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4

5 **Social perceptions of coastal hazards in the Anlo Beach Community in the** 6 **Western Region of Ghana**

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12

13 **Abstract**

14 Due to climate change, coastal areas are becoming increasingly susceptible to more frequent and
15 severe environmental catastrophes that endanger the health, safety, and way of life of coastal
16 dwellers. Understanding the social perceptions of risk and hazard-related concerns can help in the
17 development of adaptive capacity and associated management strategy preferences. This study
18 employed structured questionnaires to obtain basic information on how the households of the Anlo
19 Beach fishing community in the Western region of Ghana perceived and responded to coastal
20 hazards. The respondents ranked coastal erosion and salinization first and second, ahead of
21 seawater flooding and other hazards in terms of important risks in the study area. Responses
22 illustrated high levels of knowledge and awareness about coastal hazards but low levels of trust in
23 government and commitments in terms of taking personal mitigation measures. To varying degrees,
24 respondent characteristics such as length of residency and occupancy status are positively and
25 significantly associated with coastal hazard perception whereas the level of education was negative.
26 Generally, the findings illustrated the need for better education and awareness campaigns about
27 self-mitigation actions such as discontinuing beach sand utilization and exploiting mangroves
28 as firewood and embracing the restoration of mangrove ecosystems. More importantly, the
29 government should reconsider her earlier shelved plan of relocating the entire community to a safer
30 location.

31 **Keywords:** *Social perception; coastal hazards; coastal erosion; salinization; Anlo Beach; Ghana*
32 *coast*

33 **Introduction**

34 Globally, coastal areas are becoming more vulnerable to the impacts of increased extreme weather
35 events, storm surges, and sea-level rise due to climate change (Barnard *et al.*, 2019; Cazenave and
36 Le Cozannet, 2014; Mölter *et al.*, 2016; Neumann *et al.*, 2015) that pose threats to health, safety,
37 and livelihoods of the coastal dwellers (Elrick-Barr *et al.*, 2015; Nicholls *et al.*, 2011; Burkett and
38 Davidson, 2012). Aside from pressure resulting from the growing coastal population, most coastal
39 areas are increasingly affected by climate change-induced coastal erosion and/or flooding (Barnard
40 *et al.*, 2019) resulting from sea-level rise (Cazenave and Le Cozannet, 2014) and possible changes
41 in wind/wave conditions and storm regimes (Ruz *et al.*, 2020; Mölter *et al.*, 2016). Climate change
42 will therefore increase the vulnerability of the coastal areas to hazards.

43 Understanding public perceptions and the relative priorities given to coastal risk can help
44 in the development of adaptive capacity and associated adaptation strategies (Button, 2013; Carlton
45 and Jacobson, 2013), as perceptions tend to shape individual behaviour (Slovic, 1987; Lindell and
46 Hwang, 2008) and management strategy preferences (Slovic, 1987; Steg and Sievers, 2000;
47 Peacock *et al.*, 2005; Button, 2013). Also, Social perception of risks can constrain and influence
48 political, social, and economic activities (Leiserowitz, 2006). The household has been identified as
49 a valuable unit of analysis for perceptions of risk because it is a unit of action that exists between
50 individuals and society, where personal values, societal norms, and institutional demands converge
51 (Elrick-Barr *et al.*, 2015; Collins, 2015).

52 This paper assesses the risk perceptions and preferred strategies for facing future coastal
53 hazards at the household scale of the Anlo coastal community of the Western region of Ghana. The
54 study area was chosen because it is characterized by the problem of coastal erosion and marine
55 flooding that may likely increase in the future due to rising sea levels and a higher frequency of
56 extreme events associated with climate change (IPCC, 2012; 2021). We begin the paper by
57 outlining the methods adopted to evaluate household risk perceptions in Anlo coastal community.
58 Finally, results are discussed, highlighting variation in risk perceptions within and between the
59 communities, before outlining key considerations for policy and research.

60

61

62

63 **Study site**

64 The Anlo Beach community (Figure 1) was purposefully selected as the study site because coastal
65 flooding and shoreline erosion are increasingly impacting people, property, and ecosystems in this
66 section of the Ghana coast (CRC, 2013; Mutimukuru-Maravanyika et al., 2017). Thus, it is believed
67 that people in this area will recognize their vulnerability and have higher perceptions of risk (Brody
68 et al., 2008).

69 The Anlo Beach coastal community, comprising 740 households (population ca. 4500), is located
70 in the Shama District, Western Region of Ghana (Fig. 1). It is bordered to the north by mangroves
71 and wetlands associated with the Pra River Delta that extends from the north-eastern to the western
72 side of the community and on the south by the open Atlantic Ocean. The community, built on a
73 dune and sandwiched between the wetlands and the ocean, is highly vulnerable to floods and
74 erosion (Mutimukuru-Maravanyika et al., 2017). Although the Pra River and its associated
75 mangroves and wetland areas are highly important for livelihoods, pollution of the river by illegal
76 gold mining and indiscriminate cutting of mangroves is increasing (Mutimukuru-Maravanyika et
77 al., 2017). The dominant livelihoods in the Anlo Beach community are fishing, petty trading, fish
78 selling, and processing. Other popular occupations included: tailoring, hairdressing, catering, and
79 fabric dyeing.

80

81 **The intensity of the use of natural resources in Anlo Beach**

82 Anlo Beach has a vast array of livelihood assets and potentials and a few services. Natural capital
83 includes the sea and fisheries resources, beaches, sand, River Pra Estuary, wetlands including
84 swamps and salt marshes, mangrove swamp, mangrove forests, dry land, and farmlands. The
85 surrounding area possesses ecological features that are interesting to eco-tourism. The Pra River
86 estuary provides suitable roosting and nesting grounds for birds and marine turtles. Mangroves of
87 the genera *Avicennia*, *Rhizophora*, and *Laguncularia* are found along the entire perimeter of the
88 Pra River and its estuary and extend over three kilometres on both sides of the estuary (Okyere,
89 2015; Coastal Resources Center / Friends of the Nation, 2010). These mangroves are highly
90 exploited as the main source of firewood for cooking and smoking fish and for construction
91 purposes in the community thereby resulting in the degradation of the mangrove forest and
92 reduction in the size of this critical habitat for fish breeding activities. Degraded mangrove areas

93 are used as refuse disposal sites. In addition, sand is wined from the beach for construction purposes
 94 in the study community. This activity tends to increase coastal erosion and flooding (Kutir et al.,
 95 2022). Further north of the community has located the farmlands. Fishers in this community are
 96 actively involved in artisanal marine fishing as well as estuary fishing. Fishing and fish mongering
 97 are the major livelihood activities running from mid-July to late April while subsistence farming
 98 becomes the predominant occupation after April, lasting for about three months in the off-fishing
 99 season after which the community switches back to fishing in mid-July or early August for the
 100 main fishing season. Not all fishermen practice farming during the off-fishing months, and only a
 101 few members of the community are small-scale farmers who only fish for subsistence. Cassava and
 102 maize are the major crops produced although a few farmers cultivate cash crops such as oil palm
 103 and coconut (Okyere, 2015; Coastal Resources Center / Friends of the Nation, 2010).

104



105
 106 Fig. 1. a) Map Anlo Beach coastal fishing community. Inset: map of Ghana (sources: Mutimukuru-Maravanyika et al.,
 107 2017).

108



109

110 Figure 2. The environmental situation in the Anlo Beach community: a) erosion; b) loss of mangroves due to erosion;
111 and c) impact of salinization.

112

113 2 Materials and Methods

114 A household survey was conducted in the Anlo Beach community in the Western Region of Ghana
115 to obtain information on household risk perceptions. The survey, in which 156 respondents
116 participated, was conducted as part of the West Africa Coastal Area – mapping Vulnerability,
117 Adaptability and Resilience in changing climate (WACA-VAR) project, between July and August
118 2021 by a team of researchers from the Centre for Coastal Management-African Centre of
119 Excellence in Coastal Resilience (CCM-ACECoR), University of Cape Coast, Ghana, and the
120 Institut de Recherche pour de Developpement (IRD), Toulouse, France. The interviews were
121 conducted face-to-face with a systematic selection of every 5th household to ensure that the results
122 that will be obtained from our survey will approximate what would have been obtained if the entire
123 population had been surveyed.

124 The survey, with 156 questions, consists of several parts, out of which three are common
125 to all respondents. First, an identification of the survey site with its GPS coordinates and locality
126 (section A). Then section B is based on the characteristics of the respondents, focusing on the
127 respondents' place of residence, age, sex, professional activity, level of academic education, and
128 attachment to the place. Section C is composed of two questions, dealing with the risks linked to
129 the hazards and potentially dangerous phenomena observed and identifying the two phenomena
130 that most affected the respondents. The respondents were allowed to rank the hazards that largely
131 impact their lives, whether salinization, coastal erosion, coastal flooding, plastic pollution, or oil
132 pollution.

133 Section D corresponds to a series of detailed questions based on the most impacted hazard
134 noticed in section C. Questions were broadly structured around the manifestation of the hazard
135 observed by the respondent, its evolution in recent years, the impact of the hazard on the individual,
136 and possible measures that are taken or could be put in place in the management of these potential
137 or actual hazards (Louarn, 2020; Morand, 2021). Kobo connect software, installed on mobile
138 phones, was used to conduct the interview. In most cases, responses provided to the questionnaire
139 were used directly as binary or multi-modal variables.

140

141 *2.1 Descriptive statistics analysis*

142 A descriptive statistics analysis was performed to describe the personal characteristics of the
143 respondents, thus providing the structure of the sample.

144

145 *2.2 Construction of composite indices for Linear Regression analysis*

146 To consolidate and make more synthetic information in the evaluation of global perceptions, we
147 created composite indices from binary/multi-modal answers to basic inquiries. To do it, we
148 employed different subsets of questionnaire answers for this construction, which were sometimes
149 binary choice answers and sometimes responses on ordered qualitative scales. Each composite
150 index was calculated by adding values of 1 or 0 applied to the response categories obtained, thereby
151 creating two synthetic indices: indices of (i) perceived impact and (ii) adaptive measures. The two
152 indices were presented in the form of quantitative scores which will play, in turn, the role of the
153 dependent variable for the analyses carried out using the linear model. Each of the two synthetic
154 indices was then analyzed using a linear model. For the two indices, seven variables were used. No

155 variable taken into account in the construction of a composite index is reused as an explanatory
 156 factor for the same index, which prevents any risk of circularity in the interpretation of the results.
 157 The coefficients of the model were estimated using the Linear Regression analysis in the SPSS
 158 software. Only significant effects up to the 10% ($p < 0.1$) threshold were retained and discussed.
 159 The value of the coefficient was used to identify the direction of the effect (positive or negative)
 160 on the evolution of the index.

161

162 **3. Results**

163 **3.1 Descriptive analysis**

164 **3.1.1 Basic characteristics of the respondents**

165 Ninety-nine percent of the survey respondents lived at the study site. About 53% of them were
 166 permanent homeowners while 46.5% were non-permanent owners. Only 10% of the respondents
 167 had lived less than 10 years in the study site, indicating the majority (90 %) of them had lived in
 168 the area for more than 10 years. Of the survey respondents, 61% were females while 39% were
 169 males. Out of the entire respondents, 57.1% were between the ages of 18 and 50 years. About
 170 11.5% of the respondents had a higher tertiary education while 26.3% never went to school (Table
 171 1).

172

173 **Table 1. Descriptive statistics of the respondents**

Variable	Response	Percentage
Gender		
Female	95	60.9
Male	61	39.1
Age		
17-25	17	10.9
26-50	75	48.1
>50	64	41
Education		
Illiterate	41	26.3
Primary	59	37.8
Secondary	38	24.4
Tertiary	18	11.5

Length of residence

Permanent	83	53.2
>10 years	57	36.5
5-10 years	7	4.5
<5 years	9	5.8

Occupancy status

Permanent owners	83	53.5
Non-permanent owners	72	46.5

174
175 **3.1.2. Intensity in the usage of natural resources**
176 As shown in Table 2, freshwater, mangrove wood, and beach sand were identified by the
177 respondents to be of high use in the study area. About 75.7% of the respondents indicated high
178 usage of freshwater while 9.6 and 14.7% of the respondents, respectively, indicated low and
179 moderate utilization of freshwater. About 58.8% of the respondents indicated high use of mangrove
180 wood for domestic and professional activities, while 32.7 and 8.5% indicated low and moderate
181 usage. While beach sand was highly used by 62.8% of the respondents, river sand had low
182 utilization (by 76.7% of the respondents).

183 **Table 2. Usage of coastal natural resources in Anlo Beach based on the respondents' perception**

Freshwater usage

Low	15	9.6
Moderate	23	14.7
High	118	75.7

Mangrove wood usage

Low	50	32.7
Moderate	13	8.5
High	90	58.8

River sand usage

Low	115	76.7
Moderate	8	5.3
High	27	18

Beach sand usage

Low	43	27.6
Moderate	15	9.6
High	98	62.8

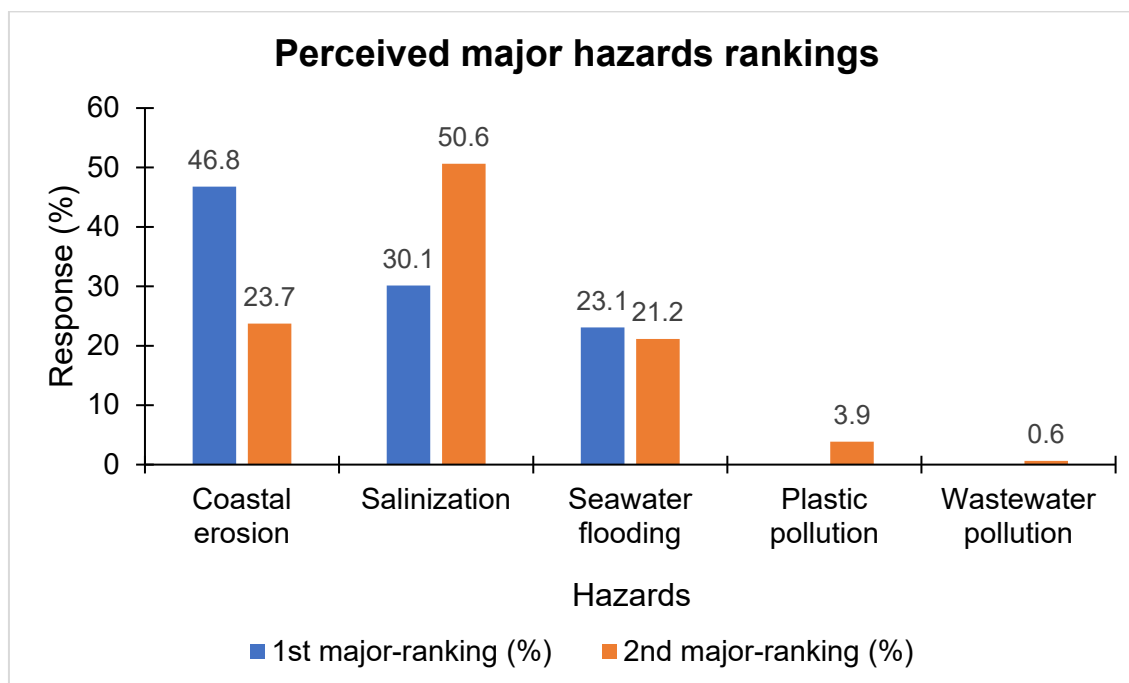
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185

186 3.1.3 Perceived coastal hazards assessment

187 To explore the level of perception of coastal hazards in the study area, first, the respondents were
 188 asked to select three hazards they perceived to have the greatest impacts on their lives and
 189 properties (Fig. 2).

190 As shown in Figure 2, coastal erosion (46.8 %) was on top of the list of the first major ranking
 191 coastal hazards perceived by the respondents in the study area, followed by salinization (30.1 %)
 192 and seawater flooding (23.1 %). Salinization (50.6 %) overwhelmingly topped the list under the
 193 second major ranking of coastal hazards perceived by the respondents, followed by coastal erosion
 194 (23.7 %) and seawater flooding (21.2 %). Plastic and wastewater pollution were not cited under
 195 the first major ranking of coastal hazards perceived by the respondents in the study area but only
 196 slightly mentioned under the second major ranking of coastal hazards perceived by the respondents
 197 (Fig. 2) whereas oil pollution and sewage pollution were never mentioned at all. Thus, coastal
 198 erosion and salinization being the first 2 major coastal hazards perceived by the respondents in the
 199 study area were considered in the present study.



200

201 Fig. 2. Major ranking of coastal hazards as perceived by the respondents

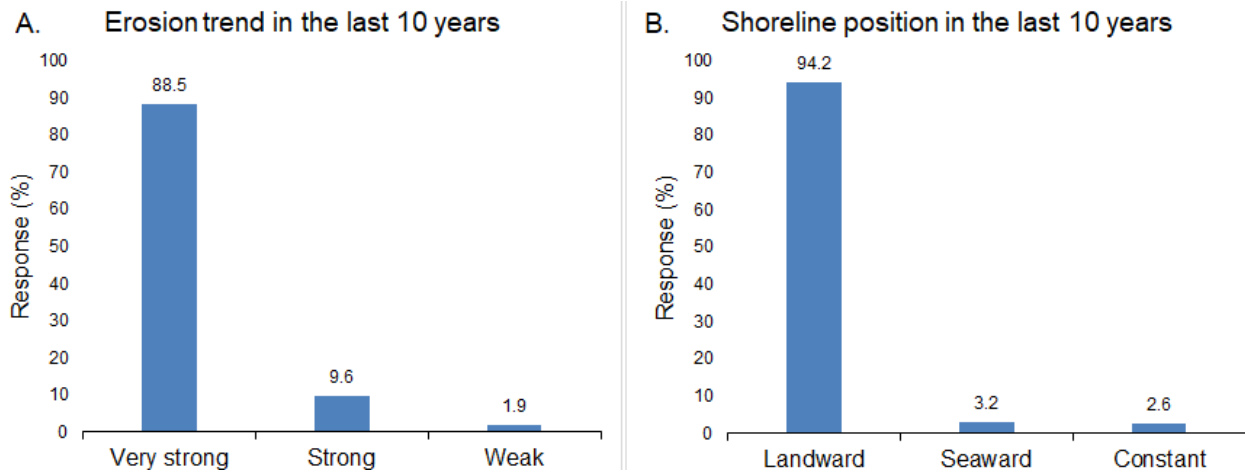
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203 **3.1.4. Knowledge, causes, potential impacts, and approaches to reducing coastal hazards risks**

204 This section explores respondents' perceptions of the causes and potential impacts and their
205 approach to mitigating the major coastal hazard risks.

206 *Perceived knowledge and awareness about coastal erosion*

207 The majority of the respondents (88.5%) stated that there has been strong coastal erosion in the last
208 10 years while only a few (1.9%) believed that it was little (Fig. 3a). About 94.2% of respondents
209 believed that the shoreline had moved landward more than it was 10 years ago, and 2.6% argued
210 that it was constant (Fig. 3b). While most respondents (70%) pointed out that the erosion was
211 highest near the Pra Estuary inlet, others (30%) believed that it was everywhere along the coast.
212

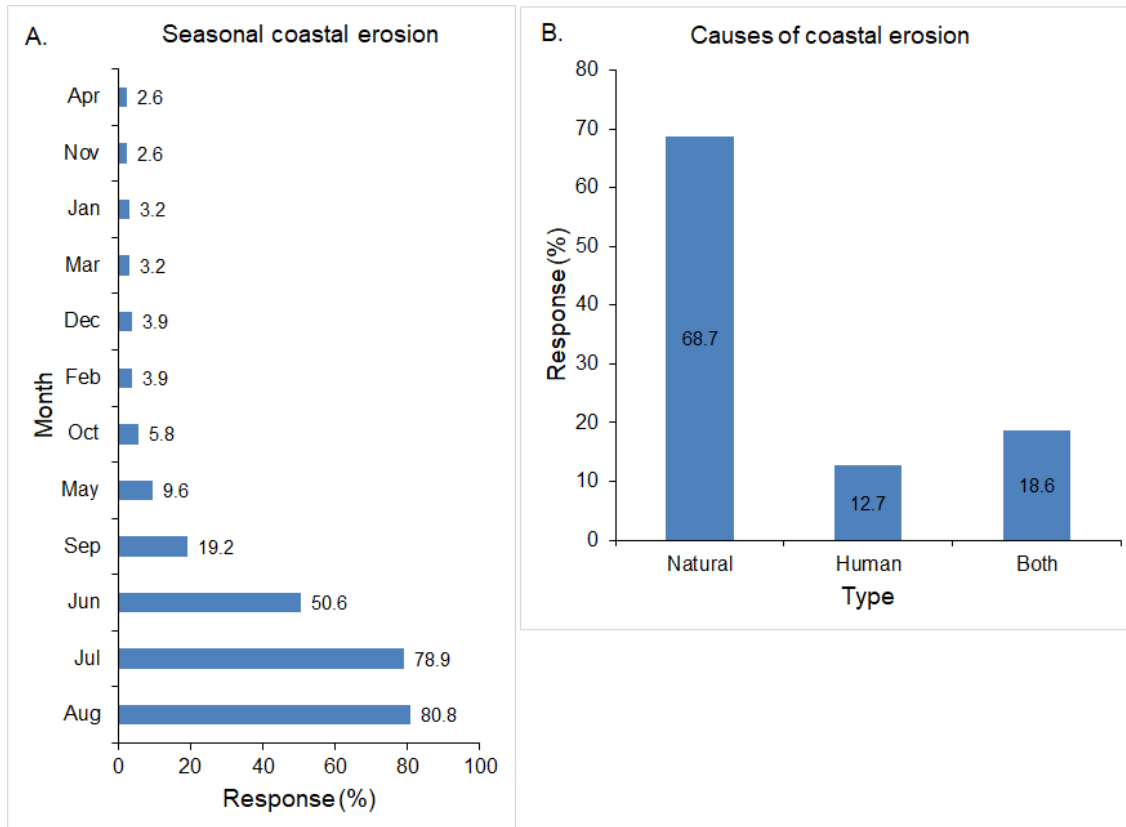


213 **Fig. 3** a) Erosion trends in the last 10 years; b) Shoreline positions in the last 10 years as perceived by the respondents
214
215

216 *Seasonality and major causes of erosion*

217 As shown in Fig. 4a, the respondents considered coastal erosion (or a landward advance of the sea)
218 to be higher between May and September and least between October and April. However, about
219 58% of respondents maintained that the beach never returned to where it was previously, indicating
220 a high level of vulnerability in the area. When asked about the major causes of the erosion
221 phenomenon in the study area, the majority of the respondents (68.7%) linked it to the combined
222 effects of natural factors (Fig. 4b) such as wave actions, sea-level rise, tidal waves, river flooding,
223 and seasonal cycles. While about 12.7% of the respondents linked erosion in the study area to
224 human activities (Fig. 4b) like beach sand mining, harbour construction at Sekondi and Takoradi,
225 nearby sea defense at Aboadze, the opening of the Pra River estuary inlet, and building houses near

226 the coast; 18.6% of them believed it was both natural and human-induced (Fig. 4b). The majority
 227 of respondents (75%) believed that erosion became aggravated during some events or years. For
 228 example, the combined effects of river and sea flooding events during the 2005/2006, 2014/2015,
 229 and 2017/2018 periods were considered to have aggravated coastal erosion in the study area,
 230 indicating a high level of awareness about the vulnerability of the area.



231
 232 **Fig. 4.** a) Monthly/ Seasonal coastal erosion trends; b) Causes of coastal erosion as perceived by the respondents.

233
 234 *Perceived impacts, efforts at mitigating coastal erosion, and suggested solutions*

235 As presented in Table 3a, 91.7 and 92% of the respondents, respectively, stated that coastal erosion
 236 had a high to extremely high impact on their domestic activities and general living conditions
 237 whereas 8.3 and 8% of the respondents said it had a moderate to low impact. Most of the
 238 respondents (84%) stated that they suffered physical or property damages as a result of coastal
 239 erosion (Table 3b). However, they displayed low preparedness levels for mitigation measures.
 240 When asked whether they were taken any measures to combat erosion, the majority (83.3%) of the
 241 respondents said they were not making any efforts (Table 3c). Owing to various impacts of coastal

242 erosion, about 68.4% of them had been forced to relocate to other parts of Anlo Beach while
 243 ~76.7% are still contemplating moving in the future (Table 3b).

244 When asked what could be done to slow down to reduce coastal erosion hazards in their
 245 community, about 78.8% opted for the construction of sea defense along the coast as it was done
 246 in Cape Coast, a nearby city, while 10.9% suggested relocation of the community to a safer place
 247 by the government (Table 3d).

248

249 **Table 3a. Impacts of coastal erosion on domestic activities, professional activities, and conditions of living**

Variable	Low		Moderate		High		Very High		Extremely High	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
i. Impact on domestic activities	14	3.2	7	4.5	5	9	23	14.7	106	68
ii. Impact on professional activities	23	14.7	10	6.4	11	7.1	46	29.5	66	41.7
iii. Impact on condition of living	11	7.1	1	0.65	7	4.5	26	16.7	109	70.8

250

251 **Table 3b. The severity of coastal erosion on the respondents and responses**

	Yes		No	
	Freq.	%	Freq.	%
i. Have you suffered any physical or property damage	131	84	25	16
ii. Have you moved to a different location because of coastal erosion?	106	68.4	49	31.6
iii. Do you think you will have to move again?	115	76.7	35	23.3
iv. Any built coastal defense e.g., dikes, breakwaters, groins in your community?	1	0.6	154	99.4

252

253 **Table 3c. Efforts at combating coastal erosion**

	None		Personally		Collectively	
	Freq.	%	Freq.	%	Freq.	%
Any effort at combating coastal erosion in your community?	129	83.8	1	0.6	24	15.6

254

255 **Table 3d. Suggested ways of combating coastal erosion**

What could be done to mitigate coastal erosion in your community?	No idea		Sea defense		Relocation	
	Freq.	%	Freq.	%	Freq.	%
	17	10.9	123	78.8	16	10.3

256

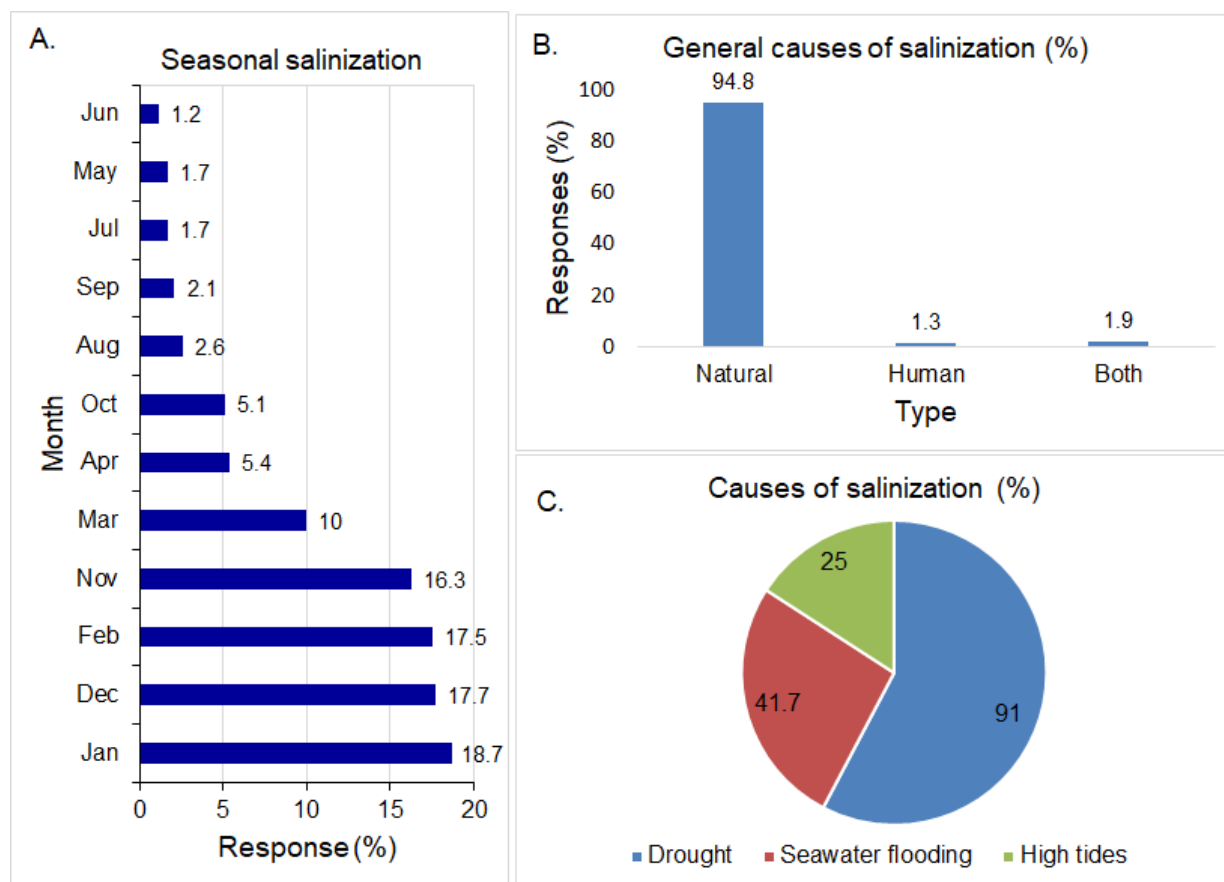
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258 *Perceived knowledge and awareness about salinization and its major causes*

259 The perception of the respondents about salinization hazards was very high. About 89.1% of the
260 respondents stated that the situation is well-known to everyone in the community. The majority,
261 99.4 and 76.3% respectively, of the respondents, reported the presence of salt in the drinking water
262 from the well and river, in the study area. About 95.5% of the respondents stated that there was an
263 occurrence of high salinity in the well water during the dry season between November and March
264 of each year (Fig. 5a). This is consistent with nationally observed weather conditions; the wettest
265 months in Ghana are May-July and September-October, with the driest period occurring from
266 December to February and a brief period in August. The majority of the respondents, about 95.5
267 and 69.9%, described the salt in the well and river as higher than in the past 10 years. The overall
268 response to the questions was an indication of good knowledge of their local environment.

269 When asked about the causes of salinization in the study area, 94.8% of respondents (Fig.
270 5b) believed that it was a natural phenomenon due to drought (91%), seawater flooding (41.7%),
271 high tide (25%) (Fig. 5c). On the other hand, 1.3% of the respondents believed that it was caused
272 by humans while 1.9% said it was both human and natural (Fig. 5b). Others also believed that the
273 nearness of the community to the Ocean was a major factor.

274



275
276 **Fig. 5.** a) Monthly/ Seasonal coastal salinization trends; b) General causes of salinization; and c) Natural causes of
277 salinization as perceived by the respondents.
278

279 *Perceived impacts of salinization and mitigation efforts*

280 Ninety-four percent (94%) of the respondents stated salinization has impacted their domestic
281 activities, 66% of the respondents stated that it has affected their professional activities, while the
282 general living conditions of 91% of the respondents have been impacted (Table 4a). When asked
283 if the community had put any measure in place to prevent salt contamination, 85.9% indicated there
284 was no measure on the ground (Table 4b). When asked what could be done to reduce salinization
285 in their community, 5.1%, 3.2%, and 41.7% of the respondents suggested relocation, water
286 treatment, and provision of pipe-borne water, respectively, while 50% of the respondents had no
287 idea of what to do (Table 4c).

288

289

290

291 **Table 4a. Impacts of salinization on domestic and professional activities and general condition of living**

Variable	Low		Moderate		High		Very High		Extremely High	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Domestic activities	2	1.28	1	0.64	5	3.21	19	12.18	129	82.69
Professional activities	27	17.31	12	7.69	13	8.33	45	28.85	59	37.82
Condition of living	4	2.56	3	1.92	6	3.85	29	18.59	114	73.08

292

293 **Table 4b. The effort to mitigate salinization in your community**

	None		Personal		Collective	
	Freq.	%	Freq.	%	Freq.	%
Any effort at mitigating salinization in your community?	134	85.9	3	1.9	19	12.2

294

295 **Table 4c. How to mitigate salinization in your community**

	No idea		Pipe-borne water		Water treatment		Relocation	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
What could be done to mitigate salinization in your community?	78	50	65	41.7	5	3.2	8	5.1

296

297 **3.2 Factors acting on perception: Linear model analysis (LMA)**298 *Perception of impact and adaptive measures regarding erosion hazard*

299 The results of the LMA show that a high level in the perception of the impact of coastal erosion
300 (appraised through a composite index) was negatively related to education level ($p < 0.05$; Table
301 5a) and positively related to Length of residency ($p < 0.05$; Table 5a). Also, the propensity of
302 respondents to take adaptive measures to coastal erosion was only negatively related to age ($p <$
303 0.01 ; Table 5a). In other words, respondents who have spent a longer period in the study area are
304 more likely to perceive the impact of coastal erosion than those that have resided in the study area
305 for a short period. Given the same impact, the higher the education level of the respondents the less
306 likely they perceive the impact of coastal erosion. In addition, it was observed that older (> 50
307 years) respondents are less likely to take adaptive measures than younger ones (< 50 years).

308

309

310

311 *Perception of impact and adaptive measures regarding salinization hazard*

312 As shown in Table 5b, a high level in the perception of the impact of salinization (appraised through
 313 a composite index) was negatively related to occupancy status ($p < 0.05$) and positively related to
 314 education level ($p < 0.1$; Table 5b). Also, the propensity of respondents taking adaptive measures
 315 (appraised through a composite index) to salinization was negatively related to occupancy status
 316 ($p < 0.01$) and positively related to education level ($p < 0.01$; Table 5b). In other words, non-owners
 317 of land in the study area are more likely to perceive the impact of the salinization than the
 318 landowners. Given the same impact, the higher the education level of the respondents the more
 319 likely they perceive the salinization impact. In the same vein, non-owners of land are more likely
 320 to take adaptive measures, and also, the higher the education level of the respondents the more
 321 likely they take adaptive measures.

322
 323 **Table 5a. Linear model analysis of social factors affecting the perception of coastal erosion impact and the**
 324 **propensity to engage in adaptation measures vs erosion**

	Coastal Erosion hazard			
	Indice of perceived impact		Indice of adaptive measures	
	coefficient	p-value	coefficient	p-value
Age	-0.094	0.258	-0.375	0.005
Gender (F vs M)	-0.067	0.482	-0.061	0.277
Level of education	-0.234	0.011	-0.105	0.189
Length of residency	0.170	0.039	0.154	0.175
Occupancy status (owner vs non-owner)	0.124	0.148	-0.007	0.889
Occupation (Farming)	-0.024	0.782	0.017	0.822
Occupation (Fishing)	0.177	0.041	0.033	0.521

325 Note: Bolded values are significant at $p < 0.05$

326
 327
 328
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 333
 334
 335

336
 337 **Table 5b. Linear model analysis of social factors affecting the perception of salinization impact and the**
 338 **propensity to engage in adaptation measures vs salinization**

	Salinization hazard			
	Indice of perceived impact		Indice of adaptive measures	
	coefficient	p-value	coefficient	p-value
Age	0.132	0.112	- 0.018	0.600
Gender (F vs M)	0.019	0.578	0.015	0.302
Level of education	0.089	0.073	0.085	<0.0001
Length of residency	0.055	0.437	- 0.045	0.113
Occupancy status (owner vs non-owner)	-0.066	0.031	- 0.038	0.002
Occupation (Farming)	-0.047	0.312	0.019	0.301
Occupation (Fishing)	-0.014	0.667	0.013	0.327

339 Note: Bolded values are significant at $p < 0.05$

340
 341 **4. Discussion**

342 The results of the present study show that the respondents are more concerned about coastal erosion
 343 than all other coastal hazard types in the Anlo community of the Western region of Ghana. This is
 344 in concordance with geomorphological studies that found that this section of the Ghana coast is
 345 eroding (e.g., [Addo, 2009](#); [Boateng, 2012](#); [Boye et al., 2018](#)). For instance, [Boateng \(2012\)](#)
 346 observed an erosion rate of 2.7 ± 0.4 m per year between Sekondi port jetty and Pra estuary in the
 347 long term. [Boye et al. \(2018\)](#) noted that in both the short and long term, the western part of the
 348 study area is eroding at a faster rate than the eastern section. Findings from the study carried out
 349 by [Friends of the Nation \(2015\)](#) in the study area revealed that about 146 houses close to the shore
 350 of the Atlantic Ocean are highly exposed to coastal erosion. Several houses stand threatened once
 351 the highly exposed ones are eroded. Another report showed that more than 1,000 houses have been
 352 destroyed by the sea in the last 30 years ([Graphic Online, 2017](#)). According to the same report,
 353 more than 198 houses were washed away, and more than 800 residents were displaced during the
 354 2017 tidal wave that hit the area ([Graphic Online, 2017](#)). It is important to note that the Anlo Beach
 355 community is built on a dune between the wetlands and the Atlantic Ocean, and it is highly
 356 vulnerable to floods and erosion ([Mutimukuru-Maravanyika et al., 2017](#)).

357 Although seawater flooding is a well-recognized problem in the study area ([Mutimukuru-](#)
 358 [Maravanyika et al., 2017](#)), it was the third hazard identified by the respondents. Studies have shown
 359 that laypeople can make a subjective assessment based on sentiments and psychometric factors

360 (Slovic, 1987; Slovic et al., 1984) and/or social values (Wildavsky and Dake, 1990; Dake, 1991)
361 rather than on data. This may be because seawater flooding was perceived by some respondents as
362 one of the natural causes of salinization in the study area (Fig. 5), and as it emerged, about 26% of
363 the respondents saw it as a major cause of salinization (Fig. 5).

364 Looking at it from a different perspective, it could also be due to the systematic failure of
365 the government (Liddle et al., 2015) to provide piped water services, thereby prompting the
366 inhabitants to rely on water from wells and boreholes (Grönwall, 2016). About 49% of Ghanaian
367 coastal dwellers rely heavily on groundwater from shallow aquifer systems for domestic and
368 professional purposes (Ghana Statistical Service, 2012; Kortatsi, 1994). Salinization of surface
369 wells and groundwater has been reported as a major problem in many coastal areas of Ghana (e.g.,
370 Lutterodt et al., 2021; Helstrup et al., 2007; Bannerman, 1994; Gill, 1969). A study indicates that
371 the salinization of wells in these areas is a result of saltwater intrusion (Helstrup et al., 2007). This
372 has caused the abandonment of several water wells in the Anlo community (Fig. 2). This may have
373 caused salinization to be seen as more impactful than seawater flooding. Therefore, there is a need
374 for control measures to check the further degradation of freshwater through the landward
375 movement of seawater into these coastal areas.

376 Such a measure could be increased public awareness of the need to lower water abstraction
377 rates and usage of other water resources that can contribute to an increase in freshwater volume,
378 which slows the infiltration of saltwater. This is the simplest, most direct, and most economical
379 solution to problems with saltwater intrusion and groundwater balance in aquifers. However, a
380 supplemental source of water will be required to substitute for the mandated reduction in the
381 groundwater pumping plan (Hussain et al., 2019; Abd-Elhamid et al., 2018; Bruington, 1972). As
382 suggested by the majority of respondents, this additional water source can be the community being
383 provided with pipe-borne water by the government (Table 4c). It is notable that, while the
384 respondents' perception of increasing coastal hazards was high, their propensity to take adaptive
385 measures was very low for both hazards (Table 3). More than 80% of the respondents were not
386 making any effort to mitigate either coastal erosion or salinization because they viewed them as
387 natural (Tables 3c and 4b). This is not surprising because previous studies also found no connection
388 between people's risk perception and their intentions to take mitigation measures (Diakakis et al.,
389 2018; Baron and Petersen, 2015; Wachinger et al., 2013; Bubeck et al., 2012; Siegrist and Gutscher,
390 2006; Kreibich et al., 2005; Takao et al., 2004). According to Brilly and Polic (2005), proper

391 actions and countermeasures do not always follow perceived threats. Based on this, Diakakis et al.
392 (2018) is of opinion that future public sensitization should focus more on the importance of self-
393 protection measures, rather than emphasizing only the risks.

394 Concerning the variables or factors that influenced the perception of the respondents, our
395 findings show that respondents' perceptions of increasing coastal erosion hazards were negatively
396 associated with their level of education and occupancy status, whereas some type of occupation
397 (fishing) was positively associated with coastal erosion hazard perception. The two factors that
398 were always statistically significant among all the relevant socio-demographic characteristics were
399 level of education and occupancy status (owner versus non-owner) (Table 5 a, b). These findings
400 are consistent with previous studies, which suggest that demographic, attitudinal, and social
401 contextual characteristics have a significant impact on perceptions of ecological risks (Bord et al.,
402 1998; Kempton, 1993; Peters and Slovic, 1996).

403 For instance, O'Connor et al. (1999) and Savage (1993) found that people with higher levels
404 of education and household income have lower levels of ecological risk perception. House
405 ownership (occupancy status) is also found to be associated with perceived risks. For example,
406 Burningham et al. (2008) and Grothmann and Reusswig (2006) argued that owning a property
407 could result in higher levels of perceived risk than renting a residence. A study has also shown that
408 permanent residence (length of residency) in a risky place may increase risk perception (Kellens et
409 al., 2011; Burningham et al., 2008; Lindell and Hwang, 2008).

410 Regarding taking adaptive measures to combat coastal hazards, age was negatively
411 associated with the perception of coastal erosion risks, which is similar to that of Kellens et al.
412 (2013) but at variance with earlier studies that found older respondents to display a higher
413 perception than younger people. (e.g., Lindell and Whitney, 2000; Grothmann and Reusswig,
414 2006; Knocke and Kolivras, 2007; Miceli et al., 2008; Burningham et al., 2008; Bonem et al.,
415 2015). Taking adaptive measures to salinization was positively influenced by the level of education
416 and associated with occupancy status. Higher education levels may increase respondents'
417 promptness to take adaptive measures (Kellens et al., 2011). The varying outcome may be due to
418 methods of measuring risk perception and different subjects (Kellens et al., 2011). For instance,
419 while Burningham et al. (2008) measured risk awareness, Grothmann and Reusswig (2006) focused
420 on the perceived ability to take protective actions against flood risks. Previous studies may not be

421 directly related to coastal erosion and salinization hazards, they shed light on the effects of socio-
422 demographics on perceptions of coastal hazards.

423 From our findings, there is a belief that the government is solely responsible for the
424 implementation of protective measures, whereas self-effort by individuals is far less important.
425 Further, they saw structural coastal protection measures as the key management strategies instead
426 of taking personal measures. A larger emphasis was placed by residents upon measures to reduce
427 coastal hazards, rather than concentrating on reducing community activities (such as the
428 construction of new buildings) in hazard-prone areas. Similarly, Wisner et al. (2004) found that
429 disadvantaged people (economically or politically) are bound to stop trusting their means of self-
430 protection and lose self-confidence. This behaviour is intensified by a lack of government attention.
431 Consequently, the people were blaming the government instead of increasing their resilience
432 capacity at the local level.

433 We believe that the people also have a role to play. For instance, our findings (see Table 2;
434 Fig. 2) revealed that mangrove woods are heavily exploited (58.8%) in the study area, and beach
435 sand (62.8%) is heavily utilized compared to river sand (18%). However, mangroves are known to
436 be a natural protector of coastlines and builders of beaches (Besset et al., 2019; Gracia et al., 2018;
437 Spalding et al., 2014). While the aerial roots of mangroves encourage sediment deposition and
438 prevent erosion, the roots, trunks, and canopy dampen the force of oncoming waves and storm
439 surges and thus reduce seawater flooding. So, there is a need for attitudinal change: to discontinue
440 beach sand utilization and exploitation of mangroves as firewood for cooking and smoking fish in
441 the community and embrace the restoration of mangrove ecosystems.

442
443 **5. Conclusions**
444 This research examines the societal perceptions of coastal risks in the Anlo Beach Fishing
445 Community in Ghana's Western Region. We identified and explained numerous critical factors
446 determining household risk perception using descriptive statistics and multivariate regression
447 models. Our findings not only reveal how individuals view coastal risks, but also provide crucial
448 information to policymakers interested in reducing the negative effects of coastal hazards on local
449 populations. Although this research gives insight into the factors that influence people's perceptions
450 of coastal risks in the study area, it should only be used as a starting point for further research.
451 More real actions are required, such as actual legislative responses to coastal dangers. Further,

452 findings from this study call for interventions from the appropriate authorities. These interventions
 453 should take the form of educating people about the necessity of self-protection measures like
 454 ceasing to use of beach sand exploitation of mangroves for fuel, as well as embracing mangrove
 455 ecosystem restoration; and awareness about the need to lower water abstraction rates and usage of
 456 other water resources such as the provision of pipe borne water to the community to an increase in
 457 freshwater volume and slows the infiltration of saltwater.

458

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