2.4 Bathymetric Survey

The bathymetric survey on this study was conducted on October to November 2009 during the baseline study in Phase 2, using a set of single-beam echo sounder, in the lagoon area of Fongafale islet as shown in Figure 5.11. Moreover, detailed bathymetric survey was performed on the end of June 2010 during the feasibility study in the target zone for coastal protection measures.

(1) Bathymetric Survey in Fongafale

a) Overview of Bathymetric Survey

The survey achieved coverage within the lagoon to an average distance of 1.0 km from the shoreline, reaching water depths of some 50 meters, mainly along the coastline of Fongafale islet as shown in Figure 2.17. The survey lines were spaced at about 100 meters interval and the total survey lines were more than 200 lines.

The positioning during the survey was performed by RTK GPS, using a Trimble R8 system. The GPS base station was set up at two different locations during the survey to get a real time kinematic GPS positions during the survey.

Observed soundings from the bathymetric survey were reduced to the Chart Datum using hourly sea level data from the tide gauge in Funafuti through the South Pacific Sea Level and Climate Monitoring Project.

The processed data were individually plotted as per the surveyed lines and these transect lines are shown in cross sectional profiles with event marks at 50 meters interval.

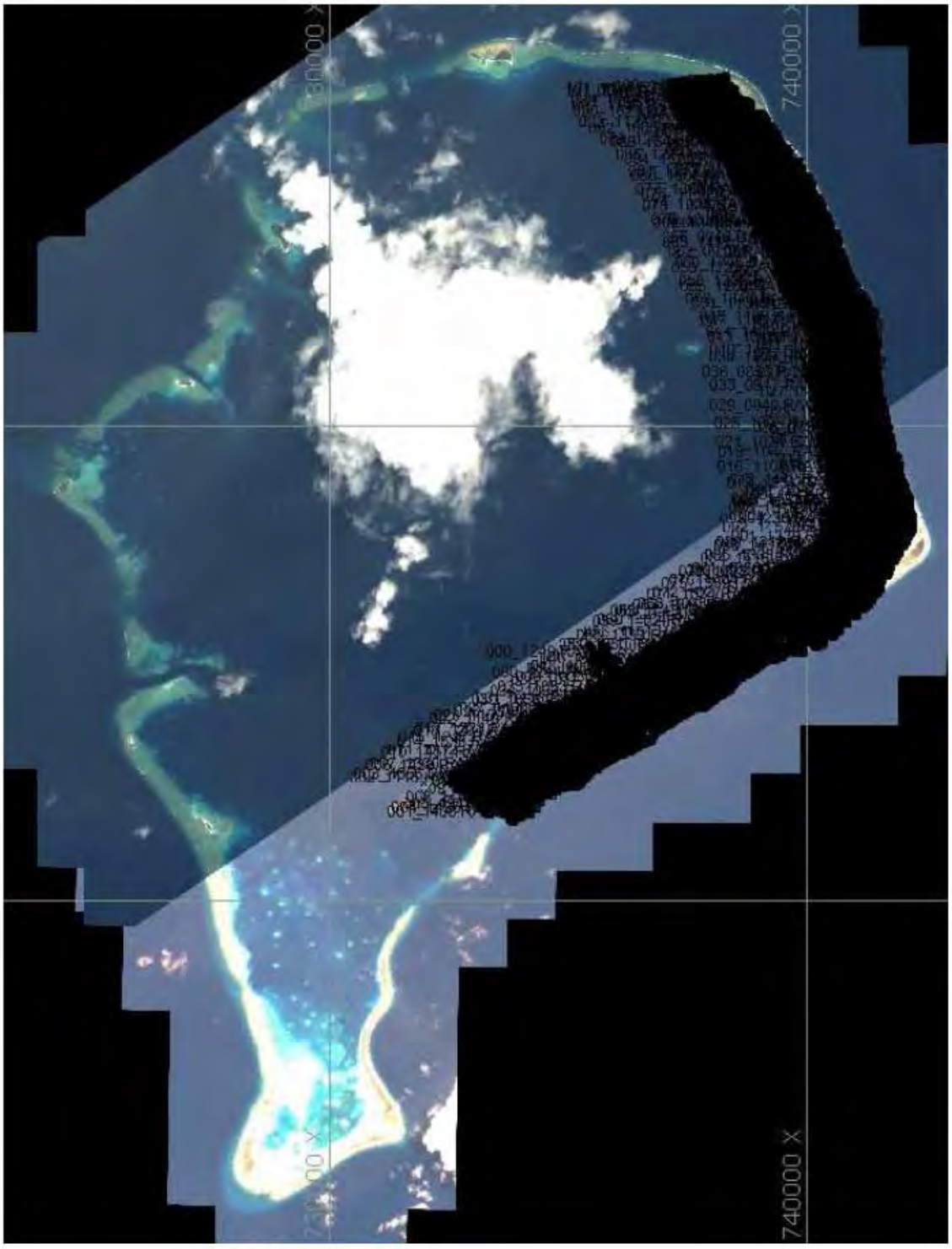


Figure 2.17 Sounding Coverage in Funafuti Lagoon

b) Result of Bathymetric Survey

The details for the bathymetric survey results are provided in "Data Book" attached to this report. The contents of the bathymetric survey in the Data Book are as follows;

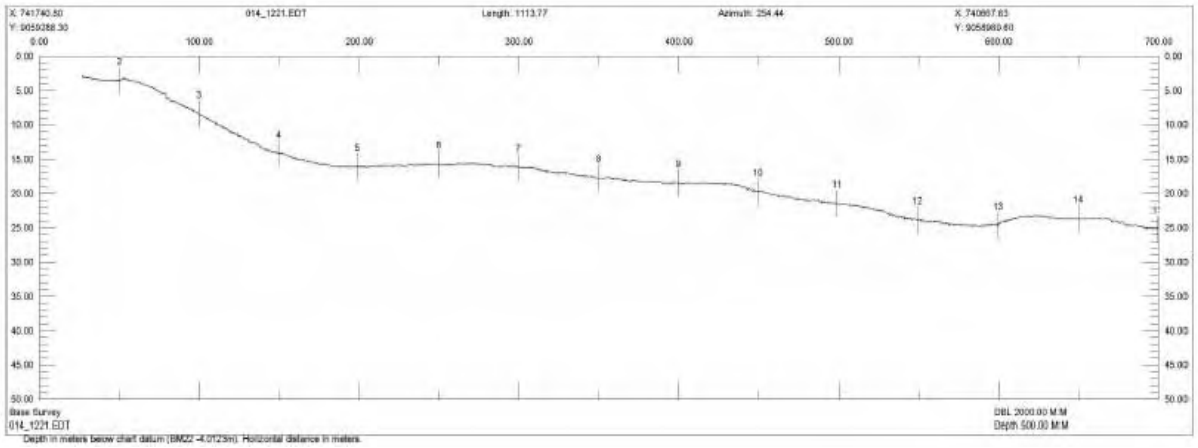
① Coverage of echo-sounding in Funafuti lagoon
② Cross-section of survey lines in Funafuti lagoon
③ Bathymetric map in Funafuti lagoon

The results of the bathymetric survey in the lagoon area on this study were compiled as a set of cross sections more than 200 lines and a bathymetric chart. These results are shown in Data Book together with coverage of echo-sounding (track chart) as mentioned above.

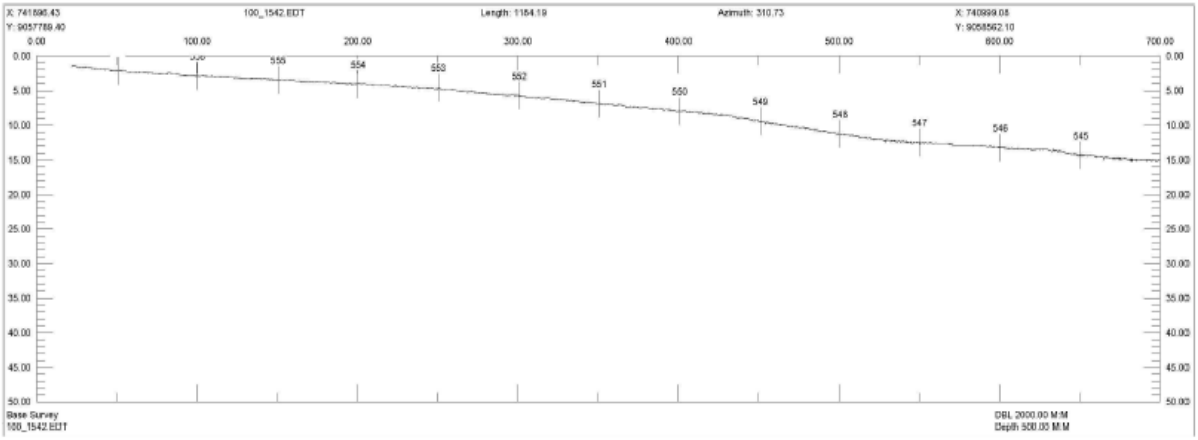
Figure 2.18 shows representative samples of cross sections in front of the Fisheries Department (the north part of Fongafale), the south of Catalina Ramp (the central part of Fongafale) and the Water Boy: seawater desalination station (the south part of Fongafale) as a reference.

The resultant data compilation was used to produce a bathymetry chart of Funafuti at a scale of 1:250,000 in the A0 sized chart. These new bathymetric maps give a descriptive picture of the ocean bottom terrain, vividly revealing the size, shape and distribution of underwater features. Figure 2.19 is the reduced drawing of these bathymetric maps.

North Part (Line N-14: Fisheries Dep.)



Central Part (Line S-100: Catalina Ramp)



South Part (Line S-85: Water Boy)

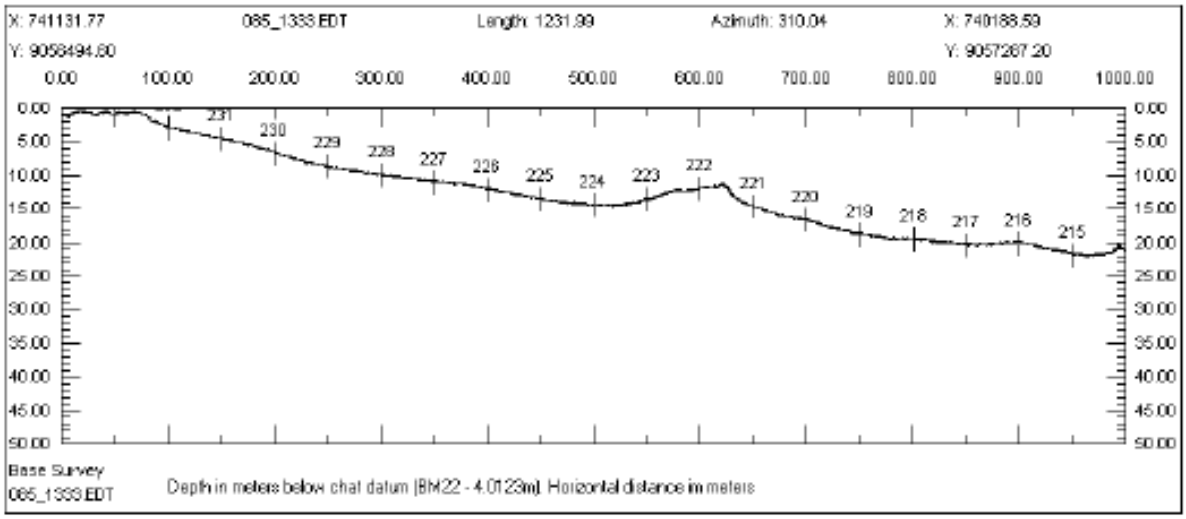


Figure 2.18 Sample of Cross Sections in Funafuti Lagoon

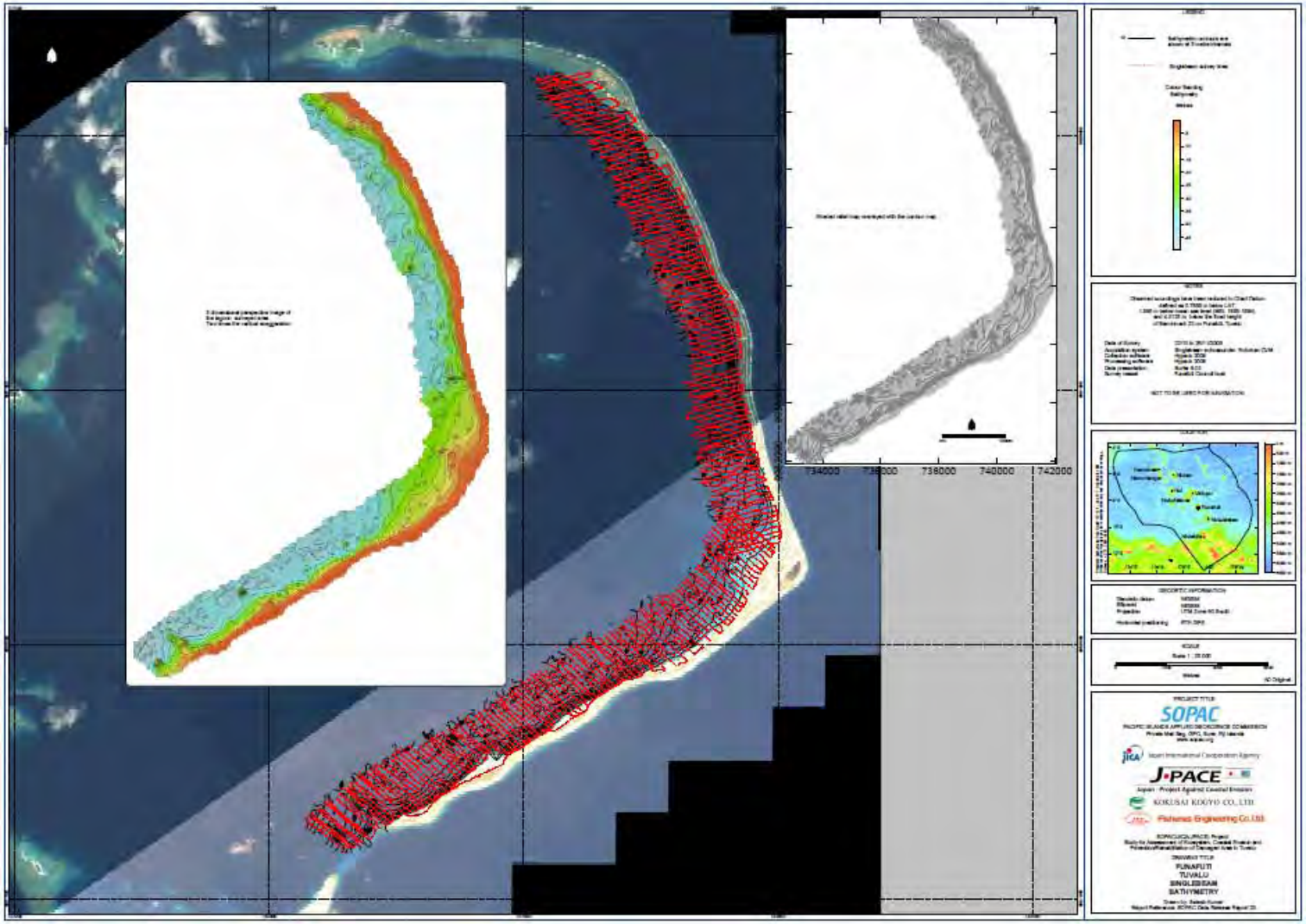


Figure 2.19 Bathymetric Maps in Funafuti Lagoon

2.5 Bottom Sediment Survey

2.5.1 Methodology

The bottom material sampling was made at 2 points on the oceanic side and at 13 points in the lagoon (sea bottom sand sampling) and at 20 points in the vicinity of the shore line (shore line sand sampling), or 35 points in total.

The sampling was be made in the surface layer.

The sampling positions were measured using a simple handheld Garmin GPS.

The sea bottom sand sampling was obtained using the Ekman-Birge type bottom sampler prepared by Client.

The shore line sand sampling was obtained by a surveyor with a hand scoop to collect samples directly. Samples were collected 3 times or more per sampling point as mixed samples.

In the field survey, the weather, atmospheric temperature, wave grade, water depth, smell of samples, appearance of samples (sand material color, admixtures) was recorded.

The collected samples were dried out in sunlight in Tuvalu and again in an oven at SOPAC premises at 70°Celsius.

The dried samples were split into two, one for grain size analysis and the other for analysis of sand composition ratio.

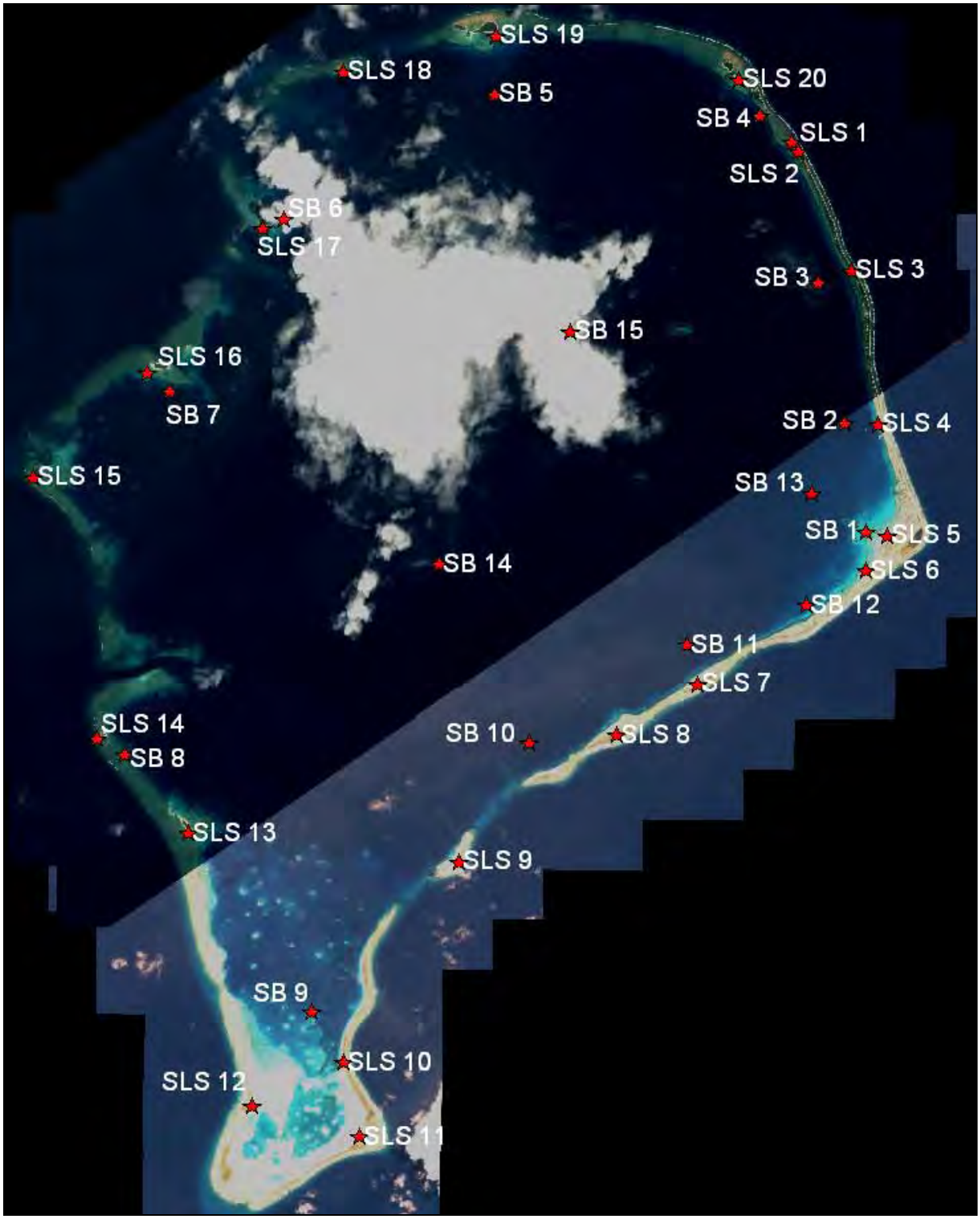


Figure2.20 Sample location map

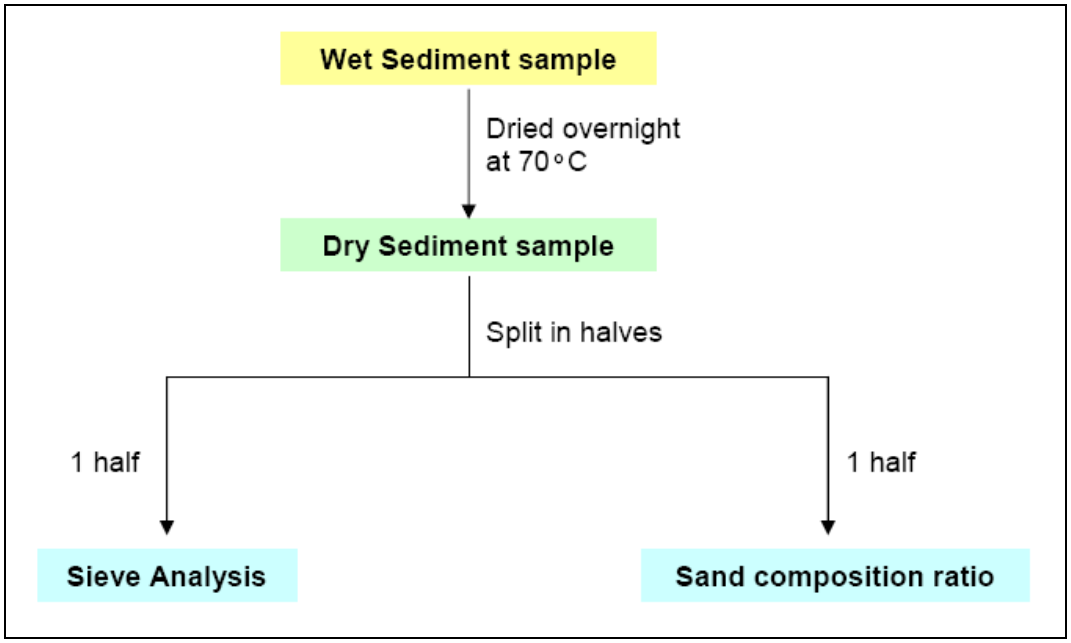


Figure 2.21 Sediment sample analysis procedure.

Figure 2.22. Hand-held GPS used for getting sample site locations.

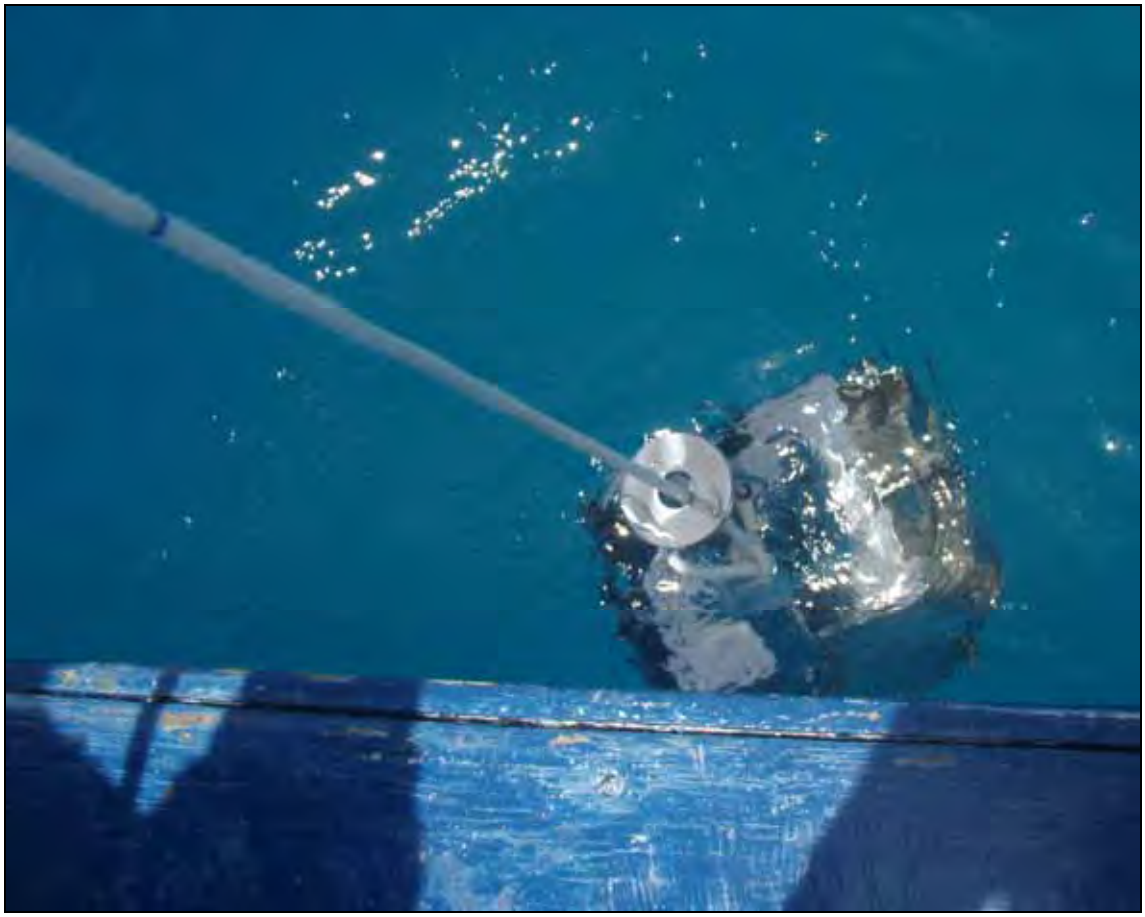


Figure 2.23 Sea bottom sand sampling using the Ekman-Birge type bottom sediment sampler

Figure 2.24 Sand samples set out to dry in Tuvalu

2.5.2 RESULTS

(1) Sediment Sample Log Sheet

Date: Monday 26/10/09
Collector: Ashishika and Salesh

Collectors No.	Location	Time	Latitude	Longitude	Colour	Size	Components	Hand Specimen
SLS 14	Vasafua	0835	08 33 31.9	179 03 01.5	Pale cream with pinkish forams	Medium to coarse with rubble cobble size	Foraminifera, shell fragments, coral rubble	Medium grain size, to coarse sand with rubble and cobble sized grains
SLS 10	Funafara	0924	08 37 05.3	179 05 46.3	White/grey	Medium	Forams, shell fragments, beach rock fragments	Coral and shell fragments, small to medium size grains. Pale grey in color
SLS 11	Telele	1000	08 37 54.8	179 05 56.5	Pinkish and white sediment particles	Fine to medium. Some coarse.	Shell fragments, lots of forams	Fine to medium, some coarse. Pink sediment (forams) dominant)
SLS 12	Tefala	1116	08 37 34.1	179 04 43.6	Light pink to orange	Fine to medium. Some pebbles.	Forams, coral fragments, rock pebbles.	Light orange colored sediments, Beachrock surrounding the area and lots of beachrock fragments in the sediment.
SB 9	Southern part of lagoon, in between Tefala and Mateiko	1123	08 36 32.3	179 05 23.7	Cream	Very fine	Very fine sand.	Very fine cream colored sand. Crabs and worms visible. Depth = 14.5m

SLS 13	Fuagea	1525	08 34 33.8	179 03 59.7	Pink (forams), white (forams, coral fragments and shells)	Medium to coarse	Forams, shell and corral fragments	Pink and white sediments, consisting of forams, shell and coral fragments.

Date: Tuesday 27/10/09
Collector: Ashishika and Salesh

Collector's No.	Location	Time	Latitude	Longitude	Color	Size	Components	Description
SLS 20	Sand key between Mulitefala and Amatuku	0848 am	08 26 11.9	179 10 06.4	White to grey	Medium to coarse. Pebbles are dominant	Coral fragments, beach rock pebbles, forams	Coarse, pebbly sediment, greyish in color. Forams dominant if dig in deeper.
SLS 17	Tepuka	0933	08 27 52.5	179 04 49.4	Pink and white	Medium to coarse	Coral fragments, forams	Mostly pinkish sediment consisting mainly of forams, with whitish coral fragments.
SLS 16	Fualopa	1108	08 29 28.5	179 03 33.7	White surface sediment with pinkish foram dominant sediment underneath	Medium to coarse	Shell fragments, coral fragments, forams, beach rock fragments	Coral rubble, beach rock fragments, forams below surface

SLS 15	Fuafatu	1216	08 30 38.5	179 02 15.5	Greyish	Medium to coarse, littered with rubble and rock cobbles	Coral and beach rock fragments. Forams.	Coral and rock fragments/ cobbles/ rubble and forams. Grey creamy color.
SB 8	Between Vasafua and Fuagea	1255	08 33 41.9	179 03 19.7	Pink and white	Medium to coarse	Lots of forams, *M. vertebralis* and *Amphistegina*	Grab sample attempted at 3 different places with no luck before sample was collected at location close to reef. Sample depth at 9m
SB 7	Off Fualopa	1402	08 29 40.8	179 03 46.7	Pale pink to creamy sediments	Very fine to medium with some coarse.	*Halimeda*, red coral and shell fragments	Grab sample with fine to coarse particles, *Halimeda* and red coral fragments shown along with forams and shell fragments
SB 6	Off Tepuka	1555	08 27 46.5	179 05 3.6	Cream colored	Very fine with forams	Very fine sand. Some forams can be seen	Grab sample at 10 m. Very fine sand with forams and worms.
SB 4	Middle of Amatuku and Tengako	1739	08 26 36.3	179 10 21.3	Cream pink	Very fine with forams	Forams, fine sand	Grab sample at 12 m. Sediment very fine and littered with forams

Date: Wednesday 28/10/09
Collector: Ashishika, Salesh and Toutou

Collector's No.	Location	Time	Latitude	Longitude	Color	Size	Components	Description
SLS 1	Northern tip of Tengako	0823	08 26 53.1	179 10 40.0	Light orange, grey at LWM	Medium to coarse	Forams, coral fragments, beachrock fragments	Medium to coarse sediments consisting of beach rock fragments and coral fragments. Forams dominant. Area surrounded by beachrock.
SLS 2	Middle of Tengako Islands	0850	08 26 59.1	179 10 44.5	Grey pinkish orange	Medium to coarse	Forams, shell fragments, coral fragments, beach rock fragments	Beach layered in sediment sizes. Generally medium to coarse sediments consisting of forams, shell, coral and beach rock fragments
SLS 3	Causeway	0928	08 28 18.4	179 11 22.0	Light orange	Medium to coarse, with scattered pebbles	Forams, shells and coral fragments	Very little sand around the causeway. Area surrounded by beachrock.
SB 3	Site in line with the causeway but in deeper waters.	0944	08 28 26.6	179 10 58.0	Pale pinkish color	Coarse	95 % *Halimeda*	Grab sample taken at depth of 33m. Sediments consist mostly of *Halimeda*.
SB 15	Middle of lagoon	1015	08 28 59.9	179 08 11.8	Cream to pale green	Coarse	Mostly *Halimeda*	Grab sample taken at 49m. Sediments consist of mostly *Halimeda*.

SB 14	Middle of lagoon	1045	08 31 34.4	179 06 47.5	Pale green	Coarse	Mostly *Halimeda*	Grab sample taken at 40m. Sediments mostly *Halimeda* of a new kind of species. *Halimeda* seems to be growing at base of an alga.
SLS 9	Falefatu	1122	08 34 51.7	179 06 59.7	Cream	Very fine sand with reef rubble surrounding the area	Sand is too fine to see with eye. Reef rubble.	A patch of very fine sand surrounded by reef rubble
SB 10	Off Funamanu (Te Ula Bunga)	1141	08 33 32.6	179 07 48.9	Pale green and pink	Coarse	*Halimeda*	Grab sample at depth 40m. 95% *Halimeda* in the sediments
SLS 8	Funangong o	1157	08 33 27.2	179 08 44.0	Cream	Fine to coarse sand with big boulders scattered around	Coral fragments, beach rock fragments, Forams	Coral and beach rock fragments. Boulders of max 50 cm diameter.
SLS 7	Fatato	1217	08 32 53.1	179 09 39.2	White to cream colored	Coarse sand, pebbles, rubble	Forams, beach rock fragments, coral fragments	Sand quite coarse with pebbles, rubble dominant all around the site.
SB 11	Paasage between Fatato and Fongafale	1230	08 32 27.1	179 09 31.2	Pinkish reddish color	Coarse	*Halimeda*, gastropods.	Grab sample at 41m. Mostly *Halimeda*, some gastropods.
SB 12	Off Fongafale	1314	08 32 00.6	179 10 50.9	Cream	Very fine, white mud	Too fine to tell with naked eye	Very fine white sediment, mud and clay sized

SLS 6	Fongafale (Vaiaku)	1330	08 31 37.2	179 11 32.7	Light pink to orange	Medium to coarse sand	Forams, coral fragments	Medium to coarse sand, with reef pebbles, cobbles, rubble and boulders scattered around
SLS 5	Fongafale	1345	08 31 14.0	179 11 44.9	Light orange	Fine to medium sand	Forams	Sandy shore. Fine to medium sand grains.
SB 1	Off Fongafale (Vaiaku)	1357	08 31 11.6	179 11 30.2	Pinkish/ brownish	Medium to coarse	Forams, seagrapes	Grab sample at 6 meters, consisting of forams and seagrapes.
SB 13	Off Fongafale	1418	08 30 46.1	179 10 53.6	Creamy	Coarse	*Halimeda*, Seagrapes, sponge, some forams	Grab sample at 28 m. Pinkish sponge in the sediment
SLS 18	Te Afualiku	1509	08 26 08.1	179 05 41.1	Orange, pink and white	Medium to coarse	Forams, coral fragments	Medium to coarse with coral pebbles and rubble.
SLS 19	Fualifeke	1524	08 25 44.0	179 07 22.6	Pinkish	Medium to coarse	Forams, coral rubble, shell fragments	Medium to coarse sediments with pebbles scattered. Some green algae growing.
SB 5	Off Fualifeke	1534	08 26 22.6	179 07 22.8	Cream	Very Fine to coarse	Fine sand with coarse *Halimeda*	Grab sample at 41 m consisted of fine sand with *Halimeda*.

SB 2	Off Fongafale (wharf area)	1626	08 29 59.9	179 11 18.8	Pale pink and cream	Fine to coarse	Fine sand with coarse *Halimeda*	Grab sample at 36m. Fine sand with coarse *Halimeda.*

Date: Monday 02/11/09
Collector: Ashishika, Salesh and Jens

Collector's No.	Location	Time	Latitude	Longitude	Color	Size	Components	Description
Causeway (C510)	Off Causeway		-8.47312	179.18774	Pale pink and cream	Fine to Medium	Forams, coral fragments	Grab sample at 10m. Fine to medium sand with Forams.
Vaiaku (Wavehunter)	Off Vaiaku in 10m of water	1100	08 31 10.9	179 11 22.2	Pale pink and cream	Fine to Medium	Forams, coral fragments	Grab sample at 10m. Fine to medium sand with Forams.

Date: Thursday 05/11/09
Collector: Ashishika, Salesh

Collector's No.	Location	Time	Latitude	Longitude	Color	Size	Components	Description
SLS 4	North of Wharf area, Fongafale	1514	08 29 55.0	179 11 40.2	Light brown to yellow	Fine to Coarse, pebbles strewn in area.	Forams, coral fragments, pebbles, washed up *Halimeda*	Fine to coarse sand with Forams. Boulders/cobbles at HWM

(2) Site Pictures

Shoreline Samples

SLS 1

SLS 2

SLS 3

SLS 4

SLS 5

SLS 6

SLS 7

SLS 8

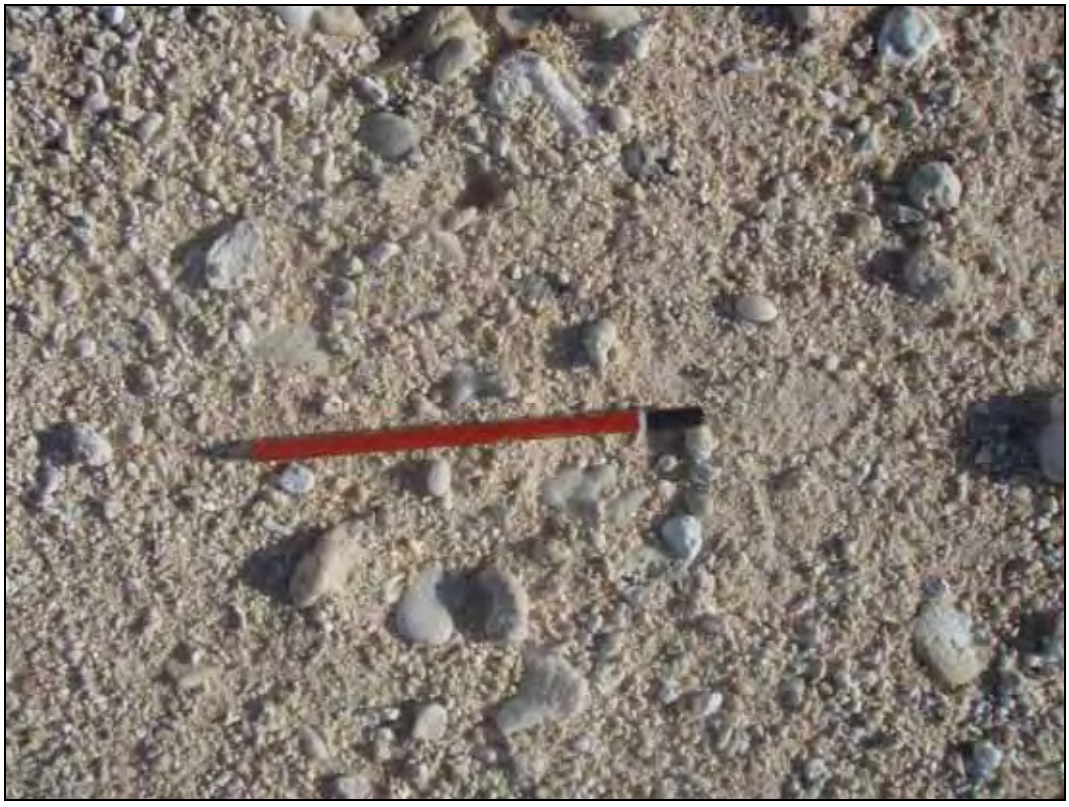
SLS 9

SLS 10

SLS 11

SLS 12

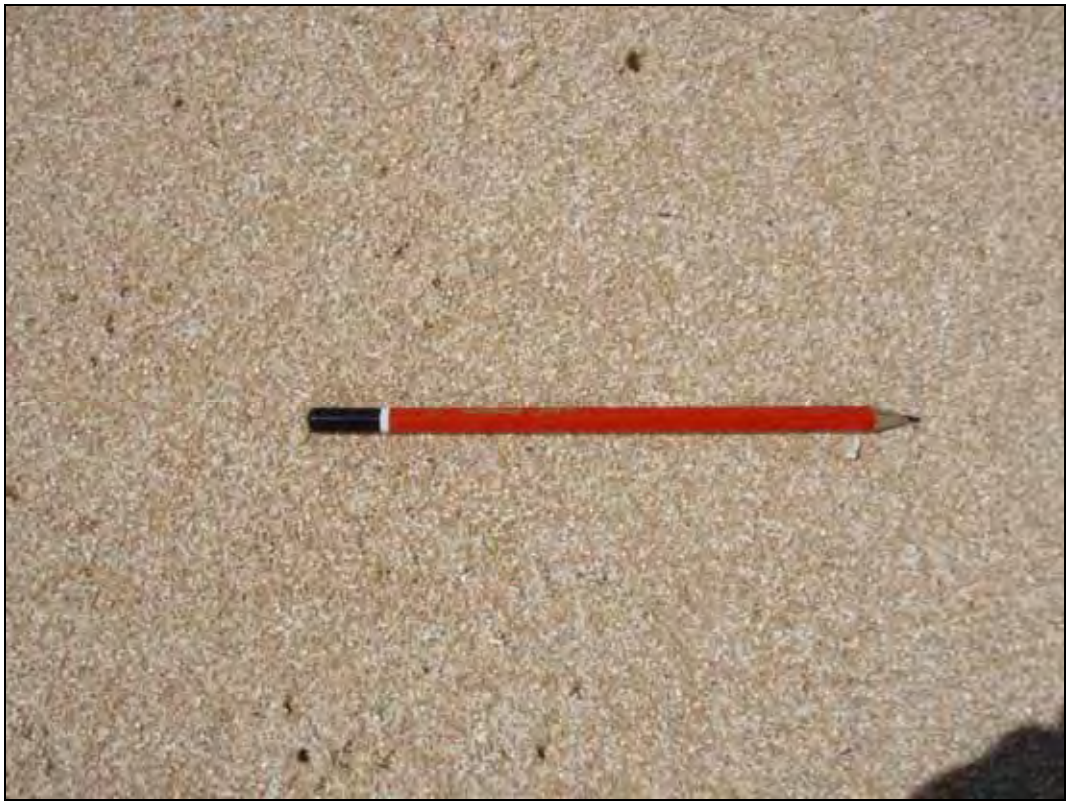
SLS 13



SLS 14

SLS 15

SLS 16



SLS 17

SLS 18

SLS 19

SLS 20

Sea Bottom Samples

SB 1

SB 2

SB 3

SB 4

SB 6

SB 7

SB 8

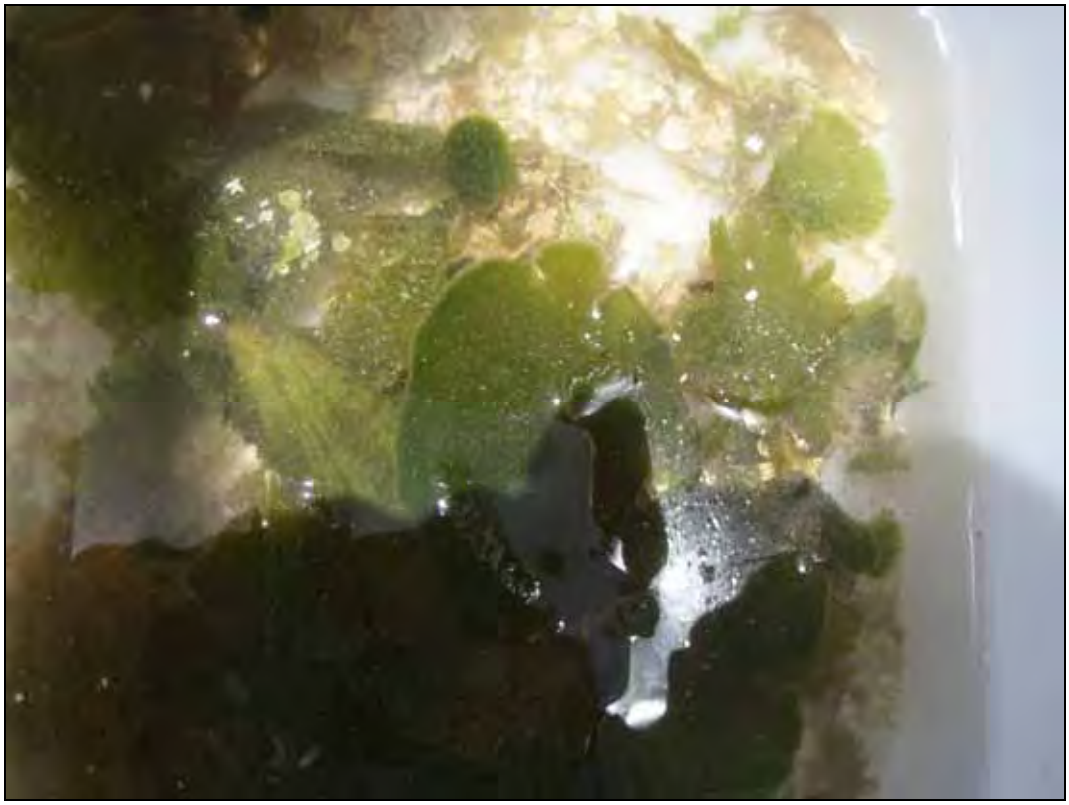
SB 9

SB 10

SB 11

SB 12

SB 13



SB 14

SB 15

(3) Grain Size Analysis

Table2.11 Sieve analysis of sediments

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 1				
Amount in Grams	290.90					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	40.70	3.60	3.60	1.24	1.24
4.00	-2.00	52.10	15.00	18.60	6.41	5.16
2.00	-1.00	113.10	76.00	94.60	32.62	26.13
1.40	-0.50	129.90	92.80	187.40	64.62	31.90
1.00	0.00	125.90	88.80	276.20	95.24	30.53
0.50	1.00	47.60	10.50	286.70	98.86	3.61
0.35	1.50	38.40	1.30	288.00	99.31	0.45
0.25	2.00	38.50	1.40	289.40	99.79	0.48
0.18	2.50	37.60	0.50	289.90	99.97	0.17
0.13	3.00	37.20	0.10	290.00	100.00	0.03
pan		0.00	0.00	290.00	100.00	0.00

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 2				
Amount in Grams	389.00					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	71.50	34.40	34.40	8.85	8.84
4.00	-2.00	73.40	36.30	70.70	18.19	9.33
2.00	-1.00	70.00	32.90	103.60	26.65	8.46
1.00	0.00	110.10	73.00	176.60	45.43	18.77
0.50	1.00	247.70	210.60	387.20	99.61	54.14
0.25	2.00	38.40	1.30	388.50	99.95	0.33
0.13	3.00	37.20	0.10	388.60	99.97	0.03
pan		37.20	0.10	388.70	100.00	0.03

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 3				
Amount in Grams	351.00					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	38.40	1.30	1.30	0.37	0.37
4.00	-2.00	43.90	6.80	8.10	2.31	1.94
2.00	-1.00	58.80	21.70	29.80	8.50	6.18
1.00	0.00	106.90	69.80	99.60	28.40	19.89
0.50	1.00	188.80	151.70	251.30	71.66	43.22
0.25	2.00	131.40	94.30	345.60	98.55	26.87
0.13	3.00	42.00	4.90	350.50	99.94	1.40
pan		37.30	0.20	350.70	100.00	0.06

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 4				
Amount in Grams	374.90					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	65.70	28.60	28.60	7.64	7.63
4.00	-2.00	76.70	39.60	68.20	18.21	10.56
2.00	-1.00	71.50	34.40	102.60	27.40	9.18
1.00	0.00	85.00	47.90	150.50	40.19	12.78
0.50	1.00	129.00	91.90	242.40	64.73	24.51
0.25	2.00	123.00	85.90	328.30	87.66	22.91
0.13	3.00	82.80	45.70	374.00	99.87	12.19
pan		37.60	0.50	374.50	100.00	0.13

Sample Description	Sand
Survey/Cruise	TU 2009

Sample No:		SLS 5				
Amount in Grams	294.90					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	0.00	0.00	0.00	0.00	0.00
4.00	-2.00	0.00	0.00	0.00	0.00	0.00
2.00	-1.00	37.50	0.40	0.40	0.14	0.14
1.00	0.00	38.70	1.60	2.00	0.68	0.54
0.50	1.00	55.00	17.90	19.90	6.76	6.07
0.25	2.00	114.60	77.50	97.40	33.10	26.28
0.13	3.00	203.40	166.30	263.70	89.60	56.39
pan		67.70	30.60	294.30	100.00	10.38

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 6				
Amount in Grams	467.20					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	122.80	85.70	85.70	18.35	18.34
4.00	-2.00	64.20	27.10	112.80	24.15	5.80
2.00	-1.00	61.60	24.50	137.30	29.40	5.24
1.00	0.00	108.30	71.20	208.50	44.65	15.24
0.50	1.00	185.70	148.60	357.10	76.47	31.81
0.25	2.00	117.10	80.00	437.10	93.60	17.12
0.13	3.00	66.80	29.70	466.80	99.96	6.36
pan		37.30	0.20	467.00	100.00	0.04

Sample Description	Sand					
Survey/Cruise		Sand				
Test Date		TU 2009				
Sample No:		SLS 7				
Amount in Grams	445.40					

Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	125.80	88.70	88.70	19.94	19.91
4.00	-2.00	108.60	71.50	160.20	36.01	16.05
2.00	-1.00	135.30	98.20	258.40	58.08	22.05
1.00	0.00	113.40	76.30	334.70	75.23	17.13
0.50	1.00	120.80	83.70	418.40	94.04	18.79
0.25	2.00	63.40	26.30	444.70	99.96	5.90
0.13	3.00	37.30	0.20	444.90	100.00	0.04
pan		0.00	0.00	444.90	100.00	0.00

Sample Description		Sand
Survey/Cruise		TU 2009
Sample No:		SLS 8
Amount in Grams	408.90	

Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	41.20	4.10	4.10	1.00	1.00
4.00	-2.00	63.90	26.80	30.90	7.57	6.55
2.00	-1.00	135.50	98.40	129.30	31.66	24.06
1.00	0.00	109.00	71.90	201.20	49.27	17.58
0.50	1.00	84.20	47.10	248.30	60.80	11.52
0.25	2.00	119.40	82.30	330.60	80.95	20.13
0.13	3.00	114.80	77.70	408.30	99.98	19.00
pan		37.20	0.10	408.40	100.00	0.02

Sample Description		Sand
Survey/Cruise		TU 2009
Sample No:		SLS 9
Amount in Grams	368.90	

Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	159.50	122.40	122.40	33.22	33.18
4.00	-2.00	38.50	1.40	123.80	33.60	0.38

2.00	-1.00	37.30	0.20	124.00	33.66	0.05
1.00	0.00	37.20	0.10	124.10	33.69	0.03
0.50	1.00	38.50	1.40	125.50	34.07	0.38
0.25	2.00	100.80	63.70	189.20	51.36	17.27
0.13	3.00	212.80	175.70	364.90	99.05	47.63
pan		40.60	3.50	368.40	100.00	0.95

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 10				
Amount in Grams	390.30					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	0.00	0.00	0.00	0.00	0.00
4.00	-2.00	53.00	15.90	15.90	4.08	4.07
2.00	-1.00	179.80	142.70	158.60	40.70	36.56
1.00	0.00	170.00	132.90	291.50	74.80	34.05
0.50	1.00	93.50	56.40	347.90	89.27	14.45
0.25	2.00	58.30	21.20	369.10	94.71	5.43
0.13	3.00	56.90	19.80	388.90	99.79	5.07
pan		37.90	0.80	389.70	100.00	0.20

Sample Description	Sand					
Survey/Cruise		TU 2009				
Sample No:		SLS 11				
Amount in Grams	322.80					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	37.50	0.40	0.40	0.12	0.12
4.00	-2.00	45.90	8.80	9.20	2.86	2.73
2.00	-1.00	80.10	43.00	52.20	16.20	13.32
1.00	0.00	131.20	94.10	146.30	28.40	29.15
0.50	1.00	174.30	137.20	283.50	71.66	42.50
0.25	2.00	72.20	35.10	318.60	98.88	10.87

0.13	3.00	40.30	3.20	321.80	99.94	0.99
pan		37.50	0.40	322.20	100.00	0.12

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 12				
Amount in Grams	379.70					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	58.30	21.20	21.20	5.58	5.58
4.00	-2.00	70.00	32.90	54.10	14.25	8.66
2.00	-1.00	78.30	41.20	95.30	25.10	10.85
1.00	0.00	121.00	83.90	179.20	47.85	22.10
0.50	1.00	165.20	128.10	307.30	82.06	33.74
0.25	2.00	92.00	54.90	362.20	95.39	14.46
0.13	3.00	53.80	16.70	378.90	99.79	4.40
pan		37.90	0.80	379.70	101.39	0.21

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 13				
Amount in Grams	421.90					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	39.50	2.40	2.40	0.57	0.57
4.00	-2.00	76.40	39.30	41.70	9.88	9.32
2.00	-1.00	125.00	87.90	129.60	30.72	20.83
1.00	0.00	115.40	78.30	207.90	49.28	18.56
0.50	1.00	245.80	208.70	416.60	98.74	49.47
0.25	2.00	42.20	5.10	421.70	99.95	1.21
0.13	3.00	37.30	0.20	421.90	100.00	0.05
pan		0.00	0.00	421.90	100.00	0.00

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 14				
Amount in Grams	455.60					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	112.30	75.20	75.20	16.53	16.51
4.00	-2.00	81.90	44.80	120.00	26.37	9.83
2.00	-1.00	141.50	104.40	224.40	49.32	22.91
1.00	0.00	169.70	132.60	357.00	78.46	29.10
0.50	1.00	132.60	95.50	452.50	99.45	20.96
0.25	2.00	39.50	2.40	454.90	99.98	0.53
0.13	3.00	0.00	0.00	454.90	99.98	0.00
pan		37.20	0.10	455.00	100.00	0.02

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 15				
Amount in Grams	400.10					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	53.50	16.40	16.40	4.10	4.10
4.00	-2.00	80.30	43.20	59.60	14.91	10.80
2.00	-1.00	83.20	46.10	105.70	26.44	11.52
1.00	0.00	223.60	186.50	292.20	73.10	46.61
0.50	1.00	141.50	104.40	396.60	99.22	26.09
0.25	2.00	40.00	2.90	399.50	99.95	0.72
0.13	3.00	0.00	0.00	399.50	99.95	0.00
pan		37.30	0.20	399.70	100.00	0.05

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 16				
Amount in Grams	458.40					

Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	69.20	32.10	32.10	7.01	7.00
4.00	-2.00	95.70	58.60	90.70	19.80	12.78
2.00	-1.00	131.80	94.70	185.40	40.48	20.66
1.00	0.00	112.10	75.00	260.40	56.86	16.36
0.50	1.00	218.50	181.40	441.80	96.46	39.57
0.25	2.00	53.30	16.20	458.00	100.00	3.53
0.13	3.00	0.00	0.00	458.00	100.00	0.00
pan		0.00	0.00	458.00	100.00	0.00

Sample Description		Sand
Survey/Cruise		TU 2009
Sample No:		SLS 17
Amount in Grams	364.60	

Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	56.70	19.60	19.60	5.38	5.38
4.00	-2.00	72.00	34.90	54.50	14.97	9.57
2.00	-1.00	80.00	42.90	97.40	26.76	11.77
1.00	0.00	62.40	25.30	122.70	33.71	6.94
0.50	1.00	276.60	239.50	362.20	99.51	65.69
0.25	2.00	38.80	1.70	363.90	99.97	0.47
0.13	3.00	0.00	0.00	363.90	99.97	0.00
pan		37.20	0.10	364.00	100.00	0.03

Sample Description	Sand	
Survey/Cruise		TU 2009
Sample No:		SLS 18
Amount in Grams	438.50	

Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	80.40	43.30	43.30	9.89	9.87

4.00	-2.00	43.80	6.70	50.00	11.42	1.53
2.00	-1.00	52.70	15.60	65.60	14.98	3.56
1.00	0.00	291.30	254.20	319.80	73.03	57.97
0.50	1.00	154.20	117.10	436.90	99.77	26.70
0.25	2.00	38.10	1.00	437.90	100.00	0.23
0.13	3.00	0.00	0.00	437.90	100.00	0.00
pan		0.00	0.00	437.90	100.00	0.00

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 19				
Amount in Grams	381.30					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	82.20	45.10	45.10	11.84	11.83
4.00	-2.00	74.30	37.20	82.30	21.61	9.76
2.00	-1.00	85.80	48.70	131.00	34.40	12.77
1.00	0.00	155.30	118.20	249.20	65.44	31.00
0.50	1.00	166.50	129.40	378.60	99.42	33.94
0.25	2.00	39.30	2.20	380.80	100.00	0.58
0.13	3.00	0.00	0.00	380.80	100.00	0.00
pan		0.00	0.00	380.80	100.00	0.00

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SLS 20				
Amount in Grams	450.90					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	118.80	81.70	81.70	18.15	18.12
4.00	-2.00	123.50	86.40	168.10	37.35	19.16
2.00	-1.00	133.40	96.30	264.40	58.74	21.36
1.00	0.00	115.80	78.70	343.10	76.23	17.45
0.50	1.00	142.50	105.40	448.50	99.64	23.38

0.25	2.00	38.70	1.60	450.10	100.00	0.35
0.13	3.00	0.00	0.00	450.10	100.00	0.00
pan		0.00	0.00	450.10	100.00	0.00

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 1				
Amount in Grams	327.30					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	40.20	3.10	3.10	0.95	0.95
4.00	-2.00	40.70	3.60	6.70	2.05	1.10
2.00	-1.00	47.20	10.10	16.80	5.13	3.09
1.00	0.00	106.50	69.40	86.20	26.34	21.20
0.50	1.00	203.40	166.30	252.50	77.17	50.81
0.25	2.00	83.20	46.10	298.60	91.26	14.08
0.13	3.00	61.40	24.30	322.90	98.69	7.42
pan		41.40	4.30	327.20	100.00	1.31

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 2				
Amount in Grams	132.70					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	38.10	1.00	1.00	0.75	0.75
4.00	-2.00	62.90	25.80	26.80	20.20	19.44
2.00	-1.00	81.80	44.70	71.50	53.88	33.69
1.00	0.00	67.90	30.80	102.30	77.09	23.21
0.50	1.00	51.00	13.90	116.20	87.57	10.47
0.25	2.00	41.90	4.80	121.00	91.18	3.62
0.13	3.00	41.50	4.40	125.40	94.50	3.32
pan		44.40	7.30	132.70	100.00	5.50

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 3				
Amount in Grams	204.80					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	38.40	1.30	1.30	0.63	0.63
4.00	-2.00	54.80	17.70	19.00	9.28	8.64
2.00	-1.00	106.30	69.20	88.20	43.07	33.79
1.00	0.00	103.70	66.60	154.80	75.59	32.52
0.50	1.00	63.30	26.20	181.00	88.38	12.79
0.25	2.00	46.70	9.60	190.60	93.07	4.69
0.13	3.00	44.60	7.50	198.10	96.73	3.66
pan		43.80	6.70	204.80	100.00	3.27

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 4				
Amount in Grams	360.70					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	37.60	0.50	0.50	0.14	0.14
4.00	-2.00	38.60	1.50	2.00	0.56	0.42
2.00	-1.00	44.80	7.70	9.70	2.69	2.13
1.00	0.00	75.70	38.60	48.30	13.41	10.70
0.50	1.00	140.90	103.80	152.10	42.24	28.78
0.25	2.00	160.80	123.70	275.80	76.59	34.29
0.13	3.00	115.50	78.40	354.20	98.36	21.74
pan		43.00	5.90	360.10	100.00	1.64

Sample Description	Sand
Survey/Cruise	TU 2009
Sample No:	SB 5

Amount in Grams	243.30					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	37.40	0.30	0.30	0.12	0.12
4.00	-2.00	49.10	12.00	12.30	5.06	4.93
2.00	-1.00	62.10	25.00	37.30	15.35	10.28
1.00	0.00	77.50	40.40	77.70	31.98	16.61
0.50	1.00	99.90	62.80	140.50	57.82	25.81
0.25	2.00	86.00	48.90	189.40	77.94	20.10
0.13	3.00	74.20	37.10	226.50	93.21	15.25
pan		53.60	16.50	243.00	100.00	6.78

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 6				
Amount in Grams	291.90					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	37.30	0.20	0.20	0.07	0.07
4.00	-2.00	37.40	0.30	0.50	0.17	0.10
2.00	-1.00	38.70	1.60	2.10	0.72	0.55
1.00	0.00	43.90	6.80	8.90	3.05	2.33
0.50	1.00	61.60	24.50	33.40	11.46	8.39
0.25	2.00	124.20	87.10	120.50	41.35	29.84
0.13	3.00	165.70	128.60	249.10	85.48	44.06
pan		79.40	42.30	291.40	100.00	14.49

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 7				
Amount in Grams	338.80					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00

8.00	-3.00	50.20	13.10	13.10	3.87	3.87
4.00	-2.00	72.60	35.50	48.60	14.37	10.48
2.00	-1.00	80.20	43.10	91.70	27.11	12.72
1.00	0.00	85.20	48.10	139.80	41.34	14.20
0.50	1.00	126.10	89.00	228.80	67.65	26.27
0.25	2.00	95.90	58.80	287.60	85.04	17.36
0.13	3.00	75.20	38.10	325.70	96.30	11.25
pan		49.60	12.50	338.20	100.00	3.69

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 8				
Amount in Grams	328.20					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	0.00	0.00	0.00	0.00	0.00
4.00	-2.00	40.00	2.90	2.90	0.89	0.88
2.00	-1.00	56.50	19.40	22.30	6.81	5.91
1.00	0.00	79.20	42.10	64.40	19.66	12.83
0.50	1.00	146.40	109.30	173.70	53.02	33.30
0.25	2.00	107.10	70.00	243.70	74.39	21.33
0.13	3.00	103.10	66.00	309.70	94.54	20.11
pan		55.00	17.90	327.60	100.00	5.45

Survey/Cruise		TU 2009				
Sample No:		SB 9				
Amount in Grams	285.80					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	0.00	0.00	0.00	0.00	0.00
4.00	-2.00	37.20	0.10	0.10	0.03	0.03
2.00	-1.00	37.80	0.70	0.80	0.28	0.24
1.00	0.00	45.10	8.00	8.80	3.08	2.80
0.50	1.00	83.10	46.00	54.80	19.17	16.10

0.25	2.00	93.50	56.40	111.20	38.91	19.73
0.13	3.00	104.70	67.60	178.80	62.56	23.65
pan		144.10	107.00	285.80	100.00	37.44

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 10				
Amount in Grams	92.40					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	38.10	1.00	1.00	1.09	1.08
4.00	-2.00	59.40	22.30	23.30	25.38	24.13
2.00	-1.00	85.00	47.90	71.20	77.56	51.84
1.00	0.00	53.20	16.10	87.30	95.10	17.42
0.50	1.00	39.70	2.60	89.90	97.93	2.81
0.25	2.00	37.90	0.80	90.70	98.80	0.87
0.13	3.00	37.60	0.50	91.20	99.35	0.54
pan		37.70	0.60	91.80	100.00	0.65

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 11				
Amount in Grams	172.60					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	40.30	3.20	3.20	1.86	1.85
4.00	-2.00	85.20	48.10	51.30	29.81	27.87
2.00	-1.00	110.80	73.70	125.00	72.63	42.70
1.00	0.00	72.10	35.00	160.00	92.97	20.28
0.50	1.00	45.00	7.90	167.90	97.56	4.58
0.25	2.00	39.20	2.10	170.00	98.78	1.22
0.13	3.00	38.30	1.20	171.20	99.48	0.70
pan		38.00	0.90	172.10	100.00	0.52

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 12				
Amount in Grams	252.30					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	0.00	0.00	0.00	0.00	0.00
4.00	-2.00	37.30	0.20	0.20	0.08	0.08
2.00	-1.00	37.80	0.70	0.90	0.36	0.28
1.00	0.00	49.80	12.70	13.60	5.40	5.03
0.50	1.00	94.20	57.10	70.70	28.07	22.63
0.25	2.00	99.50	62.40	133.10	52.84	24.73
0.13	3.00	99.40	62.30	195.40	77.57	24.69
pan		93.60	56.50	251.90	100.00	22.39

Survey/Cruise		TU 2009				
Sample No:		SB 13				
Amount in Grams	179.40					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	37.20	0.10	0.10	0.06	0.06
4.00	-2.00	39.90	2.80	2.90	1.62	1.56
2.00	-1.00	50.80	13.70	16.60	9.27	7.64
1.00	0.00	61.50	24.40	41.00	22.91	13.60
0.50	1.00	83.00	45.90	86.90	48.55	25.59
0.25	2.00	79.30	42.20	129.10	72.12	23.52
0.13	3.00	74.40	37.30	166.40	92.96	20.79
pan		49.70	12.60	179.00	100.00	7.02

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 14				
Amount in Grams	62.90					

Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	50.40	13.30	13.30	21.25	21.14
4.00	-2.00	63.50	26.40	39.70	63.42	41.97
2.00	-1.00	55.80	18.70	58.40	93.29	29.73
1.00	0.00	39.80	2.70	61.10	97.60	4.29
0.50	1.00	38.00	0.90	62.00	99.04	1.43
0.25	2.00	37.40	0.30	62.30	99.52	0.48
0.13	3.00	37.30	0.20	62.50	99.84	0.32
pan		37.20	0.10	62.60	100.00	0.16

Sample Description		Sand				
Survey/Cruise		TU 2009				
Sample No:		SB 15				
Amount in Grams	86.20					
Aperture	Ph Value	Weight	Wt retained	cum wt ret	cum %	indiv %
16.00	-4.00	0.00	0.00	0.00	0.00	0.00
8.00	-3.00	40.10	3.00	3.00	3.50	3.48
4.00	-2.00	69.20	32.10	35.10	40.91	37.24
2.00	-1.00	74.30	37.20	72.30	84.27	43.16
1.00	0.00	48.20	11.10	83.40	97.20	12.88
0.50	1.00	38.70	1.60	85.00	99.07	1.86
0.25	2.00	37.50	0.40	85.40	99.53	0.46
0.13	3.00	37.40	0.30	85.70	99.88	0.35
pan		37.20	0.10	85.80	100.00	0.12

(4) Sand Composition Ratio Analysis Data

Table2.12 Sea Bottom sediments- sand composition ratio

	Coral Fragments	Foraminifera	Shell fragments	*Halimeda*
SB 1	44.5 %	42.5 %	13 %	0 %
SB 2	2 %	4.5 %	2.5 %	91 %
SB 3	2 %	10.5 %	5.5 %	82 %
SB 4	42.5 %	31.5 %	18.5 %	7.5 %

SB 5	1 %	15 %	5.5 %	78.5 %
SB 6	33 %	43 %	24 %	0 %
SB 7	40 %	41 %	19 %	0 %
SB 8	38 %	48 %	13.5 %	0.5 %
SB 9	0 %	22 %	10.5 %	67.5 %
SB 10	3.5 %	6 %	6 %	84.5 %
SB 11	0 %	4.5 %	7 %	89.5 %
SB 12	40 %	34 %	31 %	0 %
SB 13	0 %	41 %	7.5 %	51.5 %
SB 14	0.5 %	26.5 %	7 %	64 %
SB 15	0.5 %	12 %	8 %	80 %

Table2.13 Shore Line sediments- sand composition ratio

	Coral fragments	Foraminifera	Shell fragments
SLS 1	33 %	54 %	13 %
SLS 2	38.5 %	49 %	12.5 %
SLS 3	34.5 %	42.5 %	23 %
SLS 4	49 %	28 %	23 %
SLS 5	45.5 %	44.5 %	10 %
SLS 6	49.5 %	38.5 %	12 %
SLS 7	54 %	30 %	16 %
SLS 8	43.5 %	40 %	16.5 %
SLS 9	56 %	18.5 %	25.5 %
SLS 10	39 %	45 %	18.5 %
SLS 11	20.5 %	43 %	36.5 %
SLS 12	42.5 %	40 %	17.5 %
SLS 13	28.5 %	67.5 %	4 %
SLS 14	54.5 %	35.5 %	10 %
SLS 15	78 %	13.5 %	13.5 %
SLS 16	31 %	59 %	10 %
SLS 17	22 %	74 %	4 %
SLS 18	66 %	25.5 %	8.5 %
SLS 19	27 %	67 %	6 %
SLS 20	35 %	56 %	9 %

References:

Anderson, J.R. (2010) *Sand Sieve Analysis, Laboratory 6*, Georgia Perimeter College, GA 30038 http://facstaff.gpc.edu/~janderso/historic/labman/sievean.htm

Sharma, A. (unpublished) *A study of the benthic foraminifera of Laucala Bay, with special focus on Marginopora vertebralis*. Msc Thesis.

2.6 Water Quality Survey

2.6.1 Methodology

Water quality sampling was carried out at 3 points on the oceanic side, 10 points in the lagoon, 3 points of groundwater and at 2 points on the ponds, a total of 18 points altogether.

The sampling was carried out at low tide and sampling positions were measured using a simple handheld Garmin GPS.

At each site location, the water depth was measured using a lead line and mid-water depth was determined.

A Van Dorn water sampler was used to collect water samples at middle water depth into 2 x 1-liter bottles which had been pre-washed with 10% HCL for 24 hours and rinsed with de-ionised water.

For each location, at the same water depth, Water temperature, Salinity, Turbidity, and Chlorophyll A were measured with a portable water quality meter.

A Hydrolab was also deployed at the same water depth at each of the locations to measure Temperature, PH, ORP, Specific Conductivity, Resistivity, Salinity, Total dissolved solids, Depth, Turbidity, LDO, BP and Chlorophyll.

The samples were stored in an ice-box and frozen upon reaching land and presented for analysis.

The samples were analysed for: COD, T-N, NO_3-N, NO_2-N, NH_4-N, T-P, PO_4-P, SS and Salinity.

A further 4 litres of samples were collected at each location and filtered for suspended sediments and chlorophyll analysis. The filter papers had been dried and pre-weighed before use.

The filter papers for chlorophyll analysis were placed in glass vials containing acetone.

The filter papers were treated for cool and dark storage, and provided for analysis.

Table 2.14 Water quality samples locations and times.

Sample No.	Longitude	Latitude	Date	Time
PW 1	S 08 31 08.5	E 179 12 07.7	06/01/2010	1552
PW 2	S 08 30 38.2	E 179 11 56.2	06/01/2010	1650
OW 1	S 08 32 25.9	E 179 10 39.4	07/01/2010	0855
OW 2	S 08 31 17.2	E 179 12 16.8	07/01/2010	0925
OW 3	S 08 28 16.6	E 179 11 29.0	07/01/2010	0955
LW 1	S 08 31 02.17	E179 11 49.88	10/01/2010	0730
LW 2	S 08 30 36.6	E 179 11 48.4	07/01/2010	1534
LW 3	S 08 30 10.64	E 179 11 38.14	07/01/2010	1522
LW 4	S 08 28 22.9	E 179 11 17.2	07/01/2010	1503

LW 5	S 08 26 29.10	E 179 10 12.37	07/01/2010	1440
LW 6	S 08 28 31.07	E 179 05 09.92	08/01/2010	0945
LW 7	S 08 34 27.74	E 179 04 06.41	08/01/2010	1034
LW 8	S 08 32 24.42	E 179 10 05.03	10/01/2010	0828
LW 9	S 08 31 30.31	E 179 11 34.58	10/01/2010	0809
LW 10	S 08 31 06.34	E 179 11 24.28	10/01/2010	0758
GW 1	S 08 31 22.68	E 179 11 44.82	10/01/2010	1405
GW 2	S 08 31 03.96	E 179 12 01.38	09/01/2010	1150
GW 3	S 08 31 16.50	E 179 11 52.14	09/01/2010	1130

Figure 2.25 Pond water sample locations

Figure 2.26 Ground water sample locations

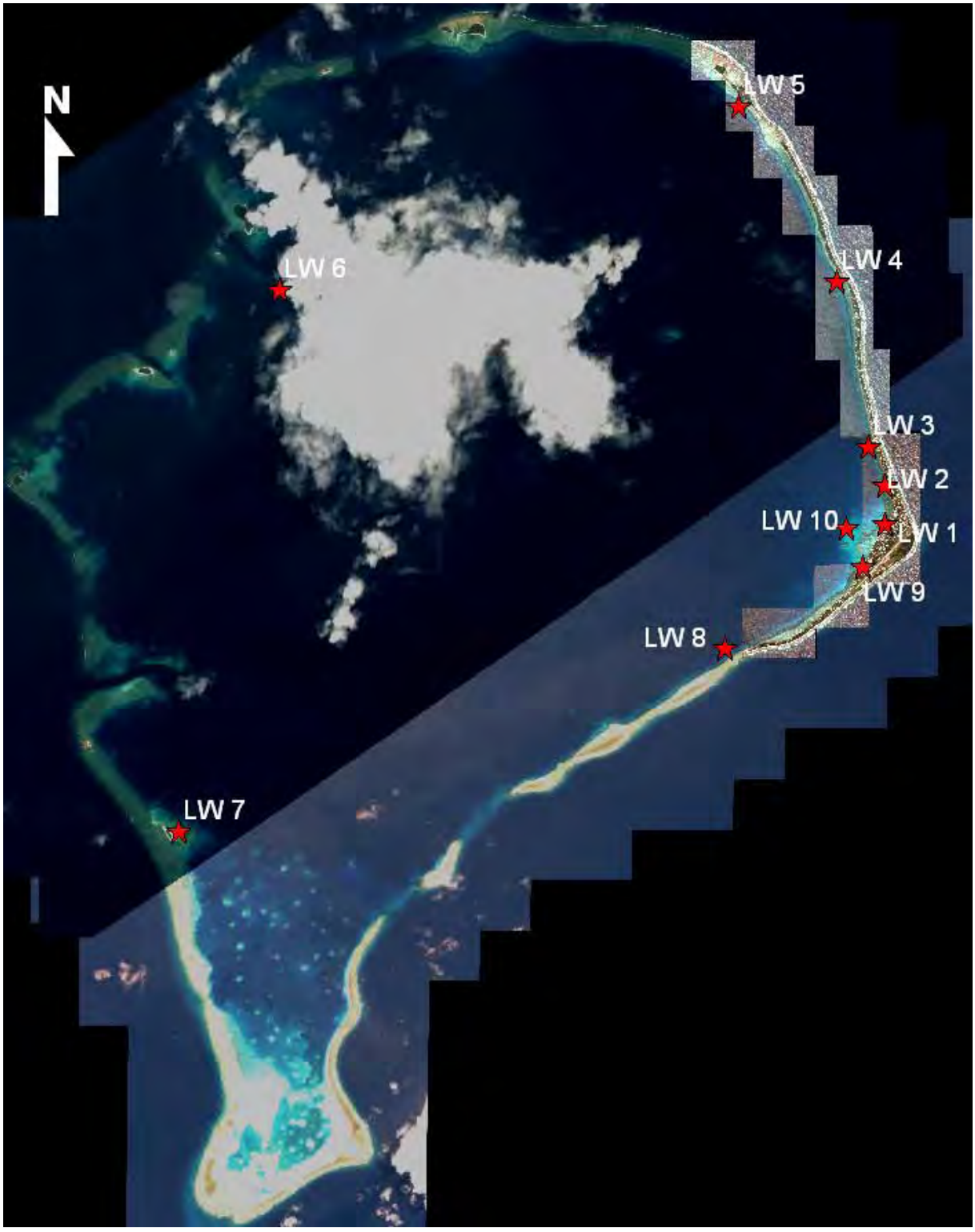


Figure 2.27 Lagoon water sample locations

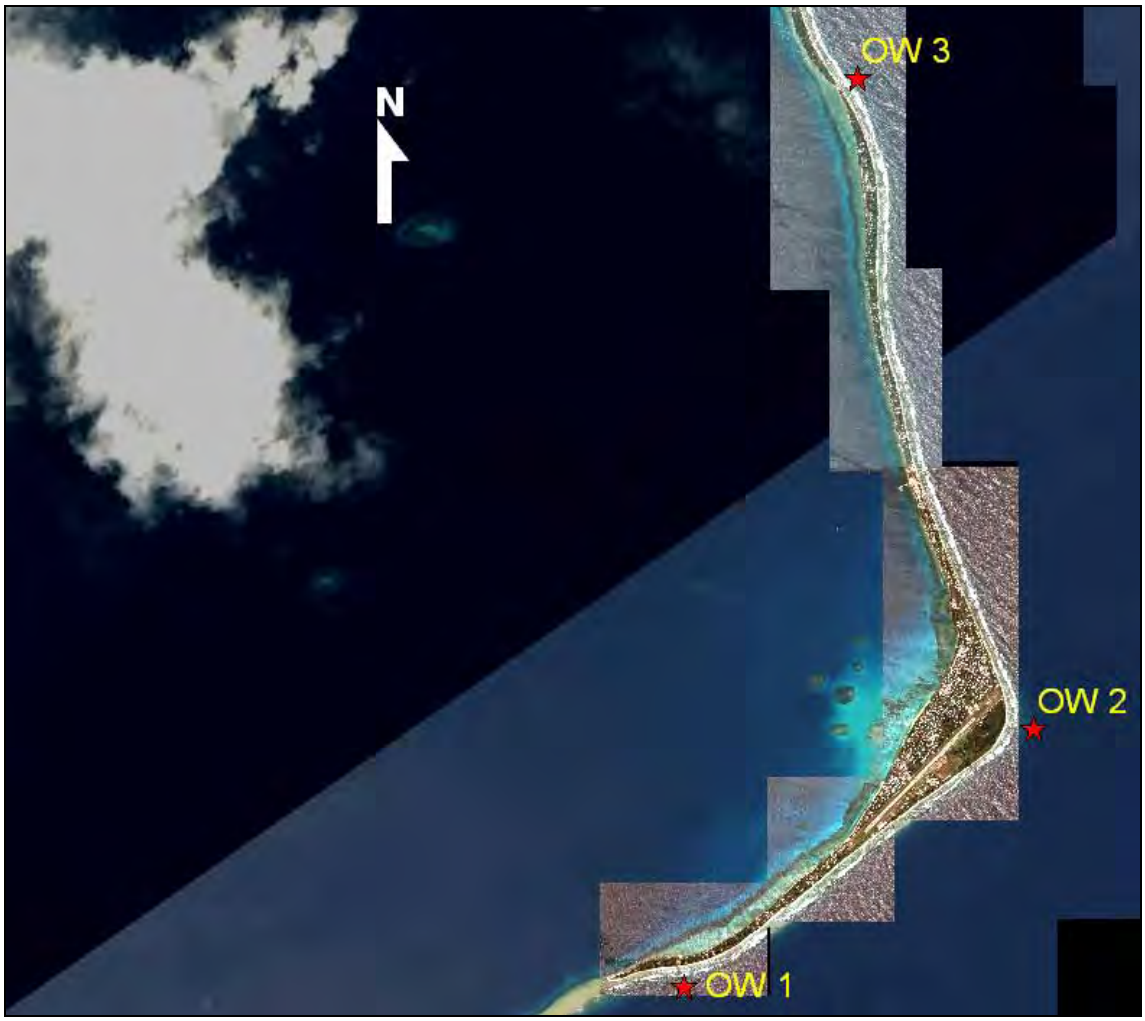


Figure 2.28 Ocean water sample locations

Figure 2.29 Hand-held GPS used for sample site locations.

Figure 2.30 Groundwater sampling in Funafuti.

Figure 2.31 Hydrolab survey data download.

Figure 2.32 Water sample filtration procedure.

2.6.2 RESULTS

(1) Hydrolab results

Location No.	Date MM/DD/YYYY	Time HH:MM:SS		Temp °C		Temp °F		Temp °K		pH Units		ORP mV		SpCond mS/cm		SpCond µS/cm		Sal ppt		TDS g/l	
PW1	1/6/2010	15:59:00		35.43		95.8		308.6		8.44		-150	*	47	*	47041	*	30.65	*	30.1	*
PW2	1/6/2010	17:09:30		37.81		100.1		311		8.64		13	*	51.4	*	51387	*	33.84	*	32.9	*
OW1	1/7/2010	9:08:30		30.3		86.5		303.5		8.56		84	*	53.2	*	53208	*	35.19	*	34.1	*
OW2	1/7/2010	9:30:00		30.4		86.7		303.6		8.6		62	*	53.2	*	53228	*	35.2	*	34.1	*
OW3	1/7/2010	9:58:00		30.22		86.4		303.4		8.59		80	*	53.2	*	53224	*	35.2	*	34.1	*
LW1	1/10/2010	7:39:30		31.14		88		304.3		8.49		67	*	53.2	*	53239	*	35.21	*	34.1	*
LW2	1/7/2010	15:38:00		31.41		88.5		304.6		8.57		72	*	53.3	*	53261	*	35.23	*	34.1	*
LW3	1/7/2010	15:25:30		31.05		87.9		304.2		8.59		79	*	53.2	*	53198	*	35.18	*	34	*
LW4	1/7/2010	15:08:00		30.97		87.8		304.1		8.61		62	*	53.2	*	53186	*	35.17	*	34	*
LW5	1/7/2010	14:50:30		30.72		87.3		303.9		8.6		63	*	53.2	*	53205	*	35.19	*	34.1	*
LW6	1/8/2010	10:02:30		30.32		86.6		303.5		8.6		52	*	53.2	*	53177	*	35.17	*	34	*
LW7	1/8/2010	10:37:00		31.13		88		304.3		8.62		62	*	53.1	*	53076	*	35.09	*	34	*
LW8	1/10/2010	8:40:30		30.63		87.1		303.8		8.58		51	*	53.2	*	53182	*	35.17	*	34	*
LW9	1/10/2010	8:18:00		31.28		88.3		304.4		8.49		46	*	53.2	*	53244	*	35.22	*	34.1	*
LW10	1/10/2010	8:03:00		31.35		88.4		304.5		8.52		59	*	53.3	*	53251	*	35.22	*	34.1	*
GW3	1/9/2010	11:39:33		28.66		83.6		301.8		7.75		81	*	10.1	*	10074	*	5.7	*	6.4	*
GW2	1/9/2010	11:53:12		28.67		83.6		301.8		7.75		80	*	9.6	*	9580	*	5.41	*	6.1	*
GW1	1/10/2010	14:08:30		29.14		84.4		302.3		8.12		92	*	32.8	*	32827	*	20.51	*	21	*

Location No.	Dep100 meters	Dep100 feet	Dep100 psia	DepthX volts	DepthY mvolts	TurbSC Volts	TurbSC NTU	LDO% Sat	LDO mg/l	BP mmHg
PW1	1.95	6.4	2.77	0.778	1.28	-2.1906	33.2	146.9	8.56	755
PW2	0.05	0.2	0.08	0.779	1.25	-2.223	11.4	166.2	9.18	755
OW1	2.24	7.3	3.18	0.775	1.48	-2.2372	1.5	98.6	6.07	755
OW2	6.69	21.9	9.51	0.775	1.93	-2.2371	1.8	100.5	6.18	755
OW3	5.63	18.5	8.01	0.776	1.83	-2.2373	1.8	97.8	6.03	755
LW1	1.19	3.9	1.69	0.774	1.37	-2.2359	2.6	78.5	4.77	755
LW2	2.97	9.8	4.23	0.777	1.55	-2.2351	3.5	106.1	6.42	755
LW3	8.56	28.1	12.17	0.777	2.13	-2.2369	2.1	103.1	6.28	755
LW4	3.57	11.7	5.07	0.777	1.61	-2.2367	2	109.9	6.7	755
LW5	5.84	19.2	8.31	0.777	1.85	-2.2374	1.6	104.3	6.38	755
LW6	7.47	24.4	10.59	0.772	2.01	-2.237	1.8	99.4	6.12	755
LW7	0.5	1.7	0.72	0.775	1.3	-2.2367	2	113.1	6.88	755
LW8	11.63	38.2	16.54	0.777	2.44	-2.2372	1.7	97.1	5.95	755
LW9	1.07	3.5	1.52	0.776	1.36	-2.2343	3.9	78.2	4.74	755
LW10	0.5	1.6	0.7	0.776	1.3	-2.0478	129.7	85.2	5.16	755
GW3	0.12	0.4	0.17	0.772	1.26	-2.2379	1.2	43.3	3.23	755
GW2	0.05	0.2	0.08	0.774	1.25	-2.2354	3	40.3	3.01	755
GW1	0.01	0	0.01	0.772	1.25	-2.234	4.3	96.9	6.59	755

(2) Turbidity Meter and Salinity Meter Results

Sample	Water Depth	Sampling Depth	Salinity S/m	Temperature (°C)	Turbidity	Color
PW 1	0.5 m	-	4.65	34.9	2	41.5
PW 2	1.0 m	0.5 m	5.12	35	1.9	13.5
OW 1	5 m	2.5 m	2.6	29.7	0	0
OW 2	15 m	7.5 m	5.13	29.2	0	0
OW 3	12 m	6 m	5.24	29.1	0	0
LW 1	3 m	1.5 m	2.6	30.7	0	0
LW 2	7 m	3.5 m	5.31	30.9	0	0
LW 3	18 m	9 m	2.61	30.6	0	0
LW 4	7 m	3.5 m	5.29	30.6	0	0
LW 5	13 m	6.5 m	5.28	30.3	0	0
LW 6	15 m	7.5 m	2.59	30.8	0	0
LW 7	2 m	1 m	2.66	32.2	0	0
LW 8	29 m	14.5 m	2.66	33	0	0
LW 9	2 m	1 m	5.32	32.8	0	0
LW 10	1 m	0.5 m	2.5	32.4	0	0
GW 1	0.5 m	-	1.63	28.8	0.8	6.5
GW 2	0.5 m	-	0.95	31.5	2.3	8
GW 3	1 m	0.5 m	1.04	29.3	0	22

(3) Analytical Results

Customer I.D. / Lab No.		P W 1 2010/136	P W 2 2010/137	Method Ref. No.
$N\text{-}NH_3$	(mg/L)	0.01	0.19	AP4500-$NH_{3\text{-}F}$
Chemical oxygen demand	(mg/L)	84	90	AO920.39
$N\text{-}NO_3$	(mg/L)	0.01	0.02	AP4500NO_3E
$N\text{-}NO_2$	(mg/L)	<0.004	0.12	AP4500NO_3E/
Salinity	(ppt)	31	36	AP2520A
Total Kjeldahl Nitrogen (TKN)	(mg/L)	<2	<2	AP4500_NorgB
Total Suspended Solids	(mg/L)	33	27	AP 2540D
Reactive Dissolved Phosphorus	(mg/L)	0.25	0.16	Danish Standard 291
Total Phosphorus	(mg/L)	0.51	0.27	Danish Standard 291

Customer I.D. Lab No.		LW 1 2010/120	LW 2 2010/121	LW 3 2010/122	L W 4 2010/123	L W 5 2010/124	L W 6 2010/125	L W 7 2010/126	L W 8 2010/127	Method Ref. No.
Chemical oxygen demand	(mg/L)	61	60	66	71	54	60	57	53	AO920.39
Total Kjeldahl Nitrogen (TKN)	(mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	AP4500_NorgB
$N\text{-}NO_3$	(mg/L)	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	AP4500NO_3E
$N\text{-}NO_2$	(mg/L)	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	AP4500NO_3E/
$N\text{-}NH_3$	(mg/L)	0.01	0.02	0.02	0.03	0.01	0.01	0.01	0.01	AP4500-$NH_{3\text{-}F}$
$P\text{-}PO_4$	(mg/L)	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	Danish Standard 291
Total Phosphorus	(mg/L)	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	0.02	Danish Standard 291
*Total Suspended Solids	(mg/L)	13	7	6	6	6	7	7	6	AP 2540D
*Salinity	(ppt)	36	37	36	37	37	35	37	37	AP2520A

Customer I.D. Lab No.	LW 9 2010/128	LW 10 2010/129	O W 1 2010/130	O W 2 2010/131	O W 3 2010/132	G W 1 2010/133	G W 2 2010/134	G W 3 2010/135	Method Ref. No.
$N\text{-}NH_3$ (mg/L)	0.03	0.02	0.01	0.02	0.02	0.02	0.02	<0.01	AP4500-$NH_{3\text{-}F}$
Chemical oxygen demand (mg/L)	106	89	57	55	69	61	<28	29	AO920.39
$N\text{-}NO_3$ (mg/L)	<0.01	<0.01	0.01	<0.01	<0.01	0.01	4.05	0.68	AP4500NO_3E
$N\text{-}NO_2$ (mg/L)	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.01	0.01	AP4500NO_3E/
Salinity (ppt)	37	37	35	37	36	21	7	5	AP2520A
Total Kjeldahl Nitrogen (TKN) (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	AP4500_NorgB
*Total Suspended Solids (mg/L)	8	7	6	7	6	13	12	2	AP 2540D
Reactive Dissolved Phosphorus (mg/L)	<0.008	<0.008	<0.008	<0.008	<0.008	0.01	0.25	0.05	Danish Standard 291
Total Phosphorus (mg/L)	<0.018	<0.018	<0.018	<0.018	<0.018	0.19	0.37	0.08	Danish Standard 291

(4) Analytical Results- Cholorophyll-a

Sample	Longitude	Latitude	Chlorophyll-a (µg/L)
PW 1	S 08 31 08.5	E 179 12 07.7	9.08
PW 2	S 08 30 38.2	E 179 11 56.2	3.63
OW 1	S 08 32 25.9	E 179 10 39.4	ND (<0.05)
OW 2	S 08 31 17.2	E 179 12 16.8	0.22
OW 3	S 08 28 16.6	E 179 11 29.0	0.15
LW 1	S 08 31 02.17	E179 11 49.88	0.11
LW 2	S 08 30 36.6	E 179 11 48.4	ND (<0.05)
LW 3	S 08 30 10.64	E 179 11 38.14	ND (<0.05)
LW 4	S 08 28 22.9	E 179 11 17.2	ND (<0.05)
LW 5	S 08 26 29.10	E 179 10 12.37	ND (<0.05)
LW 6	S 08 28 31.07	E 179 05 09.92	0.11
LW 7	S 08 34 27.74	E 179 04 06.41	ND (<0.05)
LW 8	S 08 32 24.42	E 179 10 05.03	0.11
LW 9	S 08 31 30.31	E 179 11 34.58	0.22
LW 10	S 08 31 06.34	E 179 11 24.28	0.11
GW 1	S 08 31 22.68	E 179 11 44.82	0.91
GW 2	S 08 31 03.96	E 179 12 01.38	0.45
GW 3	S 08 31 16.50	E 179 11 52.14	0.23

2.7 Coastal Ecology Survey

2.7.1 Methodology

(1) Description of Survey

A line survey was conducted to identify the overview of the coastal ecosystem of Funafuti Atoll, the life and bottom sediment distribution information required to create a habitat map, and the population density information required to estimate the biomass of foraminifera.

Table 2.15 Survey Item and Description

Item	Quantity	Remarks
[Line survey] Survey line	A set of 31 lines	16 lines on the ocean side and 15 lines on the lagoon side Life form and bottom sediment distribution (Cross-section: Coverage distribution of foraminifera, coral, and marine algae and the distribution of species) Quadrat survey results (Identification and counting results)

Table 2.16 shows the line survey duration.

Table 2.16 Line Survey Duration

Survey item	Observation duration
Line survey	17.09.2009 to 06.10.2009

The ecological survey was carried out using the line census method on 16 traverse lines on the oceanic side and 15 traverse lines in the lagoon (at a water depth of 5m or less). Before the survey, collection of existing information and interpretation of satellite image were made to determine the traverse lines. The positions of laying the survey lines were measured using a simple GPS (geographical coordinate system: WGS84).

In the ecological survey, visual observation by divers (ecological research staff) was carried out as Figure 2.33 below indicates in order to record the distribution (sectional distribution) of corals, algae, bottom materials (rocks, coral pieces, foraminifers and shell pieces). At the same time, the zonal distribution structures on each traverse line were taken down according to the distance from the strand line with coverage of the key species. We set the starting point of traverse line at the place where terrestrial plant is growing above the shore line. We determined the end point of the line at the place where coral zone is verified or water depth become deep rapidly. On each traverse line, we established 2 ~ 8 crop-cutting experiment

point. We obtained a total of 90 specimens to grasp the growing condition of foraminifera and sea grass quantitatively (standing crop, identification and number count) on the points. We immobilized the samples and take to our laboratory. We identified species of the samples and counted number. We organized the current survey results, the existing document (the survey result by JST, the satellite images by IKONOS and the aerial photographs), the distribution density (coverage) of coral, foraminifera and seaweed bed, bathymetry and distribution of sediments to make the habitat map (such as marine environment information base chart). Explanatory note for profiles of the ecological survey on each traverse line are shown in Figure 2.34.

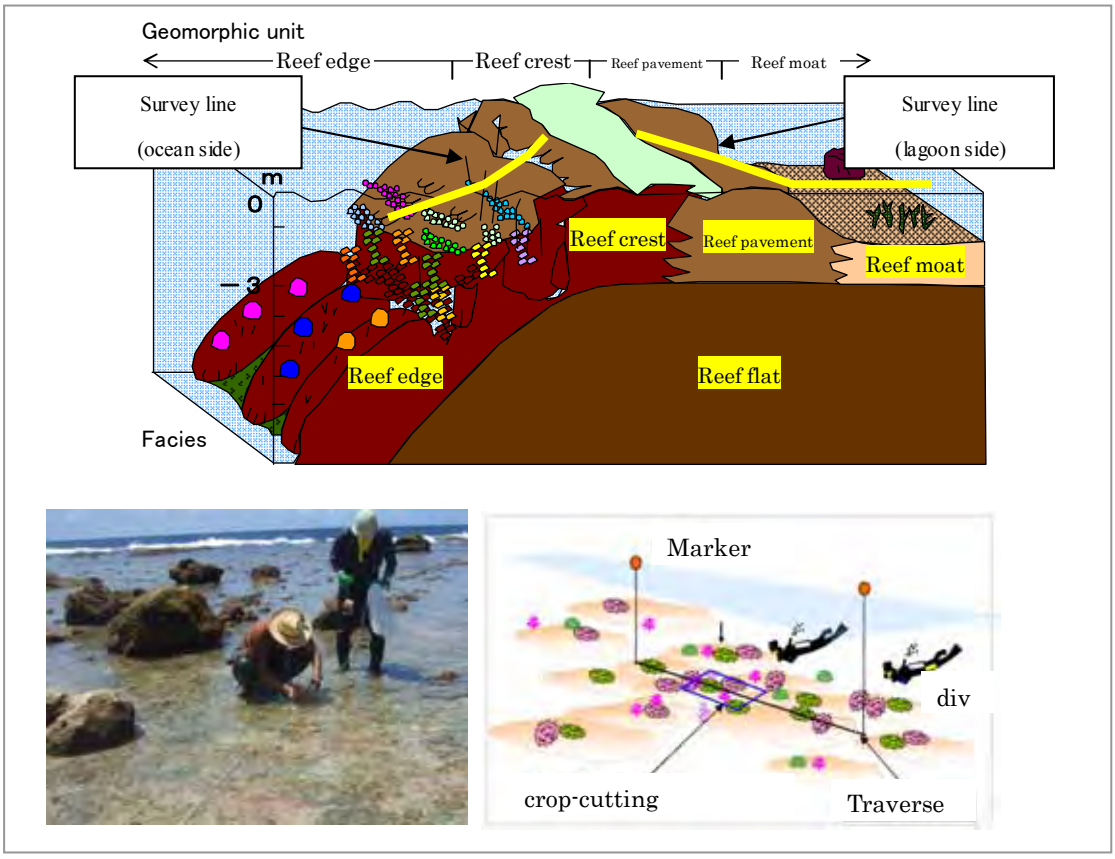


Figure 2.33 Conceptual Diagram of the Ecological Survey (Line Survey)

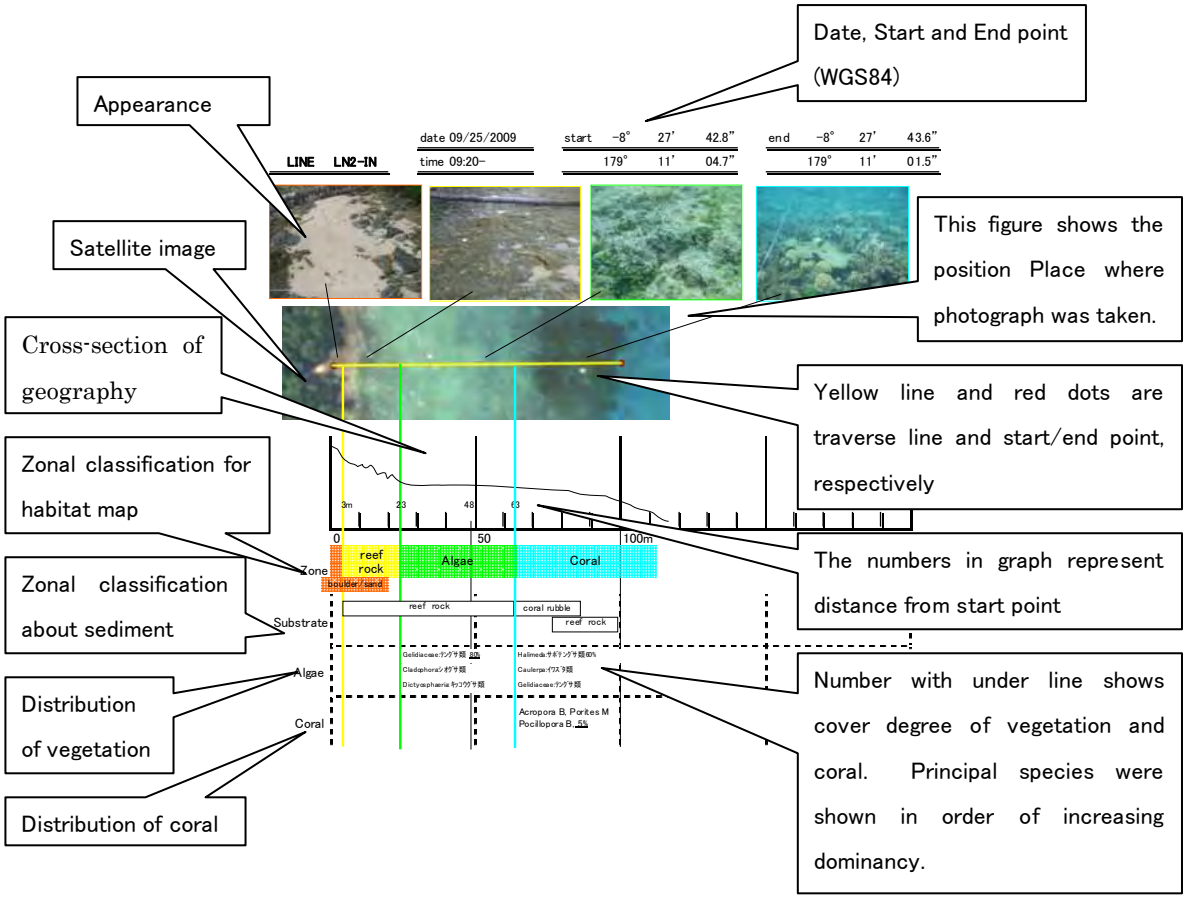
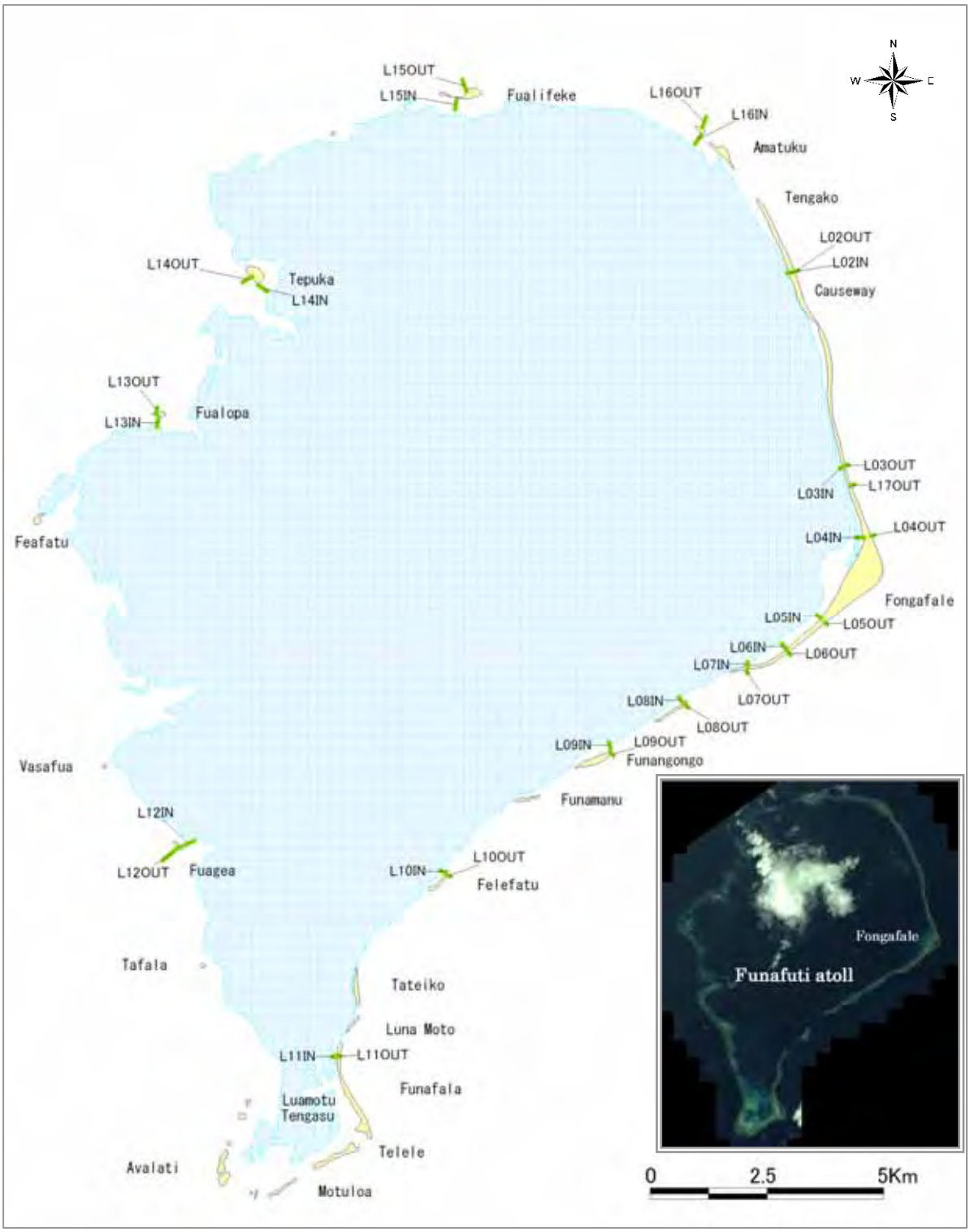


Figure 2.34 Explanatory notes for profiles of the ecological survey (Line survey))

2.7.2 Results



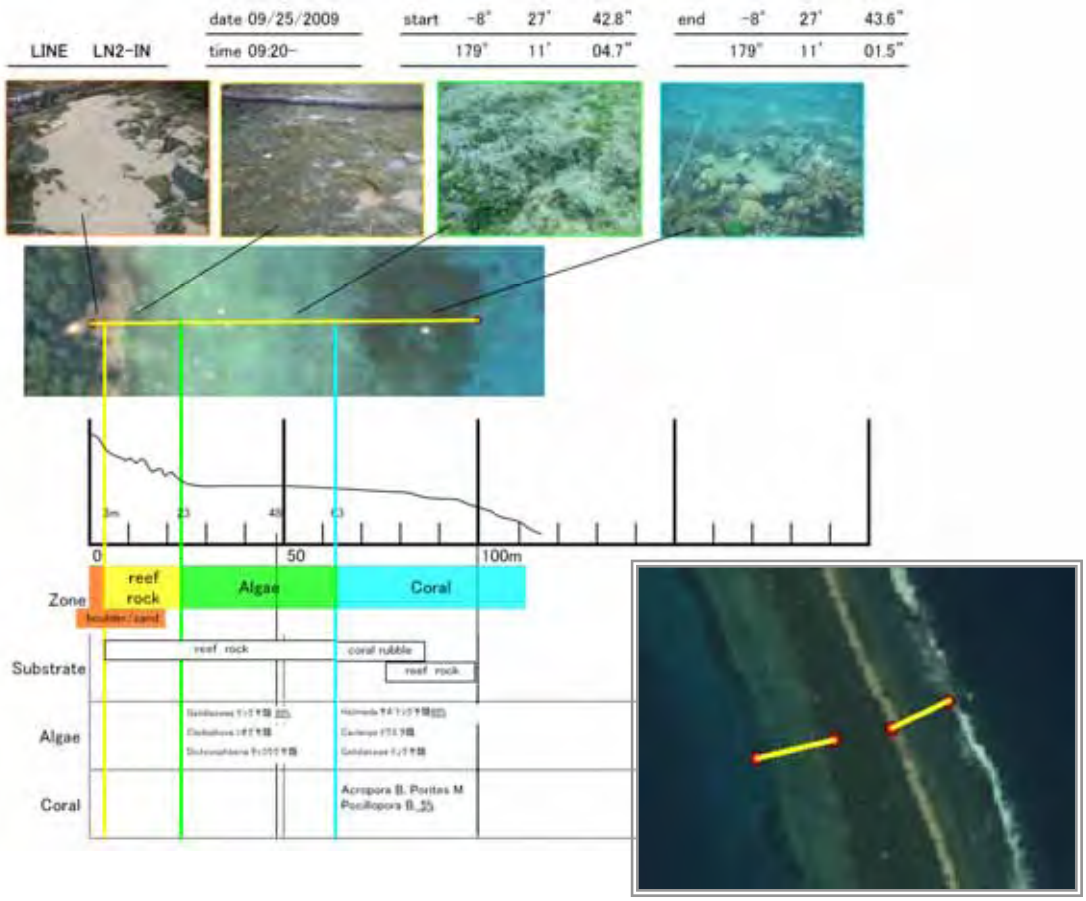
Traverse line survey location map

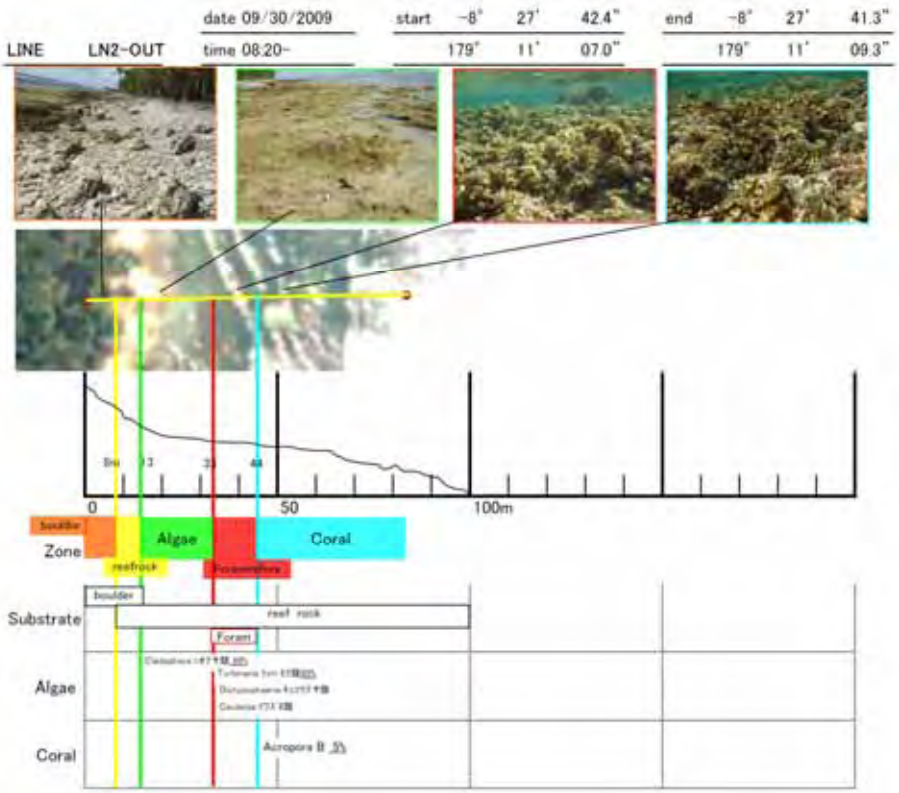
Traverse line survey position (coordinates)

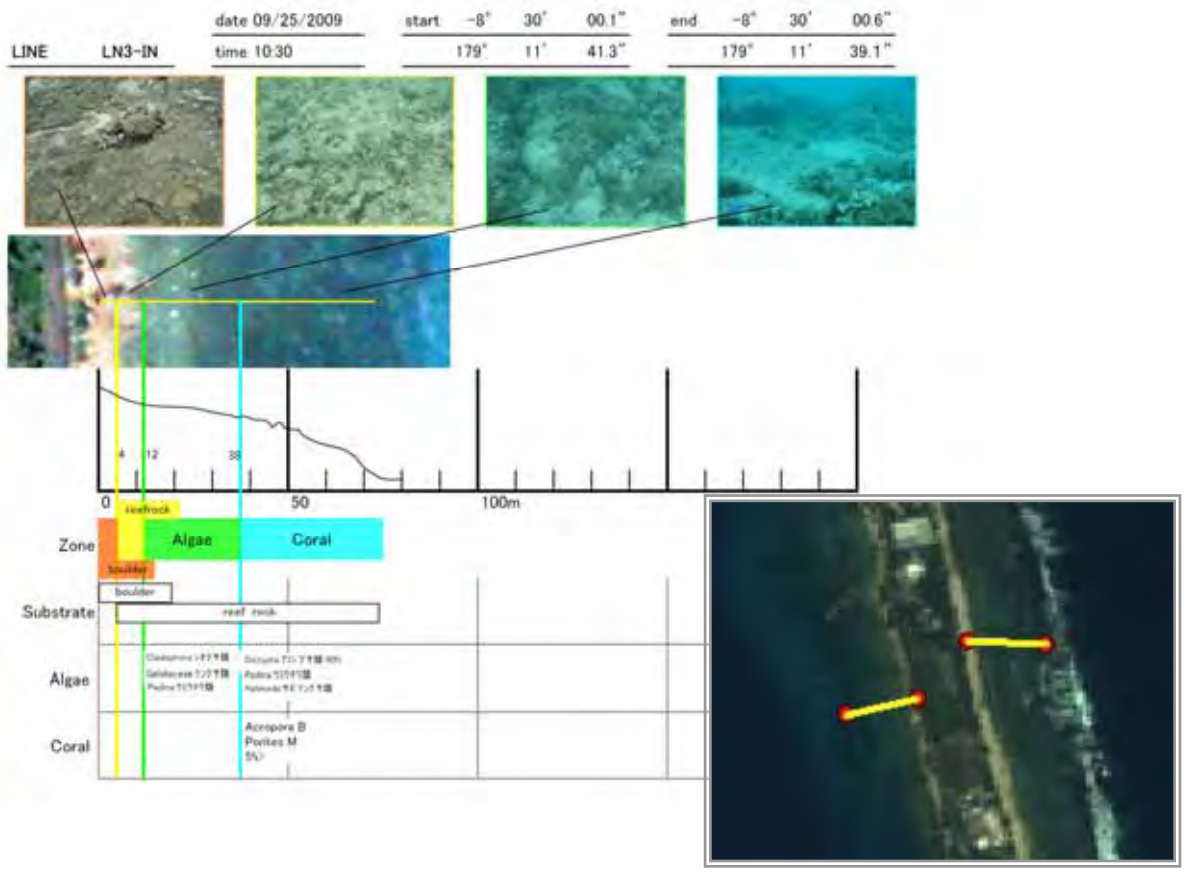
Stn.	Latitude	Longitude	length	direction (S -> E)	Place (Island)
L02IN-S	-8 27.713	179 11.078	98m	255° 58′ 56.16″	Fongafale
L02IN-E	-8 27.726	179 11.026			Fongafale
L02OUT-S	-8 27.707	179 11.115	81m	65° 40′ 42.25″	Fongafale
L02OUT-E	-8 27.689	179 11.155			Fongafale
L03IN-S	-8 30.002	179 11.688	71m	259° 01′ 00.00″	Fongafale
L03IN-E	-8 30.009	179 11.650			Fongafale
L03OUT-S	-8 29.972	179 11.714	82m	91° 16′ 43.65″	Fongafale
L03OUT-E	-8 29.973	179 11.759			Fongafale
L04IN-S	-8 30.818	179 11.951	189m	272° 14′ 01.96″	Fongafale
L04IN-E	-8 30.814	179 11.848			Fongafale
L04OUT-S	-8 30.798	179 12.027	74m	75° 33′ 22.94″	Fongafale
L04OUT-E	-8 30.788	179 12.066			Fongafale
L05IN-S	-8 31.771	179 11.451	117m	310° 02′ 55.43″	Fongafale
L05IN-E	-8 31.730	179 11.402			Fongafale
L05OUT-S	-8 31.815	179 11.491	74m	141° 50′ 12.23″	Fongafale
L05OUT-E	-8 31.846	179 11.516			Fongafale
L06IN-S	-8 32.134	179 11.043	161m	317° 54'1.22″	Fongafale
L06IN-E	-8 32.069	179 10.984			Fongafale
L06OUT-S	-8 32.166	179 11.060	82m	143° 15'20.73″	Fongafale
L06OUT-E	-8 32.202	179 11.087			Fongafale
L07IN-S	-8 32.330	179 10.594	83m	347° 15'8.16″	Fongafale
L07IN-E	-8 32.286	179 10.584			Fongafale
L07OUT-S	-8 32.370	179 10.578	84m	176° 17'8.9″	Fongafale
L07OUT-E	-8 32.416	179 10.581			Fongafale
L08IN-S	-8 32.775	179 9.840	176m	321° 28′ 06.54″	Fatao
L08IN-E	-8 32.7	179 9.783			Fatao
L08OUT-S	-8 32.793	179 9.869	82m	137° 51′ 26.84″	Fatao
L08OUT-E	-8 32.826	179 9.891			Fatao
L09IN-S	-8 33.309	179 8.986	157m	343° 07′ 06.00″	Funangongo
L09IN-E	-8 33.227	179 8.961			Funangongo

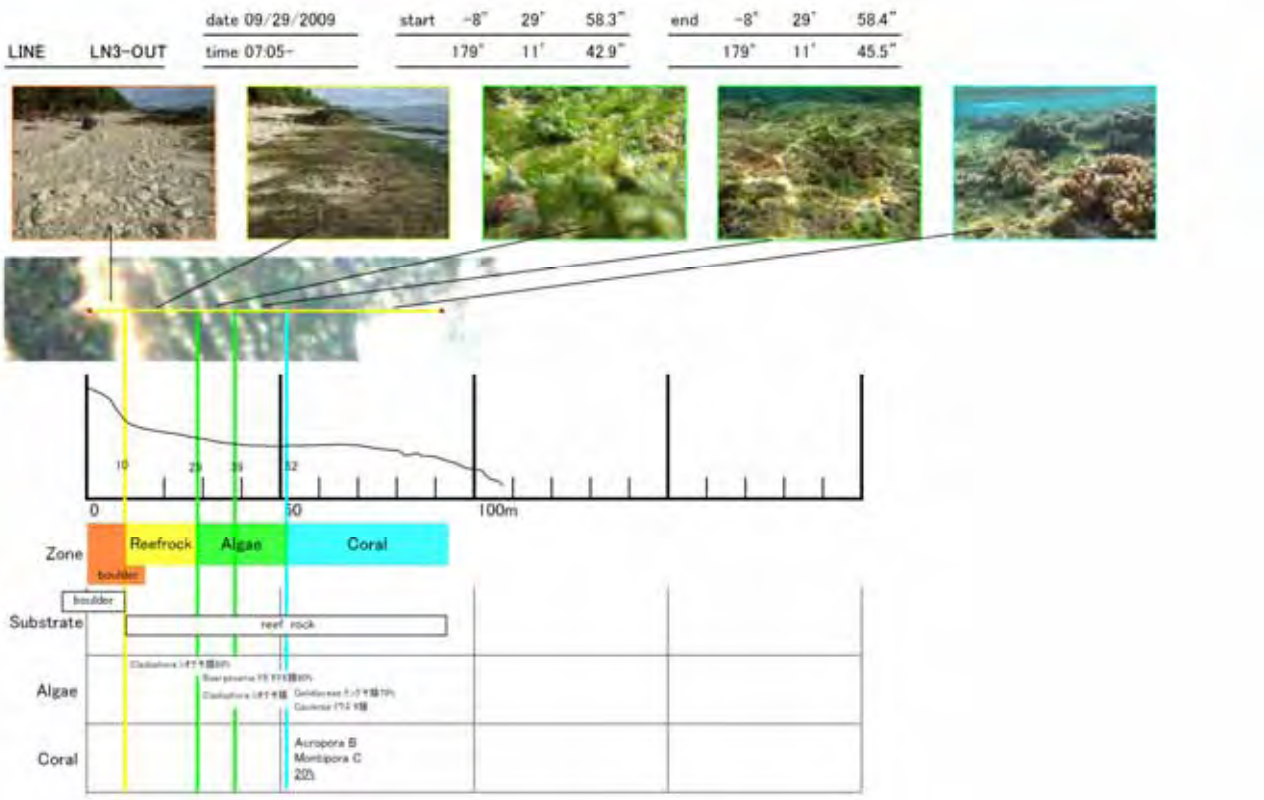
Stn.	Latitude	Longitude	length	direction (S -> E)	Place (Island)
L09OUT-S	-8 33.360	179 8.986	74m	134° 07′ 38.38″	Funangongo
L09OUT-E	-8 33.388	179 9.015			Funagongo
L10IN-S	-8 34.764	179 7.058	126m	286° 55′ 58.65″	Falefatu
L10IN-E	-8 34.744	179 6.992			Falefatu
L10OUT-S	-8 34.795	179 7.074	77m	112° 24′ 02.55″	Falefatu
L10OUT-E	-8 34.811	179 7.113			Falefatu
L11IN-S	-8 36.933	179 5.772	73m	275° 44'15.84″	Funafala
L11IN-E	-8 36.929	179 5.732			Funafala
L11OUT-S	-8 36.915	179 5.792	86m	107° 21'33.89″	Funafala
L11OUT-E	-8 36.929	179 5.837			Funafala
L12IN-S	-8 34.480	179 3.953	310m	64° 41′ 44.90″	Fuagea
L12IN-E	-8 34.408	179 4.106			Fuagea
L12OUT-S	-8 34.481	179 3.923	457m	229° 35′ 26.45″	Fuagea
L12OUT-E	-8 34.642	179 3.733			Fuagea
L13IN-S	-8 29.470	179 3.653	186m	189° 36'21.44″	Fualopa
L13IN-E	-8 29.570	179 3.636			Fualopa
L13OUT-S	-8 29.422	179 3.626	160m	189° 12'20.79″	Fualopa
L13OUT-E	-8 29.336	179 3.640			Fualopa
L14IN-S	-8 27.897	179 4.811	255m	124° 15'51.92″	Tepuka
L14IN-E	-8 27.975	179 4.926			Tepuka
L14OUT-S	-8 27.797	179 4.747	250m	238° 59'51.05″	Tepuka
L14OUT-E	-8 27.867	179 4.630			Tepuka
L15IN-S	-8 25.715	179 7.133	229m	188° 17'25.77''	Fualifeke
L15IN-E	-8 25.838	179 7.115			Fualifeke
L15OUT-S	-8 25.627	179 7.251	277m	340° 40'43.72″	Fualifeke
L15OUT-E	-8 25.485	179 7.201			Fualifeke
L16IN-S	-8 26.110	179 10.008	255m	212° 32′ 55.77″	Amatuku
L16IN-E	-8 26.227	179 9.933			Amatuku
L16OUT-S	-8 26.030	179 10.019	243m	20° 16'23.25″	Amatuku
L16OUT-E	-8 25.906	179 10.065			Amatuku
L17OUT-S	-8 30.076	179 11.283	86m	73.5°	Fongafale
L17OUT-E	-8 30.071	179 11.299			Fongafale

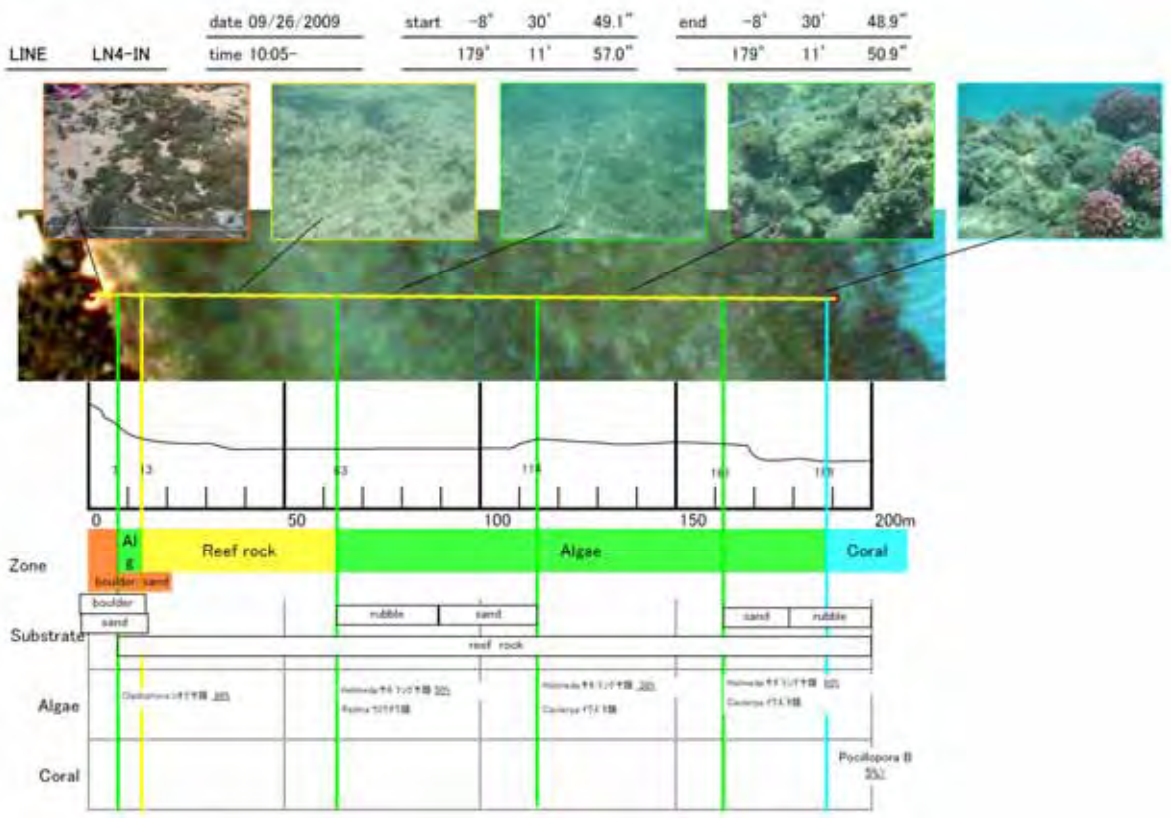
○ **Traverse line survey result（Traverse line cross section）**

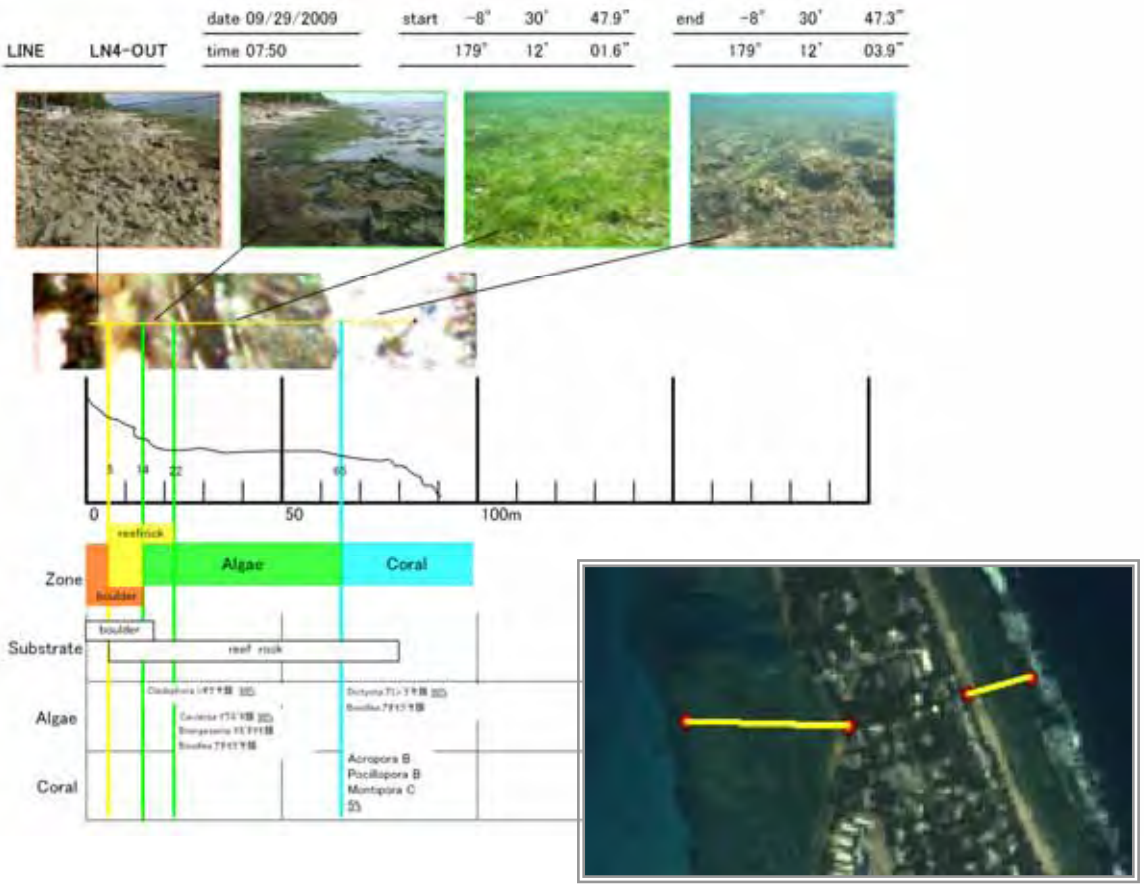


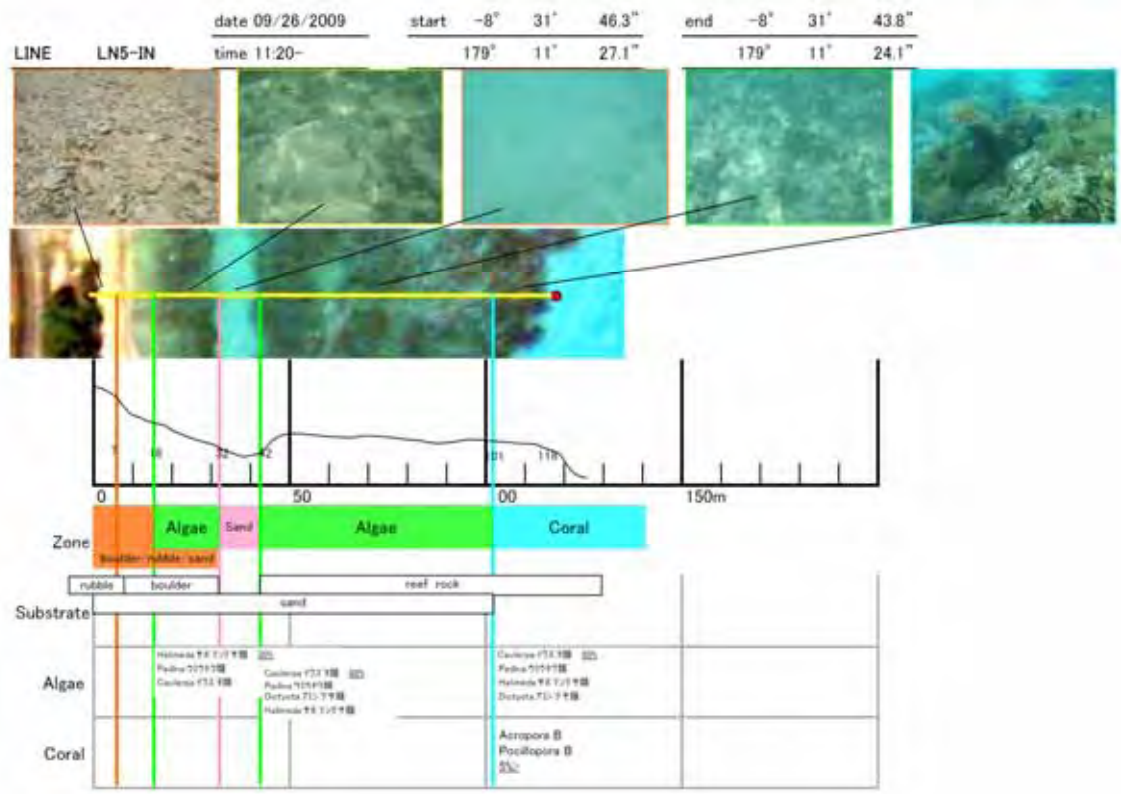


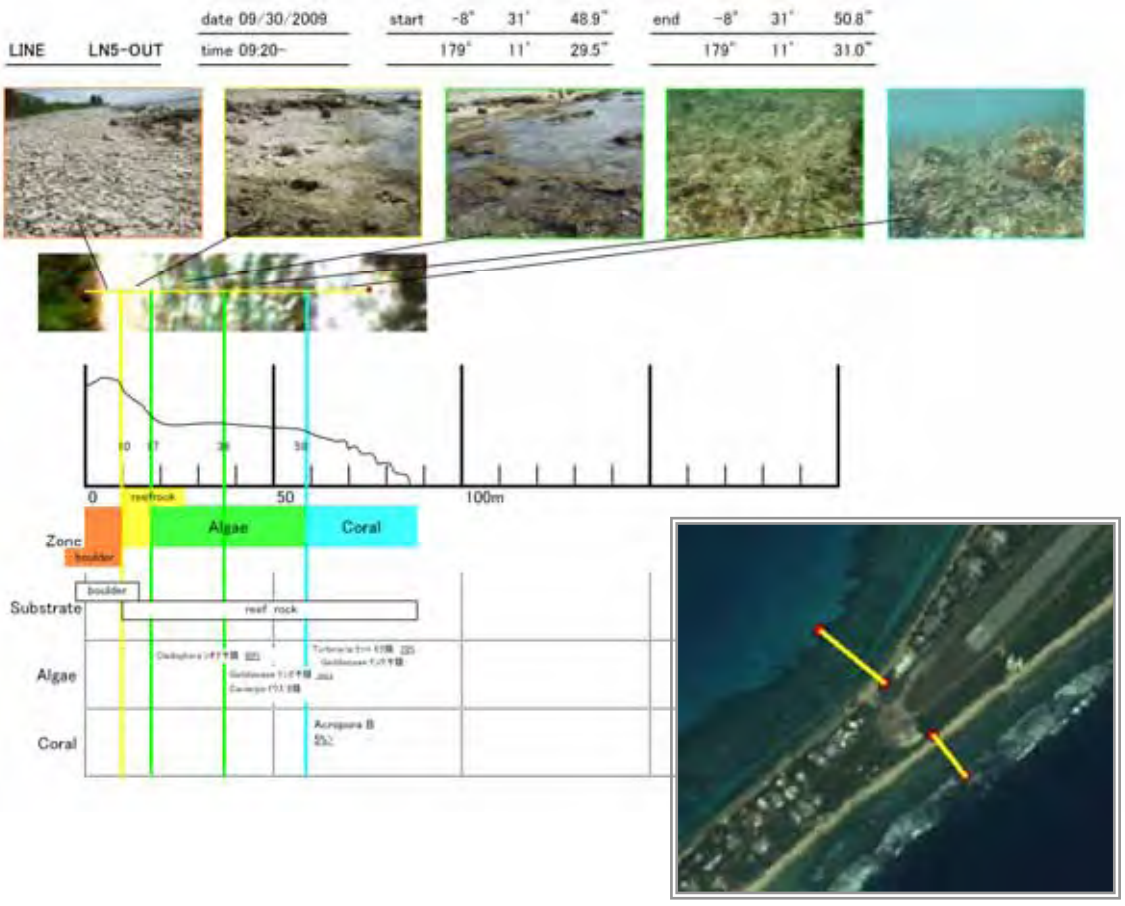

LINE LN3-IN
date 09/25/2009
time 10:30
start -8° 30' 00.1" 179° 11' 41.3"
end -8° 30' 00.6" 179° 11' 39.1"
0
50
100m
Zone
Algae
Coral
Substrate
Algae
Coral
Acropora B
Porites M

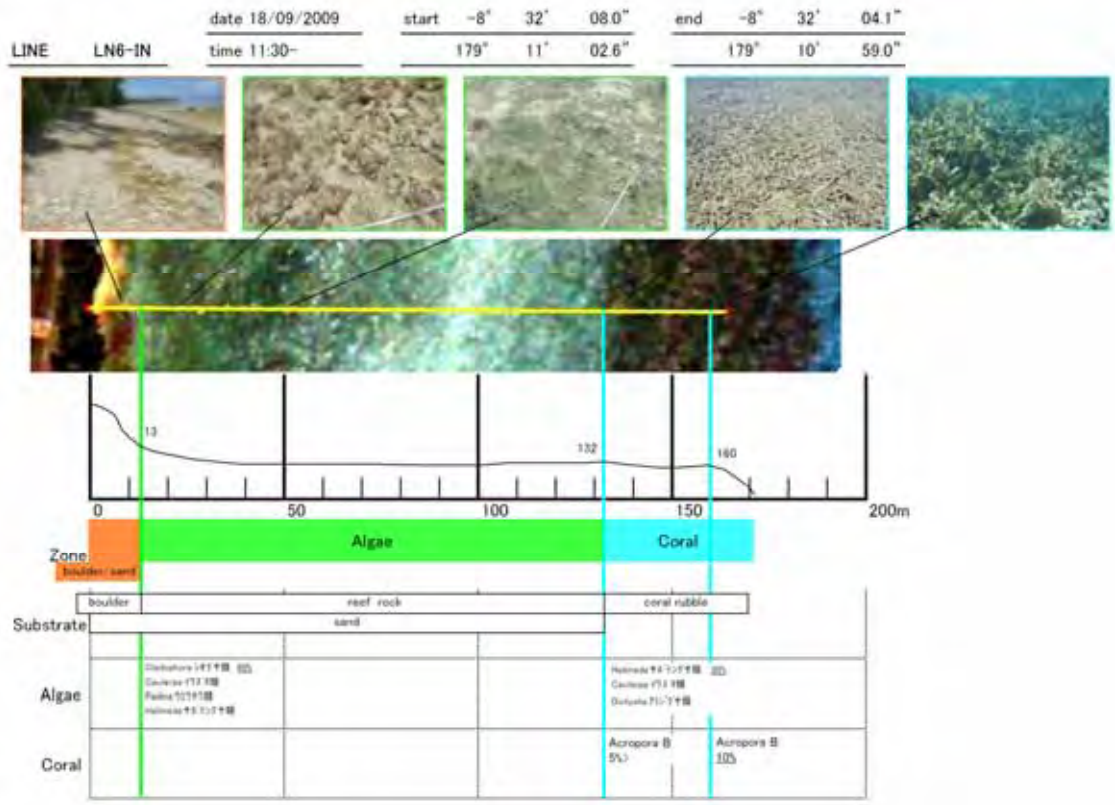

LINE LN3-OUT
date 09/29/2009
time 07:05-
start -8° 29' 58.3" 179° 11' 42.9"
end -8° 29' 58.4" 179° 11' 45.5"
0
100m
Zone
Reefrock
Algae
Coral
Substrate
Algae
Coral
Acropora B
Montipora C

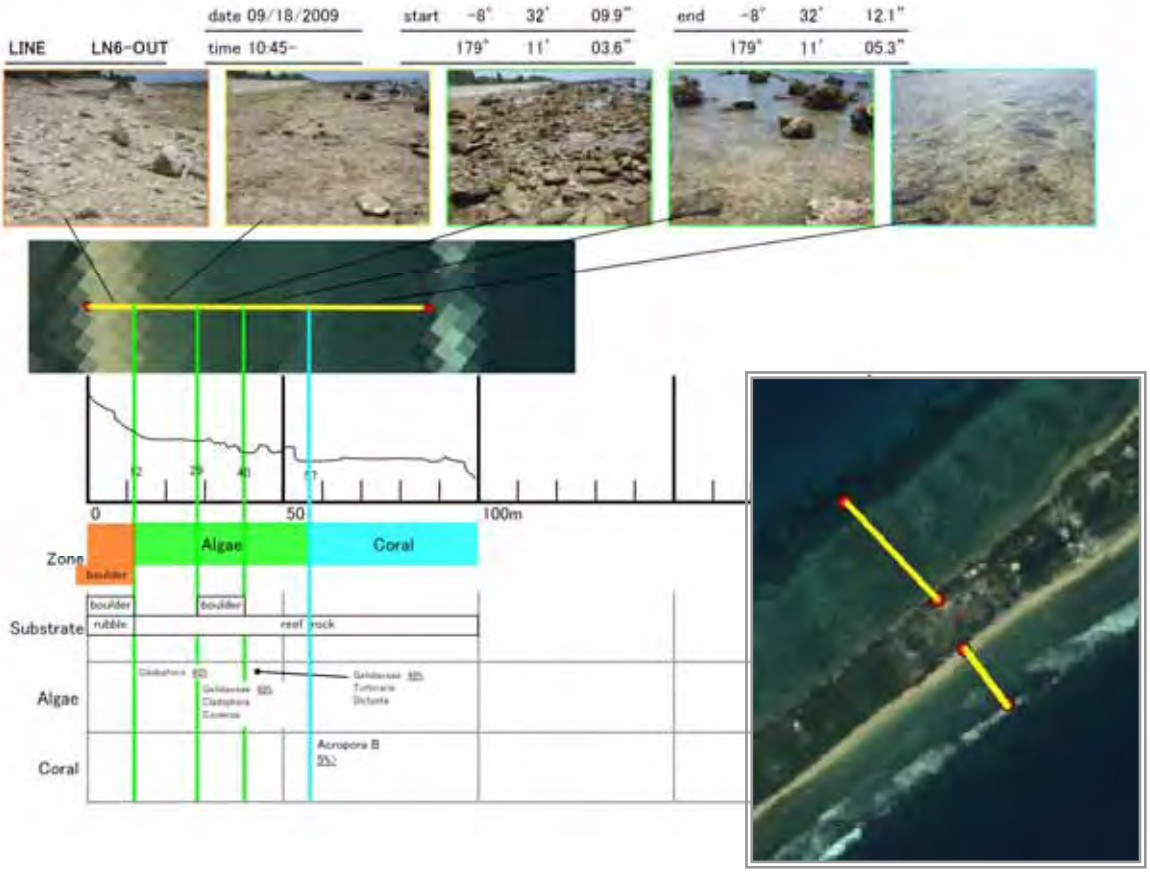

date 09/26/2009
time 10:05-
start -8° 30' 49.1" 179° 11' 57.0"
end -8° 30' 48.9" 179° 11' 50.9"
LINE LN4-IN
0
50
100
150
200m
Zone
Al
E
Reef rock
Algae
Coral
boulder
sand
Substrate
rubble
sand
reef rock
Algae
Coral
Pocillopora B

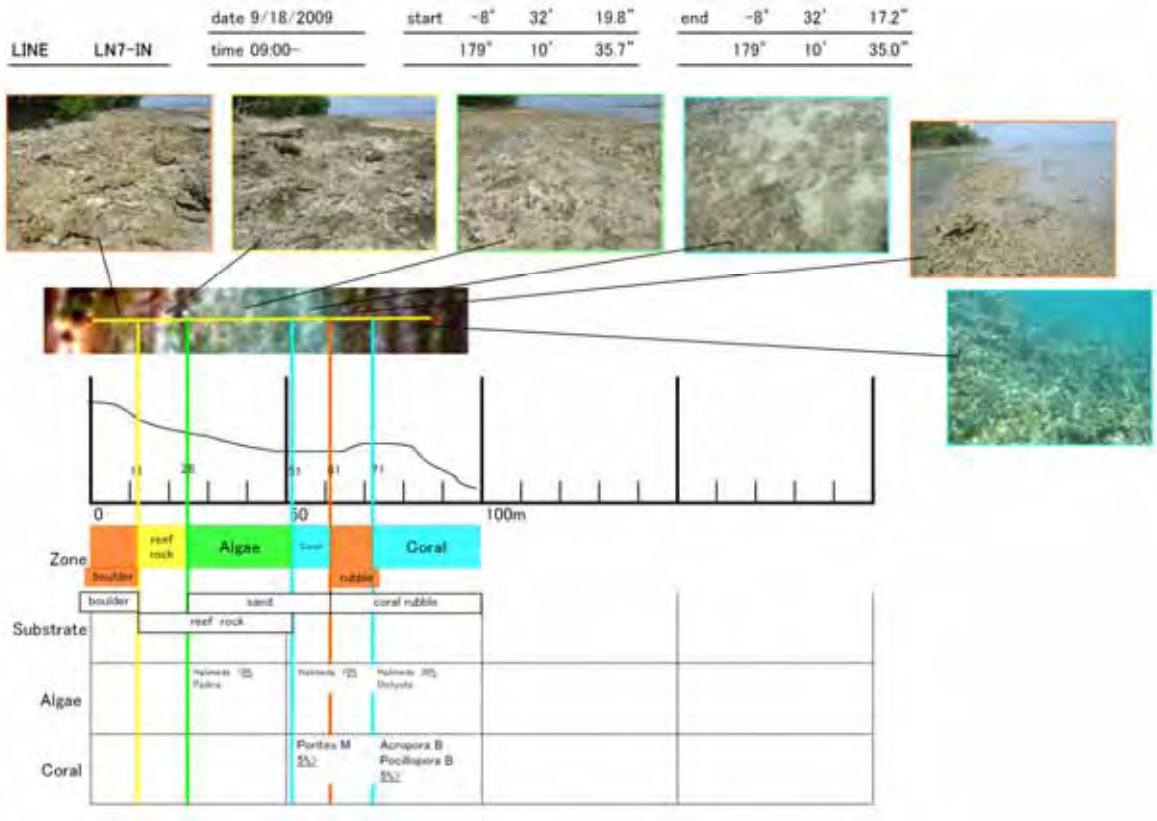

date 09/29/2009
time 07:50
start -8° 30' 47.9" 179° 12' 01.6"
end -8° 30' 47.3" 179° 12' 03.9"
LINE LN4-OUT
0
50
100m
reef rock
Zone
Algae
Coral
boulder
Substrate
boulder
reef rock
Algae
Coral
Acropora B
Pocillopora B
Montipora C

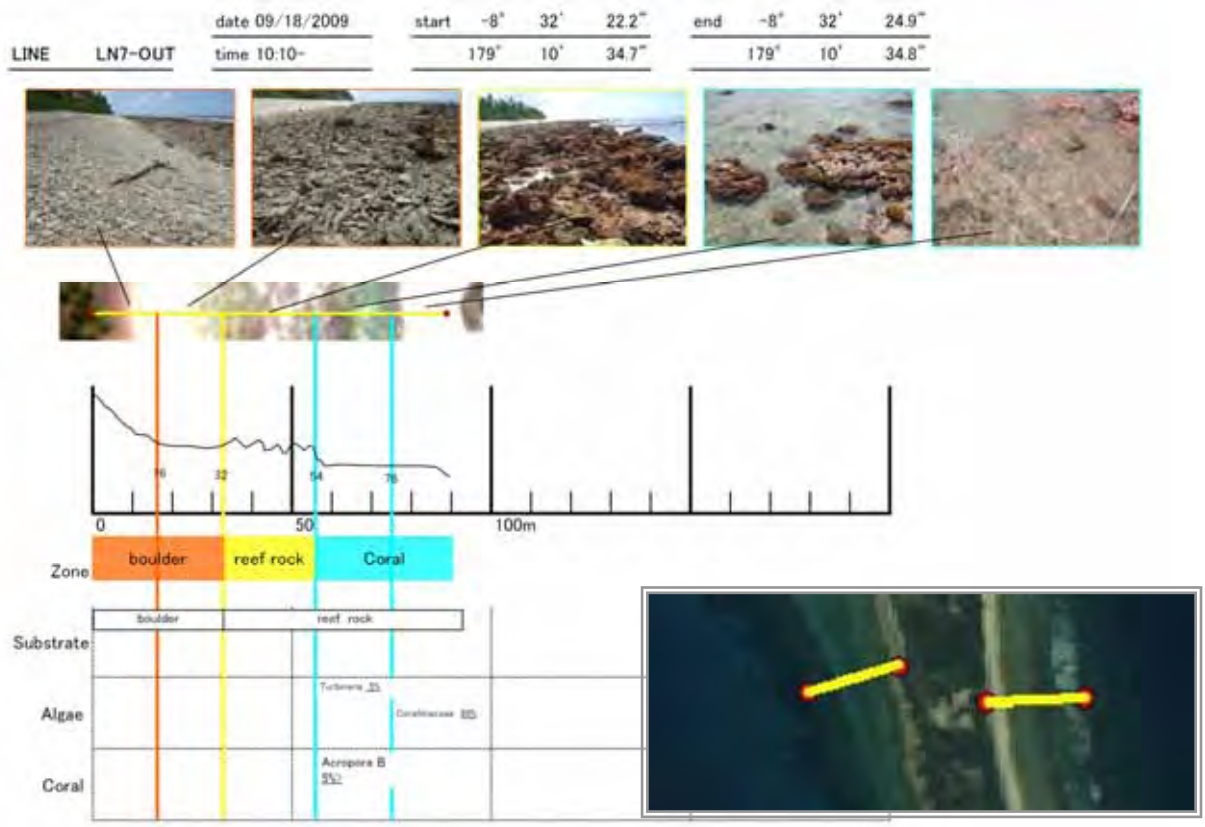

LINE LN5-IN
date 09/26/2009
time 11:20-
start -8° 31' 46.3"
179° 11' 27.1"
end -8° 31' 43.8"
179° 11' 24.1"
0
50
00
150m
Zone
Algae
Sand
Algae
Coral
rubble
boulder
reef rock
sand
Substrate
Algae
Coral
Acropora B
Pocillopora B

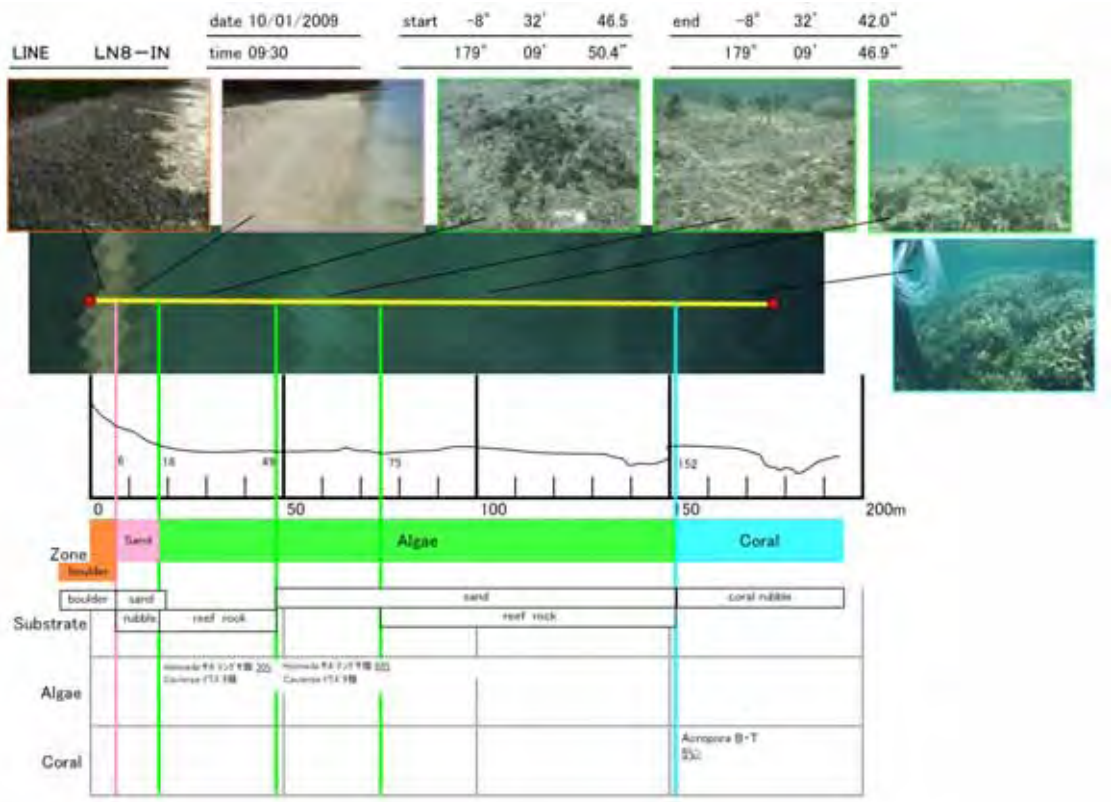

LINE LN5-OUT
date 09/30/2009
time 09:20-
start -8° 31' 48.9"
179° 11' 29.5"
end -8° 31' 50.8"
179° 11' 31.0"
0
reef rock
50
100m
Zone
Algae
Coral
boulder
Substrate
reef rock
Algae
Coral
Acropora B

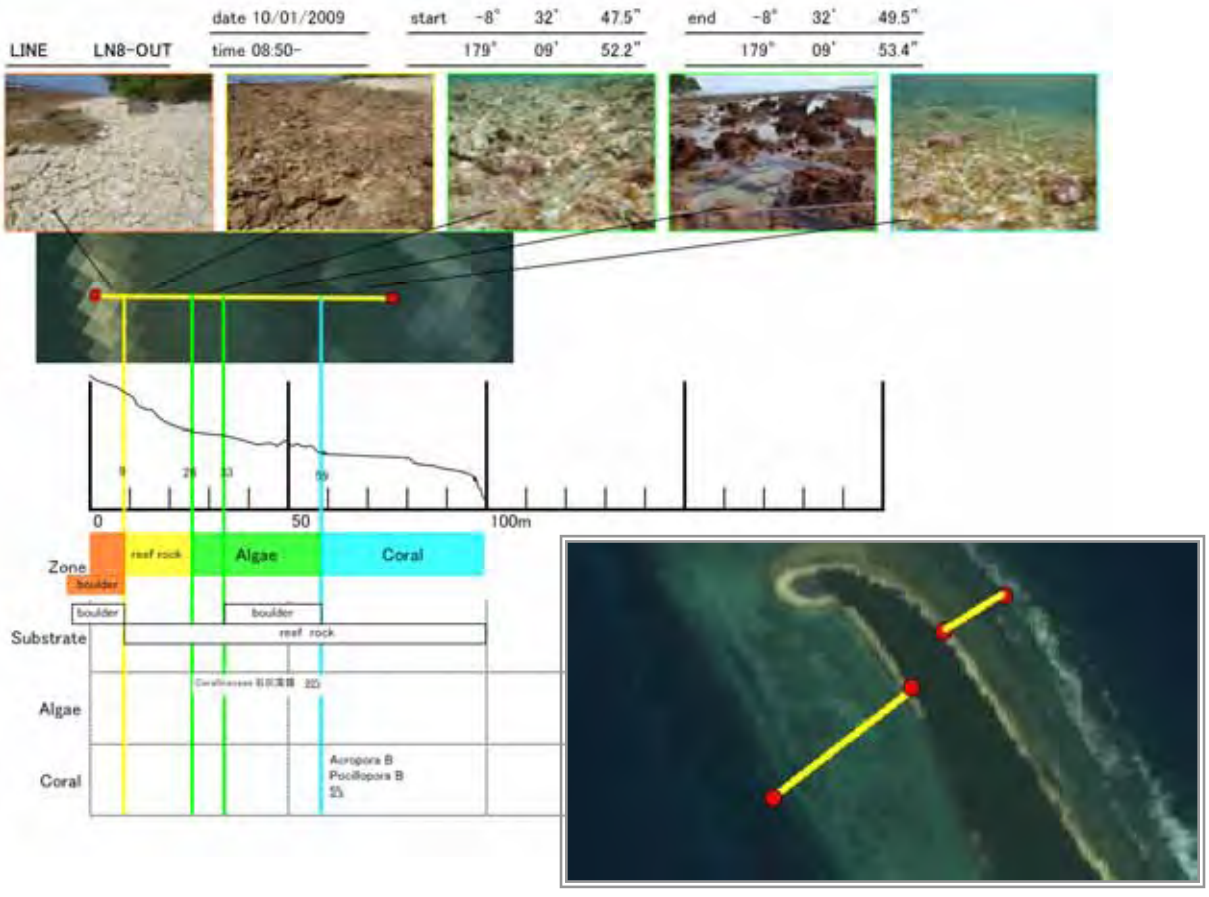

date 18/09/2009
start -8° 32' 08.0" 179° 11' 02.6"
end -8° 32' 04.1" 179° 10' 59.0"
LINE LN6-IN
time 11:30-
13
132
160
0
50
100
150
200m
Zone
Algae
Coral
boulder / sand
boulder
reef rock
coral rubble
Substrate
sand
Algae
Coral
Acropora B
5%
Acropora B
10%

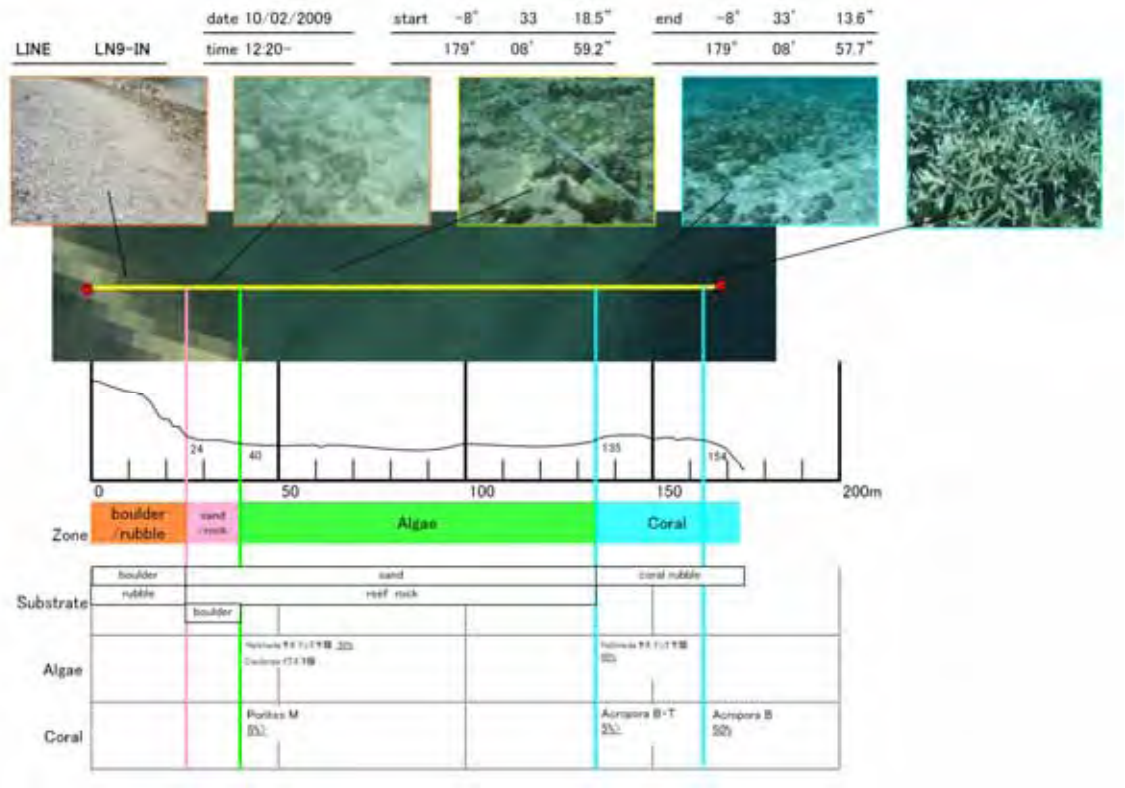

date 09/18/2009
start -8° 32' 09.9" 179° 11' 03.6"
end -8° 32' 12.1" 179° 11' 05.3"
LINE LN6-OUT
time 10:45-
12
29
40
71
0
50
100m
Zone
Algae
Coral
boulder
boulder
boulder
rubble
reef rock
Substrate
Algae
Coral
Acropora B
5%

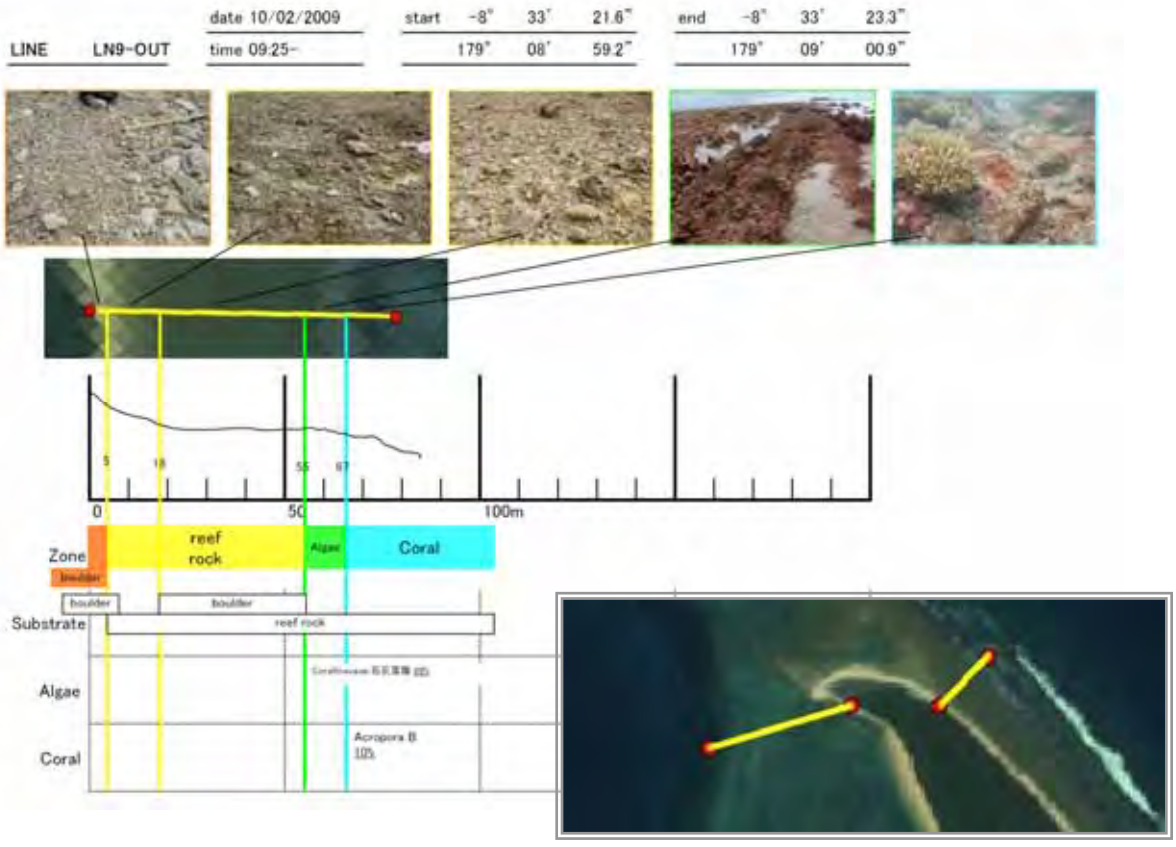

date 9/18/2009
time 09:00~
start -8° 32' 19.8" 179° 10' 35.7"
end -8° 32' 17.2" 179° 10' 35.0"
LINE LN7-IN
0
50
100m
Zone
reef rock
Algae
Coral
boulder
rubble
boulder
sand
coral rubble
reef rock
Substrate
Algae
Coral
Porites M
Acropora B
Pocillopora B

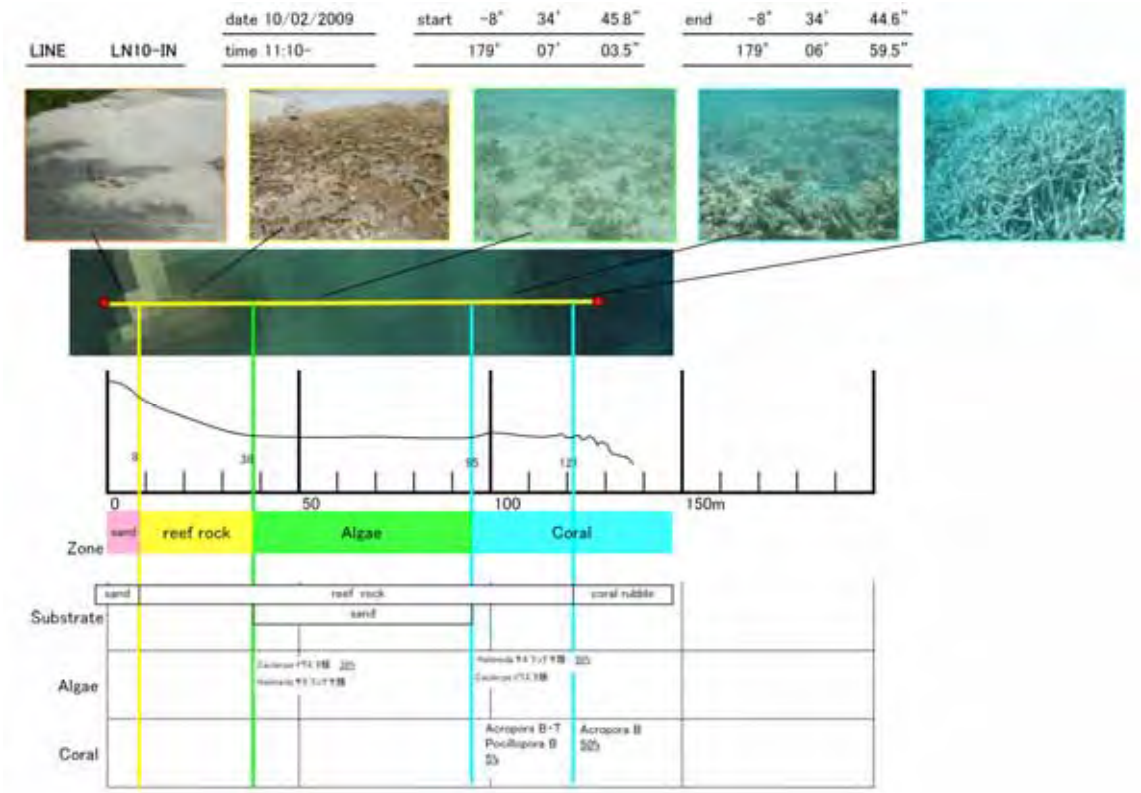

date 09/18/2009
time 10:10~
start -8° 32' 22.2" 179° 10' 34.7"
end -8° 32' 24.9" 179° 10' 34.8"
LINE LN7-OUT
0
50
100m
Zone
boulder
reef rock
Coral
boulder
reef rock
Substrate
Algae
Coral
Acropora B

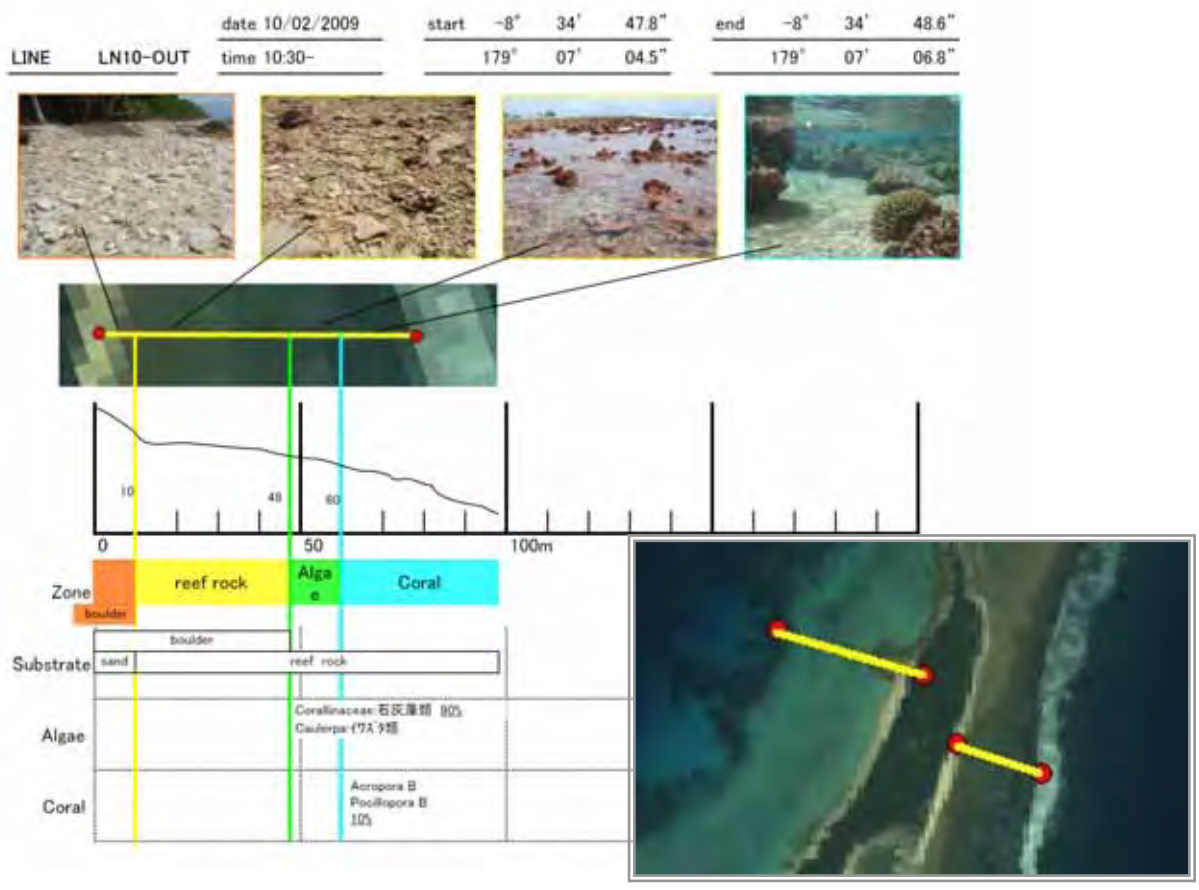

LINE LN8－IN
date 10/01/2009
time 09:30
start -8° 32' 46.5" 179° 09' 50.4"
end -8° 32' 42.0" 179° 09' 46.9"
0
50
100
150
200m
Zone
Sand
Algae
Coral
boulder
Substrate
boulder
sand
rubble
reef rock
sand
coral rubble
reef rock
Algae
Coral
Acropora B・T

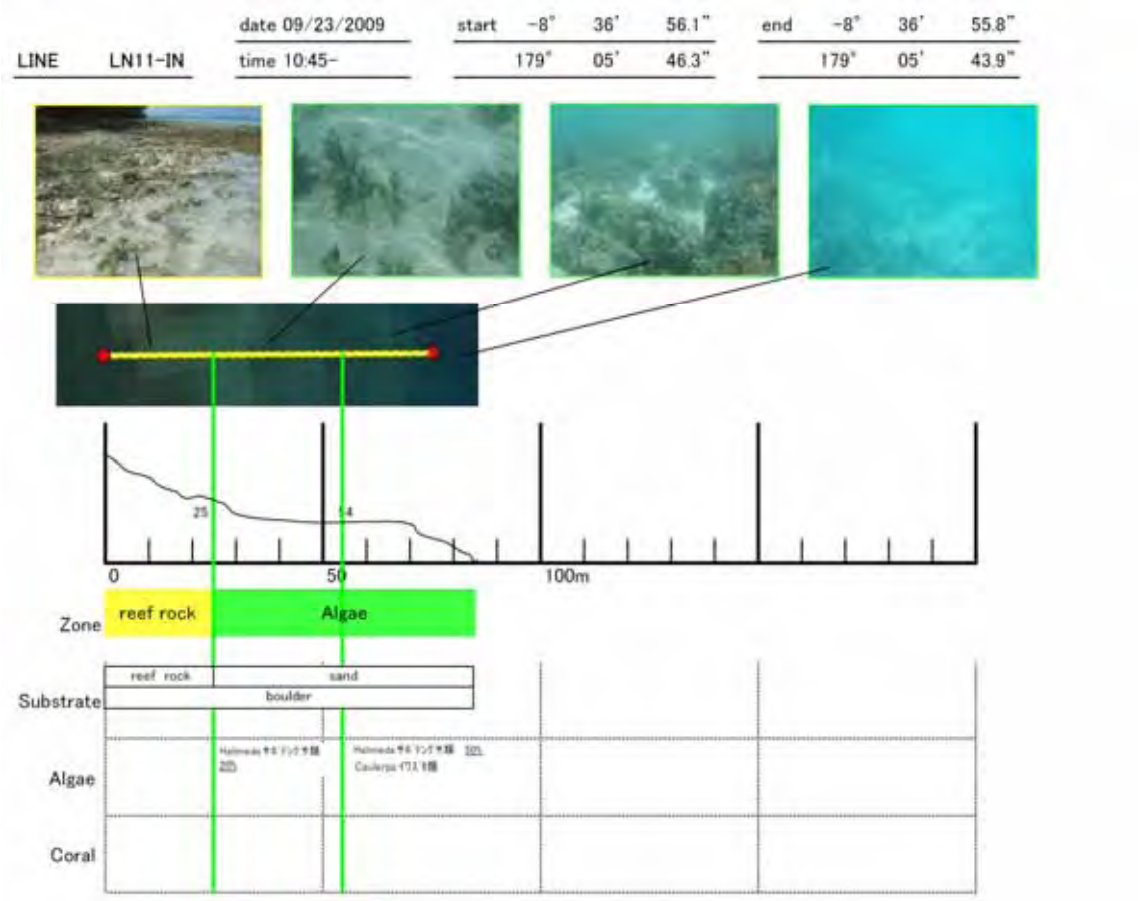

LINE LN8-OUT
date 10/01/2009
time 08:50-
start -8° 32' 47.5" 179° 09' 52.2"
end -8° 32' 49.5" 179° 09' 53.4"
0
50
100m
Zone
reef rock
Algae
Coral
boulder
boulder
Substrate
boulder
reef rock
Algae
Coral
Acropora B
Pocillopora B

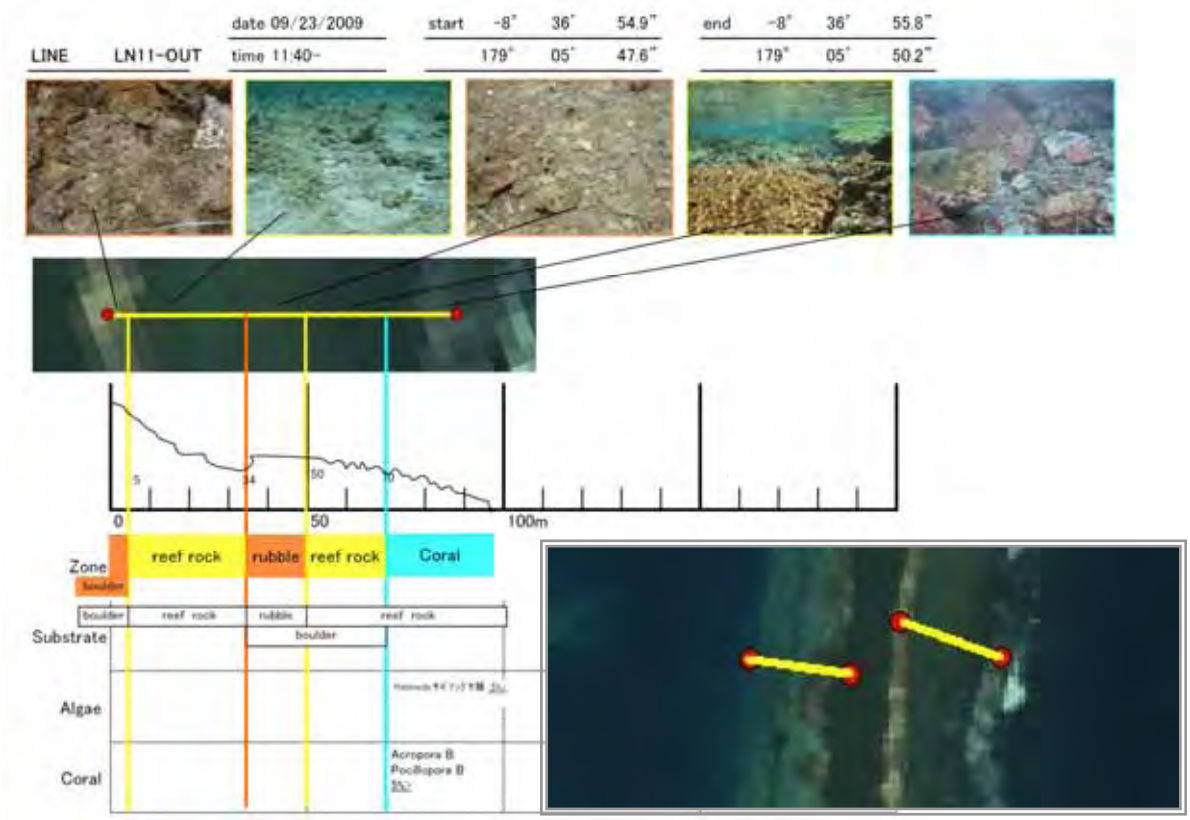

LINE LN9-IN
date 10/02/2009
time 12:20-
start -8° 33' 18.5" 179° 08' 59.2"
end -8° 33' 13.6" 179° 08' 57.7"
0
50
100
150
200m
Zone
boulder /rubble
Algae
Coral
Substrate
boulder
rubble
sand
reef rock
coral rubble
Algae
Coral
Porites M
Acropora B-T
Acropora B

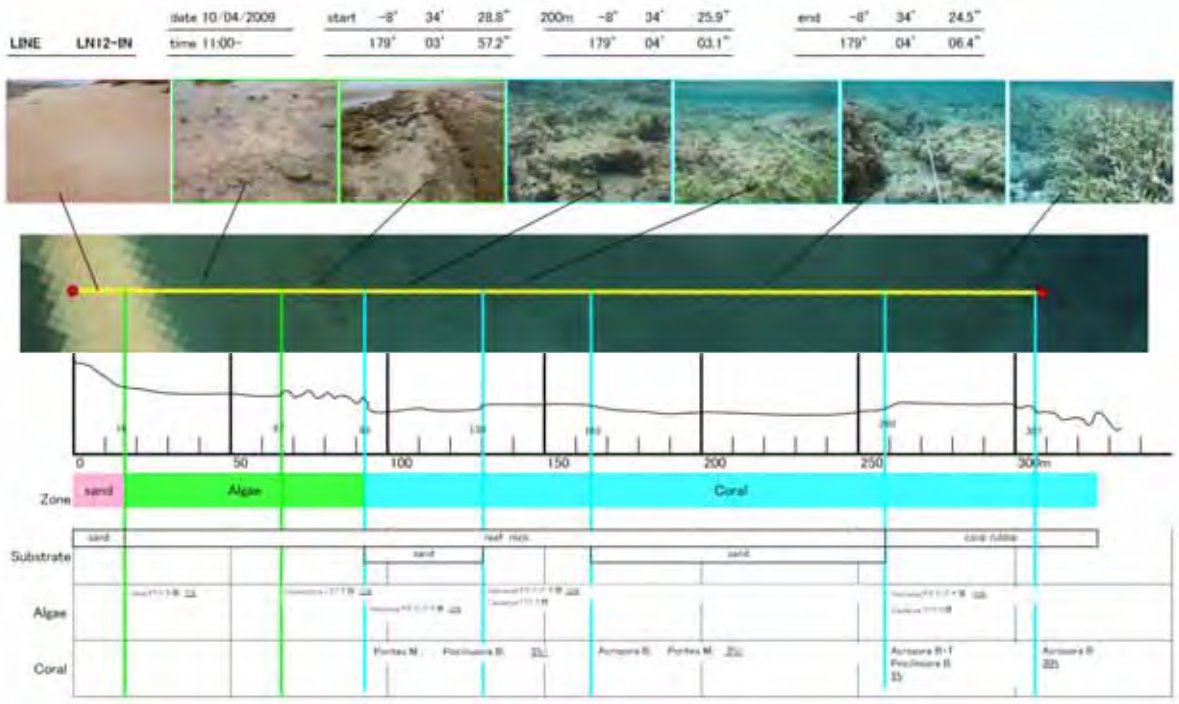

LINE LN9-OUT
date 10/02/2009
time 09:25-
start -8° 33' 21.6" 179° 08' 59.2"
end -8° 33' 23.3" 179° 09' 00.9"
0
50
100m
Zone
reef rock
Algae
Coral
Substrate
boulder
reef rock
Algae
Coral
Acropora B

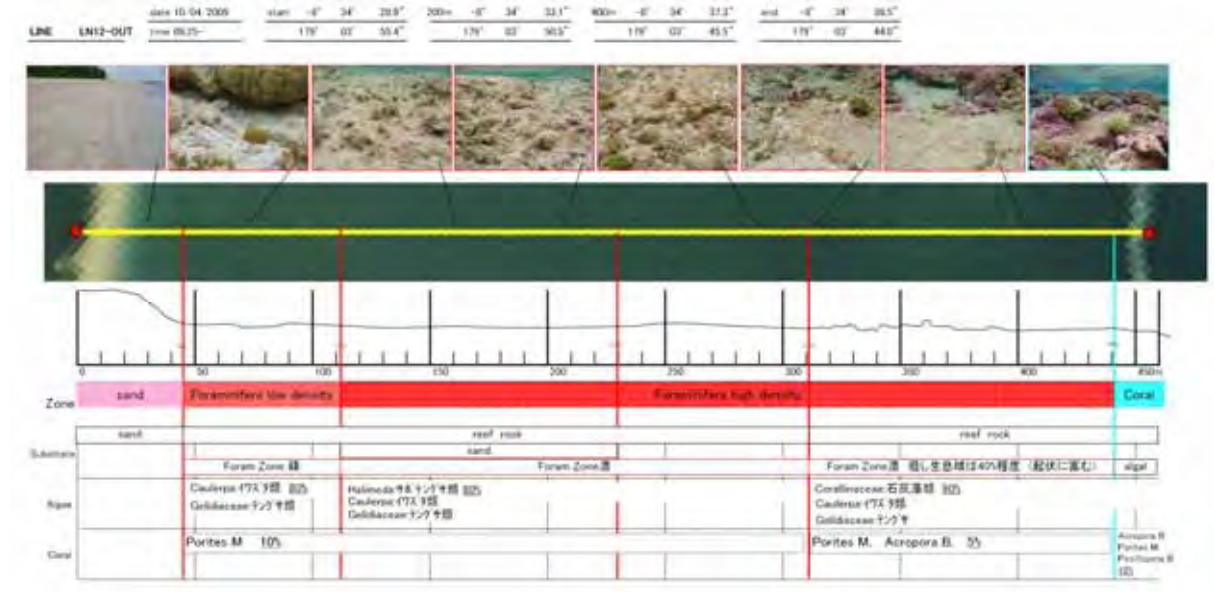

LINE LN10-IN
date 10/02/2009
time 11:10-
start -8° 34' 45.8" 179° 07' 03.5"
end -8° 34' 44.6" 179° 06' 59.5"
0
50
100
150m
Zone
sand
reef rock
Algae
Coral
Substrate
sand
reef rock
coral rubble
sand
Algae
Coral
Acropora B
Pocillopora B
5%

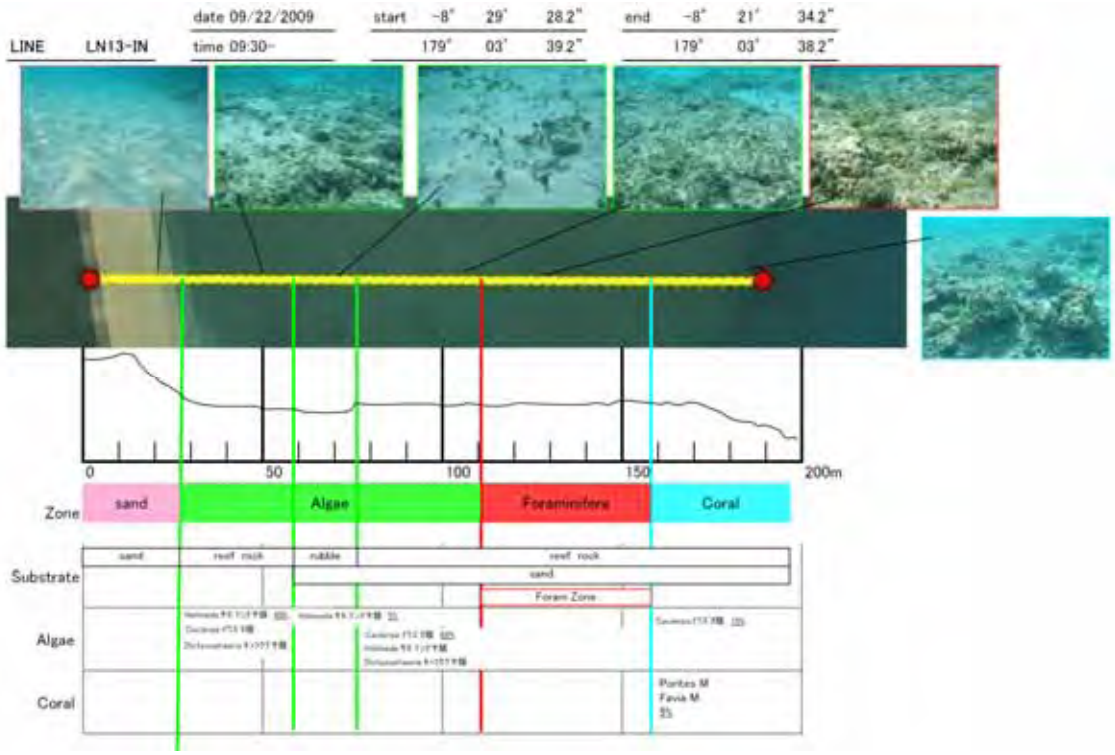

LINE LN10-OUT
date 10/02/2009
time 10:30-
start -8° 34' 47.8" 179° 07' 04.5"
end -8° 34' 48.6" 179° 07' 06.8"
0
50
100m
Zone
boulder
reef rock
Alga
e
Coral
Substrate
boulder
sand
reef rock
Algae
Coralline algae
Caulerpa
Coral
Acropora B
Pocillopora B
10%

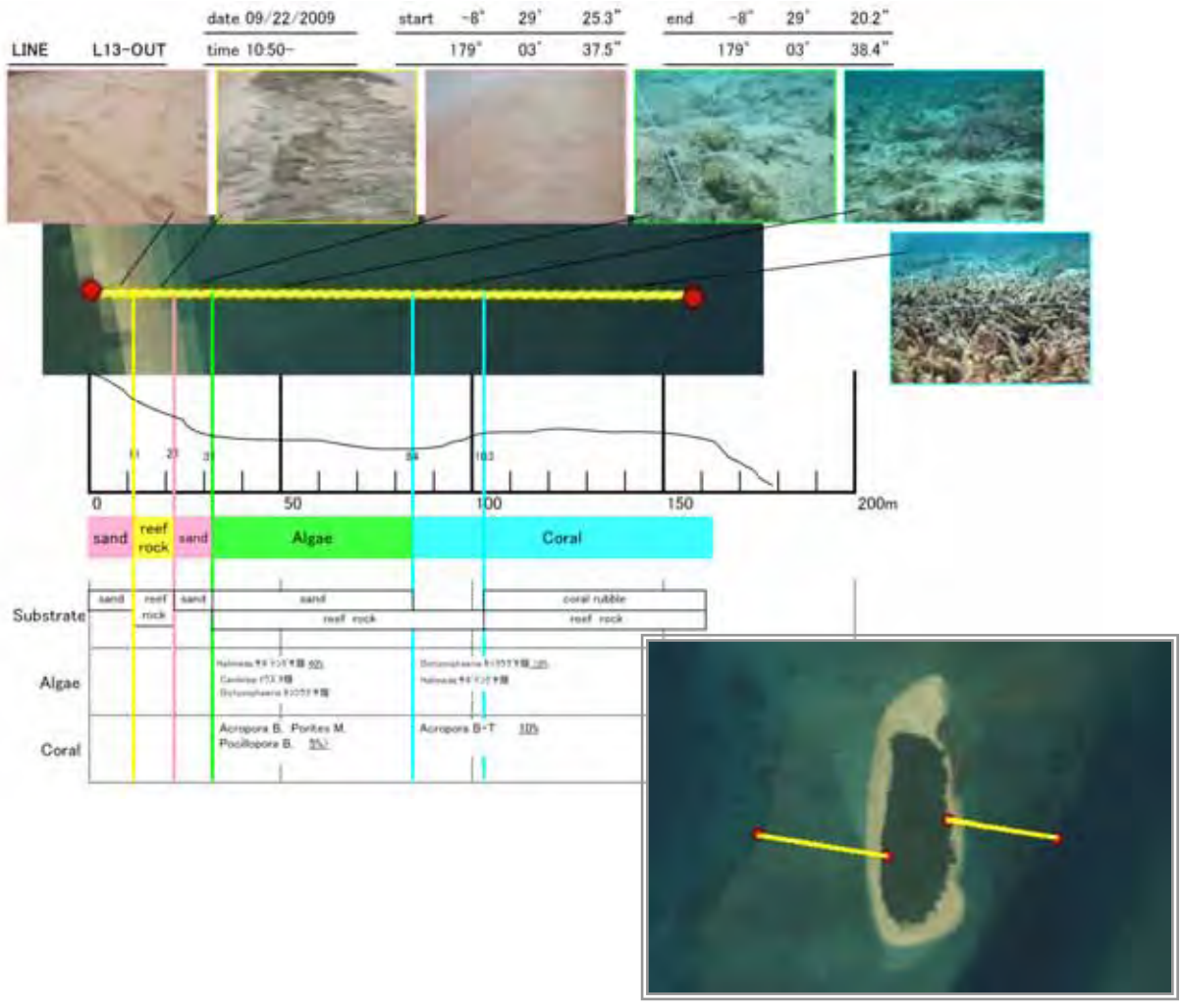

LINE LN11-IN
date 09/23/2009
time 10:45-
start -8° 36' 56.1"
179° 05' 46.3"
end -8° 36' 55.8"
179° 05' 43.9"
25
14
0
50
100m
Zone
reef rock
Algae
Substrate
reef rock
sand
boulder
Algae
Coral

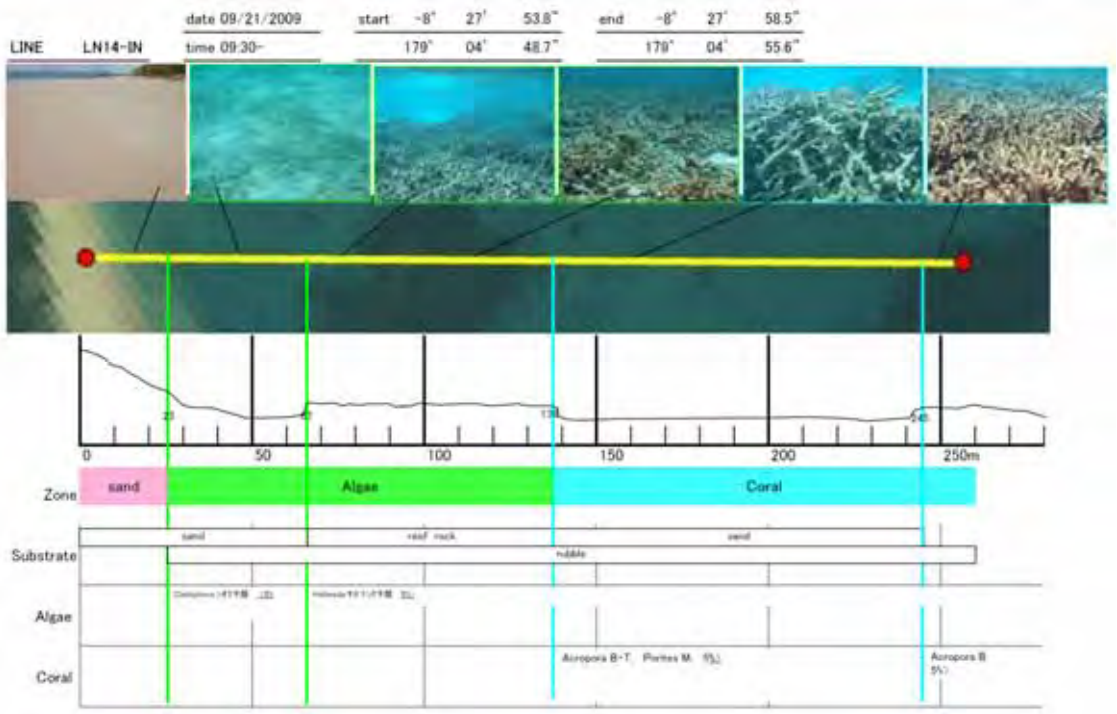

LINE LN11-OUT
date 09/23/2009
time 11:40-
start -8° 36' 54.9"
179° 05' 47.6"
end -8° 36' 55.8"
179° 05' 50.2"
5
14
50
10
0
50
100m
Zone
reef rock
rubble
reef rock
Coral
boulder
Substrate
reef rock
rubble
reef rock
boulder
Algae
Coral
Acropora B
Pocillopora B

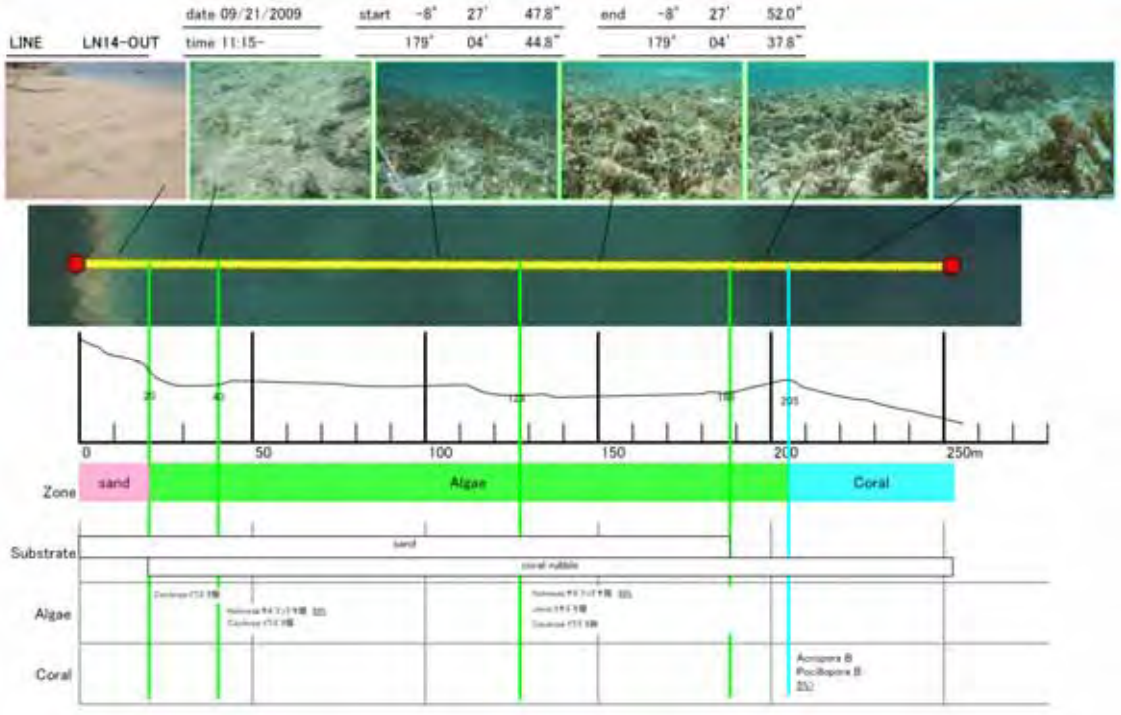

LINE LN12-IN
date 10/04/2009
time 11:00~
start -8° 34' 28.8" 179° 03' 57.2"
200m -8° 34' 25.9" 179° 04' 03.1"
end -8° 34' 24.5" 179° 04' 06.4"
0
50
100
150
200
250
300m
Zone
sand
Algae
Coral
Substrate
Algae
Coral

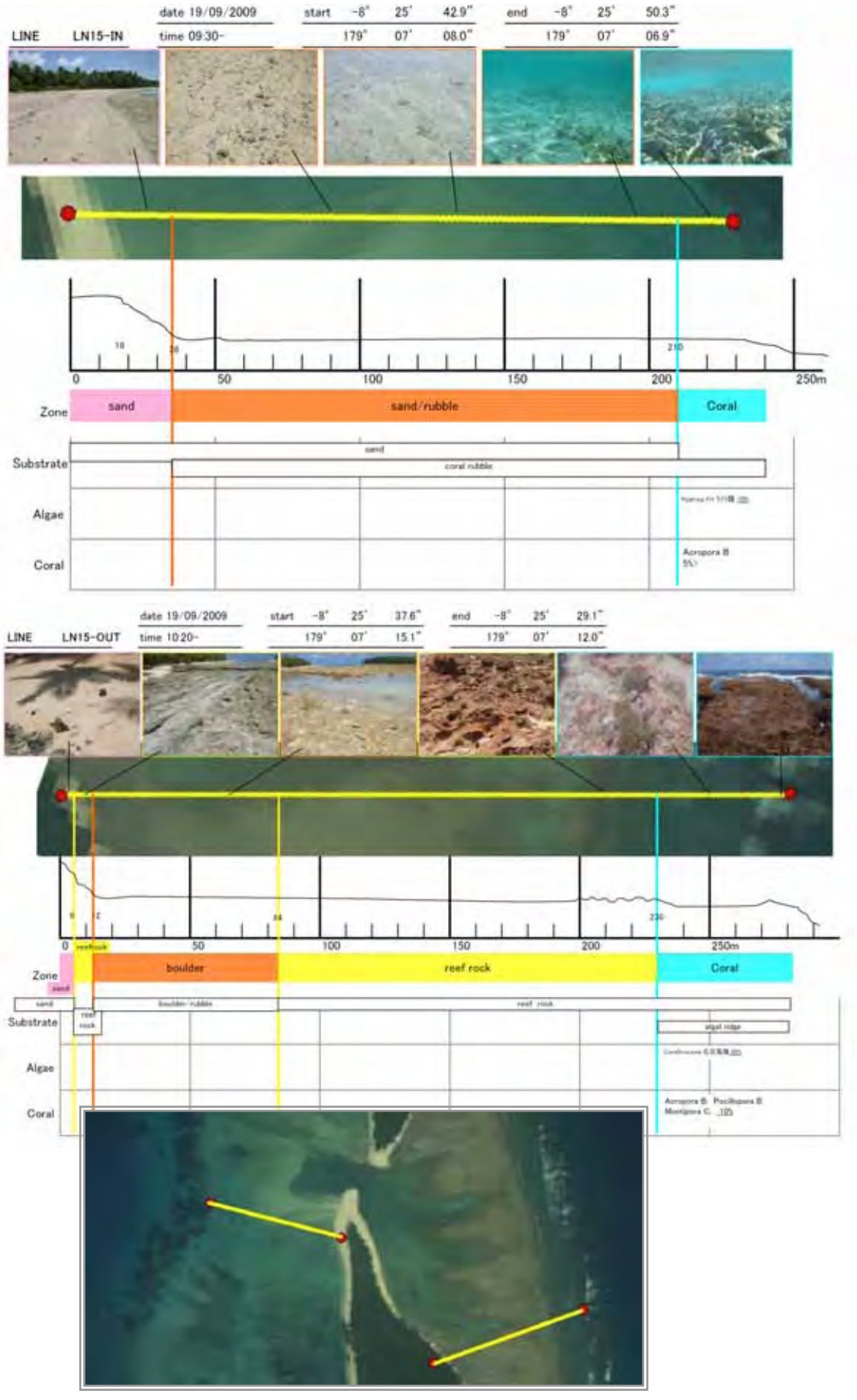

LINE LN12-OUT
Zone
sand
Coral
Substrate
reef rock
Algae
Coral
Porites M. 10%
Porites M. Acropora B. 55

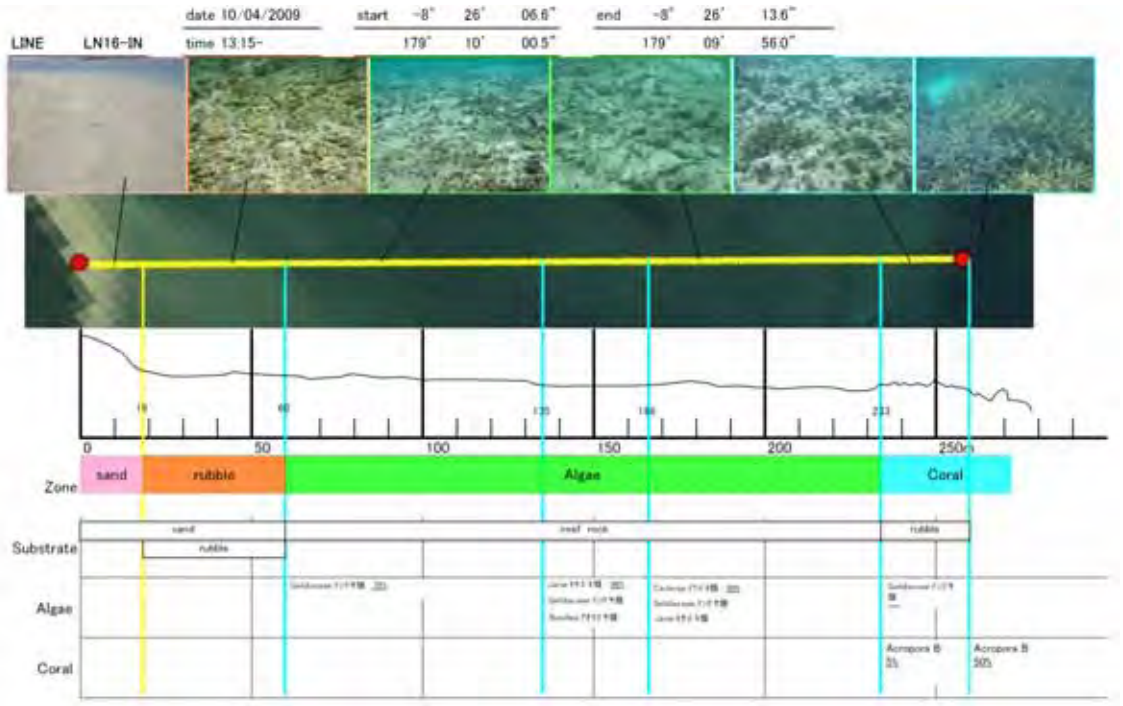

LINE LN13-IN
date 09/22/2009
time 09:30~
start -8° 29' 28.2" 179° 03' 39.2"
end -8° 21' 34.2" 179° 03' 38.2"
0
50
100
150
200m
Zone
sand
Algae
Foraminifera
Coral
Substrate
reef rock
rubble
sand
Foram Zone
Algae
Coral
Porites M
Favia M

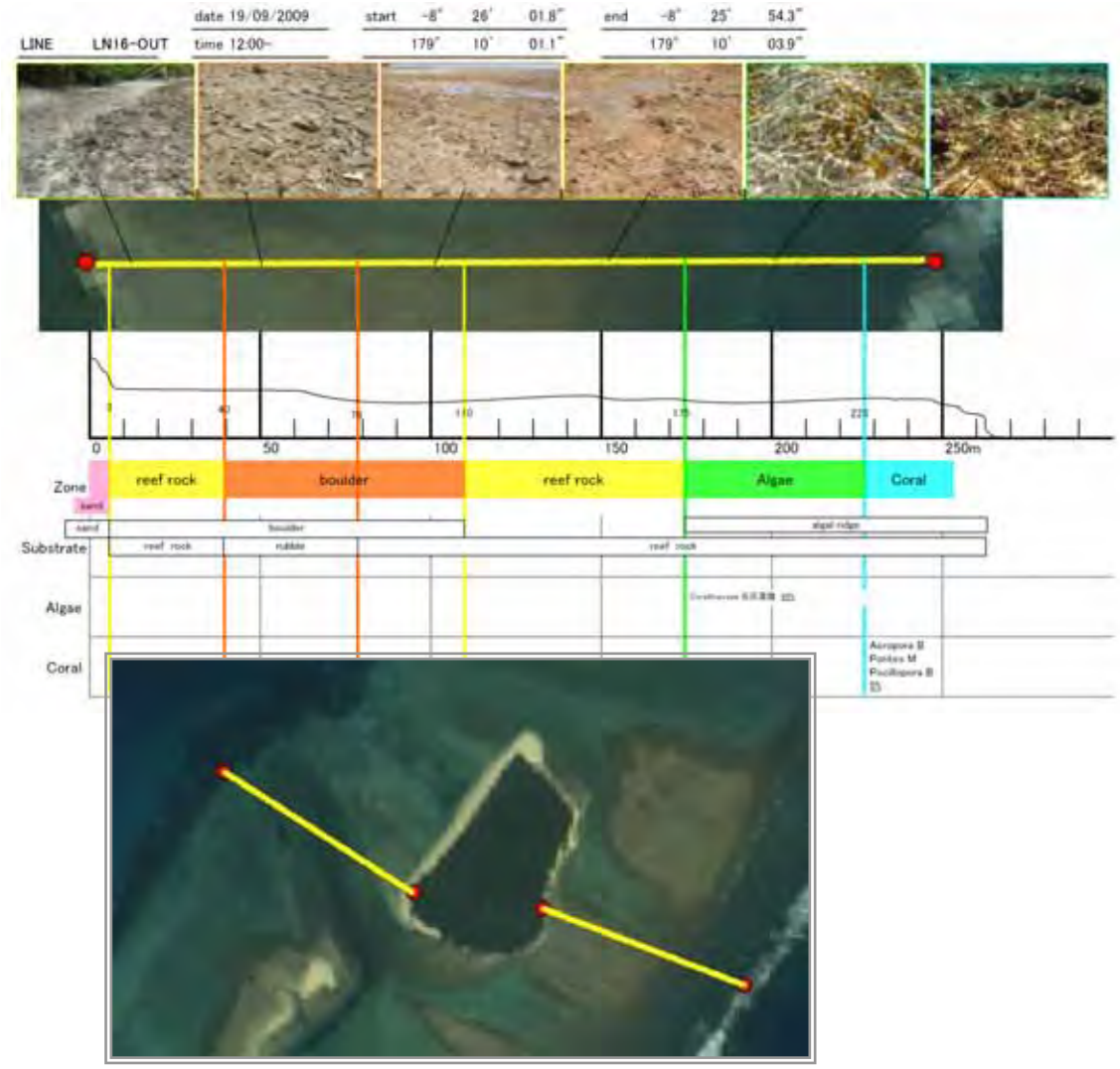

LINE L13-OUT
date 09/22/2009
time 10:50~
start -8° 29' 25.3" 179° 03' 37.5"
end -8° 29' 20.2" 179° 03' 38.4"
0
50
100
150
200m
sand
reef rock
sand
Algae
Coral
Substrate
sand
reef rock
sand
sand
coral rubble
reef rock
reef rock
Algae
Coral
Acropora B. Porites M.
Pocillopora B.
Acropora S-T

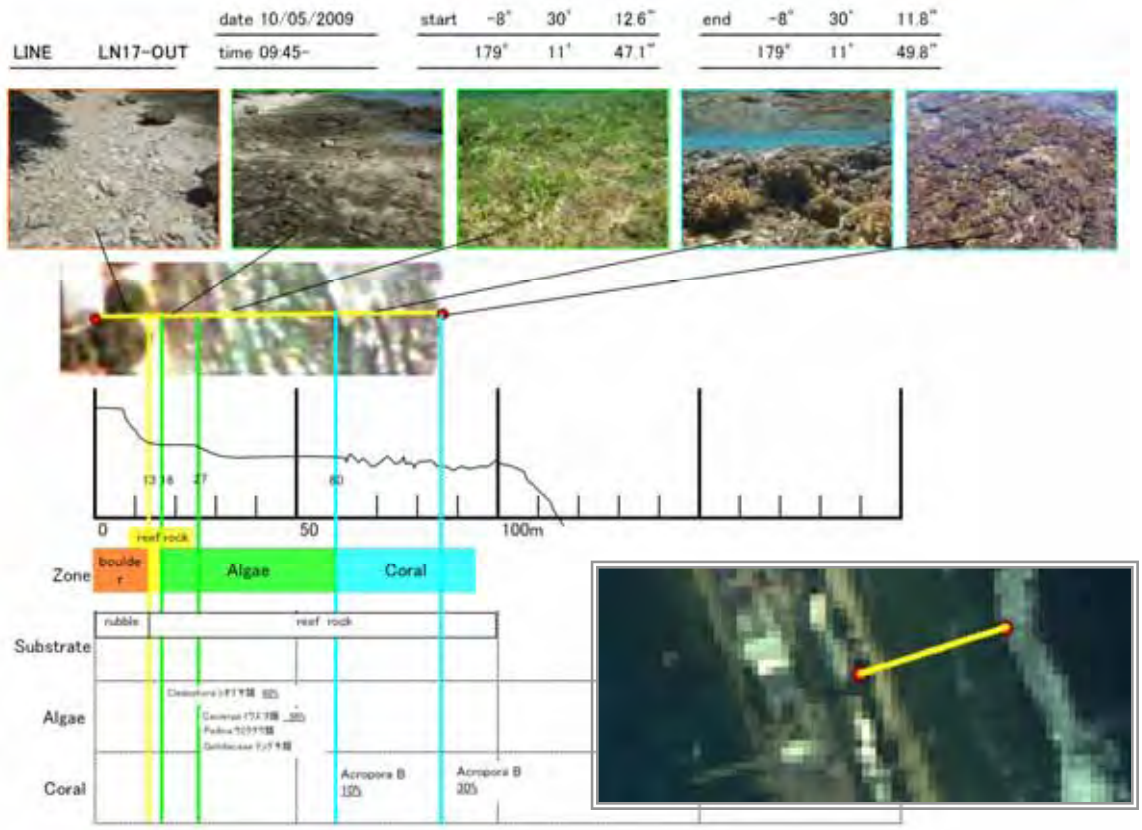

LINE LN14-IN
date 09/21/2009
time 09:30-
start -8° 27' 53.8" 179° 04' 48.7"
end -8° 27' 58.5" 179° 04' 55.6"
0
50
100
150
200
250m
Zone
sand
Algae
Coral
Substrate
Algae
Coral


LINE LN14-OUT
date 09/21/2009
time 11:15-
start -8° 27' 47.8" 179° 04' 44.8"
end -8° 27' 52.0" 179° 04' 37.8"
0
50
100
150
200
250m
Zone
sand
Algae
Coral
Substrate
Algae
Coral


LINE LN15-IN
date 19/09/2009
time 09:30-
start -8° 25' 42.9" 179° 07' 08.0"
end -8° 25' 50.3" 179° 07' 06.9"
0
50
100
150
200
250m
Zone
sand
sand/rubble
Coral
Substrate
Algae
Coral
LINE LN15-OUT
date 19/09/2009
time 10:20-
start -8° 25' 37.6" 179° 07' 15.1"
end -8° 25' 29.1" 179° 07' 12.0"
boulder
reef rock
Coral


date 10/04/2009
start -8° 26' 06.6"
end -8° 26' 13.6"
LINE LN16-IN
time 13:15-
179° 10' 00.5"
179° 09' 56.0"
0
50
100
150
200
250m
Zone
sand
rubble
Algae
Coral
Substrate
reef rock
Algae
Coral


date 19/09/2009
start -8° 26' 01.8"
end -8° 25' 54.3"
LINE LN16-OUT
time 12:00-
179° 10' 01.1"
179° 10' 03.9"
0
50
100
150
200
250m
Zone
reef rock
boulder
reef rock
Algae
Coral
Substrate
Algae
Coral


LINE LN17-OUT
date 10/05/2009
time 09:45-
start -8° 30' 12.6" 179° 11' 47.1"
end -8° 30' 11.8" 179° 11' 49.8"
0
50
100m
reef rock
Zone
boulde r
Algae
Coral
Substrate
rubble
reef rock
Algae
Coral
Acropora B
Acropora B

○ Organism Identification Results by Crop-Cutting Experiment

	Class	Order	Family	Line	2in	2in	2out	2out	2out	2out	3in	3in	3out	3out	3out	3out	4in	4in	4out	4out	4out	4out	5in	5in	5out	5out	5out	5out
				Sample No.	2	5	1	2	3	4	2	4	1	2	3	4	2	4	1	2	3	4	2	4	1	2	2	3
				distance from shoreline(m)	40	70	35	43	83	71	35	55	35	45	60	70	100	150	40	50	70	72	90	115	40	50	60
1	Rhizoda	Foraminifera	Calcarinidae	*Baculogypsina*		5	41	16	33	7			9	2	1										8	35	29
2				Calcarina		5																	13				3	
3			Amphisteginidae	*Amphisteaina lobifera*			3	3	1	11			2	2	2	5			1						32	28	24	
4				*Amphisteaina lessonii*		53					48	563						14					701	15	2	2		
5			Soritidae	Sorittinae	1	4	4	3	1	3	3		3	4		2	1		1	1					9	1	6	
6				Margmopora																								
				total(numbers)	1	67	48	22	35	21	51	563	14	8	3	7	1	14	2	1	0	0	714	15	51	66	62
1	Cyanop	Oscillatoria	Phormidiaceae	Phormidiaceae sp.	0.000		0.033		0.056		0.005							+		+				0.002			
2			Oscillatoriales	*Lyngbya* sp.		+	+	1.595	0.678	0.010	+	+	0.010	0.005	0.010	+	+	+	0.256	+	0.005	0.145		0.005	0.337	0.045	0.020	
3	Chlorop	Cladophorales	Anadyomenaceae	*Microdictyon okamurae*		+																						
4			Cladophoraceae	*Cladophora* sp.			+	+			+		0.002		0.090						+	+						
5				*Rhizoclonium* sp.				0.194																				
6		Siphonocladales	Boodleaceae	*Boodlea coacta*	0.245				0.452	0.091	0.010			0.033	0.005	0.651						0.010			0.225	0.056		
7			Siphonocladaceae	*Bergesenia forbesii*									1.611						5.746	3.105					0.005	0.090	0.021	
8				*Cladophoropsis* sp.																	+							
9			Valoniaceae	*Dictyosphaeria cavernosa*	0.098										0.030						1.427				0.315			
10				*Valonia aegagropila*						0.870	0.005				0.005													
11				*Valonia* sp.																								
12		Caulerpales	Caulerpaceae	*Caulerpa cupressoides* var. *lycopodium f.amicorum*																								
13				*Caulerpa nummularia*																								
14				*Caulerpa racemosa* var. *clavifera f.macrophysa*													0.946						0.471					
15				*Caulerpa serrulata* var. *serrulata f.lata*																								
16				*Caulerpa taxifolia*			0.275	0.035	0.040		0.065		1.289	0.043					0.213	0.078					0.092	0.085	0.018	
17				*Caulerpa urvilleana*																								
18				*Caulerpa* sp.		0.005																						
19				*Caulerpella ambigua*												0.015											0.005	
20			Udoteaceae	*Avrainvillea amadelpha*																								
21				*Halimeda discoidea*																								
22				*Halimeda incrassata*																								
23				*Halimeda micronesica*		5.475					7.368																	
24				*Halimeda opuntia*													1.215						5.581	0.061				
25				*Halimeda simulans*																								
26				*Halimeda* sp.																								
27		Bryopsidales	Bryopsidaceae	*Bryopsis* sp.																								
28			Dasycladaceae	*Acetabularia parvula*																								
29	Phaeoph	Fucales	Fucaceae	*Cystoseira* sp.																								
30			Sphacelariales	*Sphacelaria* sp.		+		+			+														0.002				
31		Dictyotales	Dictyotaceae	*Dictyota* sp.			1.078		0.033																			
32				*Lobophora variegata*				0.008		1.912	0.005	0.015	1.767	0.034						0.509	0.868				0.321			
33				*Lobophora* sp.																0.832								
34				*Padina australis*							0.804																	
35				*Padina* sp.		0.005		+																				
36		Fucales	Sargassaceae	*Sargassum* sp.				0.085																0.353			0.469	
37				*Turbinaria conoides*																							0.124	
38	Rhodop	Corallinales	Corallinaceae	*Jania capillacea*	0.031			0.044	+	1.947	0.004		+	0.104	0.205	1.952	+			+	0.041	0.083		+	0.449	0.162		
39				Corallinaceae sp.																								
40		Gelidiales	Gelidiaceae	Gelidiaceae sp.							0.005								0.005	0.001					0.005			
41			Wurdemanniaceae	*Wurdemannia* sp.			0.041			0.045				0.072	0.015	0.098								0.236			0.090	
42		Bonnemaisoniales	Bonnemaisoniaceae	*Asparagopsis taxiformis*											0.641													
43		Gigartinales	Hypneaceae	*Hypnea pannosa*																		0.285	0.615					
44				*Hypnea* sp.																								
45		Rhodymeniales	Champiaceae	*Champia parvula*																								
46				*Lomentaria* sp.			+																					
47				*Lomentaria* sp.																								
48			Rhodymeniaceae	*Gelidiopsis intricata*	1.963		0.269	0.194	0.113	0.243			0.002	0.102	2.241	0.205									1.348	1.134	0.587	
49				*Gelidiopsis* sp.																								
50		Ceramiales	Ceramiaceae	*Anotrichium tenue*																								
51				*Centroceras clavulatum*																								
52				*Ceramium* sp.				+		0.003				+	+	+					+			+				
53				*Sporidia filamentosa*																								
54				Ceramiaceae sp.					+																			
55			Rhodomelaceae	*Chondria* sp.		+				+	+						+											
56				*Herposiphonia parca*											0.031													
57				*Herposiphonia* sp.	0.008		+	+			+	0.008			0.003													
58				*Laurencia* sp.										+		0.225							+					
59				*Polysiphonia* sp.		0.698	0.010			0.008	0.045			+		0.030		0.051				+			0.025	0.010	0.008	
60				*Tolypiocladia glomerulata*								+																+
61											0.020						0.002	2.097										
				species	9	7	10	13	7	9	16	6	7	9	12	11	6	4	4	6	8	8	3	9	10	8	11	
				total(g)	2.345	6.183	1.706	2.158	1.372	5.126	0.968	7.391	2.914	2.126	3.275	3.211	2.163	2.148	6.220	3.184	3.099	1.721	5.581	1.130	3.122	1.582	1.342	

Attention 1) The foraminifera is a number of individuals. The plant shows the wet weight. Attention 2) "+" of the plant shows less than 0.001g

	Class	Order	Family	Line	6in	6in	6out	6out	7in	7in	7out	7out	8in	8in	8out	8out	9in	9in	9out	9out	10in	10in
				Sample No.	2	4	1	2	3	2	4	1	2	3	2	5	1	2	4	1	2	3	2	4
				distance from shoreline(m)	80	120	46	50	65	40	74	62	65	76	70	166	36	41	58	120	150	58	61	69	80	119
1	Rhizopodea	Foraminiferida	Calcarinidae	*Baculogypsina*			199	146	68			3	21		2		37	27				1	17			
2				Calcarina																						
3			Amphisteginidae	*Amphistegina lobifera*			8	13	13								8	20		2		3	11			
4				*Amphistegina lessonii*				2																		
5			Soritidae	Soritinae	2		5	2	5									4		2		2	33			
6				Marginopora																						
				total(numbers)	2	0	212	163	86	0	0	3	21	0	2	0	45	51	0	4	0	5	1	61	0	0
1	Cyanop	Oscillatoriales	Phormidiaceae	Phormidiaceae sp.			+					+			+		+							+		
2			Oscillatoriaceae	*Lyngbya* sp.	0.001		0.025	0.002	0.012			+	+		+		+							+	0.005		
3	Chlorop	Cladophorales	Anadyomenaceae	*Microdictyon okamurae*																						
4			Cladophoraceae	*Cladophora* sp.			0.002	+														0.008				
5				*Rhizoclonium* sp.																						
6		Siphonocladales	Boodleaceae	*Boodlea coacta*				0.005														0.004				
7			Siphonocladaceae	*Boergesenia forbesii*																						
8				*Cladophoropsis* sp.																						
9			Valoniaceae	*Dictyosphaeria cavernosa*																		1.163				
10				*Valonia aegagropila*	0.062					0.015												0.081	0.427	0.172			
11				*Valonia* sp.																						
12		Caulerpales	Caulerpaceae	*Caulerpa cupressoides* var. *lycopodium f.amicorum*																						
13				*Caulerpa nummularia*					0.035																	
14				*Caulerpa racemosa* var. *clavifera f.macrophysa*																0.134						
15				*Caulerpa serrulata* var. *serrulata f.lata*											0.498	0.202										
16				*Caulerpa taxifolia*	0.105		0.085																			
17				*Caulerpa urvilleana*																						
18				*Caulerpa* sp.						0.115																
19				*Caulerpella ambigua*			0.005																			
20			Udoteceae	*Avrainvillea amadelpha*																		5.484		6.341		
21				*Halimeda discoidea*														2.687	5.299							
22				*Halimeda incrassata*																						
23				*Halimeda micronesica*																						
24				*Halimeda opuntia*				10.251	0.327						6.122	+					10.614					8.625
25				*Halimeda simulans*																						
26				*Halimeda* sp.																						
27		Bryopsidales	Bryopsidaceae	*Bryopsis* sp.																						
28		Dasycladales	Polyphysaceae	*Acetabularia parvula*																						
29	Phaeoph	Ectocarpales	Ectocarpaceae	*Ectocarpus* sp.														0.002				0.015				
30		Sphacelariales	Sphacelariaceae	*Sphacelaria* sp.																						
31		Dictyotales	Dictyotaceae	*Dictyota fridabilis*			2.105	0.667																		
32				*Dictyota* sp.		1.185					0.032															
33				*Lobophora variegata*				0.004	0.485					0.585				0.559								
34				*Lobophora* sp.																						0.035
35				*Padina australis*						1.815																
36				*Padina* sp.			4.266	0.082			0.514															
37		Fucales	Sargassaceae	*Sargassum* sp.								2.794	12.185													
38				*Turbinaria conoides*																						
39	Rhodop	Corallinales	Corallinaceae	*Jania capillacea*				+	0.002	0.098			+	0.015										0.057	+	
40				Corallinaceae sp.						0.102			+			0.085										
41		Gelidiales	Gelidiaceae	Gelidiaceae sp.			0.531																			
42			Wurdemanniaceae	*Wurdemannia* sp.					0.005															0.045		
43		Bonnemaisonales	Bonnemaisoniaceae	*Asparagopsis taxiformis*							0.093															
44		Gigartinales	Hypnaceae	*Hypnea pannosa*			0.040				0.623	0.105		0.025												
45				*Hypnea* sp.					0.324		0.005							0.020			0.002			0.002		0.025
46		Rhodymenia	Champiaceae	*Champia parvula*					0.005																	
47				*Lomentaria* sp.																						
48			Rhodymeniaceae	*Gelidiopsis intricata*					0.405									0.038								
49				*Gelidiopsis* sp.																						
50		Ceramiales	Ceramiaceae	*Anotrichium tenue*				0.315																		
51				*Centroceras clavulatum*						0.005		0.002		+										0.002		+
52				*Ceramium* sp.																						
53				*Spyridia filamentosa*				+	+									+	+	0.035	0.010			0.002	+	+
54				Ceramiaceae sp.		0.004																				
55				*Chondria* sp.			+				+					+		+	0.001							0.002
56			Rhodomelaceae	*Herposiphonia parca*																						
57				*Herposiphonia* sp.		0.002				0.010														0.002		
58				*Laurencia* sp.		0.008				+	+				+	+		+			+		+			
59				*Polysiphonia* sp.					0.082			0.015		0.008								0.008		0.114		+
60				*Tolyptiocladia glomerulata*		+										+							+			
61					0.001					0.010																
				species	6	5	10	9	11	9	7	6	4	7	3	5	2	8	4	3	5	5	7	8	6	5
				total(g)	0.173	1.235	7.334	11.011	1.682	2.165	1.272	2.916	12.185	0.633	6.122	0.085	0.498	0.819	2.690	5.468	10.626	1.271	5.923	0.390	6.371	8.662

Attention 1)The foraminifera is a number of individuals. The plant shows the wet weight. Attention 2)"+" of the plant shows less than 0.001g.

	Class	Order	Family	Line	10out	10out	10out	11in	11in	11out	11out	12in	12in	12in	12in	12out	12out	12out	12out	12out	12out	13in	13in	13out
				Sample No.	1	2	3	2	4	1	2	1	2	3	4	1	2	3	4	5	6	7	8	2	5	1
				distance from shoreline(m)	55	62	65	45	65	70	78	30	100	250	280	80	126	180	235	265	311	340	425	50	140	50
1	Rhizopodia	Foraminiferida	Calcarinidae	*Baculogypsina*			1						3	7	1	8	79	578	981	305	197	371	458	4	76	3
2				*Calcarina*												1		5	8	1	3					
3			Amphisteginidae	*Amphistegina lobifera*	2	1	6									21	72	208	421	165	61	48	129		18	8
4				*Amphistegina lessonii*										2	2	1	1		4		2			4	4	5
5			Soritidae	*Soritinae*			8		3			2	2	7	6	11	8	11	12	7	2	10	9	2	1	1
6				*Marginopora*								1				5	1	21	8	16		8	5	4	2	
				total(numbers)	2	1	15	0	3	0	0	3	5	16	9	47	161	823	1434	494	265	437	601	14	101	17
1	Cyanoph	Oscillatoriales	Phormidiaceae	*Phormidiaceae sp.*			0.035		0.020								+	0.030		+			+	+	+	
2			Oscillatoriaceae	*Lyngbya sp.*		+	0.122	+	0.050	+	+	+	+	+	0.004	+			0.015	0.020	0.020	0.002	+	0.010	+	0.001
3	Chloroph	Cladophorales	Anadyomenaceae	*Microdictyon okamurae*									1.248			0.797	0.047	0.362	0.085	0.405	0.902	0.636	0.485	0.085	0.205	0.080
4			Cladophoraceae	*Cladophora sp.*				+												+						
5				*Rhizoclonium sp.*																						
6		Siphonocladales	Boodleaceae	*Boodlea coacta*																						
7			Siphonocladaceae	*Boergesenia forbesii*																						
8				*Cladophoropsis sp.*																						
9			Valoniaceae	*Dictyosphaeria cavernosa*												0.146				0.085		0.173		0.215		
10				*Valonia aegagropila*															0.510	0.045	0.113	0.045	0.177			
11				*Valonia sp.*																0.110						
12		Caulerpales	Caulerpaceae	*Caulerpa cupressoides var.lycopodium f.amicorum*																						
13				*Caulerpa nummularia*																						
14				*Caulerpa racemosa var.clavifera f.macrophysa*					0.515																	
15				*Caulerpa serrulata var.serrulata f.lata*																						
16				*Caulerpa faxifolia*																						
17				*Caulerpa urvilleana*	2.527	1.612	1.845						0.149	1.144	1.583		1.033	0.199	0.826					1.417	1.215	0.727
18				*Caulerpa sp.*																						
19				*Caulerpella ambigua*																						
20			Udoteceae	*Avrainvillea amadelpha*																						
21				*Halimeda discoidea*																						
22				*Halimeda incrassata*				4.135																		
23				*Halimeda micronesica*																						
24				*Halimeda opuntia*					11.542																	
25				*Halimeda simulans*							12.898															
26				*Halimeda sp.*						8.941																
27		Bryopsidales	Bryopsidaceae	*Bryopsis sp.*																						
28		Dasycladales	Polyphysaceae	*Acetabularia parvula*																						
29	Phaeoph	Ectocarpales	Ectocarpaceae	*Ectocarpus sp.*																	0.002	0.005				
30		Sphacelariales	Sphacelariaceae	*Sphacelaria sp.*										+			+	0.001						+		
31		Dictyotales	Dictyotaceae	*Dictyota friabilis*																						
32				*Dictyota sp.*																						
33				*Lobophora variegata*																						
34				*Lobophora sp.*																						
35				*Padina australis*																						
36				*Padina sp.*																						
37		Fucales	Sargassaceae	*Sargassum sp.*																						
38				*Turbinaria conoides*																						
39	Rhodoph	Corallinales	Corallinaceae	*Jania capillacea*	+							1.164	0.010			+								+	+	0.002
40				*Corallinaceae sp.*																				0.105		
41		Gelidiales	Gelidiaceae	*Gelidiaceae sp.*	+							+														
42			Wurdemanniaceae	*Wurdemannia sp.*			0.002												0.045							
43		Bonnemaisoniales	Bonnemaisoniaceae	*Asparagopsis taxiformis*																						
44		Gigartinales	Hypneaceae	*Hypnea pannosa*					0.181															0.095		
45				*Hypnea sp.*							+			0.005												0.002
46		Rhodymeniales	Champiaceae	*Champia parvula*																						
47				*Lomentaria sp.*																						
48				*Lomentaria sp.*																						
49			Rhodymeniaceae	*Gelidiopsis intricata*																						
50				*Gelidiopsis sp.*																						
51		Ceramiales	Ceramiaceae	*Anotrichium tenue*																					+	
52				*Centroceras clavulatum*										0.015				0.002	0.005							0.005
53				*Ceramium sp.*	0.005	0.001		0.035	0.005	+	+		+	0.001	0.018		+	+	+	+	0.005	0.008		0.020		+
54				*Spyridia filamentosa*																					0.004	
55				*Ceramiaceae sp.*																						
56			Rhodomelaceae	*Chondria sp.*	0.001														0.020	0.005	0.010	0.091	0.010	+		0.005
57				*Herposiphonia parca*									+											0.004	0.002	
58				*Herposiphonia sp.*	0.002								0.008	0.001	0.001		0.001		0.005	0.005	0.005	0.020	0.004	0.008	0.004	0.008
59				*Laurencia sp.*									0.012	0.005	+		0.010	0.025		0.040		0.008				
60				*Polysiphonia sp.*			+		+										+	0.002	+	0.004	+		+	
61				*Tolypiocladia glomerulata*																						
				species	6	3	5	4	7	3	4	3	8	8	5	4	7	7	10	12	8	10	7	13	10	9
				total(g)	2.535	1.613	2.004	4.170	12.313	8.941	12.898	1.164	1.427	1.171	1.606	0.943	1.091	0.619	1.511	0.717	1.057	0.992	0.676	1.959	1.430	0.830

Attention 1)The foraminifera is a number of individuals. The plant shows the wet weight. Attention 2)「+」of the plant shows less than 0.001g.

	Class	Order	Family	Line	13out	13out	13out	14in	14in	14out	14out	14out	14out	15in	15in	15out	15out	15out	15out	16in	16in	16out	16out	16out	16out	17out	17out
				Sample No.	2	3	4	2	5	1	3	4	6	2	4	1	3	4	6	2	4	1	3	4	6	1	3
				distance from shoreline(m)	70	124	150	40	250	30	140	160	250	150	230	85	207	250	280	190	250	180	210	220	240	38	65
1	Rhizopodia	Foraminiferida	Calcarinidae	*Baculogypsina*							1															1	1
2				*Calcarina*			1	2			25	2	23														
3			Amphisteginidae	*Amphistegina lobifera*	2	11		5								2	3	3	1			16	9	31	8	3	2
4				*Amphistegina lessonii*		2	12		3	2	20	6															
5			Soritidae	Soritinae	4	4		2	2		1				4	7		3		2		8			3	5	1
6				*Marginopora*																		6					
				total(numbers)	6	17	13	9	5	2	47	8	23	0	4	9	3	6	1	2	0	30	9	31	11	9	4
1	Cyanophy	Oscillatorial	Phormidiaceae	*Phormidiaceae sp.*	+			0.014		+		0.005			+	0.121						+		+			0.015
2			Oscillatoriaceae	*Lyngbya sp.*	0.001	0.012	0.002	0.027	0.105	0.015	+	0.025	+	+	0.010	1.091	+			0.712	+	+	0.044	0.108	0.025	0.085	0.061
3	Chlorop	Cladophoral	Anadyomenac	*Microdictyon okamurae*	0.206	0.403	0.428		2.242										0.499				1.326	1.950	0.184		
4			Cladophorace	*Cladophora sp.*	+										+					0.010						+	
5				*Rhizoclonium sp.*																							
6		Siphonocladi	Boodleaceae	*Boodlea coacta*				0.081						0.814						0.140							
7			Siphonocladac	*Boergesenia forbesii*																							
8				*Cladophoropsis sp.*																							
9			Valoniaceae	*Dictyosphaeria cavernosa*	0.050														0.519			0.021			0.360		
10				*Valonia aegagropila*					0.090									0.085				0.030	0.105	0.217	0.120	0.060	0.015
11				*Valonia sp.*																							
12		Caulerpales	Caulerpaceae	*Caulerpa cupressoides var lycopodium f.amicorum*							0.291						1.258										
13				*Caulerpa nummularia*																							
14				*Caulerpa racemosa var clavifera f.macrophysa*																1.492							
15				*Caulerpa serrulatu var serrulata f.lata*						1.114																	
16				*Caulerpa faxifolia*																						1.617	
17				*Caulerpa urvilleana*	1.008	0.813						1.749						1.945									
18				*Caulerpa sp.*																							
19				*Caulerpella ambigua*																							
20			Udoteceae	*Avrainvillea amadelpha*																							
21				*Halimeda discoidea*			3.418																				
22				*Halimeda incrassata*																							
23				*Halimeda micronesica*							10.105	0.418															
24				*Halimeda opuntia*									10.799														
25				*Halimeda simulans*																							
26				*Halimeda sp.*						0.039																	
27		Bryopsidales	Bryopsidacea	*Bryopsis sp.*				0.010																			
28		Dasycladale	Polyphysacea	*Acetabularia parvula*				0.005																		0.005	
29	Phaeoph	Ectocarpale	Ectocarpacea	*Ectocarpus sp.*																							
30		Sphacelarial	Sphacelariace	*Sphacelaria sp.*					0.015									+			+			+		0.001	0.080
31		Dictyotales	Dictyotaceae	*Dictyota friabilis*																							
32				*Dictyota sp.*						0.002																	
33				*Lobophora variegata*																		0.715	0.147	0.085	0.721		
34				*Lobophora sp.*															0.208								
35				*Padina australis*																							
36				*Padina sp.*																							
37		Fucales	Sargassaceae	*Sargassum sp.*																							
38				*Turbinaria conoides*																							
39	Rhodoph	Corallinales	Corallinaceae	*Jania capillacea*	0.005	+		0.136		+	+	0.030		+		0.015		+	0.005	0.002	0.002	+	0.025	0.040	+	0.269	0.146
40				*Corallinaceae sp.*																0.080							
41		Gelidiales	Gelidiaceae	*Gelidiaceae sp.*																						0.135	
42			Wurdemannia	*Wurdemannia sp.*																						0.085	
43		Bonnemaiso	Bonnemaisoni	*Asparagopsis taxiformis*																							
44		Gigartinales	Hypneaceae	*Hypnea pannosa*																	1.595					0.215	0.492
45				*Hypnea sp.*		0.005				0.005																	
46		Rhodymenia	Champiaceae	*Champia parvula*																							
47				*Lomentaria sp.*																				0.005			
48				*Lomentaria sp.*																							
49			Rhodymeniac	*Gelidiopsis intricata*																						0.809	3.933
50				*Gelidiopsis sp.*																							
51		Ceramiales	Ceramiaceae	*Anotrichium tenue*																							
52				*Centroceras clavulatum*								0.010		0.015				0.009							0.045		
53				*Ceramium sp.*	+	0.001	0.010		0.124	0.001	0.010	0.005	+		+		+		0.001	+	+	0.001		0.010	+		
54				*Spyridia filamentosa*					0.004																		
55				*Ceramiaceae sp.*																							
56			Rhodomelace	*Chondria sp.*	0.010	0.010	0.010				0.005		0.001					0.015	+			0.004		0.010		0.005	
57				*Herposiphonia parca*					0.035										0.004			0.002	0.008	0.020	0.005		
58				*Herposiphonia sp.*	+	0.002	0.015		0.249	+	0.001							+	0.001		0.003	+	0.030	0.045	+	0.008	+
59				*Laurencia sp.*											2.977									0.004	0.005	0.045	+
60				*Polysiphonia sp.*			0.005											+	+								+
61				*Tolypiocladia glomerulata*					0.020																		
				species	10	8	7	6	9	9	7	7	4	4	5	3	3	8	9	7	6	10	7	13	11	14	10
				total(g)	1.280	1.246	3.888	0.273	2.884	1.176	10.412	2.242	10.800	0.829	2.987	1.227	1.258	2.054	1.237	2.436	1.600	0.773	1.685	2.494	1.465	3.339	4.742

Attention 1) The foraminifera is a number of individuals. The plant shows the wet weight. Attention 2) [+]of the plant shows less than 0.001g.