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INVESTIGATION AND QUANTIFICATION OF ENGINE BOAT GENERATED WATER TURBULENCE EFFECTS ON FARM SHORELINE EROSION

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Keywords:
Water Turbulence; boating data; Farm Shoreline Erosion; Turbulence effect; Erosion Risk Assessment; Reclaimable farm coast

Abstract: *This work investigated and quantified engine boat generated water turbulence effects on farm shoreline erosion. Upon conduction of site identification as erosion prone area, erosion risk assessment for present and 50 years time - frame, and soil type test of the study area, site and laboratory experimentations were used to obtain values of turbulence level and shoreline erosion rate which were used in the computation of their correlation in order to acquire the level of their correspondence. In the field experimentation, turbulence level generated by 7295 engine boats was used to study its correlation with shoreline erosion rate. In controlled laboratory experiment, the interaction between waves and shorelines with regard to farm shoreline erosion were studied. Also, computations following relevant measurements and experimentation were conducted to study the effect of waves (generated from engine boats actions) on farm shoreline erosion through sediment loss, wave impact height, wave velocity, maximum shock pressure, wave energy, wave speed and wave power, for condition I (during boat passage) and condition II (during no boat passage) to quantify the effect and magnitude of these generated waves on farm shoreline erosion. Shore reclamation was also conducted at the study area to provide a solution to farm shoreline erosion prior dredging, soil improvement and cultivation to study the viability for agricultural production. It was found that the effects of engine boats generated water turbulence affected the rate of farm shoreline erosion negatively in both site and laboratory experimentations with turbulence and erosion positively correlated, and that shore reclamation proved a reliable method of re - securing erodible farm shorelines for agricultural production.*

1 INTRODUCTION

1.1 Background of the Study Water turbulence refers to the flow irregularities that possess non – laminar flow caused by disruption of the regular motion of water bodies due to influence of external force. Farm

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Shoreline erosion refers to the erosion (washing off) of valuable farm soil along the shorelines (meeting point or line of contact between a water body and land near it). When an engine boat move on a water body, released air bubbles required for boat propulsion create agitation in water, and such turbulent flow generates and sometimes, travels to shorelines with the tendency of affecting the rate of erosion on farmable shorelines. Thus, these water turbulence effects on farm shoreline erosion were investigated and quantified.

1.2 Statement of the Problem The major problem driving this research is farm shoreline erosion: a threat to farm lands within the coastal regions, that facilitates problems like; (1) Washing out of coastal vegetation and crop fields. (2) Loss of valuable farm soils. (3) Loss of aesthetics and creation of erosion sites. (4) Disruption of fish and other aquatic lives.

1.3 Aim and Objectives of the Study The aim of this study is to investigate and quantify engine boat generated water turbulence effects on farm shoreline erosion. The objectives are: (1) To determine the turbulence level of observed wave types using wave characterization technique. (2) To determine shoreline erosion rate. (3) To use the determined values of turbulence level and shoreline erosion rate in studying their correlation. (4) To determine sediment loss, wave impact height, wave velocity, shock pressure, wave energy, and wave power, for condition I (during boat passage) and condition II (during no boat passage) to understand the effect magnitude of these generated waves on shoreline erosion. (5) To study wave interaction with shoreline erosion using a laboratory built coast. (6) To proffer a solution to farm shoreline erosion and loss of coastal lands through shore reclamation.

1.4 Knowledge Gap Various erosion studies have been conducted relative to waves. Examples include the works of Kaliraj *et. al.* (2013), MacVean *et. al.* (2014), Yuan *et. al.* (2014), Bilkoovic *et. al.* (2019), Tsoukala *et. al.* (2015), e.t.c. None of the previous studies provided the effect magnitudes of wave attributes or the correlation between these waves and erosion. This study thus fills the following gaps; (1) Provision of correlation magnitude of engine boat generated water turbulent waves and farm shoreline erosion. (2) Quantification of the effect magnitude of engine boat generated water turbulent waves on farm shoreline erosion. (3) Restoration of natural coastal farmland through shore reclamation.

2 MATERIALS AND METHODS

2.1 Materials

The study area (Otu Ogwu – Kebul marine of Asaba River Niger section) in Asaba Delta Sate of Nigeria, West Africa) is the major material used. Others include; water breakers, standby engine boat, manual speed meter, metal erosion pins, professional putero power tape, *e.t.c.*

2.2 Methods

2.2.1 The Research Design

Following the needs of this study, the research design otherwise the research plans towards achieving a conclusive result are presented in Figures 2.1, 2.2, 2.3 and 2.4.

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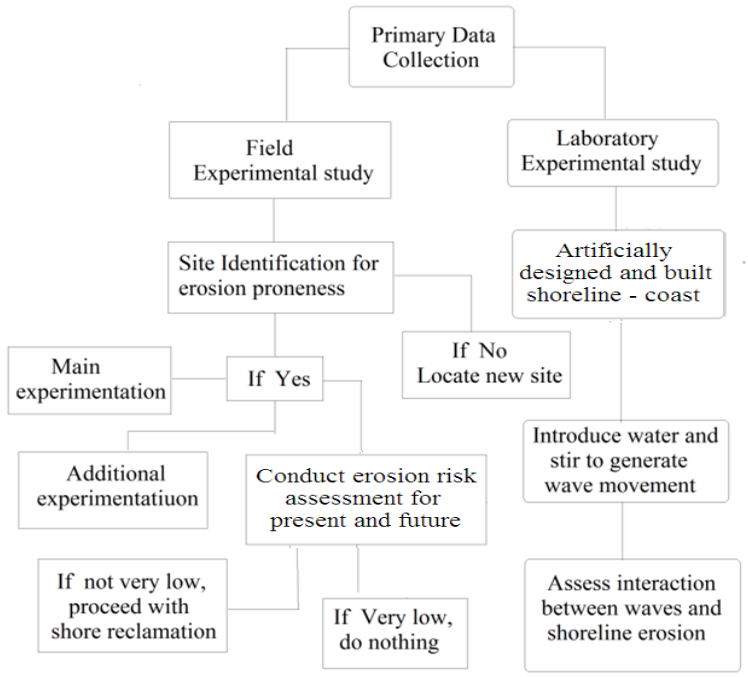

Figure 2.1: Experimental design for data collection

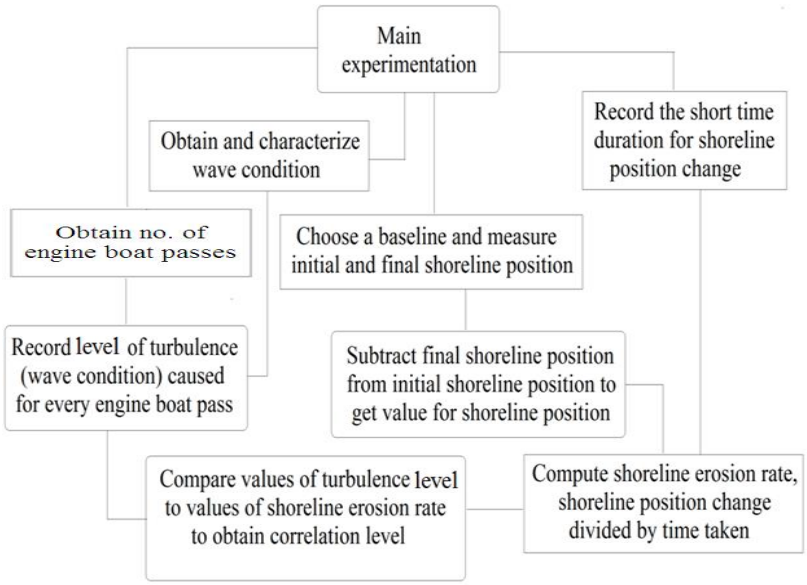

Figure 2.2: Experimental design for main experimentation

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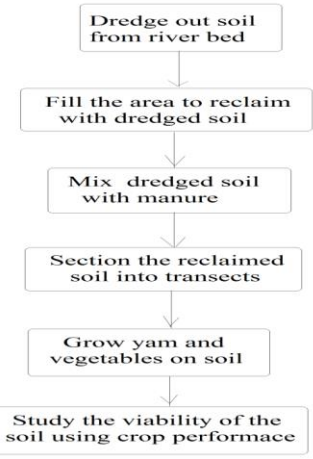

Figure 2.3: Experimental design for shore reclamation

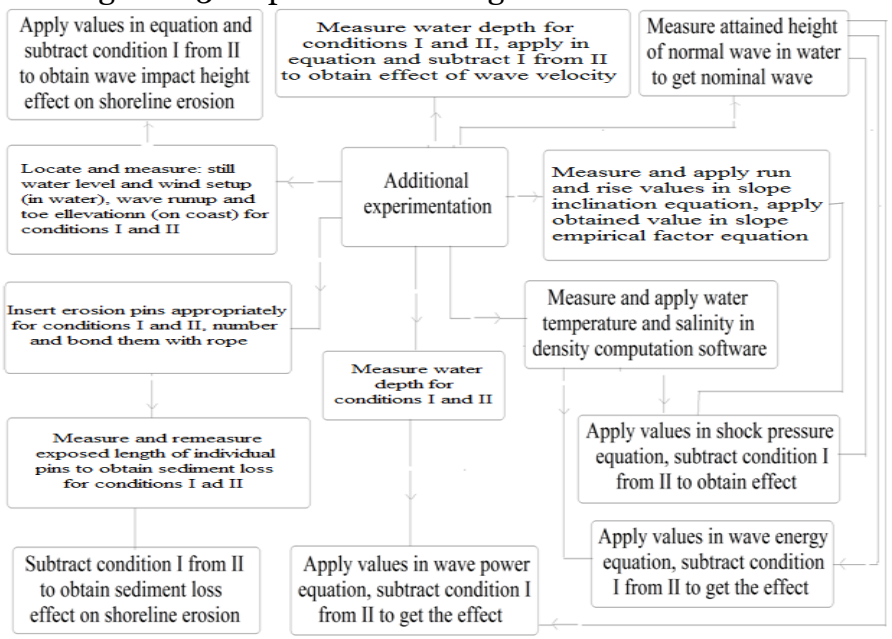

Figure 2.4: Experimental design for additional experimentation

2.2.2 The Research Process

The experimental design utilized during this research process was completely randomized design (CRD). Site identification as erosion prone area was conducted using guideline from FAO (2015). Erosion risk assessment for present and future (50 years time - frame) was computed using the risk matrix formula prior guidelines from PRIF (2017). Upon drying and weighing of 72 sub – soil samples dug, the study area soil type was obtained by conducting soil type test using the jar test procedure, and

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soil textural class diagram by American Gardening Resource (2019). Turbulence Level and turbulence rate were obtained from observed wave conditions from 7295 boat pass within 24 months interval (2years) using wave characterization technique by Tomkins *et al.* (2014). Shoreline erosion rate was computed using Cox *et al.,* (1994) formula, on the bases of obtaining the shoreline variation (Distance or depth of change between initial and final shoreline position with respect to a fixed baseline) per time. Obtained turbulence level and turbulence rate values were used in comparison with shoreline erosion rates computed using Byjus, (2020) Pearson correlation coefficient formula.

To understand wave attributes, additional experimental study was carried out to study the effect/impact of these waves on; Sediment loss (obtained by measurement of the amount of sediment loss over time prior change in level of sediment on inserted erosion pins according to Cahoon *et al.,* 2002 directives), wave impact height (obtained using method by CAE, 2019, where wave impact height is equal to still water level plus wave settings of water plus wave run-up in absence of bluff minus elevation of bluff toe), wave velocity (computed using method by Thomson brook, 2006, where, wave velocity is proportional to square roots of water depth and acceleration due to gravity), shock pressure (obtained using method by Powell *et al.,* 1985, where maximum shock pressure is equal to the multiple of density of water, acceleration due to gravity, nominal wave height and empirical factor relative to slope, while, water density of the river was computed using the water density calculator software by CSG, 2019), wave energy, wave speed and wave power (computed using formulas by Tomkins *et al.,* 2014, where, water energy per unit area of wave is equal to product of water density, acceleration due to gravity and square - two of wave height, all divided by eight, while wave speed is equal to the root of acceleration due to gravity and water depth, also, wave power being equal to the product of wave energy and wave speed). Values of these waves attributes in additional experiments were computed for two conditions, the first condition is for water depth without turbulence wave (no boat passage), and the second is for water depth during turbulence wave (during boat passage), the two conditions values were used to obtain the variation of the impacts from both waves on shoreline, this gives the amount of impact from the waves generated from the movement action of boats offshore to the shoreline.

Boat Sailing Speed was obtained using manual speed meter implanted in every boat that sought passage along the selected waterway and upon each exit the values were recorded and the meter detached. Breakwater pipes were marked and used to determine location range within the water and upon boat passage, measurement of sailing distance from shoreline were recorded and categorized for necessary computations. Sailing range values used are: 1 (1m to 15m), 2 (15m to 30m), 3 (30m to 45m), 4 (45m to 60m). Boats' class values were obtained by recording boat length measurement and categorization, where, boat class values are: class A (Boats measuring less than 16 ft), class 1 (Boats measuring more than 16 ft but less than 26ft), class 2 (Boats measuring more than 26 ft but less than 40ft), class 3 (Boats measuring more than 40 ft but less than 65ft).

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Laboratory shoreline coasts built with two types of sediments (silt and sand) as Coops *et. al.* (1996), were used to assess the erosive impact of waves, in each experiment, water was introduced and stirred to generate wave movement at beach angles of 59^0 - 70^0 used to examine shoreline erosion response to waves, turbulence level and erosion level were recorded while their correlation was computed. Dredge out sand from the river bed was used as infill on – shore to raise the soil elevation higher than the water level (leaving the water body retreating off – shore), dredged soil obtained was mixed with organic manure, NPK fertilizer and its original soil type collected from unaffected area, yams and vegetables were grown for viability of the soil productivity.

3 RESULTS

The various results obtained are presented in the following sub – tittles below.

3.1.1 Erosion Risk Assessment (Present and Future)

Coastal flooding hazards on beach side resorts infrastructures are low risk for present and high risk for year 2069. Coastal flooding hazards for Low lying houses infrastructures are low risk for present and high risk for year 2069. Coastal erosion and flooding hazards on farm yield <30m to shoreline are high risk for present and moderate risk for year 2069. Coastal flooding hazards on buildings <50m to shoreline are low risk for present and very high risk for year 2069.

3.1.2 Turbulence and Erosion Average results from year 2016 and 2017 are; turbulence level of 2 and erosion level of 2. Average erosion rates are 0.0007 m/hr for 2016 and 0.0004 m/hr for year 2017. The correlation of turbulence level and erosion level were positively large with r = + 0.6 in both 2016 and 2017. The correlation of turbulence level and erosion rate were positively medium with r = + 0.3 in 2016 and r = + 0.4 in 2017.

3.1.3 Additional Experimental Study On Wave Attributes

These wave attributes results are presented in table 3.1 below;

Table 3.1: wave attributes results

S/N	Wave Variable	Unit	Condition I	Condition II	Effect
1	Sediment Loss	cm	2.38	4.68	2.3
2	Wave Impact Height	m	7.234	7.264	0.03
3	Wave Velocity	m/s	9.60571	9.6152	0.0095
4	Maximum Shock Pressure	mm/hg or Pa	110.6424	442.5761	331.9337
5	Wave Energy	Jm^{-2}	0.0120	0.2439	0.2319
6	wave speed	ms^{-1}	9.60571	9.6152	0.0095
7	Wave Power	kw m^{-1}	0.1136	2.3143	1.9593

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3.1.4 Experimental Study On boat Attributes:

Speed range, distance range, and boat class showed negative influence on farm shoreline erosion in both year 2016 and 2017.

3.1.5 Laboratory Experiments:

The turbulence level and erosion level correlation for various slope angles resulted r = + 9 (positively large).

3.1.6 Shore Reclamation

The farm shoreline was reclaimed and the land produced favourable crop yields.

4 CONCLUSIONS

A conclusive result can be summarized (from correlation and additional experimentations) that boat generated water turbulence affects farm shoreline erosion negatively in both site and laboratory experimentations with turbulence and erosion positively correlated.

From the additional experimentation carried out, condition II (boat passage) showed more effects than condition I (no boat passage) in all sub - experimentations, signifying that boat generated water turbulent waves contributed to farm shoreline erosion. From boat attributes, effects of boat generated turbulence waves affected the rate of farm shoreline erosion.

In laboratory experimentation of wave effect on shoreline erosion, the observed results led to the conclusion that shoreline erodes faster when turbulent wave forms were introduced.

Shore reclamation proved a reliable method of securing coastal agricultural land within the shorelines.

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APPENDICES

Appendix 1: Engine boat individual Turbulence Data

Appendix 1.1: Engine boat individual Turbulence Data for 2016

Appendix 1.1.1: Engine boat individual Turbulence Data for January to April 2016

Boat No.	January				February				March				April			
	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level
1	A	35	2	2	1	37	3	2	A	35	2	3	A	37	2	1
2	A	52	2	2	1	37	2	2	A	40	1	1	A	43	2	3
3	A	28	2	3	A	43	2	2	A	40	2	3	A	35	2	3

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4	1	43	2	2	1	53	3	2	A	43	2	2	1	23	3	3
5	2	32	3	2	A	47	1	2	A	35	4	2	A	27	2	3
6	A	50	2	2	A	48	2	2	A	30	2	2	A	22	2	2
7	1	38	2	2	A	50	1	3	1	32	3	3	A	30	2	2
8	1	38	3	2	A	42	2	2	A	53	2	2	A	27	3	2
9	A	38	3	3	2	45	2	1	A	28	3	2	A	27	3	2
10	A	43	2	2	A	52	3	2	1	43	3	2	A	22	3	1
11	A	52	2	2	A	52	4	2	A	53	3	2	A	22	3	2
12	1	42	2	2	A	48	2	2	1	50	2	3	1	32	3	2
13	1	37	2	2	A	52	3	2	1	37	2	2	A	52	2	2
14	1	42	1	3	A	50	2	2	A	45	1	3	A	23	3	1
15	1	30	2	3	A	45	1	2	A	43	3	2	A	23	3	2
16	1	27	2	3	1	47	1	2	A	42	1	2	A	30	3	2
17	2	38	3	3	A	53	1	3	A	33	1	2	A	23	3	1
18	1	43	3	2	1	52	3	2	1	43	3	3	A	23	4	1
19	1	30	3	2	A	45	2	2	A	53	1	3	A	27	3	2
20	1	32	1	2	A	48	3	2	A	48	2	3	A	47	2	2
21	1	48	3	1	A	5	2	2	A	50	3	1	A	23	3	2
22	1	27	2	2	A	47	1	3	A	47	1	3	A	28	3	2
23	1	32	3	2	2	53	3	3	A	57	3	3	A	32	3	2
24	1	38	3	2	A	38	4	2	A	27	3	3	A	25	3	1
25	1	48	2	2	A	43	3	2	A	45	2	3	A	43	2	2
26	1	30	3	2	A	48	2	2	A	52	3	1	A	40	3	2
27	1	40	3	2	A	53	2	2	1	30	2	3	A	27	2	2
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44	A	27	1	3	A	45	3	2	A	40	2	1	A	37	3	2
45	1	35	2	2	A	48	3	2	A	48	2	2	1	32	2	2
46	1	33	3	2	A	52	2	2	A	37	2	3	1	20	4	2
47	A	30	2	2	1	50	2	2	2	30	3	3	1	30	3	3
48	1	28	3	1	1	47	2	2	A	38	3	1	1	25	3	3
49	1	33	3	2	A	45	3	2	A	38	4	2	A	37	2	3
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54	1	28	3	2	A	53	2	2	1	52	2	3	A	30	2	3
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56	A	47	4	1	A	47	1	2	2	45	2	3	A	37	3	3
57	A	30	2	2	A	45	2	2	2	32	3	3	A	27	3	2
58	A	38	3	2	A	52	2	3	1	53	3	2	2	32	3	2
59	A	33	2	2	A	48	1	2	2	40	2	3	A	32	2	2
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62	2	37	2	3	A	53	2	3	A	37	1	3	A	32	2	1
63	A	52	1	3	A	50	1	2	A	52	2	3	A	32	2	2
64	1	48	3	2	A	47	1	3	A	35	2	3	A	33	2	2
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68	1	32	2	2	1	52	4	2	A	40	2	3	A	32	1	3
69	1	32	3	2	1	48	3	3	A	30	2	3	A	22	2	2
70	A	40	3	2	2	48	2	2	A	32	2	3	A	27	1	3
71	1	30	1	3	1	50	3	2	A	52	1	3	A	32	2	2
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297	A	53	3	1	A	30	1	3	A	37	3	1	A	17	3	3
298	A	53	2	2	A	30	2	3	-	-	-	-	A	18	3	3
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303	1	27	4	1	1	30	3	2	-	-	-	-	A	18	2	3
304	A	20	3	2	-	-	-	-	-	-	-	-	2	20	2	2
305	A	20	2	2	-	-	-	-	-	-	-	-	A	23	3	2
306	A	20	3	2	-	-	-	-	-	-	-	-	A	18	3	2
307	1	22	1	1	-	-	-	-	-	-	-	-	A	17	2	2
308	A	23	3	2	-	-	-	-	-	-	-	-	A	17	2	1
309	2	20	3	2	-	-	-	-	-	-	-	-	A	18	2	2
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316	A	20	3	1	-	-	-	-	-	-	-	-	A	22	2	2
317	A	20	3	1	-	-	-	-	-	-	-	-	1	18	3	2
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319	2	23	2	2	-	-	-	-	-	-	-	-	A	17	2	2
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322	2	23	2	2	-	-	-	-	-	-	-	-	A	17	3	3
323	A	25	3	1	-	-	-	-	-	-	-	-	A	18	3	2
324	2	22	3	2	-	-	-	-	-	-	-	-	A	17	3	2
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326	A	20	3	2	-	-	-	-	-	-	-	-	A	18	1	2
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335	2	23	2	2	-	-	-	-	-	-	-	-	A	18	1	2
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337	-	-	-	-	-	-	-	-	-	-	-	-	A	28	2	2
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348	-	-	-	-	-	-	-	-	-	-	-	-	A	23	3	1
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363	-	-	-	-	-	-	-	-	-	-	-	-	A	20	3	2
364	-	-	-	-	-	-	-	-	-	-	-	-	A	18	3	2
365	-	-	-	-	-	-	-	-	-	-	-	-	A	18	3	1
Total	-	11333	-	-	-	9935	-	-	-	10540	-	-	-	10952.7	-	-
Av.	**A**	**34**	**3**	**2**	**1**	**33**	**2**	**2**	**A**	**35**	**3**	**3**	**A**	**30**	**3**	**2**

Appendix 1.1.2: Engine boat individual Turbulence Data for May to August 2016

Boat No.	May				June				July				August			
	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level
1	1	23	3	2	A	37	2	3	1	33	2	3	A	37	1	3
2	A	38	3	1	A	30	2	2	A	37	1	3	A	28	1	2
3	1	42	3	1	1	38	2	2	A	27	1	3	A	33	1	3
4	1	27	2	3	A	28	2	2	A	30	1	3	A	35	1	3
5	A	32	3	1	A	43	2	2	A	22	1	3	1	22	1	3
6	A	30	3	1	1	32	2	2	A	45	2	3	1	23	1	3
7	A	45	3	1	A	37	2	2	A	35	1	3	2	32	2	3
8	A	38	3	2	A	25	2	2	A	30	1	2	A	23	1	3
9	A	40	2	2	A	32	3	2	1	23	2	3	A	30	1	3
10	A	25	2	3	A	28	2	2	1	32	2	3	A	27	1	3
11	A	40	2	1	A	42	2	2	A	30	1	3	1	23	2	3
12	A	43	2	2	A	48	1	2	1	45	2	3	A	52	2	3
13	A	1.9	3	2	A	42	1	2	A	48	2	3	A	20	2	2
14	A	45	2	2	1	33	1	3	A	52	3	2	A	27	2	2
15	2	35	2	3	A	53	3	1	A	37	2	3	A	25	1	3
16	A	40	1	3	A	30	2	3	A	23	2	2	A	30	1	2
17	A	25	2	3	A	35	2	2	A	48	2	3	A	32	2	2
18	A	50	1	3	A	30	2	2	1	27	2	3	A	30	2	2
19	A	43	1	3	A	32	2	2	A	28	2	3	A	32	2	2
20	1	33	3	2	A	40	2	2	A	40	2	3	1	27	3	2
21	A	48	2	3	A	23	2	2	A	48	2	3	A	32	3	2
22	1	40	2	2	A	28	2	3	A	25	2	2	A	35	1	2
23	1	45	2	3	A	48	2	3	1	38	2	3	2	23	2	3
24	2	35	3	2	A	52	1	2	1	30	2	3	A	22	1	3
25	1	32	3	2	1	32	3	2	1	35	2	3	1	42	2	3
26	A	25	1	2	A	38	2	2	1	33	2	3	1	37	2	3
27	1	43	3	2	A	43	2	2	1	27	2	2	A	28	2	3
28	1	38	3	2	A	28	2	2	1	37	2	3	A	40	1	3
29	A	43	1	2	2	32	2	2	1	25	2	2	A	27	2	3
30	A	35	2	2	1	23	2	2	1	32	2	2	A	32	2	3
31	A	43	1	2	2	27	2	2	A	50	2	3	A	23	2	3
32	A	30	1	2	2	47	3	2	A	40	1	3	A	28	2	3
33	A	33	3	2	2	48	3	2	2	22	3	3	A	22	2	3
34	A	28	2	2	1	53	3	2	A	27	2	2	A	28	2	3
35	A	30	2	2	2	23	3	2	A	30	2	3	A	30	2	3
36	A	25	2	2	1	43	3	2	A	43	3	2	A	23	2	3
37	A	27	2	2	1	30	3	2	A	28	2	3	1	25	2	3
38	A	25	2	2	A	25	2	3	1	43	2	3	1	32	2	2
39	A	25	3	2	A	28	2	3	A	38	1	3	1	30	2	3
40	A	32	3	1	A	52	2	3	A	32	1	3	A	32	2	3
41	1	43	3	2	A	30	2	2	A	53	1	3	A	38	3	3
42	1	32	2	2	A	23	2	3	A	32	1	3	A	23	1	3
43	A	38	3	2	A	48	2	2	A	30	1	3	1	30	3	2
44	1	30	3	2	A	40	3	2	A	28	2	3	A	35	1	3
45	1	43	2	2	A	32	2	2	A	32	2	3	A	22	2	3
46	1	38	3	2	A	50	3	2	A	40	2	3	A	25	1	3
47	1	43	3	2	1	40	3	2	A	37	1	3	A	23	1	3
48	A	30	2	3	A	28	2	3	A	30	3	1	A	43	3	2
49	A	52	1	3	A	32	2	3	A	32	2	3	A	20	3	2
50	A	47	1	2	A	47	2	3	A	27	3	2	A	27	3	2
51	A	40	2	2	A	25	2	3	A	40	3	2	A	22	3	2
52	A	27	3	2	2	30	2	3	A	45	2	3	2	23	3	2
53	A	45	2	2	A	32	2	2	A	27	1	3	A	37	3	3
54	1	32	3	2	A	42	2	2	A	32	1	3	A	23	3	1
55	A	35	3	2	A	28	2	2	1	43	2	3	A	22	2	3
56	A	38	3	2	A	33	2	2	A	30	1	3	A	32	1	3
57	A	37	3	2	2	28	3	2	1	43	2	3	A	30	1	3
58	A	37	2	3	A	38	2	2	1	28	2	3	A	28	1	3

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59	A	35	3	2	A	32	2	2	2	23	3	3	1	42	2	3
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125	A	28	2	2	A	32	2	2	A	23	2	3	A	28	2	3
126	A	25	2	2	A	23	2	2	A	28	2	3	A	30	2	3
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135	A	23	3	2	A	40	3	2	1	22	2	3	2	30	3	2
136	A	22	3	1	2	22	2	2	A	48	2	3	A	40	2	3
137	A	28	3	1	A	22	2	2	A	27	1	3	A	23	2	3
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143	A	22	3	1	2	30	2	2	A	23	2	3	A	40	3	2
144	1	25	3	2	A	27	2	2	A	43	2	3	A	27	2	2

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145	A	23	2	2	A	37	2	2	1	22	2	3	A	30	3	2
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374	-	-	-	-	-	-	-	-	A	22	2	2	A	45	1	3
375	-	-	-	-	-	-	-	-	A	28	2	2	A	23	1	3
376	-	-	-	-	-	-	-	-	A	32	2	2	A	37	1	3
377	-	-	-	-	-	-	-	-	A	28	2	3	A	30	2	3
378	-	-	-	-	-	-	-	-	A	25	2	2	1	27	2	3
379	-	-	-	-	-	-	-	-	A	40	2	3	A	25	2	3
380	-	-	-	-	-	-	-	-	A	52	2	3	A	30	2	2
381	-	-	-	-	-	-	-	-	A	43	2	3	A	28	1	2
382	-	-	-	-	-	-	-	-	A	32	2	3	A	27	1	3
383	-	-	-	-	-	-	-	-	A	28	2	3	A	23	1	3
384	-	-	-	-	-	-	-	-	A	40	2	3	A	22	1	3
385	-	-	-	-	-	-	-	-	A	32	2	3	A	28	1	3
386	-	-	-	-	-	-	-	-	1	30	2	3	A	22	2	2
387	-	-	-	-	-	-	-	-	A	27	2	3	-	-	-	-
388	-	-	-	-	-	-	-	-	A	25	2	2	-	-	-	-
389	-	-	-	-	-	-	-	-	A	30	3	2	-	-	-	-
390	-	-	-	-	-	-	-	-	2	28	3	2	-	-	-	-
391	-	-	-	-	-	-	-	-	A	43	2	2	-	-	-	-
392	-	-	-	-	-	-	-	-	2	32	2	2	-	-	-	-
393	-	-	-	-	-	-	-	-	2	22	2	3	-	-	-	-
394	-	-	-	-	-	-	-	-	A	28	1	3	-	-	-	-
395	-	-	-	-	-	-	-	-	A	38	2	3	-	-	-	-
396	-	-	-	-	-	-	-	-	A	33	1	2	-	-	-	-
397	-	-	-	-	-	-	-	-	1	22	2	2	-	-	-	-
Total	-	10211.9	-	-	-	9331	-	-	-	12938	-	-	-	11501	-	-
Av.	**A**	**29**	**2**	**2**	**A**	**32**	**2**	**2**	**A**	**33**	**2**	**3**	**A**	**30**	**2**	**3**

Appendix 1.1.3: Engine boat individual Turbulence Data for September to December 2016

Boat	September	October	November	December

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No.	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level
1	A	27	2	3	A	22	1	3	1	42	4	1	A	37	2	2
2	A	30	2	3	1	30	2	2	1	30	4	1	A	22	3	1
3	1	32	2	3	1	22	3	2	1	32	4	1	A	27	2	2
4	A	40	2	3	1	27	3	1	A	23	3	2	A	22	2	2
5	A	27	2	3	1	22	3	2	1	53	3	1	A	22	3	1
6	A	37	2	2	A	30	3	2	A	30	3	1	1	47	4	1
7	A	22	2	3	1	45	3	1	A	32	4	1	A	25	3	1
8	A	32	2	3	1	48	3	3	2	43	4	1	A	22	3	2
9	A	28	2	3	1	27	2	3	1	37	4	1	A	28	1	2
10	1	23	2	3	2	23	3	2	A	25	3	1	2	32	2	2
11	A	30	1	2	1	25	3	2	1	48	3	1	A	22	2	2
12	A	32	1	3	A	23	3	2	A	27	3	2	A	27	2	3
13	A	30	1	3	A	30	3	2	A	32	2	1	A	45	3	1
14	A	48	1	3	A	45	3	2	A	32	4	1	A	48	3	1
15	1	28	2	3	1	32	3	2	A	27	3	1	1	40	3	1
16	A	35	2	3	A	30	3	2	A	28	3	2	1	30	3	1
17	A	23	2	3	A	27	3	2	A	38	3	2	1	23	3	1
18	A	27	2	3	A	23	3	2	A	25	3	2	A	32	3	1
19	1	32	2	2	A	23	3	1	A	52	3	1	A	38	3	1
20	1	27	2	2	A	27	3	2	A	28	3	1	A	43	2	1
21	2	22	1	3	A	32	3	2	A	23	3	1	1	30	3	1
22	1	47	1	3	1	28	3	2	A	32	3	1	A	32	2	2
23	1	27	2	3	A	22	3	2	A	22	3	1	A	40	1	3
24	A	32	1	3	2	32	3	2	2	28	3	2	A	45	3	1
25	A	52	1	3	A	42	3	2	2	32	3	1	A	22	3	1
26	A	25	1	3	A	27	3	2	A	23	3	2	A	27	2	3
27	A	30	2	2	A	22	3	1	A	22	2	3	A	52	2	1
28	A	27	4	1	A	30	3	2	A	30	3	1	A	45	3	1
29	2	32	2	3	A	23	3	2	A	38	3	1	A	32	3	1
30	A	38	2	2	A	28	3	2	A	25	3	1	A	37	3	1
31	A	30	1	2	A	32	3	2	2	30	4	1	A	22	3	1
32	A	32	1	2	A	28	3	2	A	27	3	1	A	22	3	1
33	A	43	1	3	2	40	3	2	A	22	3	1	A	47	3	1
34	A	40	1	3	1	23	3	2	A	32	3	1	A	40	3	1
35	A	47	1	3	1	22	3	2	1	30	3	2	A	40	2	1
36	A	35	1	3	2	30	3	2	A	25	3	1	A	43	3	1
37	A	23	1	3	1	23	3	2	A	22	3	1	A	30	3	1
38	A	22	2	2	1	50	3	2	A	32	3	1	A	30	3	1
39	A	22	2	2	1	28	4	1	A	43	3	1	1	37	3	3
40	A	25	1	3	A	28	2	2	A	22	3	1	2	27	1	3
41	A	32	2	3	A	32	3	1	A	47	3	1	2	40	4	1
42	A	28	2	3	A	30	3	2	A	52	4	1	A	47	4	1
43	1	43	2	2	A	23	3	1	A	43	3	1	1	48	1	3
44	A	47	2	2	A	22	3	2	A	48	3	2	A	30	3	1
45	A	32	2	2	A	27	3	1	A	48	2	2	A	40	2	1
46	A	33	2	2	A	32	3	2	A	45	1	2	A	50	1	3
47	A	43	1	3	A	25	3	2	A	42	2	3	A	27	2	1
48	A	40	2	3	A	22	3	2	2	45	2	2	A	25	2	1
49	A	30	2	3	A	27	3	2	1	40	2	2	A	43	3	1
50	2	28	2	3	A	28	3	2	A	32	2	2	A	48	2	1
51	A	23	2	2	A	43	3	2	A	40	2	2	A	25	3	1
52	A	32	2	3	A	30	3	2	A	48	3	1	A	22	2	1
53	A	22	2	3	1	42	3	2	A	40	2	2	A	30	3	1
54	A	30	2	3	A	32	3	1	A	40	2	1	A	42	4	1
55	A	42	2	3	A	28	3	2	A	35	2	1	1	28	2	2
56	A	28	1	3	A	23	3	2	A	27	2	1	A	25	3	2
57	A	22	2	2	A	37	3	2	A	32	2	2	A	23	2	2
58	A	27	2	2	A	32	3	2	A	28	2	2	1	30	3	2
59	A	35	2	2	A	25	3	2	A	53	2	2	A	25	3	1
60	A	37	1	3	A	27	3	2	A	23	3	2	A	28	3	1
61	A	32	2	3	A	23	3	2	A	30	3	2	A	28	3	1
62	A	23	1	3	A	53	3	2	A	23	3	2	A	25	1	2
63	A	22	1	3	1	30	2	2	A	28	3	2	2	48	3	1
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65	A	27	1	3	A	28	3	2	A	43	3	1	A	23	3	1
66	A	52	1	1	A	32	3	2	A	37	3	2	A	47	3	1
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68	A	23	1	3	A	47	3	2	1	22	3	1	A	23	3	1
69	A	22	1	3	A	43	3	2	A	32	1	2	A	27	3	1
70	A	30	1	3	A	23	3	2	A	32	1	3	A	32	3	1
71	A	32	1	3	A	32	3	2	A	50	3	1	A	40	3	1
72	A	28	1	3	A	42	3	2	A	45	3	2	A	45	2	2
73	A	33	1	2	A	22	2	2	A	23	3	2	A	48	1	2
74	A	43	2	2	A	28	3	2	A	30	3	2	A	25	1	1
75	A	23	1	2	A	25	3	2	A	32	3	1	A	30	1	3
76	A	32	1	2	A	27	3	2	A	23	2	3	A	23	1	3
77	A	28	1	3	A	23	2	2	A	35	3	2	A	30	3	1
78	A	38	1	3	1	25	3	2	A	25	3	2	1	28	4	1
79	A	35	1	3	2	22	3	2	2	30	3	2	A	40	2	3
80	A	22	1	3	1	32	3	2	A	27	3	2	1	55	1	3
81	A	27	2	2	2	23	2	2	2	23	3	2	A	28	1	3

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141	A	22	2	3	A	30	2	2	A	32	3	2	A	37	1	1
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147	A	25	2	3	A	37	1	2	A	45	3	1	A	20	1	2
148	2	22	1	3	1	23	2	2	1	48	2	2	A	23	3	1
149	A	32	2	2	A	22	1	2	A	38	3	1	A	30	2	1
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156	A	23	2	3	A	23	2	1	A	30	3	1	A	27	3	1
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158	A	28	2	3	A	22	2	2	A	23	2	1	A	37	3	1
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166	A	28	1	3	A	38	3	2	2	43	4	1	A	28	1	3
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168	A	30	1	3	A	22	3	2	A	37	2	1	A	35	3	1
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191	A	35	1	2	A	30	2	2	A	40	2	2	A	45	2	3
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193	1	27	1	2	A	23	1	3	A	48	2	2	A	48	3	1
194	1	23	4	1	A	42	1	3	-	-	-	-	A	23	3	1
195	1	32	2	2	A	48	1	3	-	-	-	-	A	22	3	1
196	A	22	2	3	A	23	1	3	-	-	-	-	A	23	3	1
197	2	22	2	3	A	30	1	2	-	-	-	-	A	30	3	1
198	A	27	2	3	A	32	1	3	-	-	-	-	1	27	3	1
199	1	23	2	3	A	23	1	3	-	-	-	-	A	32	1	3
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204	A	25	2	3	A	22	2	3	-	-	-	-	1	40	3	1
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206	A	48	2	3	A	25	2	3	-	-	-	-	1	43	2	3
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208	A	27	2	3	A	45	1	3	-	-	-	-	1	30	3	1
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211	A	30	1	3	1	32	2	3	-	-	-	-	2	22	3	1
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218	A	28	2	3	A	22	1	3	-	-	-	-	A	30	3	1
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223	1	38	1	2	1	32	3	2	-	-	-	-	-	-	-	-
224	1	45	2	2	1	25	2	3	-	-	-	-	-	-	-	-
225	1	43	2	2	1	23	3	3	-	-	-	-	-	-	-	-
226	1	23	2	3	1	30	2	3	-	-	-	-	-	-	-	-
227	1	25	2	3	1	28	3	3	-	-	-	-	-	-	-	-
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254	A	23	1	2	1	23	4	2	-	-	-	-	-	-	-	-
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303	A	23	1	3	A	22	1	3	-	-	-	-	-	-	-	-
304	A	23	2	2	A	32	3	2	-	-	-	-	-	-	-	-
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317	-	-	-	-	1	27	2	3	-	-	-	-	-	-	-	-
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319	-	-	-	-	1	22	2	3	-	-	-	-	-	-	-	-
320	-	-	-	-	2	28	3	2	-	-	-	-	-	-	-	-
321	-	-	-	-	1	35	2	2	-	-	-	-	-	-	-	-
322	-	-	-	-	1	43	2	2	-	-	-	-	-	-	-	-
323	-	-	-	-	1	30	2	2	-	-	-	-	-	-	-	-
324	-	-	-	-	1	23	1	3	-	-	-	-	-	-	-	-
325	-	-	-	-	1	48	2	3	-	-	-	-	-	-	-	-
326	-	-	-	-	1	22	2	2	-	-	-	-	-	-	-	-
327	-	-	-	-	2	32	3	3	-	-	-	-	-	-	-	-
Total	-	8956	-	-	-	9969	-	-	-	6557	-	-	-	7487	-	-
Av.	**A**	**29**	**2**	**3**	**A**	**30**	**3**	**2**	**A**	**34**	**3**	**1**	**A**	**34**	**3**	**1**

Note: Assigned values are; Low, L: 1; High, H: 2; Very High, VH 3.

Appendix 1.2: Engine boat individual Turbulence Data for 2017

Appendix 1.2.1: Engine boat individual Turbulence Data for January to April 2017

B No	January				February				March				April			
	Boat Class	Boat Sailing	Boat Sailing	Turb. Level	Boat Class	Boat Sailing	Boat Sailing	Turb. Level	Boat Class	Boat Sailing	Boat Sailing	Turb .	Boat Class	Boat Sailing	Boat Sailing	Turb .

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		Speed (km/hr)	distance Range			Speed (km/hr)	distance Range			Speed (km/hr)	distance Range	Level		Speed (km/hr)	distance Range	Level
1	A	30	1	2	1	43	2	2	A	28	3	1	A	32	3	2
2	A	42	2	2	A	25	4	1	A	25	3	2	A	37	2	2
3	A	37	2	2	1	38	3	2	A	23	3	1	A	23	3	1
4	A	28	2	2	1	48	3	2	2	35	2	3	A	20	2	2
5	A	23	3	2	1	55	4	1	1	30	3	1	1	28	2	2
6	1	23	2	3	A	30	2	2	A	27	2	3	A	32	2	2
7	A	32	2	2	1	43	2	2	A	22	2	1	A	32	3	1
8	A	45	2	2	1	25	2	3	A	28	1	3	A	18	3	1
9	A	43	3	1	2	32	2	2	A	25	1	3	2	27	2	2
10	A	22	3	2	1	25	2	2	A	22	1	3	2	30	3	2
11	A	30	2	2	2	20	2	2	A	40	1	3	2	32	3	2
12	A	45	2	2	1	28	3	2	A	47	1	2	1	27	3	2
13	A	25	2	2	A	37	2	3	A	48	2	2	2	20	1	3
14	A	30	2	2	A	48	3	2	A	45	3	2	2	32	2	2
15	1	32	3	2	A	47	3	2	A	47	2	3	A	27	2	2
16	A	37	2	2	A	38	2	2	A	45	3	2	A	23	3	2
17	A	40	2	2	A	30	3	2	A	32	2	2	A	20	2	2
18	A	32	2	2	A	23	1	3	A	28	3	2	A	27	2	2
19	A	52	1	3	A	28	2	3	2	30	3	2	A	32	2	2
20	A	30	2	2	A	32	1	3	1	32	2	2	A	23	3	1
21	1	25	3	2	A	45	3	2	1	43	2	2	A	22	2	2
22	1	47	3	2	A	40	3	2	1	48	3	2	A	28	1	2
23	1	43	3	1	A	48	2	2	A	42	3	2	A	32	2	2
24	A	48	3	2	A	38	3	1	A	53	2	2	A	22	3	2
25	1	50	3	2	A	28	2	2	A	45	3	2	A	32	2	2
26	A	27	3	2	A	32	1	2	A	48	2	2	A	27	3	2
27	1	30	3	2	A	25	3	2	A	48	3	2	A	32	2	3
28	A	23	2	2	A	22	1	3	A	43	3	1	A	37	3	2
29	A	25	3	1	A	43	3	2	A	25	3	1	A	30	1	3
30	A	22	2	3	A	48	2	2	A	30	3	1	1	32	2	3
31	A	32	2	3	A	23	2	2	A	45	2	1	2	27	1	3
32	A	22	1	3	A	30	2	3	A	28	3	1	1	30	3	2
33	A	22	2	3	A	27	1	3	A	32	3	1	1	30	2	3
34	A	23	2	2	1	32	3	2	A	30	3	1	A	25	1	3
35	A	27	4	1	A	50	2	2	A	33	1	3	A	25	2	2
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39	A	22	3	1	A	48	1	3	A	35	1	3	A	30	3	2
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42	A	45	1	2	A	48	1	2	A	22	3	2	A	28	3	2
43	A	40	1	2	A	53	1	2	A	23	2	2	A	37	3	2
44	A	42	1	2	A	50	2	2	A	30	3	2	A	35	2	2
45	A	47	1	2	A	43	2	2	A	27	1	3	A	27	2	2
46	1	42	1	2	A	47	2	2	1	50	3	2	A	23	2	2
47	A	48	1	2	A	45	1	2	A	43	2	2	A	20	2	2
48	A	27	1	2	A	55	1	3	A	47	3	2	A	30	3	2
49	A	23	1	2	A	48	2	1	1	48	3	2	A	32	3	2
50	A	28	2	2	A	43	3	2	1	35	2	2	A	37	4	1
51	A	32	1	2	A	42	3	2	A	45	2	2	A	28	3	2
52	A	28	2	2	A	47	2	2	1	43	3	2	A	25	2	2
53	A	25	2	2	A	43	1	3	A	48	3	2	A	22	3	1
54	A	28	2	3	A	52	2	1	A	47	2	2	A	22	3	1
55	A	23	2	2	A	38	1	3	A	37	3	2	A	27	3	1
56	A	37	2	2	A	23	1	3	A	27	2	2	A	30	3	1
57	A	27	2	2	A	27	1	3	A	30	3	2	A	20	2	2
58	A	23	2	2	A	23	3	2	A	32	2	2	A	40	2	2
59	A	22	2	2	A	27	3	2	A	27	3	2	A	43	3	1
60	A	47	2	2	A	47	2	2	A	35	3	2	A	22	3	1
61	A	48	2	2	A	45	3	2	A	45	3	2	A	23	3	1
62	A	47	2	2	A	25	3	2	A	48	2	2	A	38	2	2
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71	A	32	3	1	A	43	1	3	A	30	3	1	A	35	1	2
72	A	22	3	2	A	47	1	3	A	32	3	1	A	42	1	2
73	A	25	3	3	A	48	2	2	A	52	3	1	A	47	2	2
74	1	30	3	2	A	52	1	2	A	23	3	2	A	43	1	2
75	A	32	3	2	A	43	2	2	A	28	2	2	A	38	1	2
76	A	25	3	2	A	47	3	2	A	35	2	2	A	45	3	1
77	A	23	3	2	2	42	2	2	A	48	3	2	1	40	3	1
78	A	53	2	2	A	30	1	3	A	43	2	1	A	38	2	2
79	A	48	3	2	A	43	3	2	A	37	2	1	A	45	3	2
80	A	43	3	3	A	35	3	2	A	25	3	1	A	38	2	2
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306	-	-	-	-	-	-	-	-	-	-	-	-	A	28	1	2
307	-	-	-	-	-	-	-	-	-	-	-	-	A	32	1	2
308	-	-	-	-	-	-	-	-	-	-	-	-	A	22	3	2
309	-	-	-	-	-	-	-	-	-	-	-	-	A	23	3	2
310	-	-	-	-	-	-	-	-	-	-	-	-	A	28	2	1
311	-	-	-	-	-	-	-	-	-	-	-	-	A	20	2	2
312	-	-	-	-	-	-	-	-	-	-	-	-	A	22	3	2
313	-	-	-	-	-	-	-	-	-	-	-	-	A	22	2	2
314	-	-	-	-	-	-	-	-	-	-	-	-	A	25	3	2
315	-	-	-	-	-	-	-	-	-	-	-	-	1	22	2	2
Total	-	8059	-	-	-	9384	-	-	-	10273	-	-	-	9957	-	-
Av.	**A**	**32**	**3**	**2**	**A**	**37**	**2**	**2**	**A**	**37**	**3**	**2**	**A**	**32**	**3**	**2**

Appendix 1.2.2: Engine boat individual Turbulence Data for May to August 2017

B No	May				June				July				August			
	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level
1	A	28	3	1	2	27	1	3	A	20	2	3	1	43	3	3
2	A	28	3	1	1	37	1	3	A	28	3	3	1	23	3	2
3	A	32	3	2	2	45	2	3	A	23	2	3	A	28	1	3
4	A	25	2	2	2	52	2	3	1	28	2	3	1	22	3	3
5	A	27	2	2	1	32	2	3	A	33	2	3	A	23	3	2
6	A	27	3	1	A	25	2	3	A	22	3	2	A	32	3	2
7	A	32	2	2	2	28	4	1	1	18	2	3	A	27	3	2
8	A	52	2	2	A	32	1	3	1	25	2	3	A	22	2	3
9	A	40	2	2	A	32	2	3	1	23	2	3	2	25	3	3
10	1	43	2	2	1	23	2	3	1	20	2	3	A	30	3	2
11	A	40	3	2	A	45	2	3	1	27	2	3	1	20	3	2
12	1	32	2	2	A	40	2	3	1	28	2	3	A	27	1	2
13	1	37	2	2	A	38	1	3	1	22	3	3	A	23	3	3
14	A	40	2	2	A	37	2	3	A	20	2	3	A	20	1	3
15	2	35	3	2	1	43	2	3	A	23	2	3	A	22	3	3
16	1	52	2	2	A	38	2	3	A	18	2	3	A	43	3	3

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17	A	25	2	2	A	42	2	2	A	25	2	3	A	23	1	3
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189	A	53	3	2	A	25	3	2	A	22	3	3	A	38	3	2
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207	A	48	3	2	A	47	2	3	A	48	3	3	A	22	1	3
208	A	50	3	2	A	52	2	3	A	28	2	3	A	20	3	3
209	A	48	3	2	A	47	3	2	A	32	2	3	A	32	3	3
210	A	45	3	2	A	43	2	3	A	62	3	2	1	22	3	3
211	A	38	3	2	A	38	2	3	A	37	2	3	A	22	2	3
212	A	43	2	2	A	35	2	3	A	25	3	2	A	27	3	2
213	A	45	3	2	A	40	2	3	A	27	3	2	A	52	3	3
214	A	48	2	2	A	48	2	3	A	30	2	2	A	40	2	3
215	A	32	3	1	A	53	2	3	A	32	1	2	A	48	2	3
216	A	42	4	1	A	28	2	3	A	32	4	1	A	37	3	3
217	A	47	4	1	A	32	2	3	A	23	1	3	A	28	3	1
218	1	47	2	2	A	33	2	3	1	50	2	3	A	23	3	3
219	1	38	2	2	A	38	2	3	1	32	2	3	1	32	3	3
220	A	30	2	2	A	30	2	3	A	27	1	3	A	23	2	3
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327	-	-	-	-	-	-	-	-	A	28	1	3	-	-	-	-
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340	-	-	-	-	-	-	-	-	1	23	3	1	-	-	-	-
341	-	-	-	-	-	-	-	-	A	28	2	3	-	-	-	-
342	-	-	-	-	-	-	-	-	A	30	2	2	-	-	-	-
343	-	-	-	-	-	-	-	-	1	22	2	2	-	-	-	-
Total	-	8459	-	-	-	11395	-	-	-	10342	-	-	-	8608	-	-
Av.	**A**	**33**	**3**	**2**	**A**	**36**	**3**	**3**	**A**	**30**	**2**	**3**	**A**	**27**	**3**	**3**

Appendix 1.2.3 Engine boat individual Turbulence Data for September to December 2017

B No	September				October				November				December			
	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level	Boat Class	Boat Sailing Speed (km/hr)	Boat Sailing distance Range	Turb. Level
1	A	20	2	1	1	27	2	2	A	25	2	2	A	28	3	1
2	1	23	2	3	A	47	3	2	A	30	3	1	A	32	3	1
3	A	32	3	1	A	43	3	2	1	23	3	1	1	23	3	1
4	A	20	2	3	A	47	3	2	A	22	3	1	A	20	3	1
5	A	22	2	3	A	40	3	2	A	47	3	1	2	27	4	2
6	1	27	3	3	A	32	3	2	A	23	3	1	A	28	3	1
7	A	22	3	2	A	43	3	1	1	48	4	1	A	40	2	2

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8	2	22	3	3	A	48	3	2	A	38	3	2	1	35	3	2
9	1	18	4	1	2	47	3	2	A	37	3	2	A	43	3	2
10	A	27	3	3	A	38	3	2	2	28	3	1	A	47	3	1
11	A	28	4	2	A	45	2	2	1	23	3	1	A	38	4	1
12	A	23	2	3	A	35	3	2	1	30	3	2	A	37	3	1
13	A	27	2	2	A	45	3	2	2	20	4	1	1	28	4	1
14	1	20	2	3	A	40	3	2	A	22	3	1	2	42	4	1
15	A	23	2	2	A	48	3	3	1	28	3	1	1	35	3	1
16	A	35	2	3	1	47	4	3	A	30	3	1	1	40	3	1
17	A	30	2	2	1	37	4	3	A	25	3	1	A	45	3	2
18	A	25	3	2	1	28	2	3	A	30	3	1	A	48	2	1
19	A	28	2	2	A	32	3	2	1	23	3	1	A	43	3	1
20	A	23	3	2	A	38	3	2	A	33	3	1	A	38	2	3
21	A	32	3	2	A	47	3	3	A	27	3	1	A	35	3	2
22	A	23	3	2	A	43	3	2	A	22	3	1	A	35	1	2
23	A	22	3	2	A	37	3	3	A	28	2	1	A	47	3	1
24	A	28	3	2	A	48	3	2	A	52	2	1	A	40	2	2
25	A	25	3	3	A	47	3	2	A	30	2	1	A	35	3	1
26	A	38	3	3	A	52	3	2	A	37	2	1	A	38	3	1
27	A	52	3	3	A	45	3	2	A	27	3	1	1	40	4	1
28	1	45	2	3	A	43	3	2	A	32	3	2	A	35	3	1
29	2	27	2	3	A	53	3	2	A	25	3	1	A	37	3	2
30	A	30	2	3	A	43	3	3	2	20	2	3	A	48	3	2
31	A	25	3	3	A	40	3	2	A	30	4	1	A	40	3	2
32	A	22	3	1	A	48	3	2	A	23	3	1	A	47	2	1
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35	A	27	2	3	A	43	2	3	2	23	2	3	A	23	3	1
36	A	32	2	3	A	37	3	3	1	28	2	1	A	28	3	1
37	A	22	2	3	2	48	2	3	1	30	2	3	A	25	2	1
38	A	43	3	3	A	42	2	3	A	30	3	1	A	30	2	1
39	A	47	2	3	A	45	1	3	A	27	3	2	A	27	2	1
40	A	40	2	3	A	38	2	3	A	23	3	1	A	33	2	1
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43	A	47	2	3	1	22	3	2	A	40	2	1	A	32	3	1
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45	1	43	3	2	2	40	3	2	A	47	2	1	A	28	3	1
46	A	35	2	3	1	30	3	2	A	38	3	1	A	23	2	2
47	A	40	2	2	A	20	3	2	A	35	2	3	A	28	3	1
48	A	30	2	2	1	25	3	2	A	32	3	1	A	23	1	2
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50	1	22	4	2	1	32	3	2	A	43	1	3	A	38	2	1
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52	A	47	2	3	A	52	3	2	A	45	3	1	A	35	2	2
53	A	32	2	3	A	42	2	2	A	45	2	3	A	43	2	2
54	A	40	2	3	A	30	3	3	A	22	2	2	A	23	2	2
55	A	45	2	3	A	32	3	3	A	43	3	1	A	25	3	1
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57	A	47	2	3	A	22	3	2	A	35	3	1	A	25	4	2
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59	A	45	2	3	A	30	3	2	A	40	2	2	A	23	2	1
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61	A	45	2	3	A	20	3	2	A	30	3	1	A	30	3	1
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79	1	40	4	3	A	22	3	2	A	28	1	1	1	30	3	1
80	A	45	2	3	A	30	3	2	A	38	3	1	1	32	3	1
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306	-	-	-	-	-	-	-	-	-	-	-	-	A	45	2	1
307	-	-	-	-	-	-	-	-	-	-	-	-	A	27	3	1
308	-	-	-	-	-	-	-	-	-	-	-	-	A	28	2	1
309	-	-	-	-	-	-	-	-	-	-	-	-	A	23	3	1
310	-	-	-	-	-	-	-	-	-	-	-	-	A	32	3	1
311	-	-	-	-	-	-	-	-	-	-	-	-	A	38	2	1
312	-	-	-	-	-	-	-	-	-	-	-	-	A	27	3	2
313	-	-	-	-	-	-	-	-	-	-	-	-	A	32	2	1
314	-	-	-	-	-	-	-	-	-	-	-	-	A	23	2	1
315	-	-	-	-	-	-	-	-	-	-	-	-	1	28	2	3
316	-	-	-	-	-	-	-	-	-	-	-	-	A	23	2	2
317	-	-	-	-	-	-	-	-	-	-	-	-	A	32	2	2
318	-	-	-	-	-	-	-	-	-	-	-	-	A	22	3	2
319	-	-	-	-	-	-	-	-	-	-	-	-	A	30	2	2
320	-	-	-	-	-	-	-	-	-	-	-	-	A	20	2	2
321	-	-	-	-	-	-	-	-	-	-	-	-	A	42	3	1
322	-	-	-	-	-	-	-	-	-	-	-	-	1	47	2	2
323	-	-	-	-	-	-	-	-	-	-	-	-	A	43	2	1
324	-	-	-	-	-	-	-	-	-	-	-	-	A	35	3	1
325	-	-	-	-	-	-	-	-	-	-	-	-	A	40	2	1
326	-	-	-	-	-	-	-	-	-	-	-	-	A	37	2	3
327	-	-	-	-	-	-	-	-	-	-	-	-	A	42	2	3
328	-	-	-	-	-	-	-	-	-	-	-	-	A	38	2	1
329	-	-	-	-	-	-	-	-	-	-	-	-	A	30	2	1
330	-	-	-	-	-	-	-	-	-	-	-	-	A	23	3	2
331	-	-	-	-	-	-	-	-	-	-	-	-	A	48	3	2
332	-	-	-	-	-	-	-	-	-	-	-	-	A	25	2	1
333	-	-	-	-	-	-	-	-	-	-	-	-	1	22	2	2
334	-	-	-	-	-	-	-	-	-	-	-	-	A	28	2	2
335	-	-	-	-	-	-	-	-	-	-	-	-	A	32	2	1
Total	-	9413	-	-	-	10250	-	-	-	10253	-	-	-	11270	-	-
Av.	**A**	**32**	**2**	**3**	**A**	**34**	**3**	**2**	**A**	**37**	**3**	**1**	**A**	**34**	**3**	**1**