

Development of a real-time depth monitoring system for small fishing gear using an acoustic telemetry technique

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Table 1 Specifications of the developed system

Units	Items	Specifications
Pinger	Size	24 mm in diameter and 100 mm in length
	Weight	77 g in air and 31 g in water
	Frequency	62.5 kHz
	Source level (propagation distance)	155 dB re 1 μ Pa at 1 m (about 500 m)
	Battery life	1 month (transmission interval is 1 s)
Surface unit	Hydrophone size	45 mm in diameter and 150 mm in length
	Receiver size	170 mm by 100 mm and 40 mm in height
	Display of Receiver	LCD panel

Table 2 Results of the evaluation experiment

Measurement number	Number of data (erroneous data)	Duration of measurement (min)	Reception ratio (%)	Percentage of erroneous data (%)	RMSE (including error) (m)	RMSE (excluding error) (m)
First	823 (165)	24	72.0	20.0	2.2	0.3
Second	210 (39)	5	92.0	18.6	3.7	0.7
Overall	1033 (204)	29	75.3	19.7	2.6	0.4

Table 3 Summary of the two implementation experiments

Date	Operation No.	Total of depth data (erroneous data)	Duration of operation (min)	Reception ratio (%)	Percentage of erroneous data (%)	Boat speed during trolling (knot)	Wind speed (m/s)
21 Nov. 2013	1	439 (2)	29	32.5	0.5	-	4.2
	2	368 (8)	27	28.9	2.2	-	4.3
	3	233 (11)	28	17.6	4.7	-	4.3
	4	368 (24)	26	30.0	6.5	-	5.3
	5	235 (36)	30	16.7	15.3	-	4.6
	6	410 (19)	33	26.3	4.6	-	4.0
	7	337 (25)	33	21.7	7.4	-	4.0
11 Mar. 2014	8	448 (36)	29	32.8	8.0	1.0 ± 0.2	0.5
	9	956 (129)	29	70.4	13.5	1.2 ± 0.3	0.9
	10	776 (162)	32	50.9	20.9	1.1 ± 0.3	1.7
	11	1265 (113)	34	79.0	8.9	1.1 ± 0.3	2.7
	12	735 (279)	45	34.3	38.0	1.2 ± 0.2	2.7
	13	936 (137)	26	75.6	14.6	1.0 ± 0.2	4.2
	14	701 (48)	38	39.3	6.8	1.0 ± 0.2	4.6

Table 4 Results of calculated error values for each operation

Operation No.	Average (m)	Standard deviation (m)
1	No data available	
2	13.8	1.3
3	10.8	2.4
4	13.3	2.6
5	12.1	1.8
6	11.8	2.3
7	11.8	2.3
8	14.4	1.8
9	12.6	2.3
10	17.2	2.5
11	15.8	2.5
12	15.5	2.1
13	14.6	1.3
14	16.6	1.4