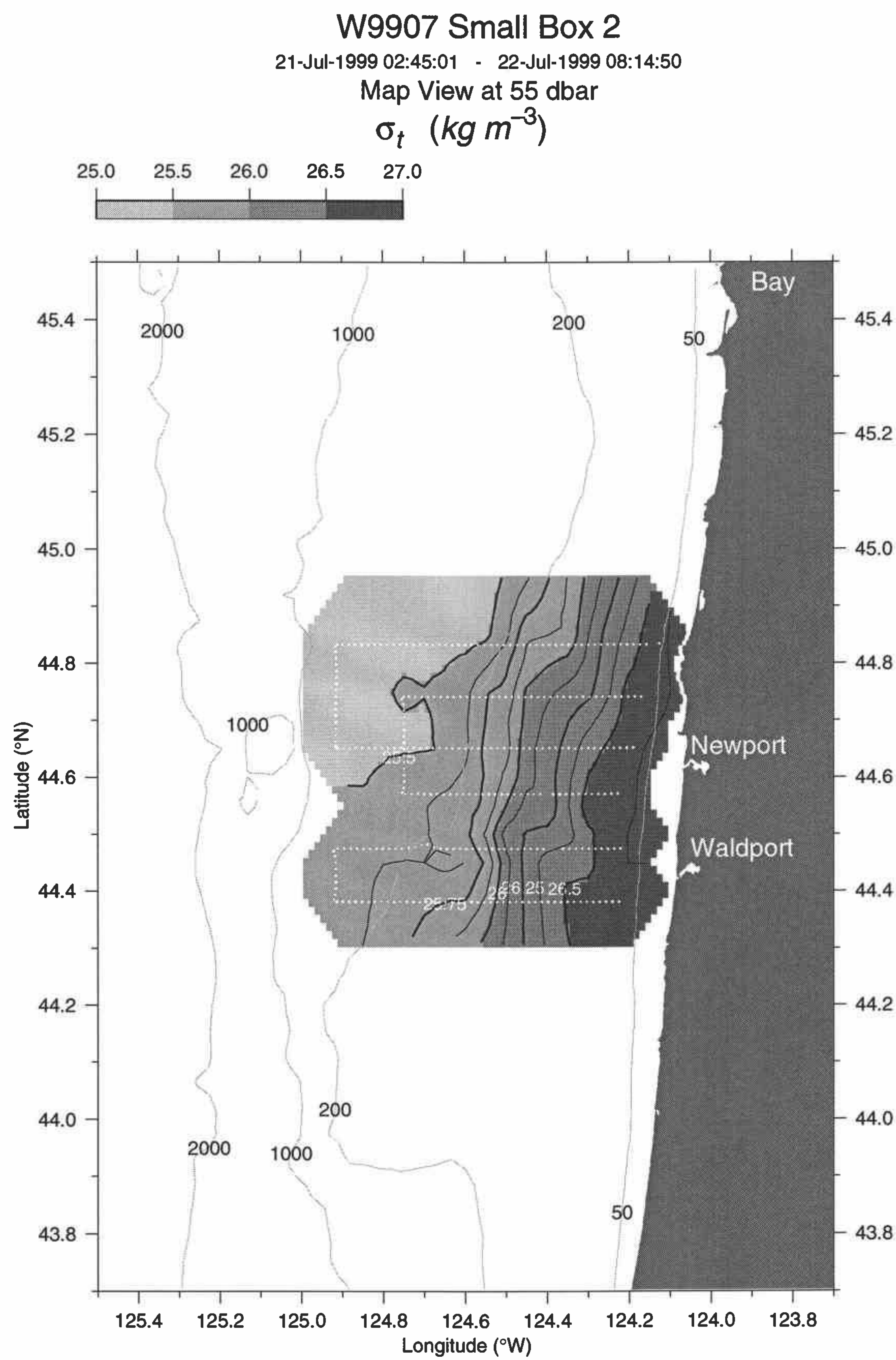
W9907 Small Box 2

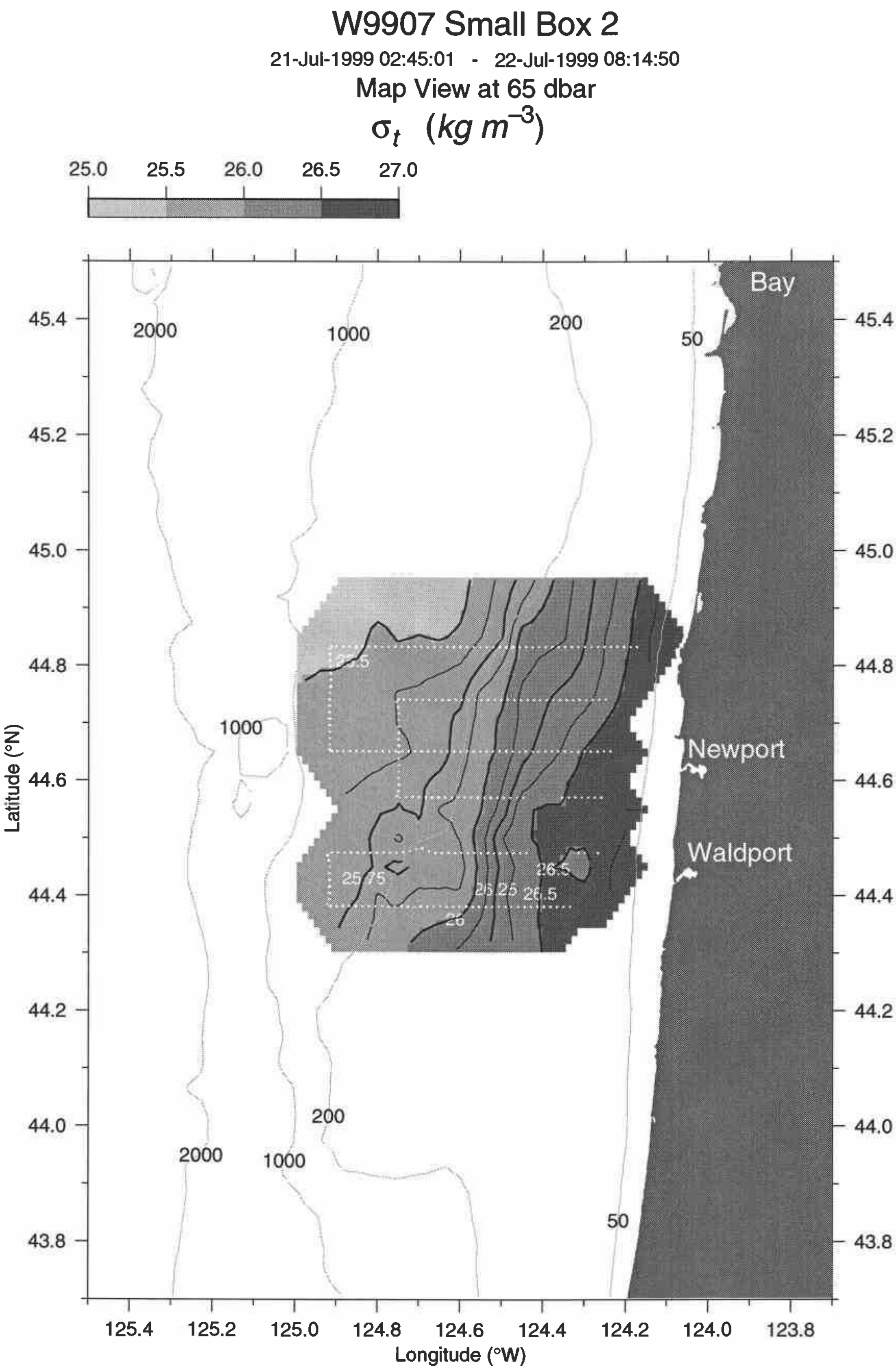
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 45 dbar

σ_t $(kg\ m^{-3})$




W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 55 dbar
σ_t $(kg\ m^{-3})$
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
25.75
26.5
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

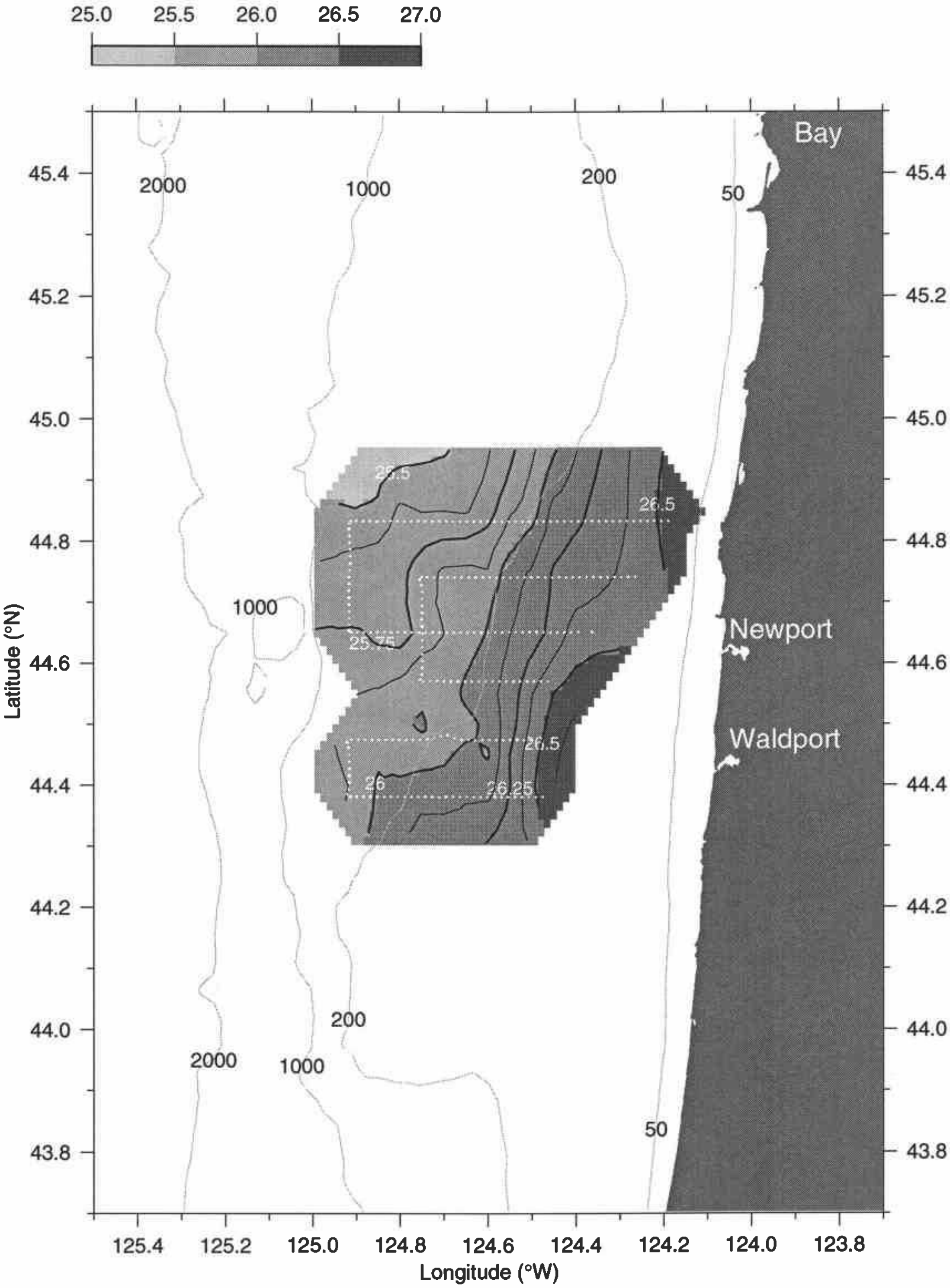

W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 65 dbar
σ_t $(kg\ m^{-3})$
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
25.5
25.75
26
26.25
26.5
Latitude (°N)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Longitude (°W)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

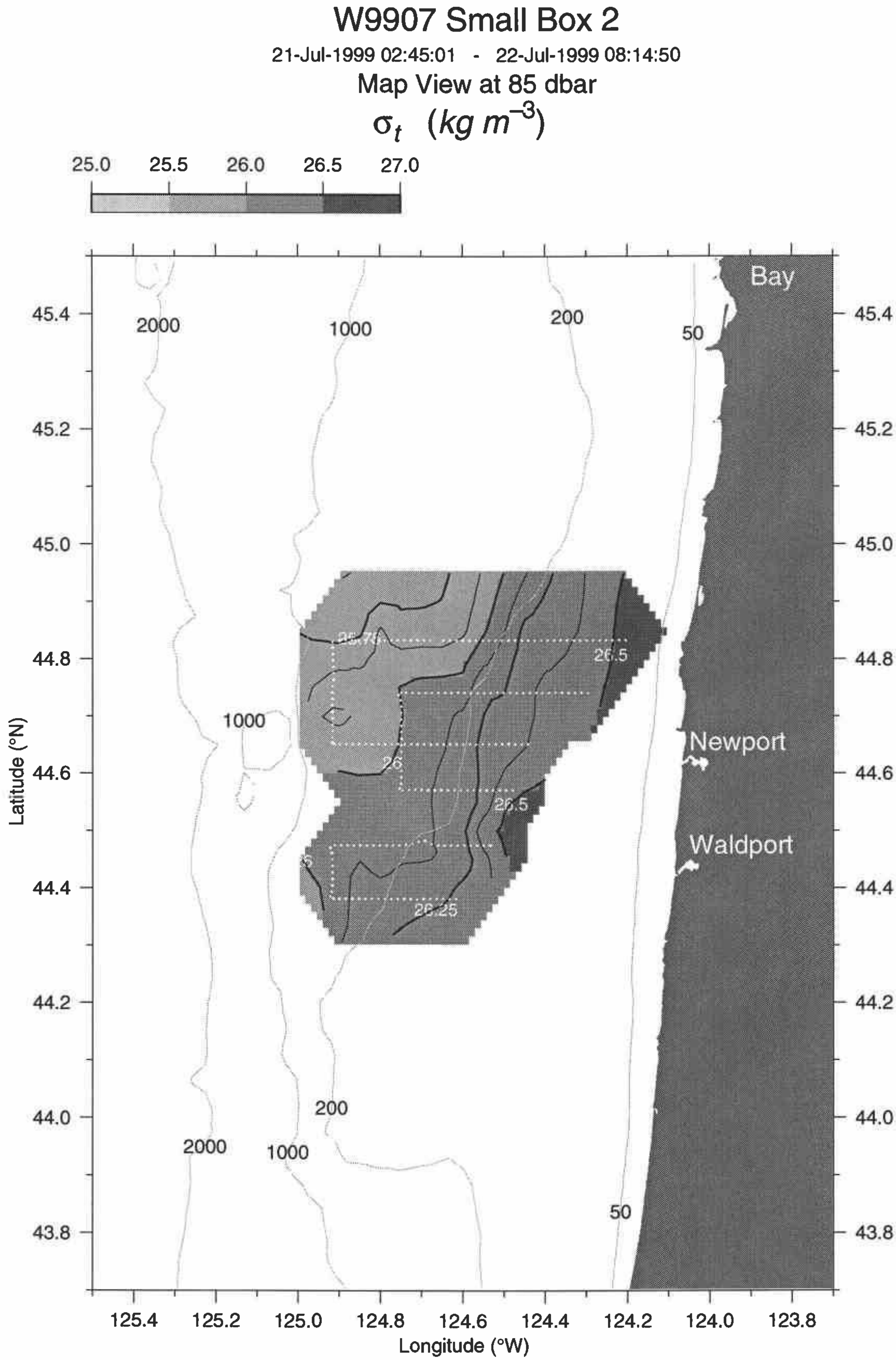
W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 75 dbar

σ_t $(kg\ m^{-3})$



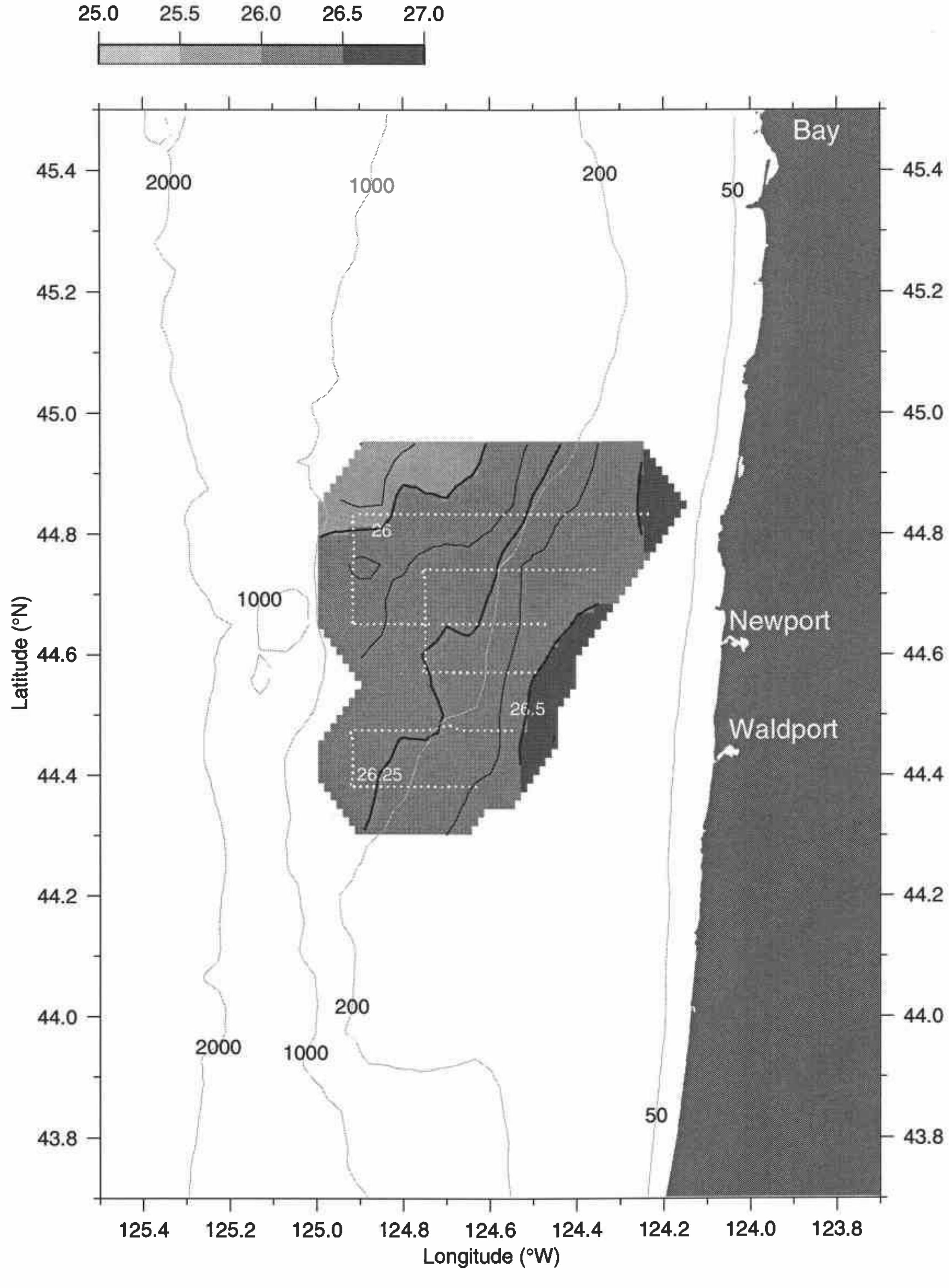

W9907 Small Box 2
21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50
Map View at 85 dbar
σ_t ($kg\ m^{-3}$)
25.0
25.5
26.0
26.5
27.0
Bay
Newport
Waldport
2000
1000
200
50
26.5
26
26.25
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 95 dbar

σ_t $(kg\ m^{-3})$

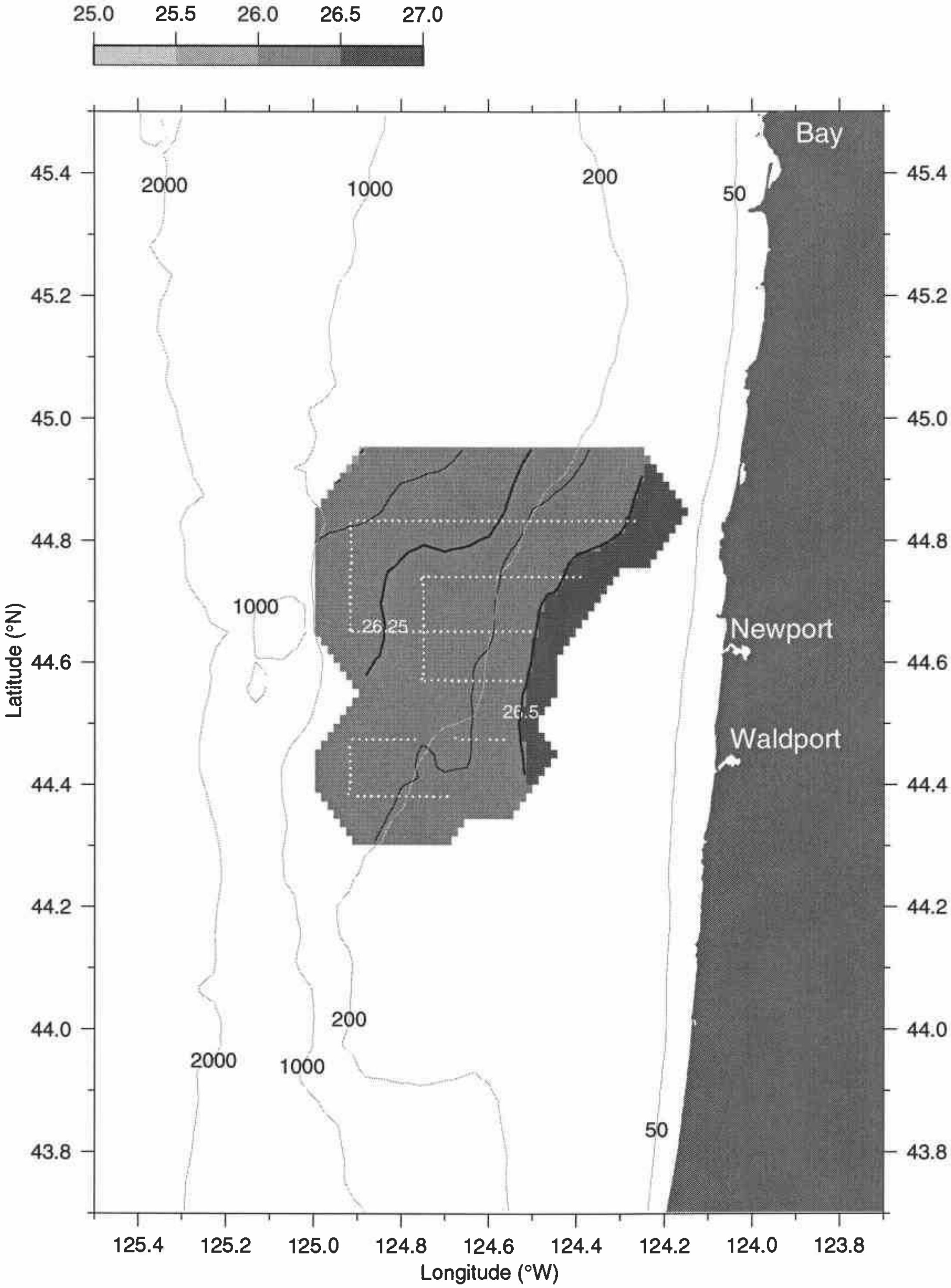


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 105 dbar

σ_t $(kg\ m^{-3})$

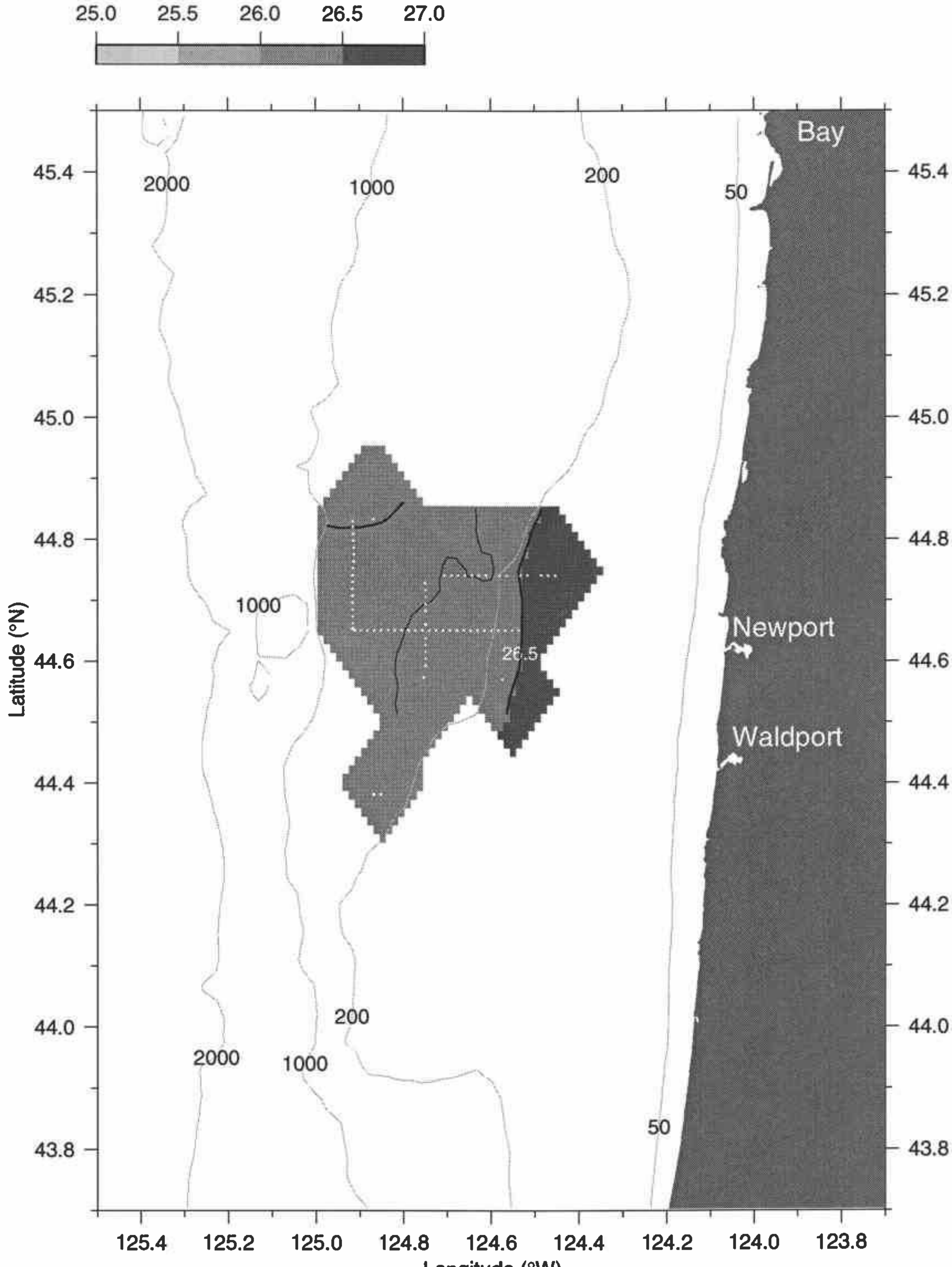


W9907 Small Box 2

21-Jul-1999 02:45:01 - 22-Jul-1999 08:14:50

Map View at 115 dbar

σ_t $(kg\ m^{-3})$



Big Box 2 Maps

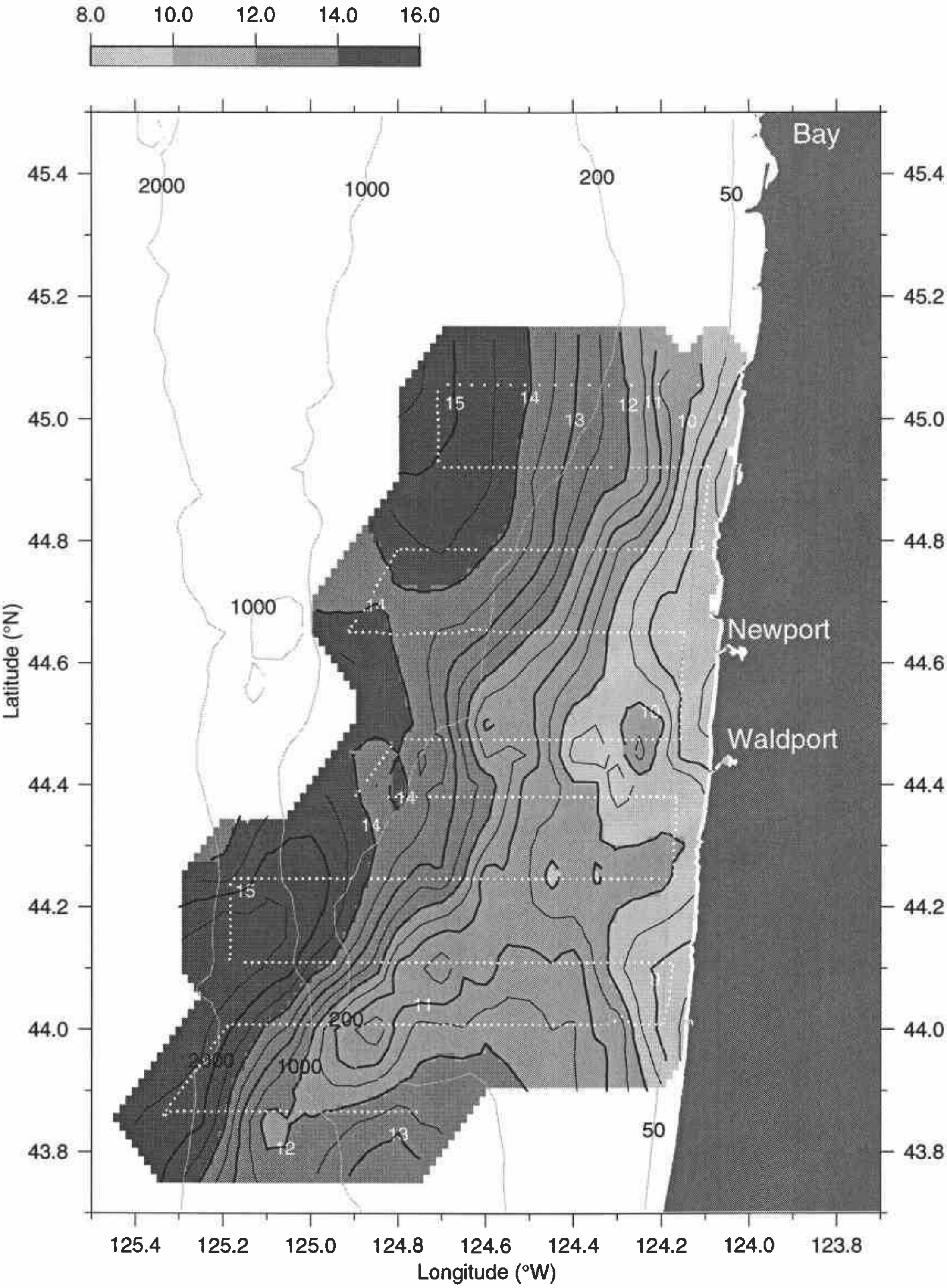
Maps of Temperature, Salinity, and σ_t at Specified Depths

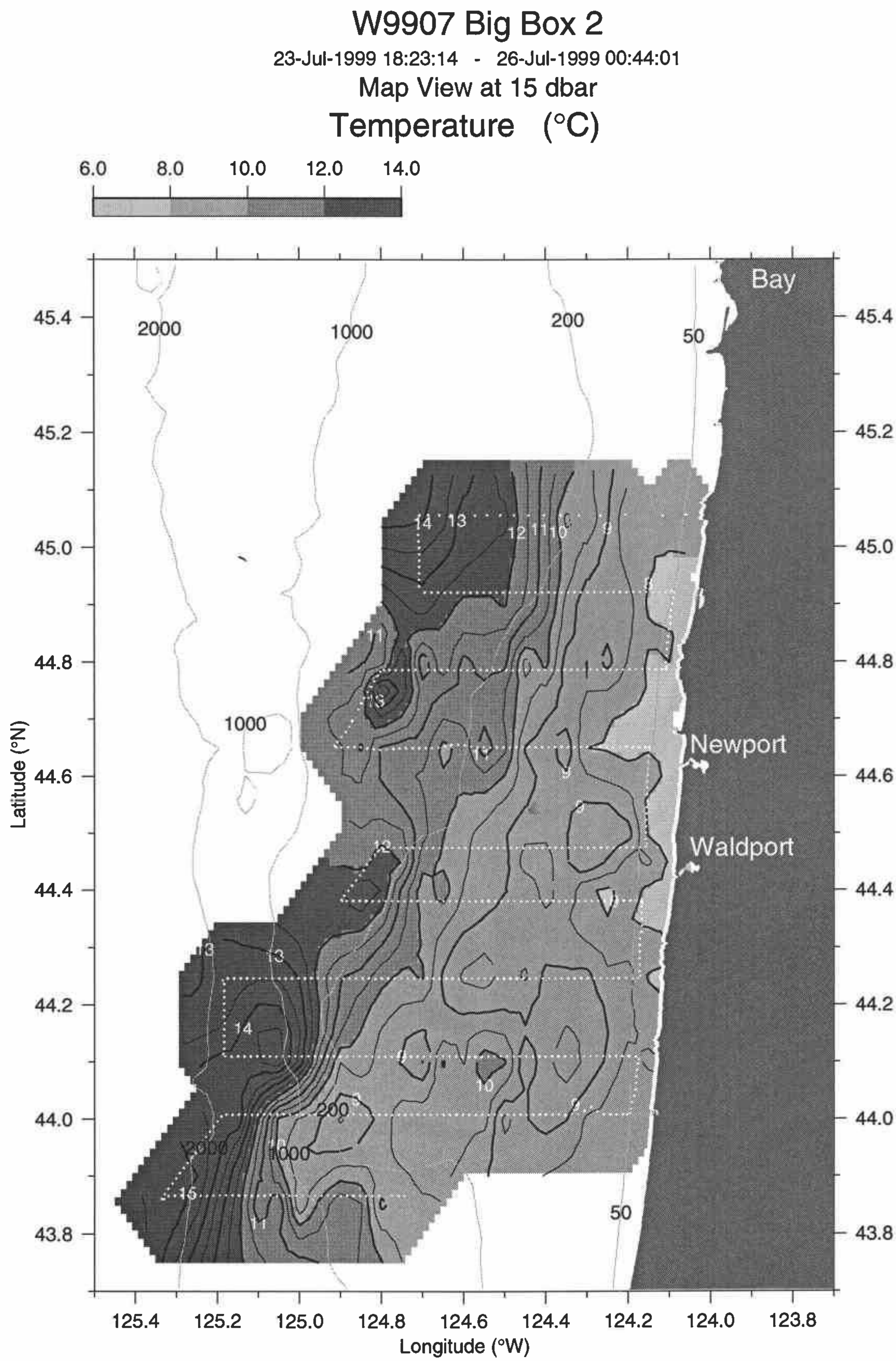
W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 5 dbar

Temperature (°C)





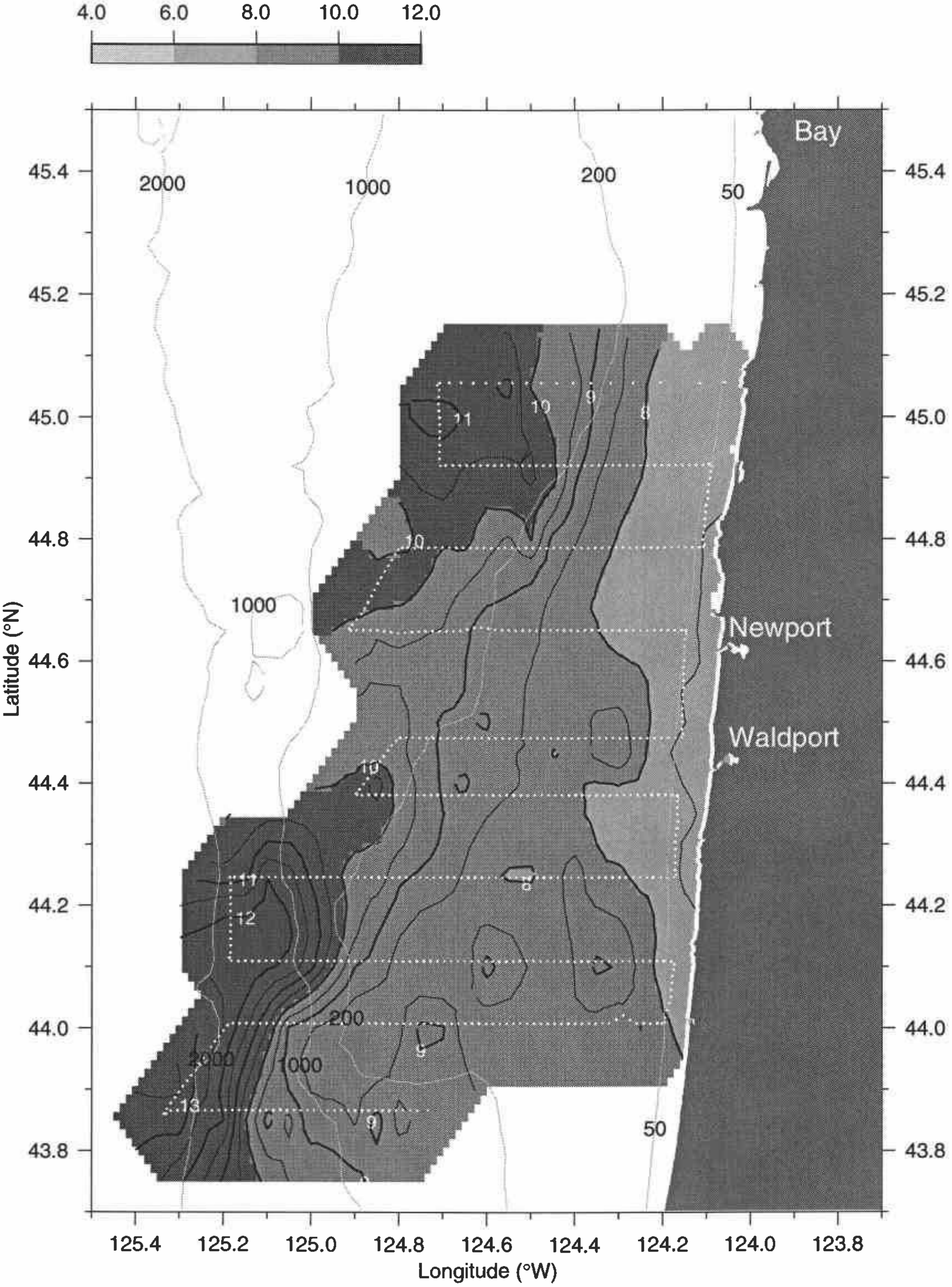
W9907 Big Box 2
23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01
Map View at 15 dbar
Temperature (°C)
6.0
8.0
10.0
12.0
14.0
Bay
Newport
Waldport
2000
1000
200
50
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 25 dbar

Temperature (°C)

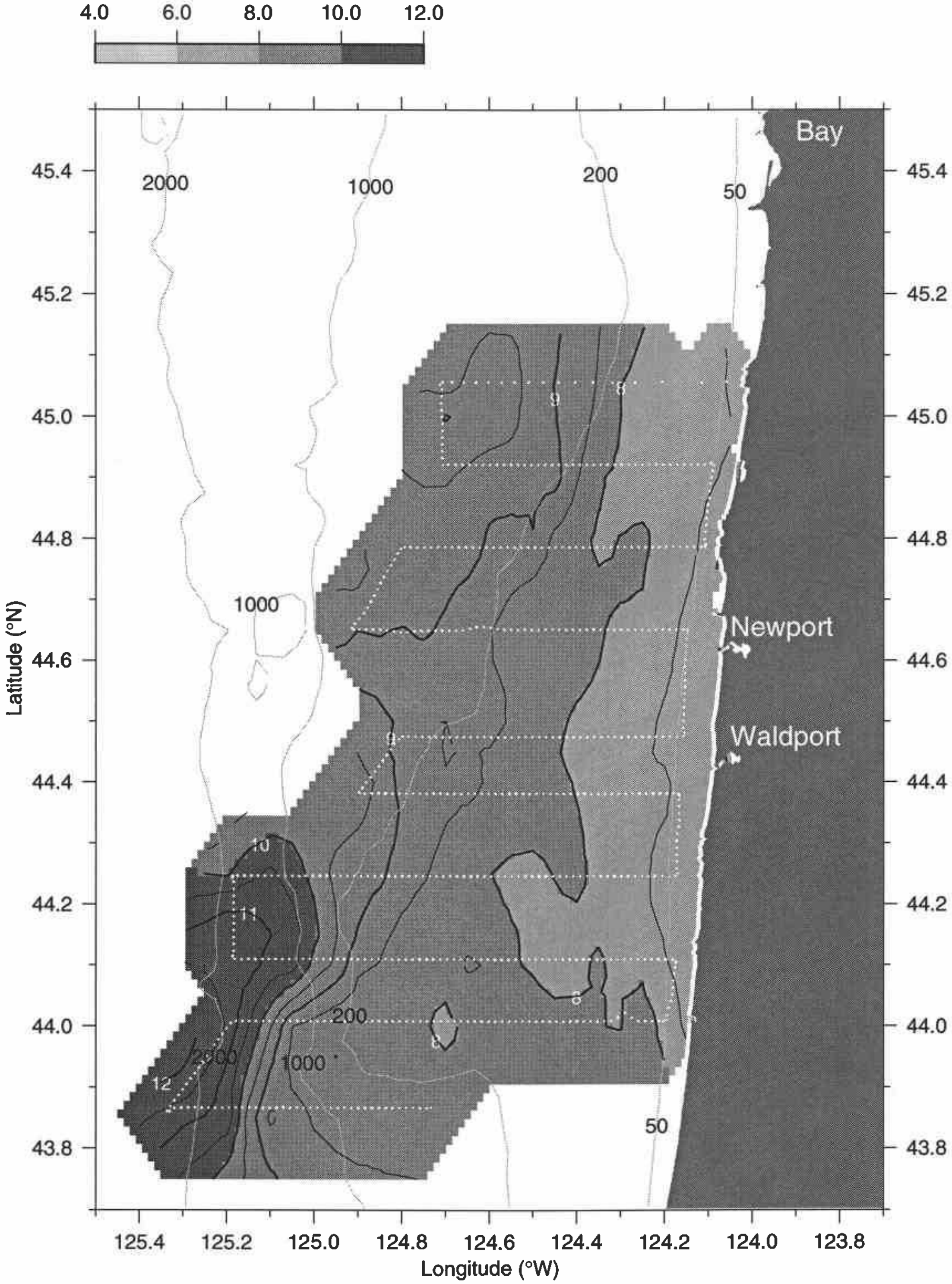


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 35 dbar

Temperature (°C)

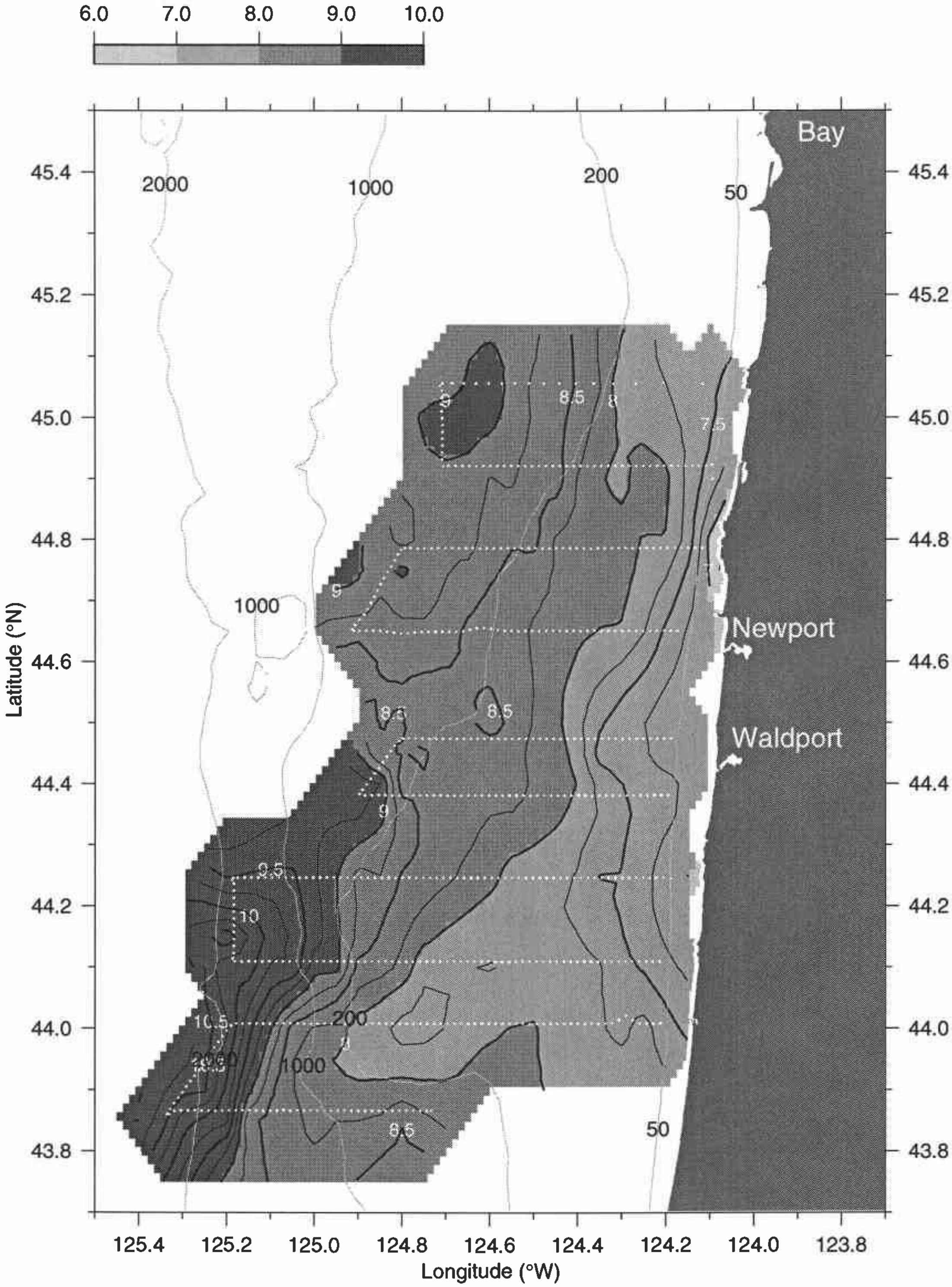


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 45 dbar

Temperature (°C)

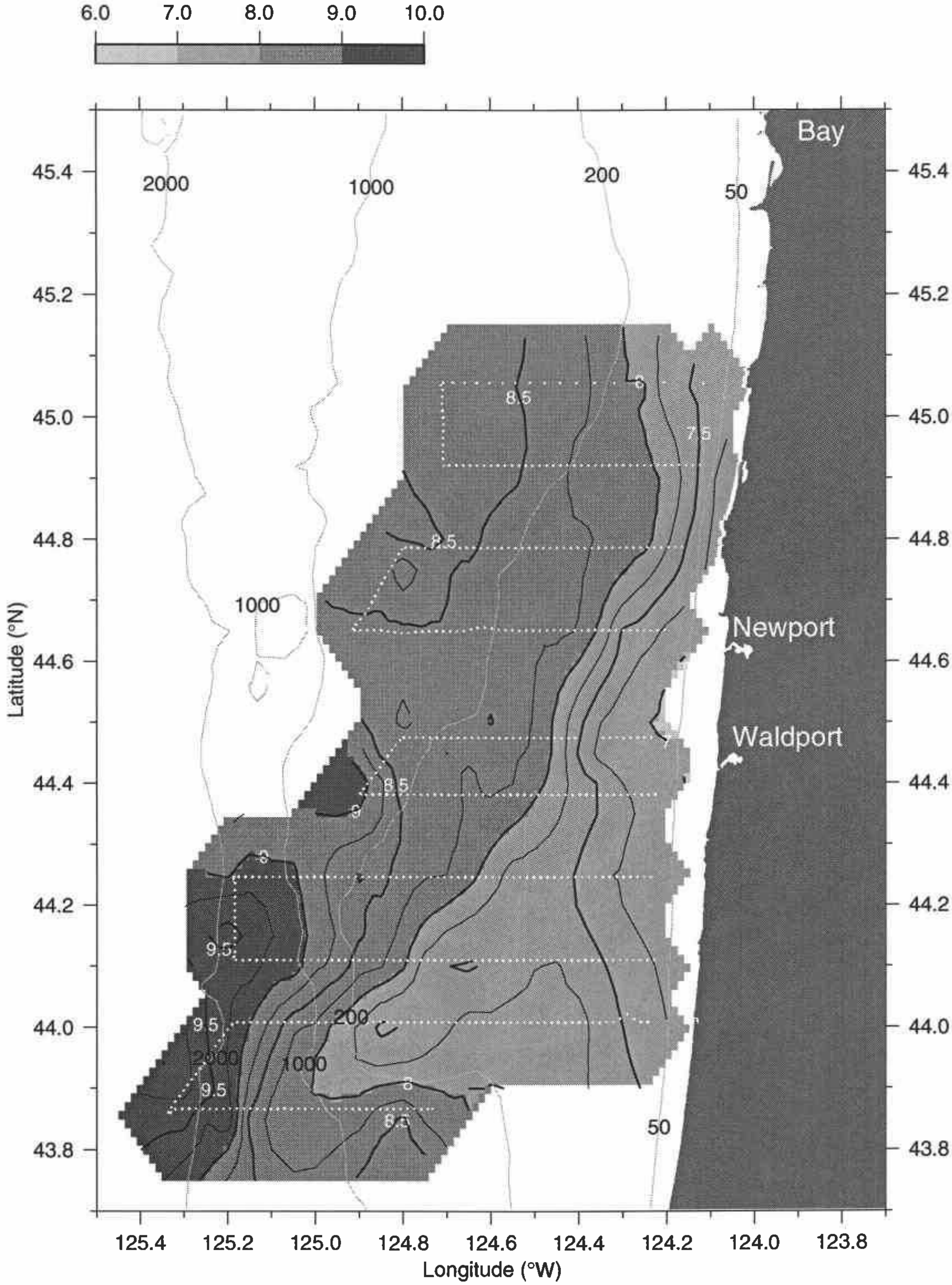


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 55 dbar

Temperature (°C)

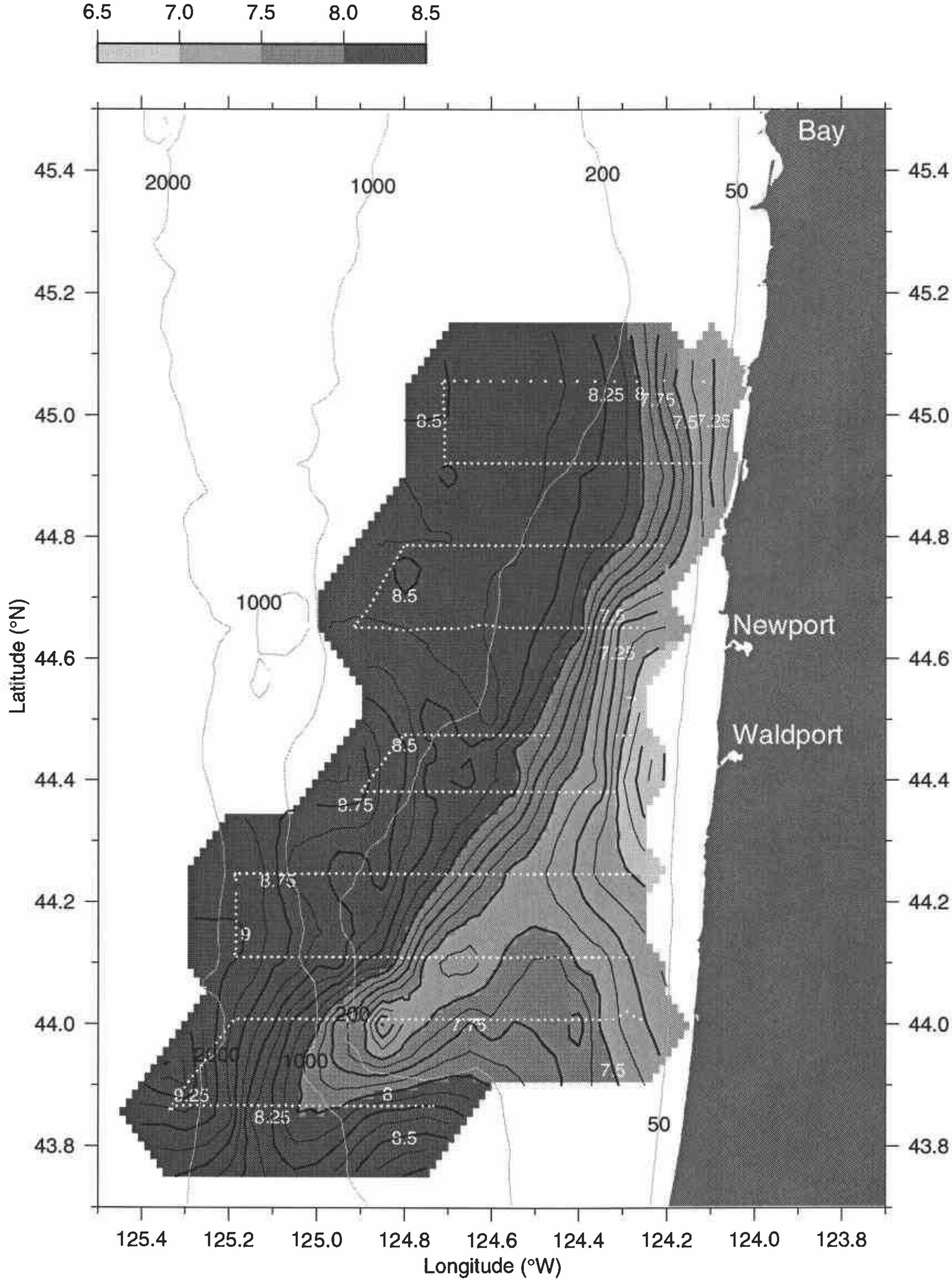


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 65 dbar

Temperature (°C)

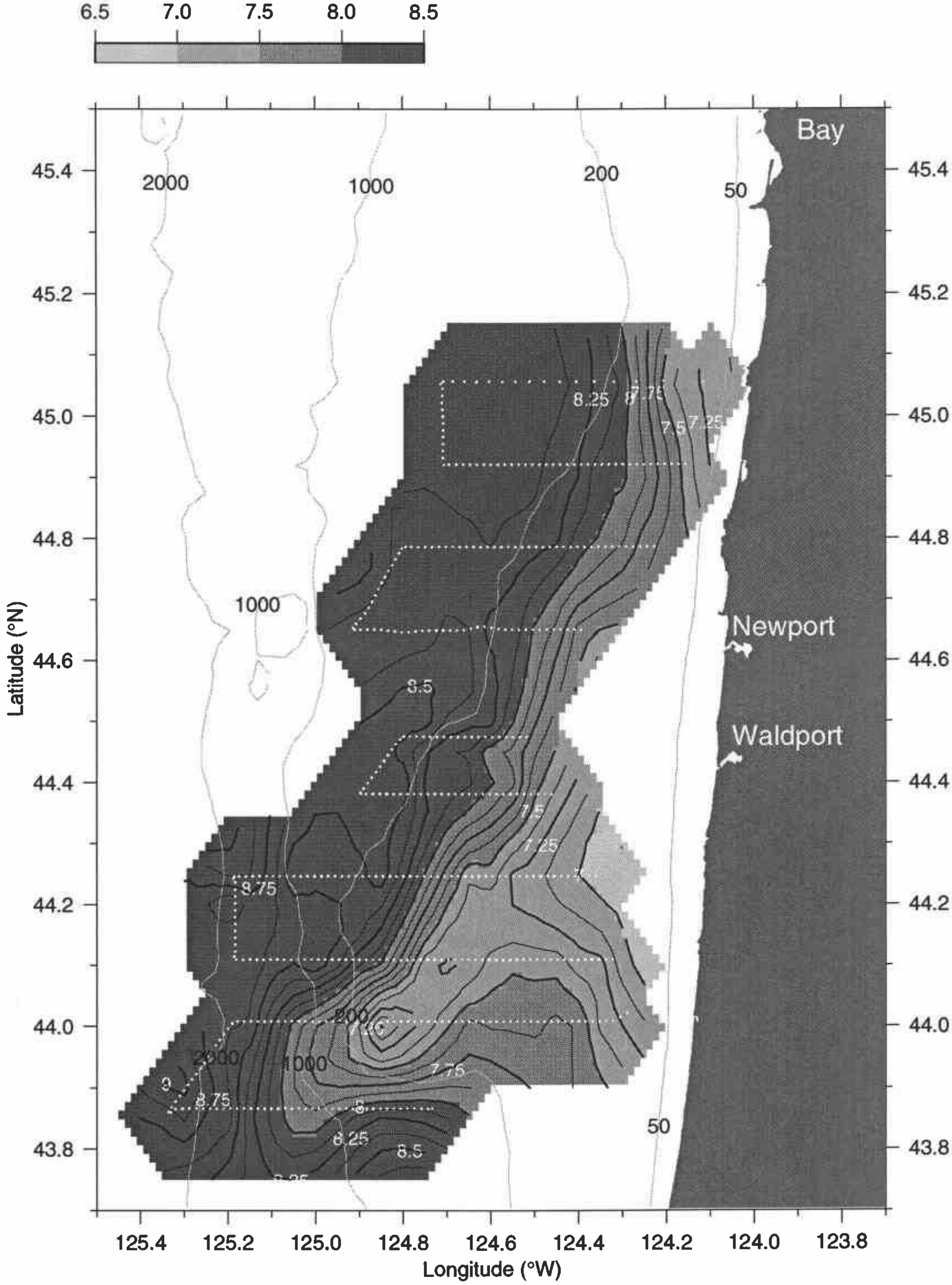


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 75 dbar

Temperature (°C)

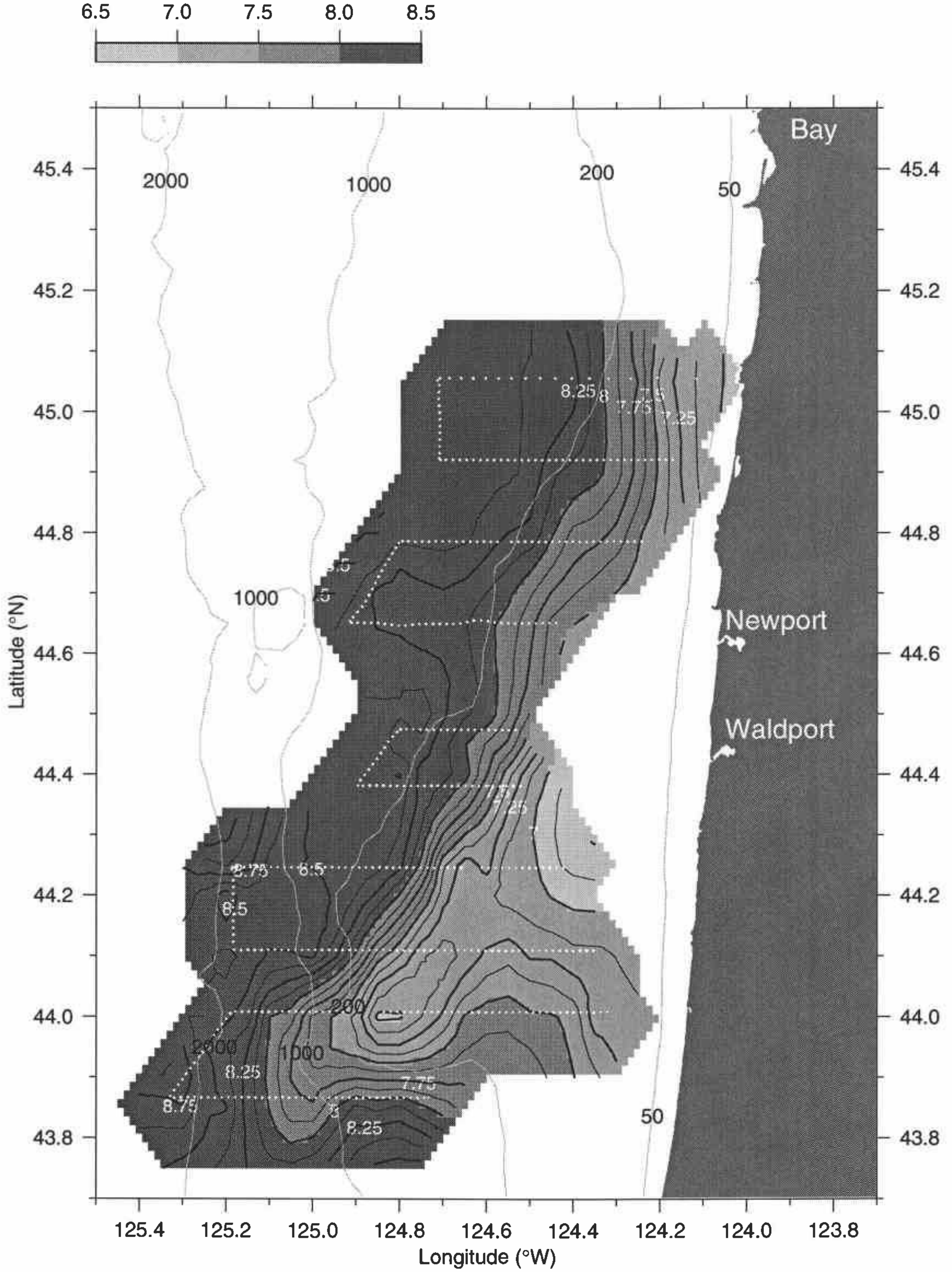


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 85 dbar

Temperature (°C)

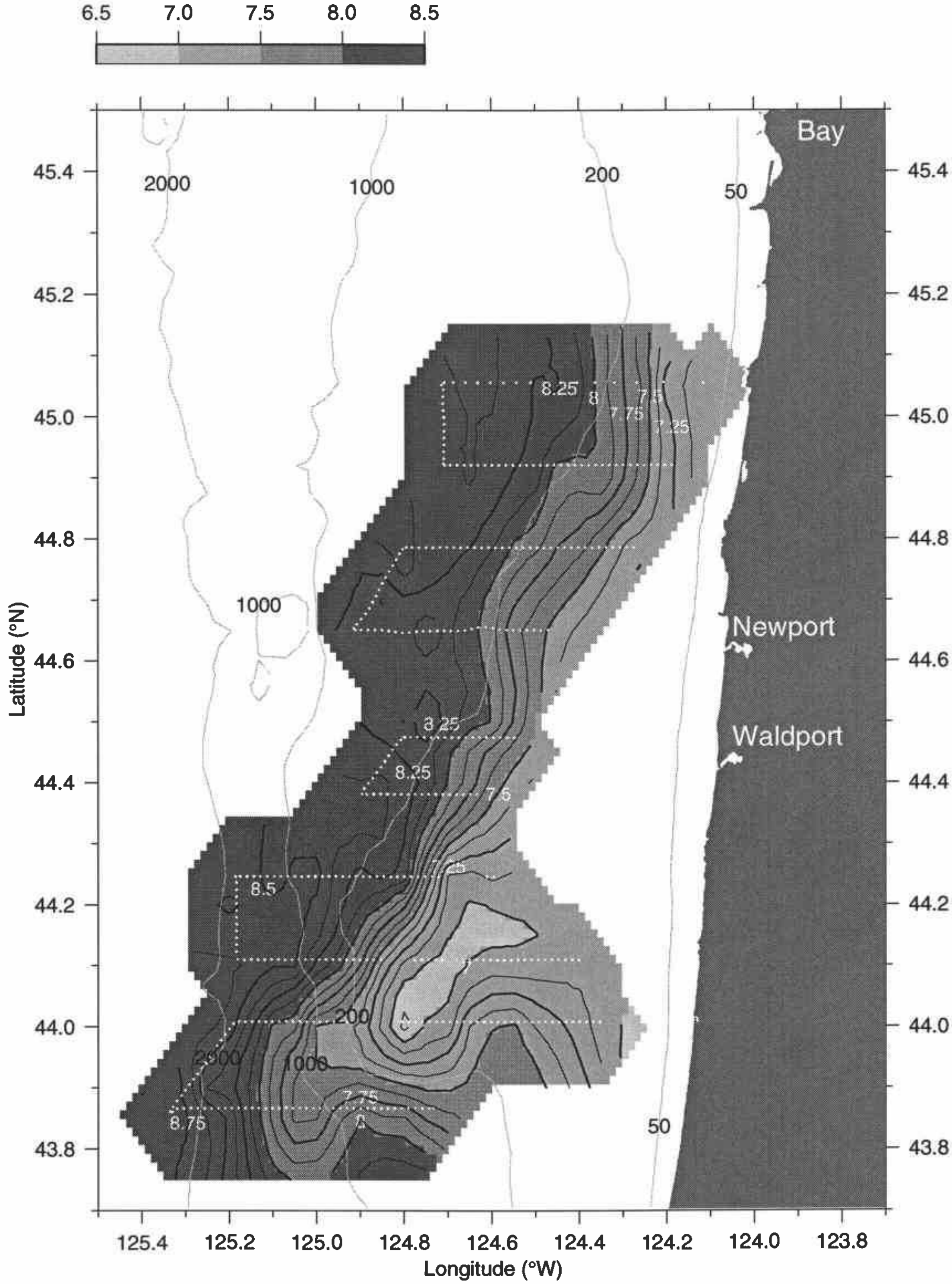


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 95 dbar

Temperature (°C)

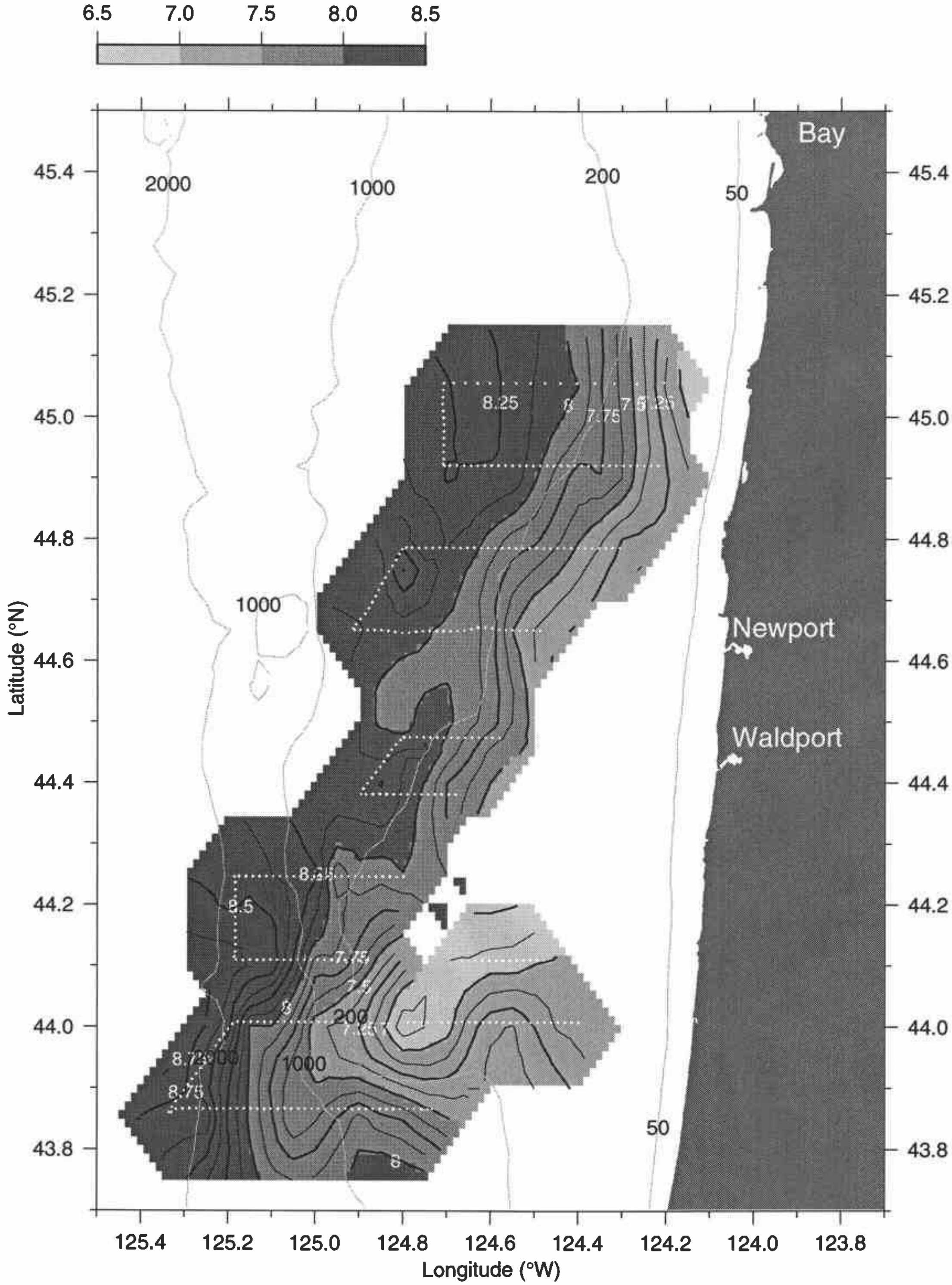


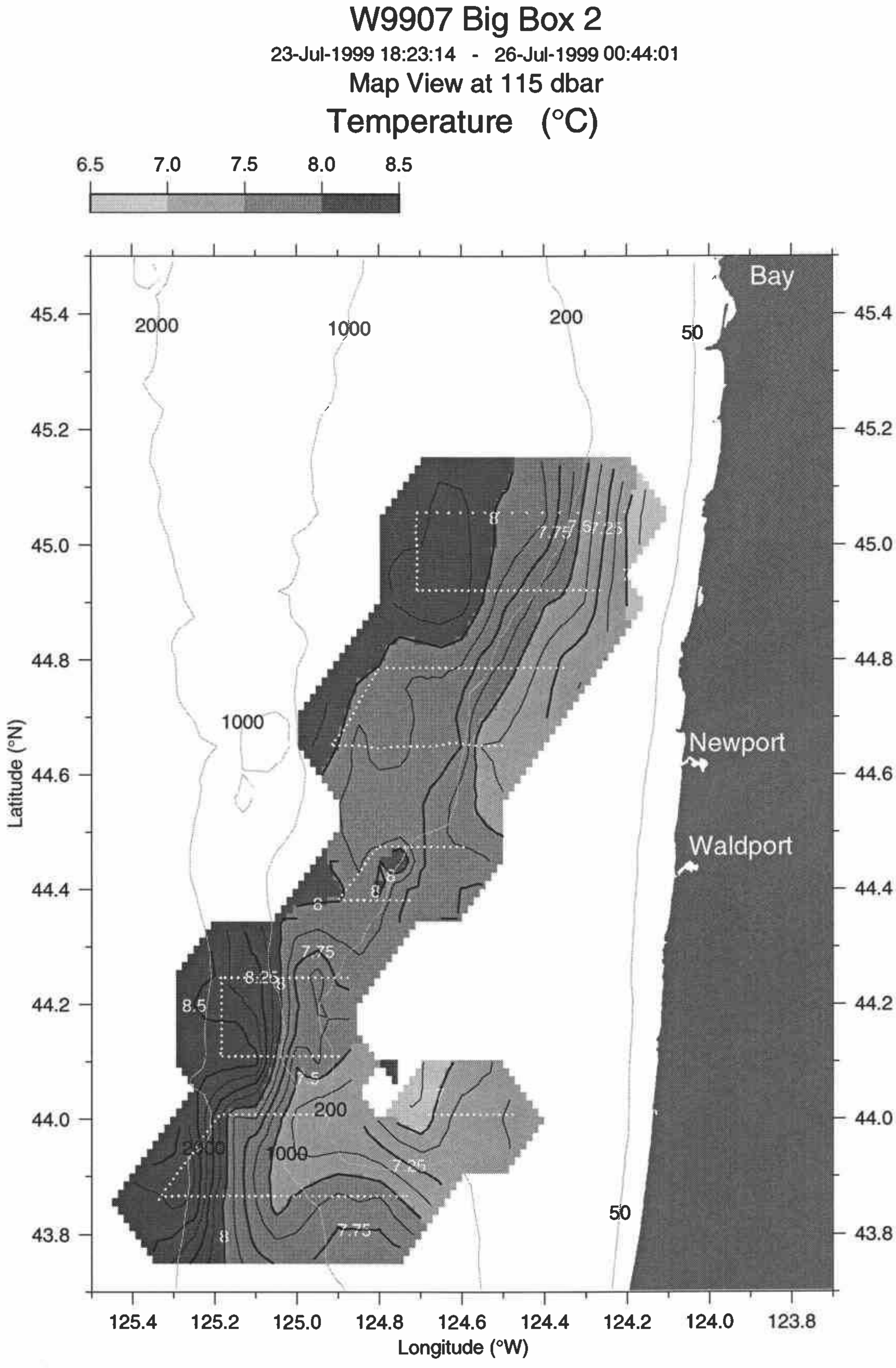
W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 105 dbar

Temperature (°C)



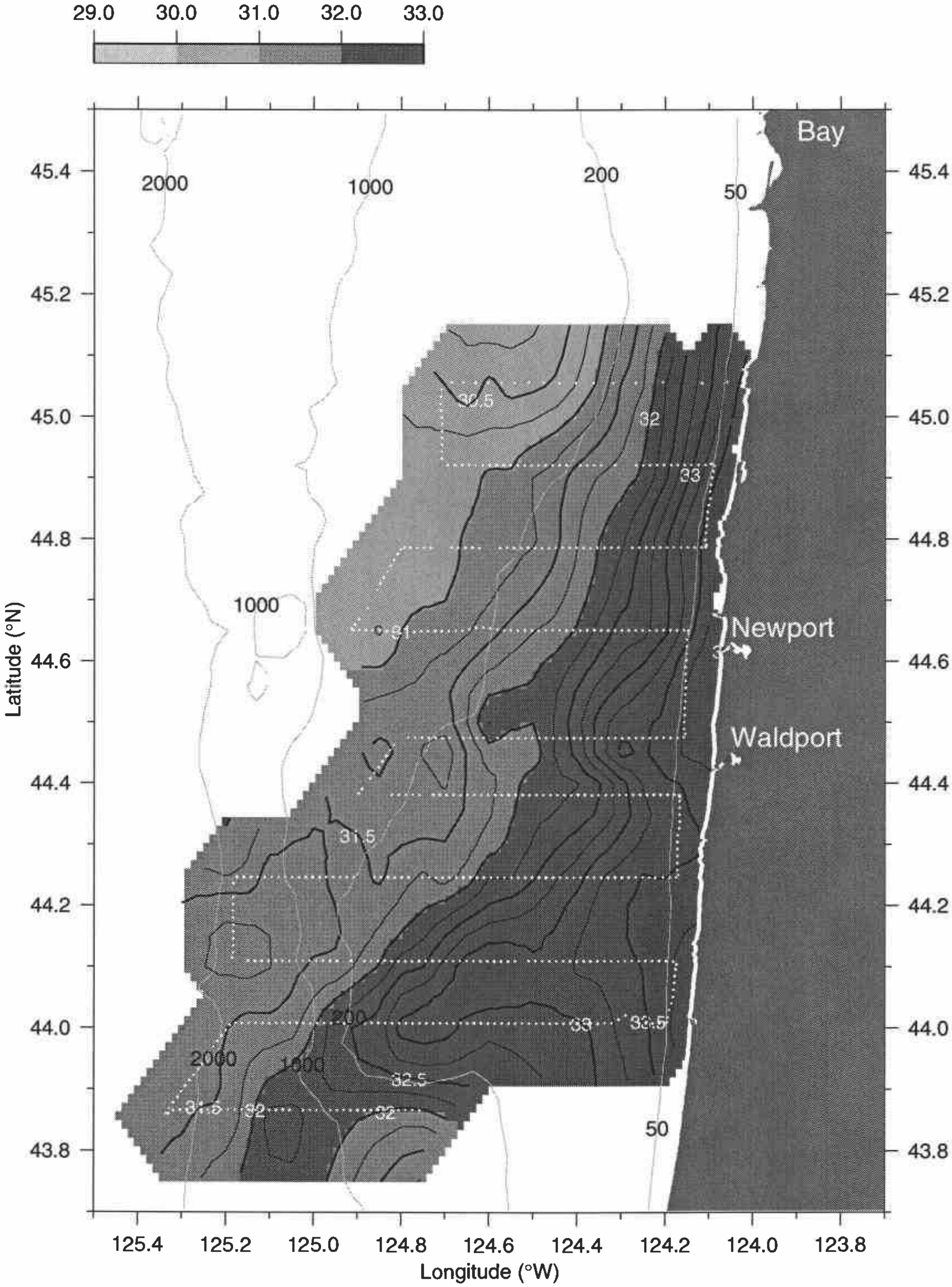

W9907 Big Box 2
23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01
Map View at 115 dbar
Temperature (°C)
6.5
7.0
7.5
8.0
8.5
Bay
Newport
Waldport
2000
1000
200
50
Latitude (°N)
Longitude (°W)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8

W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 5 dbar

Salinity (PSS)

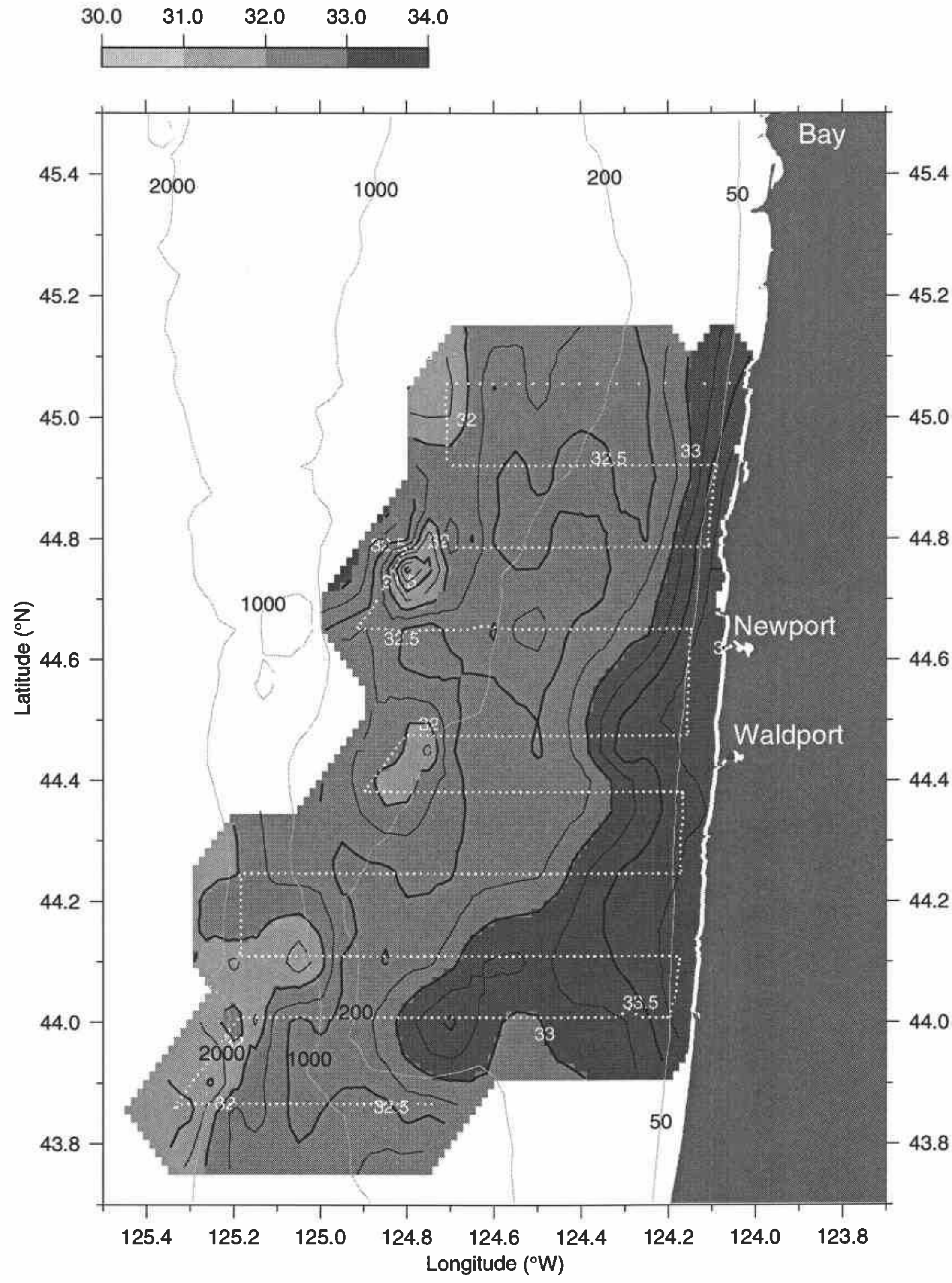


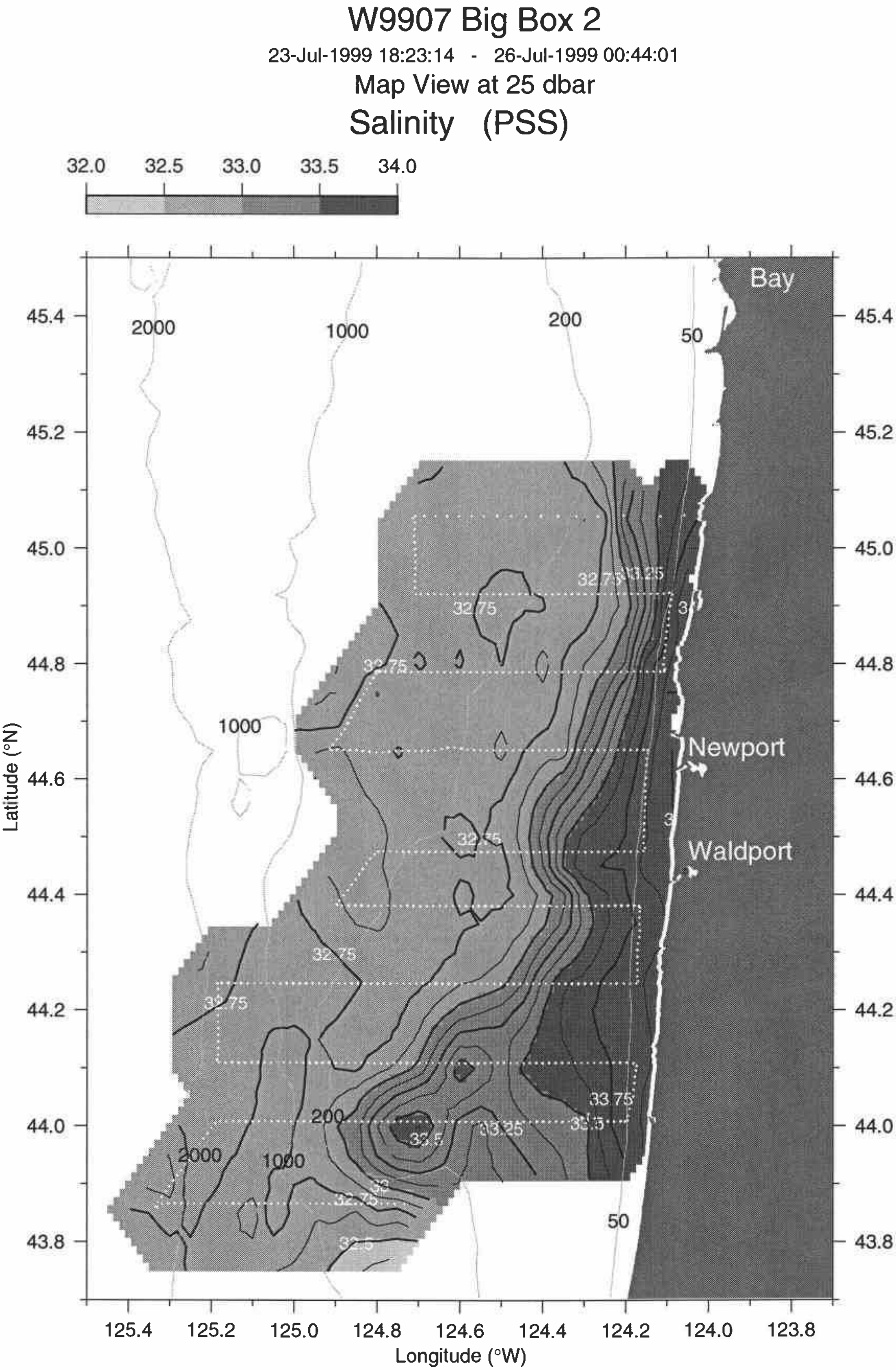
W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 15 dbar

Salinity (PSS)



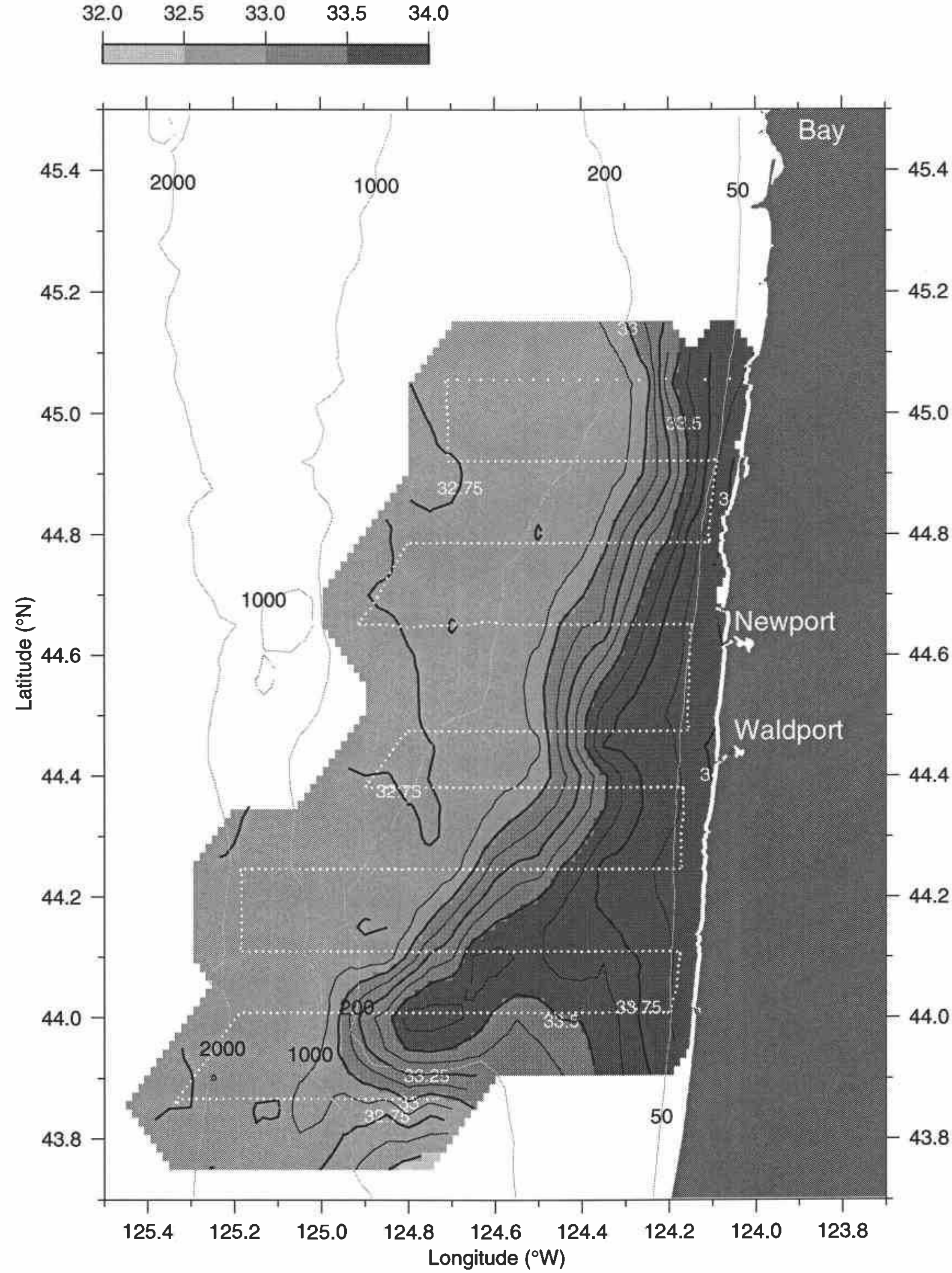

W9907 Big Box 2
23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01
Map View at 25 dbar
Salinity (PSS)
32.0
32.5
33.0
33.5
34.0
Bay
2000
1000
200
50
Newport
Waldport
32.75
33.25
33.75
33.5
33
32.5
Latitude (°N)
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)

W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 35 dbar

Salinity (PSS)

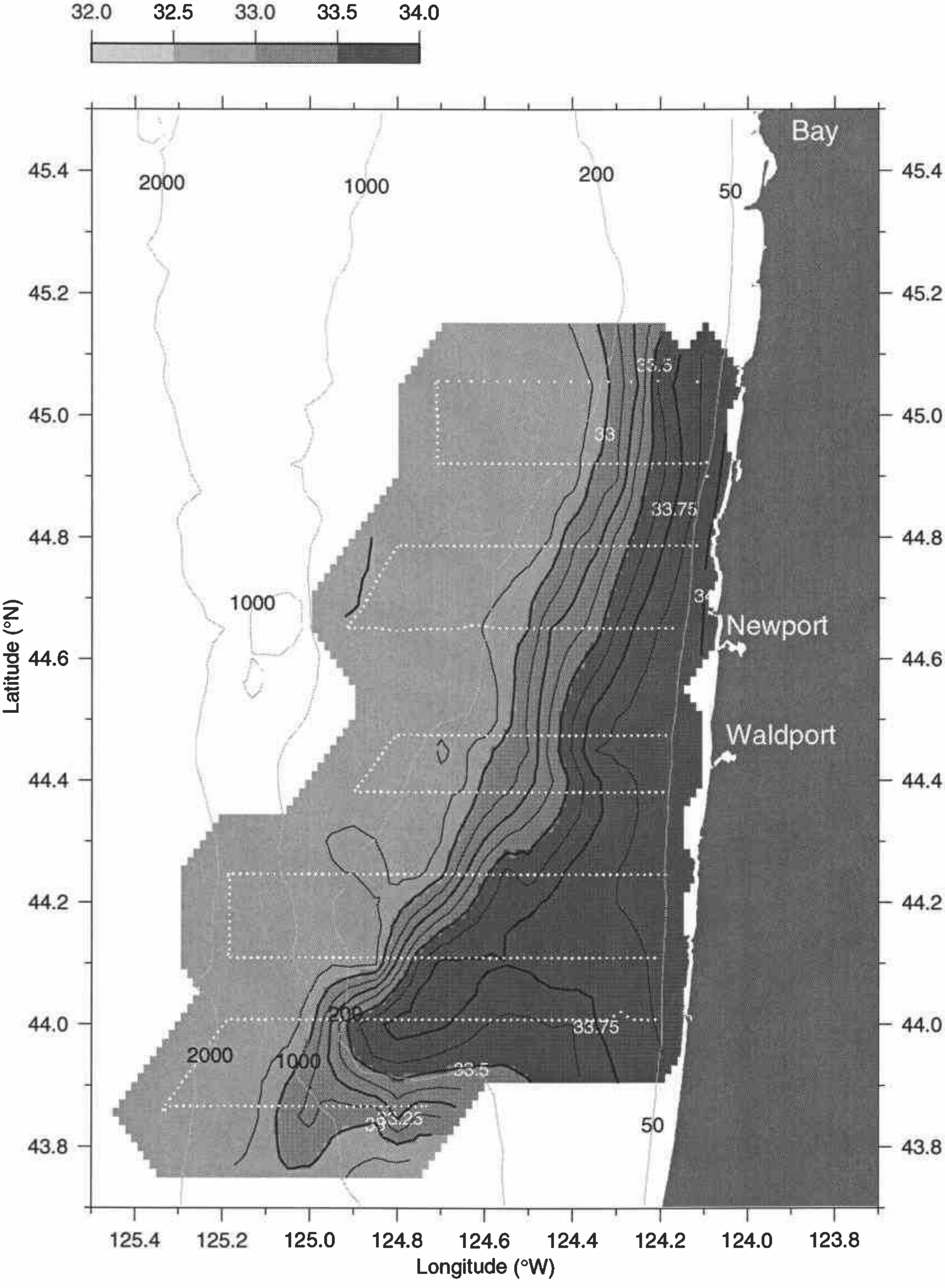


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 45 dbar

Salinity (PSS)

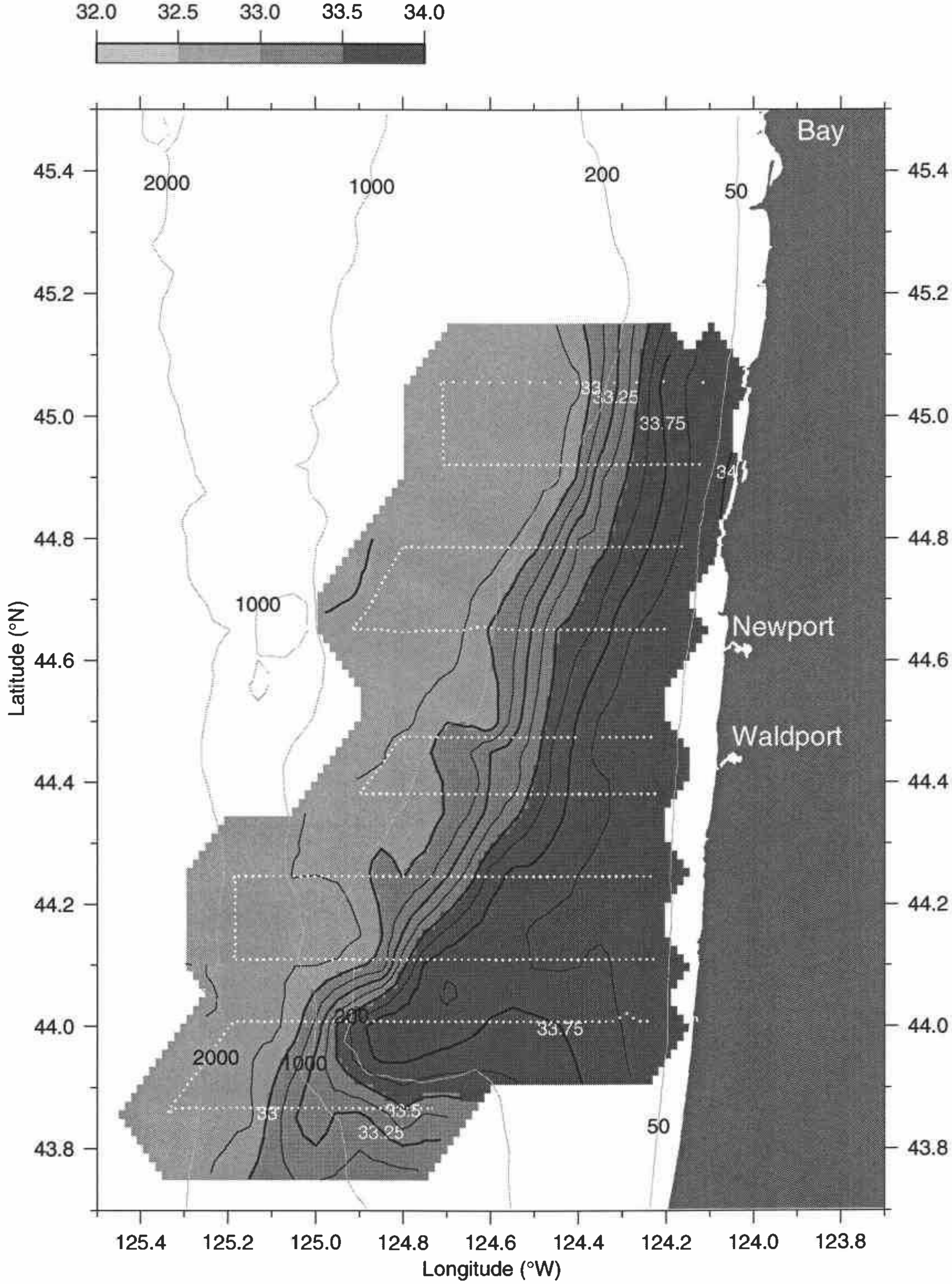


W9907 Big Box 2

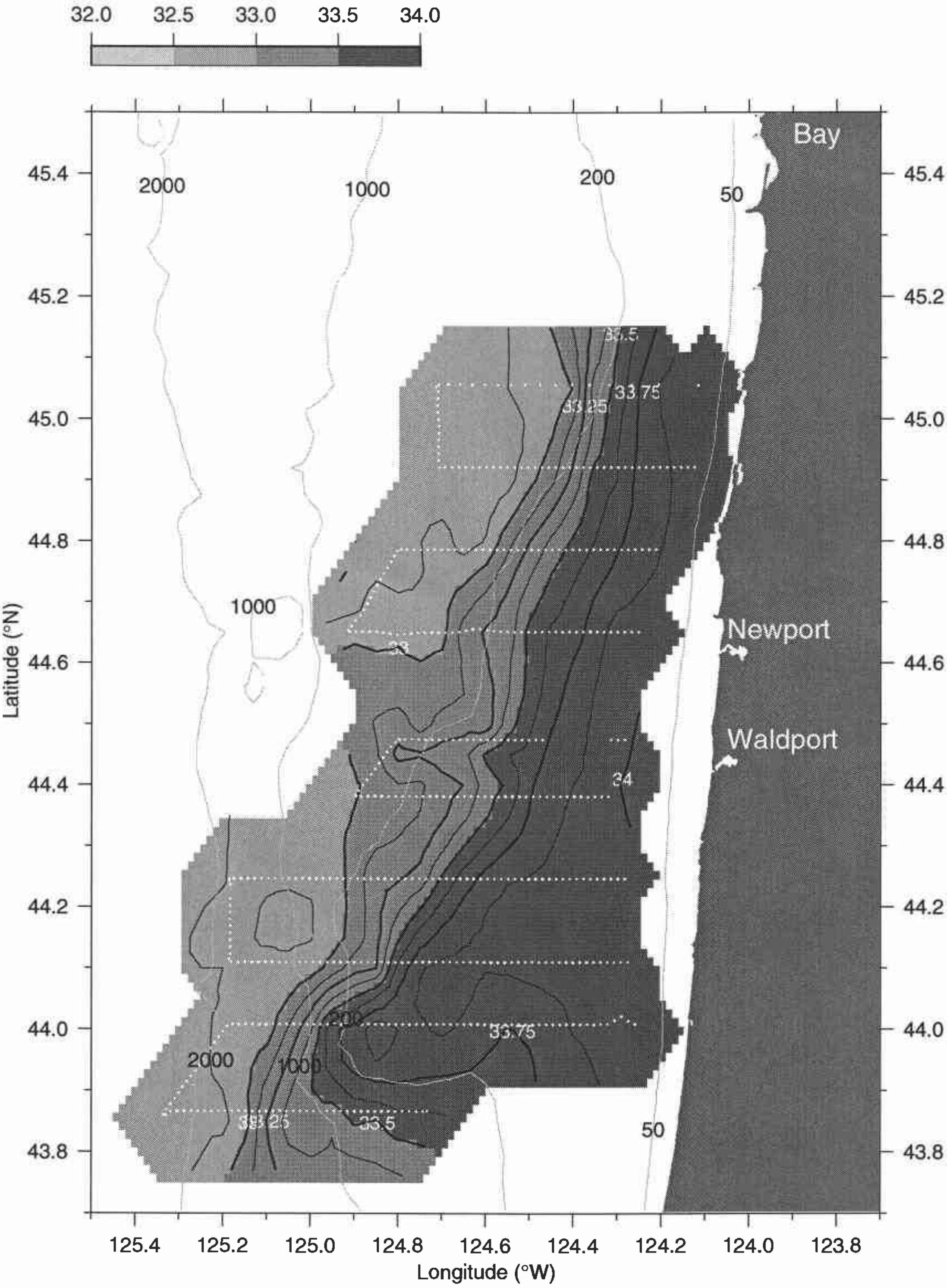
23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 55 dbar

Salinity (PSS)



W9907 Big Box 2
23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01
Map View at 65 dbar
Salinity (PSS)

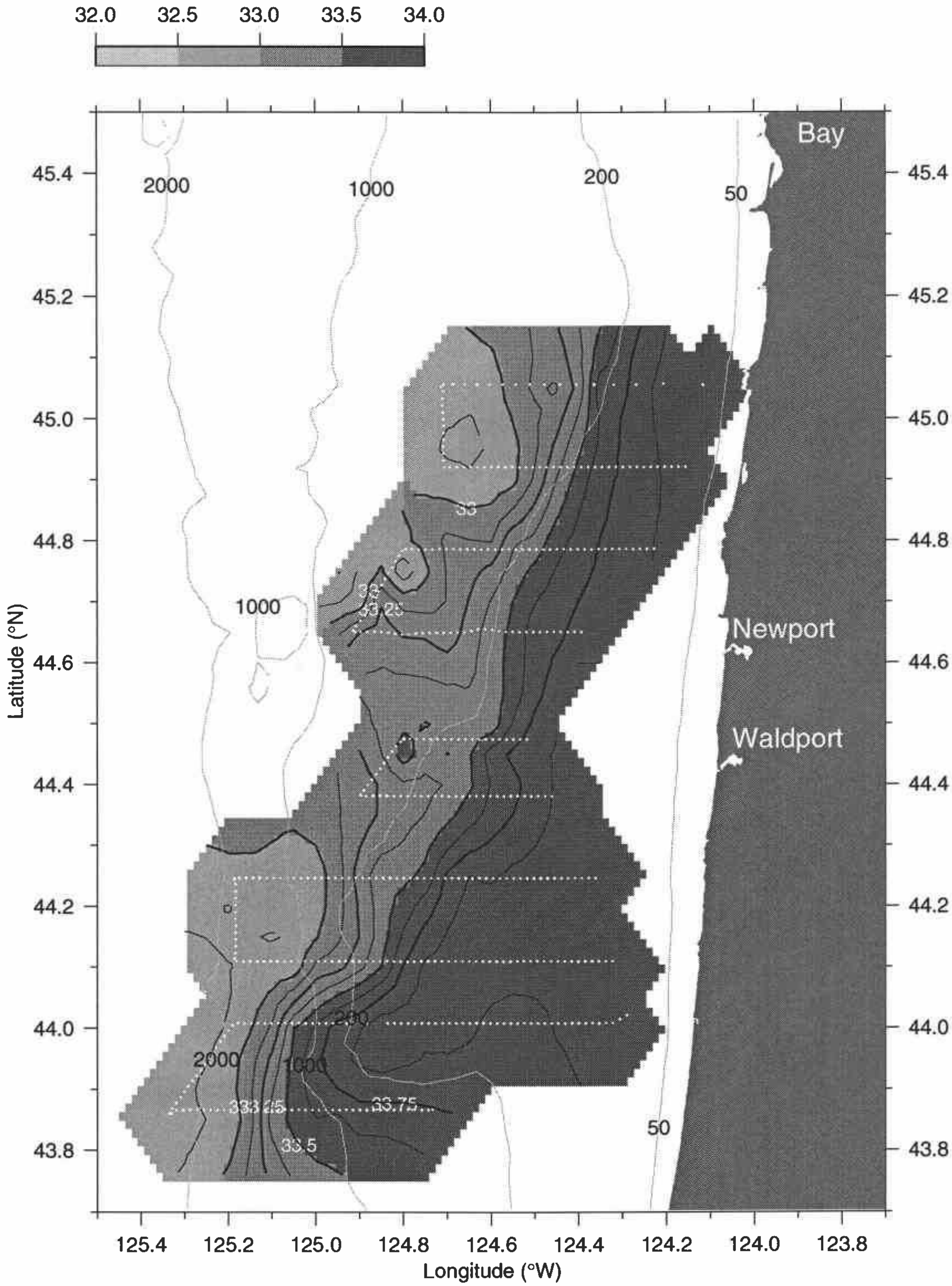


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 75 dbar

Salinity (PSS)

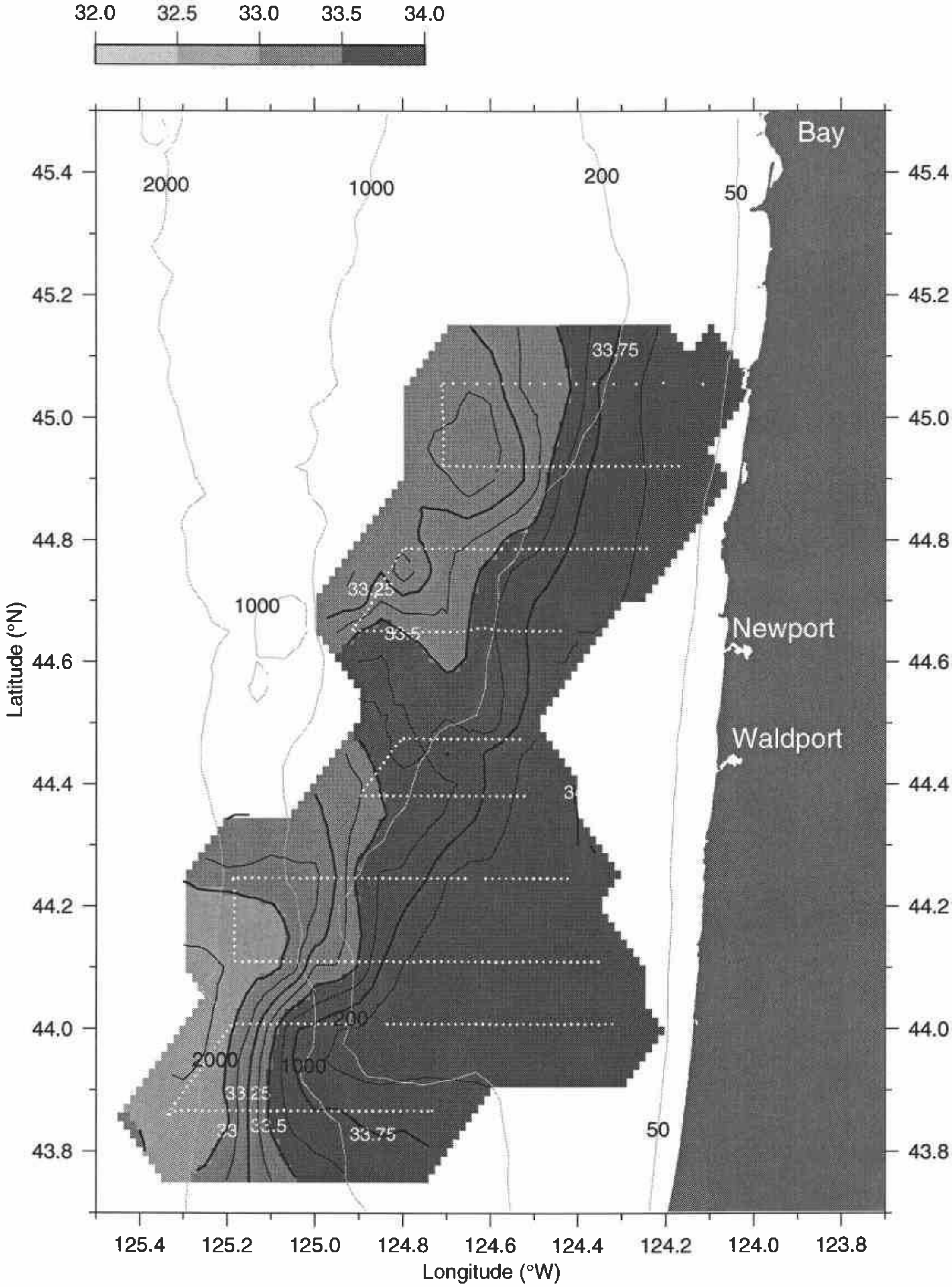


W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 85 dbar

Salinity (PSS)

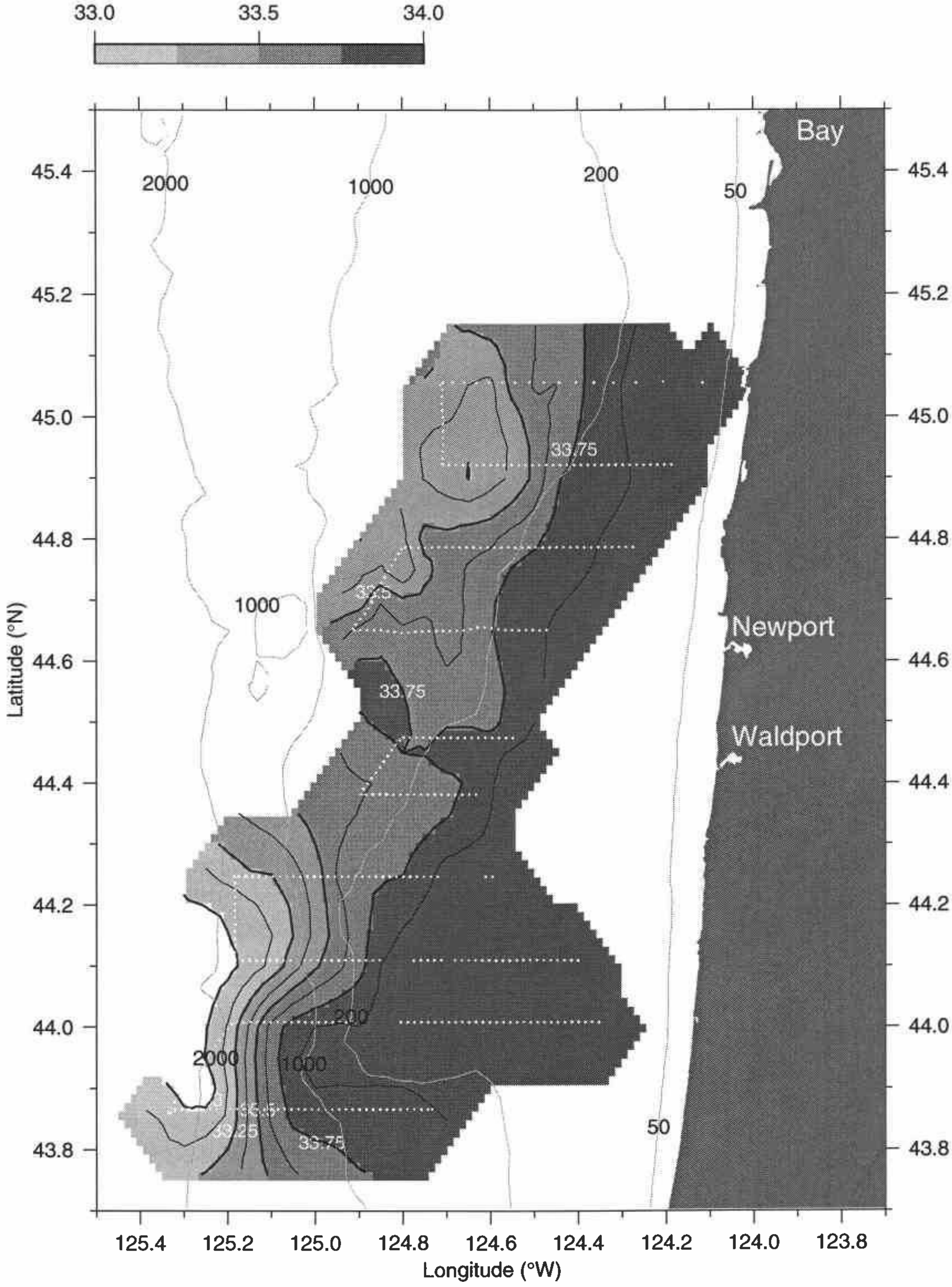


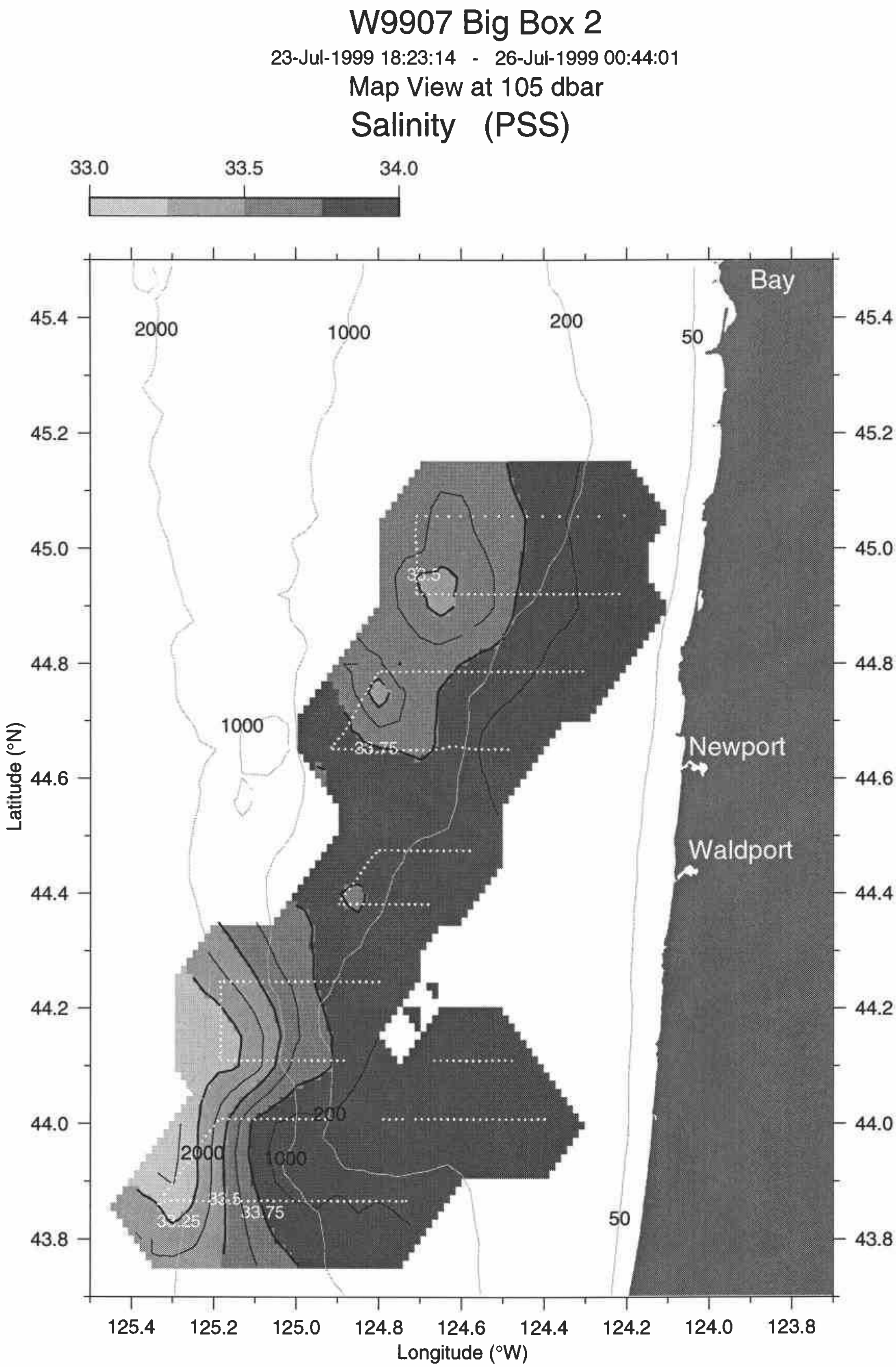
W9907 Big Box 2

23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01

Map View at 95 dbar

Salinity (PSS)





W9907 Big Box 2
23-Jul-1999 18:23:14 - 26-Jul-1999 00:44:01
Map View at 105 dbar
Salinity (PSS)
33.0
33.5
34.0
Bay
Newport
Waldport
2000
1000
200
50
33.5
33.75
33.25
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
43.8
Latitude (°N)
125.4
125.2
125.0
124.8
124.6
124.4
124.2
124.0
123.8
Longitude (°W)