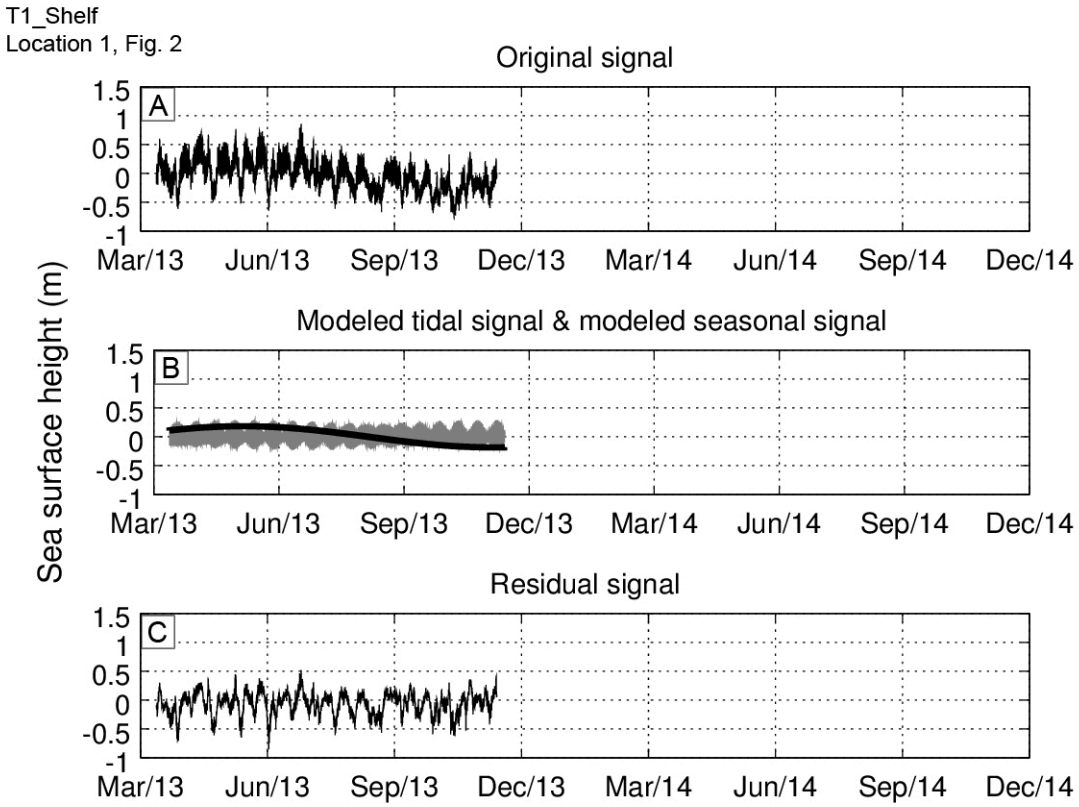
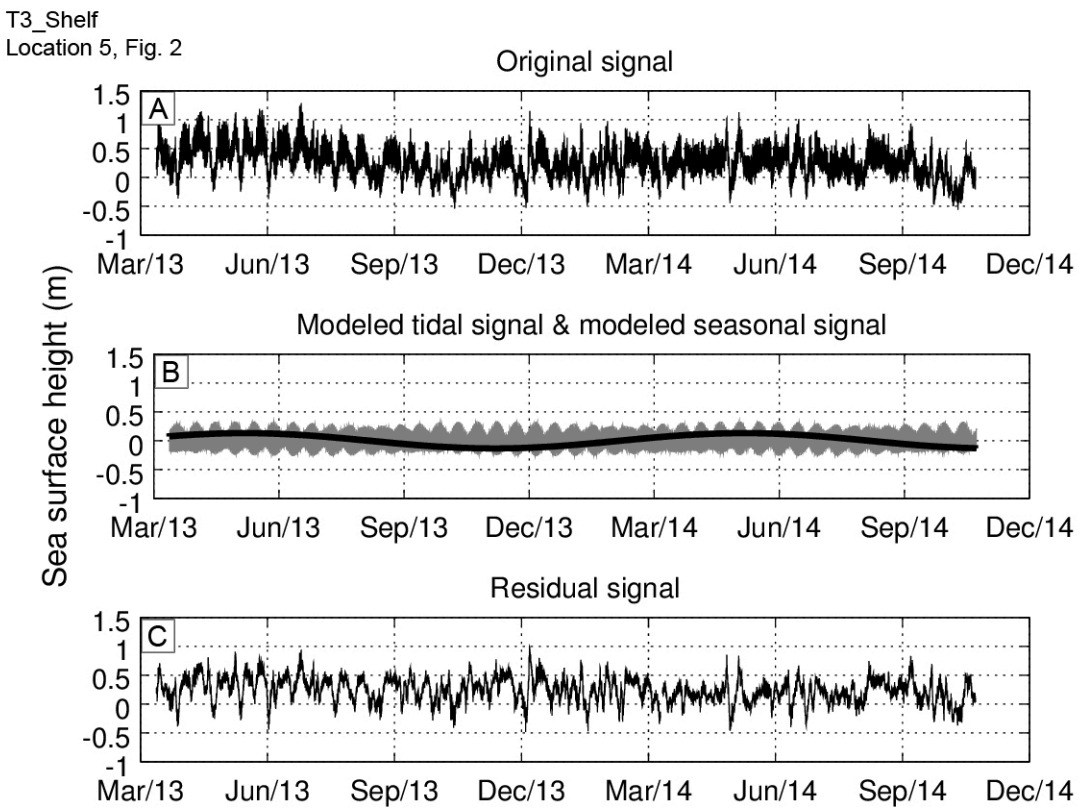
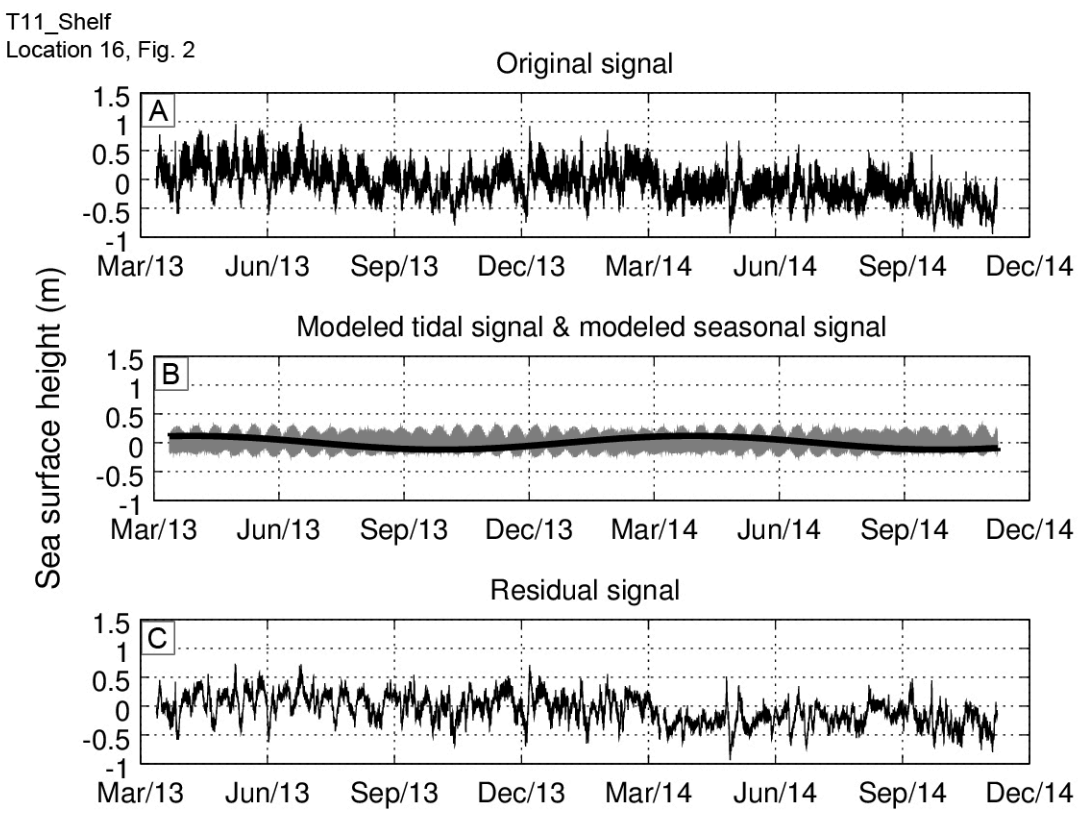
Supplemental Figures



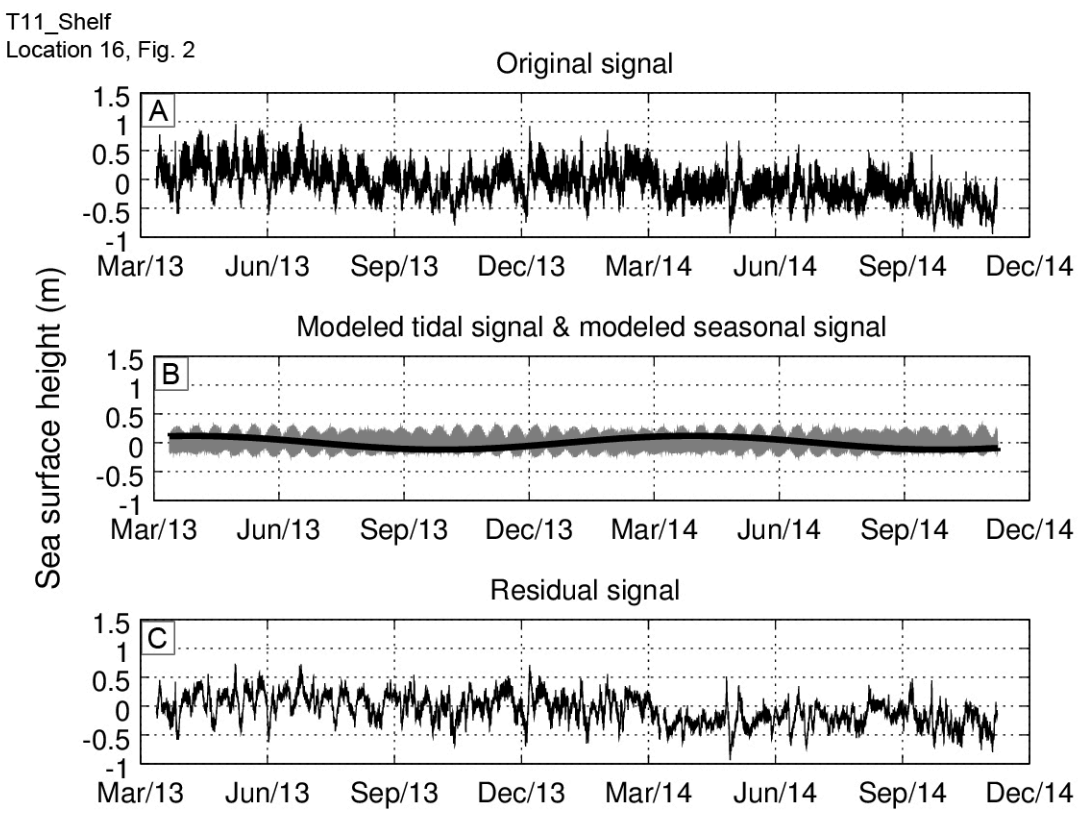
SUPPLEMENTAL FIG. S1.—Harmonic analysis of water level (tide) data from logger T1_Shelf (location 1, Fig. 2). **A)** The original signal (raw). **B)** The modeled astronomical signal from the most influential tidal constituents (M_2, S_2, K_1, O_1, M_4, and MS_4) identified by Burling et al. (2003) (light grey line), overlain by the seasonal sinusoidal curve shown in black. **C)** The residual signal after the modeled astronomical and seasonal cycles were removed, showing water level fluctuation caused by meteorological affects. Data are truncated due to logger failure.



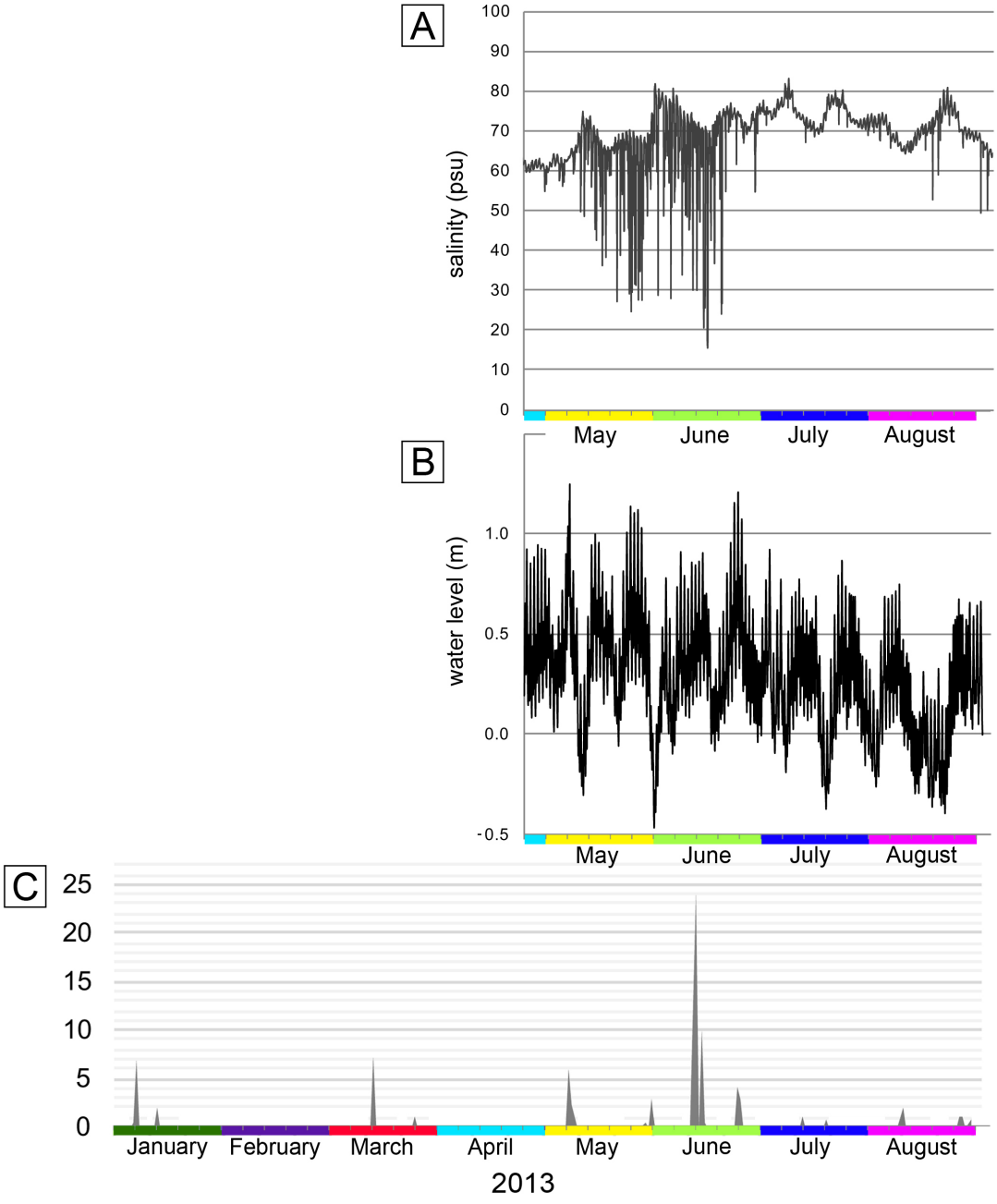
SUPPLEMENTAL FIG. S2.—Harmonic analysis of water level (tide) data from logger T3_Shelf (location 5, Fig. 2. **A)** The original signal (raw). **B)** The modeled astronomical signal from the most influential tidal constituents (M_2, S_2, K_1, O_1, M_4, and MS_4) identified by Burling et al. (2003) (light grey line), overlain by the seasonal sinusoidal curve shown in black. **C)** The residual signal after the modeled astronomical and seasonal cycles were removed, showing water level fluctuation caused by meteorological affects.



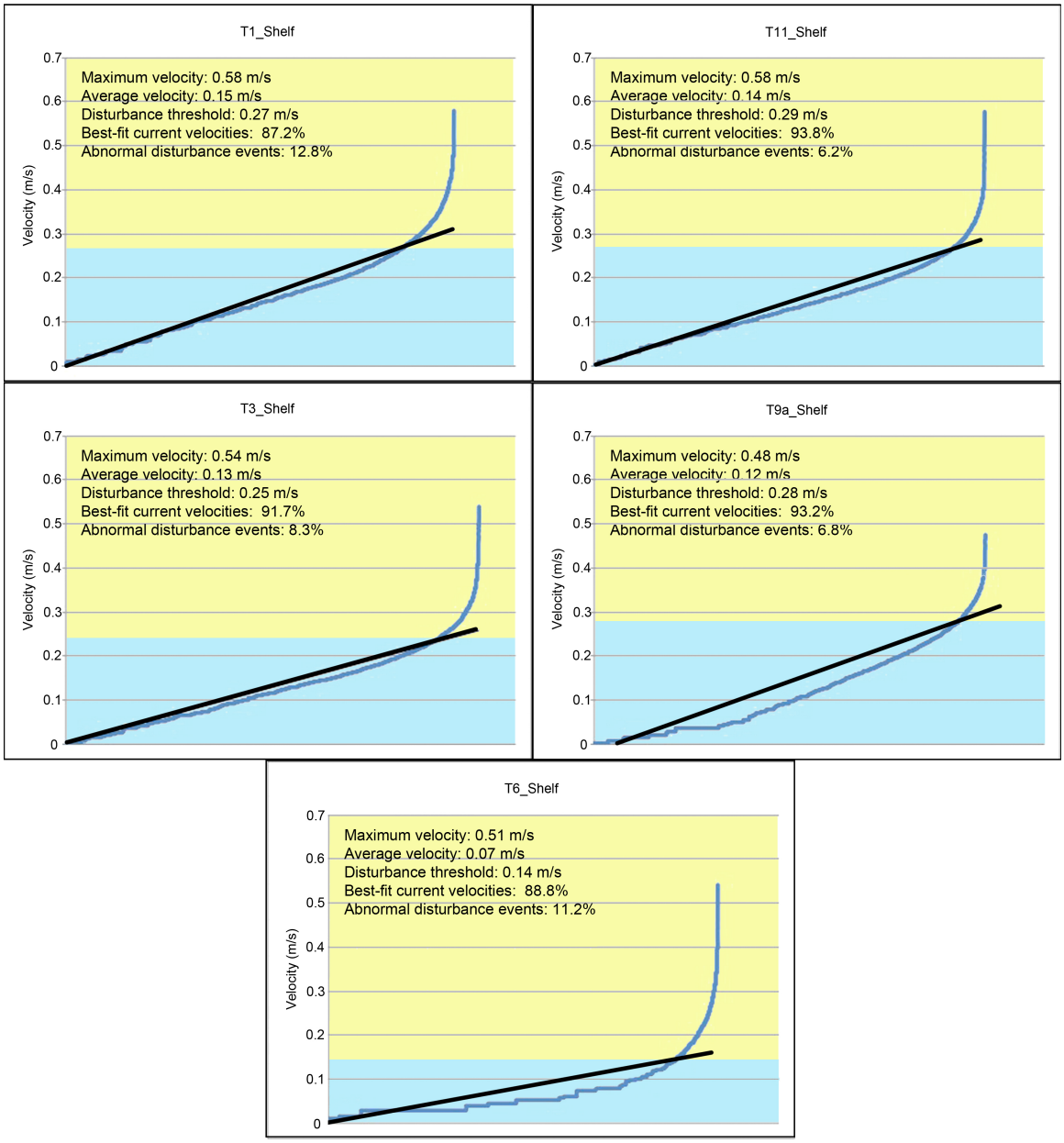
SUPPLEMENTAL FIG. S3.—Harmonic analysis of water level (tide) data from logger T9_Shelf (location 12, Fig. 2). **A)** The original, raw signal. **B)** The modeled astronomical signal from the most influential tidal constituents (M_2, S_2, K_1, O_1, M_4, and MS_4) identified by Burling et al. (2003) (light grey line), overlain by the seasonal sinusoidal curve shown in black. **C)** The residual signal after the modeled astronomical and seasonal cycles were removed, showing water level fluctuation caused by meteorological affects.



SUPPLEMENTAL FIG. S4.— Harmonic analysis of water level (tide) data from logger T11_Shelf (location 16, Fig. 2). **A)** The original, raw signal. **B)** The modeled astronomical signal from the most influential tidal constituents (M_2, S_2, K_1, O_1, M_4, and MS_4) identified by Burling et al. (2003) (light grey line), overlain by the seasonal sinusoidal curve shown in black. **C)** The residual signal after the modeled astronomical and seasonal cycles were removed, showing water level fluctuation caused by meteorological affects.



SUPPLEMENTAL FIG. S5.—Graphs showing **A)** salinity and **B)** sea surface elevation for logger T9a_shelf (location 13, Fig. 2) from April to August 2013 compared with **C)** precipitation records for Hamelin Station (Fig. 1; records from the Bureau of Meteorology station number 6026) from January to August 2013. Note that high frequency changes of salinity do not correlate with water level and/or rainfall events.



SUPPLEMENTAL FIG. S6.—Graphs showing current meter velocities (m/s) recorded from shelf loggers with sampling increments every 4-minutes (locations in Fig. 2, and duration of data collection on Supplemental Table 2). Current velocities at each location were plotted in ascending order to determine velocity of site-specific irregular disturbance events, determined at the velocity departure of best fit line. Abnormal disturbance events are within the yellow block; current velocities within typical ranges are within the blue block.

Supplemental Tables

SUPPLEMENTAL TABLE S1.—Historical environmental records of average temperature, rainfall, and evaporation data collected by the Royal Australian Airforce over 45 years (Logan and Cebulski, 1970).

Location	Month	Average max. temp.	Average min. temp.	Rainfall (cm)	Evaporation (cm)
Hamelin Pool	January	36.67	20.22	0.66	27.94
	February	36.28	20.72	1.27	22.86
	March	34.39	19.61	1.45	25.40
	April	30.50	16.83	0.99	17.78
	May	25.00	12.94	3.15	10.16
	June	21.33	10.17	4.95	7.62
	July	20.50	8.89	3.84	10.16
	August	22.00	9.28	1.93	12.70
	September	25.28	10.83	0.89	15.24
	October	27.78	12.61	0.36	17.78
	November	31.78	15.67	0.36	25.40
	December	34.83	18.22	0.23	25.40
	Mean/Total	28.83	14.67	20.07	218.44

SUPPLEMENTAL TABLE S2.—Logger metadata, providing logger location, name, geographic location, water depth, type of logger (T – temperature, P – pressure, S – conductivity, and C – current meter), and time-series span.

Figure 2 Location	Logger	Latitude	Longitude	Depth (m)	Time Series Coverage		
					Variable	Start	Finish
1	T1_Shelf	-26.04753	113.91936	2.3	T	12-Mar-13	9-Nov-14
					P	12-Mar-13	12-Nov-13
					S	24-Apr-13	11-Mar-14
					C	7-Mar-13	24-Apr-13
2	T1_Basin	-26.04384	113.92874	8.5	T	6-Apr-12	9-Nov-14
3	T2_Basin	-26.12900	113.98600	8.0	T	19-Apr-12	lost
4	T2b_Ramp	-26.15922	113.95570	4.0	T	10-Mar-13	9-Nov-14
5	T3_Shelf	-26.21559	113.99254	2.3	T	10-Mar-13	6-Nov-14
					P	12-Mar-13	23-Oct-14
					S	24-Apr-13	29-Apr-14
					C	8-Mar-13	23-Apr-13
6	T3_Basin	-26.20816	114.02254	7.0	T	6-Apr-12	21-Mar-14
7	T4_Basin	-26.34161	114.00436	7.0	T	6-Apr-12	24-Mar-14
8	T5_Basin	-26.40490	114.06389	5.5	T	6-Apr-12	9-Nov-14
9	T6_Shelf	-26.43982	114.08538	2.1	T	6-Apr-12	9-Nov-14
					S	1-Mar-13	20-Aug-14
					C	7-Mar-13	24-Apr-13
10	T7_Basin	-26.38274	114.14532	5.0	T	6-Apr-12	9-Nov-14
11	T8_Basin	-26.33017	114.13693	8.0	T	18-Apr-12	5-Nov-14
12	T9a_Shelf	-26.26523	114.21578	2.8	T	8-Mar-13	9-Nov-14
					P	12-Mar-13	7-Nov-14
					S	24-Apr-13	15-May-14
					C	7-Mar-13	24-Apr-13
13	T9a_Ramp	-26.26497	114.19306	4.5	T	6-Apr-12	3-Mar-13
14	T10_Basin	-26.18640	114.56700	6.5	T	25-Apr-12	9-Nov-14
15	T11_Basin	-26.09334	114.14616	8.0	T	8-Mar-13	9-Nov-14
16	T11_Shelf	-26.08072	114.20004	2.4	T	8-Mar-13	9-Nov-14
					P	12-Mar-13	7-Nov-14
					S	24-Apr-13	14-Nov-13
					C	7-Mar-13	24-Apr-13

SUPPLEMENTAL TABLE S3.—Temperature data recorded from shelf and basin loggers (location as on Fig. 2; logger duration as Supplemental table 2).

	Temperature (°C)			
Logger Location	***Maximum***	***Minimum***	***Range***	***Average***
T1_Shelf (Location 1, Fig. 2)	31.5	14.2	17.3	22.0
T1_Basin (Location 2, Fig. 2)	29.9	14.6	15.3	21.9
T2b_Ramp (Location 4, Fig. 2)	31.2	14.0	17.2	22.0
T3_Shelf (Location 5, Fig. 2)	30.7	15.1	15.7	22.0
T3_Basin (Location 6, Fig. 2)	30.6	15.6	15.0	23.0
T4_Basin (Location 7, Fig. 2)	30.6	14.8	15.8	22.5
T5_Basin (Location 8, Fig. 2)	31.0	14.4	16.6	22.1
T6_Shelf (Location 9, Fig. 2)	33.0	11.2	21.8	22.1
T7a_Basin (Location 10, Fig. 2)	31.3	13.7	17.6	22.3
T8_Basin (Location 11, Fig. 2)	31.6	14.5	17.0	22.2
T9a_Shelf (Location 12, Fig. 2)	32.0	14.1	17.9	22.2
T9a_Ramp (Location 13, Fig. 2)	31.1	14.7	16.4	22.4
T10_Shelf (Location 14, Fig. 2)	32.1	14.6	17.5	22.3
T11_Shelf (Location 16, Fig. 2)	32.0	13.9	18.1	22.5

SUPPLEMENTAL TABLE S4.—Tidal data from shelf loggers (locations as Fig. 2; duration as in Supplemental Table 2). Maximum, minimum, range and average sea surface elevation, relative to Australian Height Datum (AHD) tied to Benchmark A906.

	Sea Surface Elevation (m)			
Logger Location	***Maximum***	***Minimum***	***Range***	***Average***
T1_Shelf (Location 1, Fig. 2)	0.793	-0.801	1.594	-0.086
T3_Shelf (Location 5, Fig. 2)	1.212	-0.596	1.808	0.202
T6_Shelf (Location 9, Fig. 2)	Logger failure			
T9a_Shelf (Location 12, Fig. 2)	1.239	-0.649	1.888	0.158
T11_Shelf (Location 16, Fig. 2)	0.896	-0.977	1.873	-0.123

SUPPLEMENTAL TABLE S5.—Salinity data recorded from shelf loggers (locations as in Fig. 2; duration as in Supplemental Table 2), calculated from conductivity readings and converted to practical salinity units (psu) using temperature and pressure data as outlined by Poisson et al. 1991.

	Salinity (psu)			
Logger Location	***Maximum***	***Minimum***	***Range***	***Average***
T1_Shelf (Location 1, Fig. 2)	75.8	30.4	45.5	63.0
T3_Shelf (Location 5, Fig. 2)	80.1	53.1	27.0	67.9
T6_Shelf (Location 9, Fig. 2)	91.5	53.8	37.7	71.2
T9a_Shelf (Location 12, Fig. 2)	86.6	15.7	71.0	66.1
T11_Shelf (Location 16, Fig. 2)	80.7	39.9	40.8	65.6