

# Review of the paper “Optimizing offshore wind export cable routing using GIS-based environmental heat maps” – Joni T. Backstrom, Nicholas M. Warden

## Paper summary

This paper explores the challenges related to subsea power cable routing and installation, using a case study of southeastern North Carolina. The area is chosen based on the proposed location of a new OSW farm. The authors identify several factors for an optimal cable burial location. The authors also identify several factors that impact the feasibility of routing and installing cables. These factors are quantified based on how great their potential impact would be. A heat map is generated based on the scores. From the heat map, the authors propose a few different cable routes to the proposed wind farm. The authors acknowledge limitations of the study, including a lack of high-resolution environmental survey data.

## Requests for Further Information

1. **Line 36 – 38:** Unclear if this is claiming that acoustic disturbances are a problem or not. More information on this would be helpful – what type of behavioral impacts? Why is (or isn't) this a problem?
2. **Line 41 – 43:** What are the impacts of EMF? Are the behavioral impacts similar to those from acoustic disturbances? Why are behavioral impacts not considered a concern?
3. **Line 56 – 58:** The mention of social impacts seems out of place in this paragraph about seabed and sediments. What are the positive social impacts? Would like to see further discussion of this aspect of offshore wind.
4. **Line 93 – 94:** What do the authors mean by “best”? Are the highest wind speeds in the country occurring here? Does this region have the most consistent wind? Does wind in this area always fall within the ideal range for OSW turbines?
5. **Line 95 – 96:** What is the impact of tropical storms on the area's potential for an OSW farm? Unclear if these are mentioned because it is a positive or negative factor.
6. **Line 109:** Additional context requested regarding the size of the eligible area. How does 100,000 acres compare to other wind farms? What is the expected energy from an area of this size?
7. **Line 148 – 149:** How are “minor” and “major” impacts quantified?
8. **Line 151:** If policies disallow such infrastructure, why were these areas not completely removed from the model?
9. **Line 197 – 198:** What is the significance of this depth? Is this deeper or shallower than usual for placing cable? Does this add any additional challenges?
10. **Line 217 – 234:** This section mentions several types of habitats (EFH, HAPC, BIA). What are the restrictions for building in each type of habitat?
11. **Line 243 – 245:** How is this type of zone quantified in the model?
12. **Line 260:** How are the physical obstructions quantified in the model? If the obstruction makes it impossible to lay cable here, is the location completely removed from consideration?

13. **Line 270 – 272:** What does “significant concern” mean in this context?
14. **Line 287 – 288:** More information about these “scores” would be helpful. Are there any zones with scores 4 or lower that are not actually accessible, due to previously discussed factors?
15. **Line 297 – 298:** Aren’t these implications definitive? The protected areas would need to be completely avoided when routing cables.
16. **Line 305 – 306:** Is there a feasible route that would use a shorter cable? Is this just a comparison to physical distance, or will this be compared with another path that may be more expensive, but shorter?
17. **Line 347:** What is “MPA’s”? This term has not been used or defined yet.
18. **Line 385 – 286:** What is the significance of including the descriptor “sediment-starved” here?
19. **Line 391 – 393:** Has the other 90% been mapped in other ways (such as less modern survey methods) or not at all? This sentence conflates “being mapped” and “specifically being mapped with modern survey methods.” Are these the same thing in practice? Without the modern methods, would mapping be useless?
20. **Line 423 – 425:** How easy is this to minimize? Are there other temporal limitations on construction (i.e. marine migration patterns, weather)? What is the overlap with busy tourist season?

### Grammar Comments

1. **Line 25 – 27:** This sentence is unclear. Recommend separating into two sentences: one focusing on “Off coastal ... this study” and the other focusing on “the state has ... Executive Order No. 218.”
2. **Line 76 – 78:** This sentence reads as if the prospective developers, rather than the WEA, are “comprising a 11,000 acre offshore region.” Recommend reordering the sentence or separating into two sentences.
3. **Line 87 – 88:** Unclear if authors intend “are located along the coast” as a restrictive or nonrestrictive clause. Is the location meant to be additional information, or is the sentence specifying that tourism is a major source of income only for rapidly growing towns in this specific area?
4. **Line 91 – 93:** Unclear why the word “range” is repeated in this sentence. Recommended edit: “... within the study area range between 7.5 m/s at the coast and 9.0 m/s at ...”
5. **Line 187:** “... most prominent feature of ...” should be “... most prominent features of ...”
6. **Line 279:** “Although avoiding navigation areas are not a requirement...” should be “Although avoiding navigation areas is not a requirement...”
7. **Line 319 – 320:** “Each substation ... are the closest ...” should be “Each substation ... is the closest”
8. **Line 328 – 330:** This sentence is unclear.
9. **Line 330 – 331:** This sentence is unclear.
10. **Line 331 – 332:** Unclear what the authors mean by “creating impacts remain primarily human.” Recommend rewording.
11. **Line 348 – 350:** In the list of locations, the word “off” applies to all three items, which does not make sense with the final item (“off” the Baltic Sea). Recommend changing to “... off Taiwan, off Spain, and in the Baltic Sea.”
12. **Line 354 – 355:** “... environmental consultancy companies which use similar techniques ...” should be “... environmental consultancy companies that similar techniques ...”

13. **Line 357 – 360:** This sentence is unclear. Reads as though “the main wind energy area / production site and the coast” are two parties that have competing interests. Rephrase to make it clearer that this is a description of the location.
14. **Line 362:** “... but also similar marine industries ...” should be “... but also **by** similar marine industries ...”
15. **Line 363:** Why is the word ‘receptor’ in quotes when its other uses have not been in quotes?
16. **Line 377 – 380:** The second half of this sentence (“... and importantly ...”) is a key point. Recommend separating into a new sentence so that it does not get lost in the first section.
17. **Line 385:** “... Essential Fish Habitat (**ESH**) ...” should be “... Essential Fish Habitat (**EFH**) ...”

I have thoroughly reviewed the manuscript and I commend the authors for their work. The authors identified key factors that impact the routing and installation of subsea cables, many of which will be relevant in other proposed OSW farm locations. The methods used can be applied to many other studies, which will be very helpful in planning activities. The visual aids in the paper greatly improved my understanding of the factors and their impacts.

There are some sections that are unclear, of which I would like to see further discussion. I have included some comments explaining requests for further information/explanation. I have also included some comments related to grammar. I recommend this paper’s acceptance for publication provided satisfactory response to these comments.