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AI vs Human Translation of Oceanography Discourse (English to Arabic)

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ABSTRACT: Translating general technico-scientific terminology is a challenging task that becomes more so when handling oceanography discourse, particularly from English into Arabic. With recent developments in artificial intelligence (AI) and its translation applications, the question becomes whether AI tools can produce human-like translations of such specialized terminology. This study examines human and AI translations of 150 oceanography terms from English into Arabic yielding a corpus of 450 translations. The terms were mined from *Guide to the Oceans* (Pernetta, 2004) for which the human translation (HT) into Arabic was carried out by Fathi Majdalawieh titled دليل المحيطات (Pernetta, 2013). AI-translations were generated by ChatGPT (GPT) and Google Gemini (GG). Using Pedersen's (2011) taxonomy of translation strategies, the Arabic renderings were interpretatively analyzed. The analysis indicates HT and GPT employed primarily the substitution strategy (64% and 59.33%, respectively, compared to 20% by GG). GG topped the three in its use of direct translation (58%), compared to GPT (24%) and HT (22.67%). Such findings suggest that GPT's output was closer to HT's in maintaining meanings and nuances of oceanography terminology. The findings offer insights into the current capabilities of AI models in translating technico-scientific terminology, with GPT showing a closer alignment with HT than GG.

Keywords: Oceanography, Artificial Intelligence, Terminology, ChatGPT, Google Gemini, English-Arabic.

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1. Introduction

The field of machine translation (MT) has evolved significantly; shaped by advances in artificial intelligence (AI) and computational linguistics. Early translation efforts were dominated by rule-based systems, which relied on predefined grammatical structures and syntax rules. While these systems provided a structured approach, they often failed to capture linguistic nuances and contextual meanings, resulting in inappropriate and unnatural translations. The introduction of statistical machine translation (SMT) in the early 1990s marked a turning point, as these systems used probabilistic models trained on bilingual corpora to improve fluency and accuracy (Brown et al., 1993), but the effectiveness of SMT was still constrained by the availability and quality of parallel texts.

A major breakthrough came in the mid-2010s with the emergence of neural machine translation (NMT). Unlike SMT, NMT leverages deep learning techniques, particularly sequence-to-sequence models with attention mechanisms, allowing for better contextual understanding and translation fluency (Bahdanau et al., 2015). The introduction of the Transformer architecture by Vaswani et al. (2017) further revolutionized the field, making AI-driven translation systems more effective in handling complex sentence structures and diverse linguistic contexts. These advancements have set the foundation for modern AI-powered translation tools, including OpenAI's ChatGPT (GPT) and Google's Google Gemini (GG), which use large-scale multilingual data to enhance translation quality. More recently, AI models such as DeepSeek have emerged, promising further improvements in translation capabilities. These technological advancements highlight the growing potential of AI in translation but also raise questions about its ability to handle domain-specific and highly specialized texts. Particularly in technical and scientific domains, the ability of AI to process vast amounts of linguistic data and produce translations at high speed has positioned it as a viable alternative to human translation in many contexts. However, the question remains: can AI effectively handle the complexities inherent in technical-scientific translation, particularly in specialized fields like oceanography?

Translating oceanographic texts poses challenges due to the field's specialized terminology and the necessity of conveying appropriate scientific meaning across languages. Oceanography often involves terms that have no direct equivalents in other languages or whose meanings can shift subtly depending on the context. For example, terms like "upwelling" or "pycnocline" are deeply embedded in specific scientific frameworks, and translating these terms requires both linguistic fluency and subject matter expertise (Newmark, 1988). Oceanography, the scientific study of the oceans, is deeply rooted in specialized terminology and requires linguistic accuracy and a deep understanding of the scientific concepts involved. Appropriate translation in this field is crucial for cross-border scientific collaboration, as it ensures that key discoveries, methodologies, and data can be shared globally without serious losses of intended meanings. For instance, inaccuracies in translating technical terms such as "thermohaline circulation" or "eustatic sea level changes" could result in significant misinterpretations in research and applications.

Today, AI systems like GPT and GG utilize vast amounts of linguistic data to predict word sequences and generate contextually appropriate translations. These systems are trained on multilingual corpora, allowing them to handle a variety of languages and domains, including technical fields like oceanography (Zahid et al., 2024). However, despite these advances, AI systems still struggle with complex linguistic features such as idiomatic expressions, and cultural references, and domain-specific jargon. Moreover, cultural and linguistic differences between English and Arabic (the language pair examined in this study) further complicate the translation process. Arabic, for instance, has a highly inflected grammar system that differs significantly from English's more analytic structure, which can lead to challenges in maintaining the syntactic and semantic integrity of complex scientific structures. Additionally, translating technical terms into Arabic often requires creating new terms or adapting existing ones to fit its linguistic norms (Baker, 2018). These factors raise essential questions about the ability of AI to handle such complexities compared to human translators, who can draw on their linguistic and cultural knowledge to make more informed translation choices.

In tackling these challenges, both AI and human translators strive to balance accuracy with readability using different strategies. Pedersen (2011) provides an effective taxonomy of strategies to assess translation, particularly cultural references through subtitling. It can broadly be categorized into source-oriented (SO) and target-oriented (TO) strategies. SO strategies aim to preserve the original meaning and structure of the source text, while TO strategies adapt the content to be more accessible or culturally relevant to the target audience. Pedersen's taxonomy provides a useful framework for analyzing the translation of oceanographic texts, as it highlights the specific choices translators make when faced with complex terminology and cultural references.

In this study, Pedersen's taxonomy was deployed to interpretatively evaluate and compare 450 translations from English into Arabic of oceanography terms by AI (GPT and GG) and human translators. The analysis considered the distribution of strategies used and their impact on the quality and appropriateness of the translated texts. Ultimately, this study indicates that given recent advancements, AI tools can approximate the nuanced, context-sensitive translations traditionally achievable only by human expertise, including the integrity and accessibility of specialized knowledge of domains such as oceanography.

2. Data and Methodology

This study investigates the effectiveness of translation strategies used by human and AI translators in rendering oceanographic terminology from English to Arabic. Chapter 4 was selected from the book *Guide to the Oceans* by Pernetta (2004), a text rich in technico-scientific language. The human Arabic version of the chapter was taken from the full book Arabic translation by Fathi Majdalawieh (human translator, HT) of Pernetta's English text that appeared in 2013 and serves as the reference translation for evaluating and analyzing AI-generated (GPT and GG) Arabic translations.

A dataset of 150 oceanographic terms was extracted from the source English text, chosen for their relevance to scientific discourse and potential to challenge translators. These terms served as focal points for comparing how each translator (human and AI) approached oceanographic terminology. In total, 450 Arabic translations (150 for each translator) were analyzed (Appendix – raw data). The prompt for both GPT and GG was the same: 'Translate this text into Arabic.' Both sets of AI Arabic translations were generated on 16 September 2024.

For the analysis, Pedersen's (2011) taxonomy of translation strategies was used. This is a framework well-suited to assessing translators' nuanced decisions when working with scientific terms that are also culturally embedded. Pedersen's taxonomy identifies six distinct strategies, each reflecting a specific translation approach and degree of closeness to the source text. The taxonomy includes two categories with three strategies each.

Source oriented (SO) strategies include retention (R), specification (SP), and direct translation (DT).

- R preserves or slightly adapts source text (ST) material to meet target-language (TL) needs. It maintains scientific integrity but may reduce accessibility for readers unfamiliar with the references. According to Pedersen, retention occurs when "the ST is retained … unchanged or slightly adapted to meet TL requirements. Retention could be marked off from the rest of the text, e.g., by the use of italics" (2011, p. 76).
- SP occurs when "more information is added, making the subtitled … more specific than the source one. This is done by completing or fleshing out a name or an acronym (Completion) or by adding more semantic content, such as adding someone's occupation or an evaluative adjective (Addition)" (ibid. p. 76).
- DT is realized when "the only thing that gets changed [...] is the language; no semantic alteration is made" (ibid. p. 76). DT keeps the original meaning while potentially requiring linguistic adaptation to fit Arabic conventions.

Target oriented (TO) strategies include generalization (G), substitution (SU), and omission (O).

- G simplifies the term by using a general and inclusive term or rewording. Pedersen notes that G "makes the TT rendering less specific than the ST … [and] can be done either by using a Superordinate Term or a Paraphrase" (ibid. p. 76).
- SU replaces the ST item with another, either from the source or target culture, or with something completely different, which may facilitate comprehension for the target audience while potentially sacrificing source-specific detail of a domain such as oceanography.
- O excludes terms that may be deemed unnecessary or overly complex for the target audience. Pedersen notes that O is "perhaps more used in subtitling than in any other form of translation, due to the constraints of the medium" (ibid., p. 76). While O economizes space, it risks omitting critical information for subtitling and other translation types.

In addition to Pedersen's SO and TO, a category labeled "Combined Strategies" (CS) was added for the purposes of this study to account for translation instances where more than one strategy was employed. CS includes examples in which translators drew on multiple strategies to address translation challenges. The use of CS allows for an inclusive understanding of the decision-making processes involved in translation, reflecting the dynamic and multifaceted nature of the translational act.

To quantitatively assess the applications of these strategies, each occurrence of a translation strategy was recorded and compared across the three versions (HT, GPT, GG) for the 450 translations. This allowed for a percentage-based comparison, providing insights into the tendencies of human and AI translation methods. By analyzing these percentage distributions, this study aims to highlight trends in strategy usage and determine whether AI translations align more with HT approaches or exhibit distinctive patterns. This quantitative analysis, combined with qualitative observations of specific term choices, offers an interpretative evaluation of the effectiveness of AI translation tools in the field of oceanographic terminology versus human translation. By so doing, this study contributes to the broader understanding of the role of AI in specialized translation tasks.

3. Results

The findings reveal distinct patterns in the use of translation strategies by HT, GPT, and GG when translating oceanographic terminology from English to Arabic. These patterns reflect the unique approach of each translator in their attempt at balancing cultural adaptation with technical accuracy. The Appendix provides raw data for all the Arabic translations and corresponding strategies deployed by each translator for each of the 450 renderings. It also provides the percentages of occurrences for each translation for HT, GPT and GG (the Appendix provides full details for source English oceanography terms along with their Arabic translations by HT, GPT and GG as well as the strategies employed to render each term by each translator).

Table 1 compares SO and TO distributions across the data set of 150 English terms and their corresponding 450 Arabic translations by HT, GPT and GG.

SO		**HT**		**GPT**		**GG**	
	Strategy	Total	%	Total	%	Total	%
	R	15	10%	14	9.30%	18	12%
	DT	34	22.70%	36	24%	87	58%
	SP	1	0.70%	6	4%	5	3.30%
TO							
	SU	93	62%	87	58%	30	20%
	G	0	0%	1	0.70%	0	0%
	O	4	2.70%	4	2.70%	8	5.30%
	CS	3	2%	2	1.30%	2	1.30%

Table 1: Source Oriented vs. Target Oriented Strategies for HT, GPT and GG.

As table 1 indicates, the TO category exhibits higher frequencies across most strategies, particularly for SU, which was deployed 93 (62%), 87 (58%) and 30 (20%) by HT, GPT and GG respectively. For SO strategies, DT was used 34 (22.7%), 36 (24%) and 87 (58%) by HT, GPT and GG respectively. Figure 1 below presents the combined summary of the distribution across different strategies for all the 450 translations into Arabic.

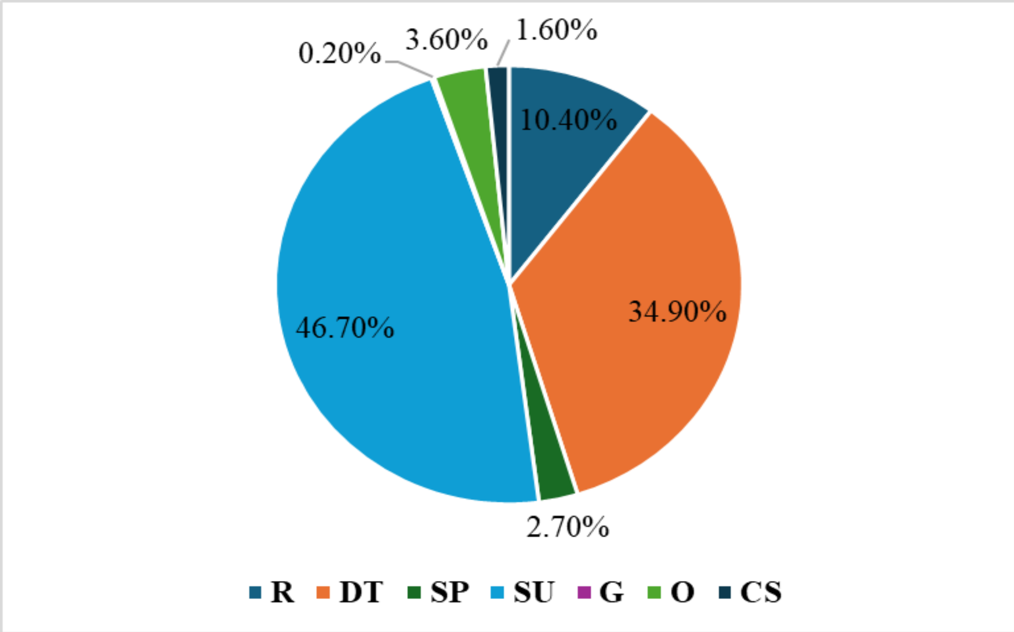

Figure 1: Percentage occurrences for each strategy for all translators (HT, GPT and GG).

As figure 1 indicates, SU is the most prevalent category, accounting for 46.7% of the total. DT also holds a significant proportion at 34.9%, aligning with its higher representation in the TO category. R appears at 10.4%, but SP is at 2.7%, O at 3.6%, and G at (0.2%). CS uses were low at 1.6%. The relatively lower percentages for these strategies indicate their limited role compared to SU and DT.

4. Discussion

The observed variations in strategy usage underscore fundamental differences in how human and AI translators approach technico-scientific language, particularly oceanography. Each translation tool's reliance on certain strategies reveals specific underlying design priorities and the potential impact on translation quality and accessibility. The data, as shown in the Appendix, table 1 and figure 1, reveals clear trends in how human translators, GPT, and GG approach translation tasks, offering valuable insights into their strengths and limitations. In this case, both HT and GPT demonstrate a strong preference for TO strategies, emphasizing adaptation to the target audience's needs. In contrast, GG relies heavily on SO strategies, prioritizing DT.

SO strategies: SO strategies dominate the renderings generated by GG, with DT having the lion's share. R, which involves preserving the original text as closely as possible, is used at comparable rates by HT (10%) and GPT (9.3%), indicating their shared effort to maintain source fidelity when necessary. GG, however, employs retention slightly more frequently (12%), showing its inclination toward a stricter adherence to the source material. For example, the term "diatoms" was transliterated to "الداياتومات" throughout the three versions. Similarly, DT—a strategy that directly reproduces the structure and meaning of the source—makes up a substantial 58% of GG's output, far exceeding HT (22.7%) and GPT (24%). This heavy reliance on DT highlights the tendency of GG to prioritize literalness over flexibility. SP, which involves adding details to clarify the source text, is used minimally across all three methods, though GPT (4%) slightly outpaces GG (3.3%) and HT (0.7%), reflecting its ability to handle unique translation challenges.

TO strategies: TO strategies dominate HT and GPT outputs, with SU being the most prominent. HT employs SU in 62% of cases, and GPT in 58%, showcasing their shared focus on adapting the source text to better suit the target audience's context and expectations. GG, however, uses SU in only 20% of cases, reinforcing its source-heavy approach. For instance, the word "heterocercal" was translated as "غير متماثل (lit. asymmetrical)" by HT and GPT but as "متباين (lit. dissimilar)" by GG. G, which simplifies specific elements of the source text, appears only once in GPT's output (0.7%), indicating that this strategy is rarely applied across all methods. While this approach simplifies comprehension for target audiences, it may dilute the original specificity. This dilution is especially noticeable in GPT's translation of the word "picoplankton," which it translates as "العوالق الدقيقة (lit. microscopic plankton)." Interestingly, O, which involves leaving out parts of the source text, is more common in GG (5.3%) than in HT or GPT (both 2.7%). This suggests GG's occasional tendency to drop (delete) challenging or ambiguous sections, potentially sacrificing meaning.

Lastly, **combined strategies** (CS), which integrate multiple methods, were used sparingly by all three methods (HT: 2%, GPT: 1.3%, GG: 1.3%), indicating a shared reluctance to employ such complex solutions. For example, السمكة البالعة الكبيرة (Chiasmodon niger) is one instance where GPT and GG both included the Arabic and English names within the text, demonstrating an application of combined strategies (R and DT).

These patterns highlight the unique strengths and limitations of both HT and AI-tools. HT excels in balancing source fidelity and target audience adaptation, showcasing their ability to navigate complex linguistic and cultural nuances. Closely mirroring HT, GPT demonstrates potential as a reliable AI tool, though its slightly higher use of specification may indicate occasional inconsistency in handling nuanced contexts. In contrast, GG relies heavily on source-oriented strategies like direct translation and retention, which may limit its effectiveness in contexts requiring cultural adaptation or audience engagement.

In practical terms, these findings underscore that while HT remains the gold standard for nuanced and culturally sensitive translation, GPT shows promise as a viable alternative for many tasks, especially where a balance between source fidelity and adaptation is required. GG, however, may struggle in scenarios demanding a communicative approach or cultural sensitivity, as its focus leans heavily on reproducing the source text without significant modification. For specialized fields such as oceanography, where precision, clarity, and even cultural relevance are crucial, these differences can significantly impact the usability and quality of the translation. However, while AI tools like GPT and GG have made impressive advancements, they still fall short of matching the adaptability and nuance that human translators bring to complex and specialized translation tasks (Zahid et al., 2024). These findings contribute to our understanding of how AI and human translators differ in handling specialized oceanographic terminology, illustrating both the potential and limitations of AI tools in replicating human translation quality. The predominant use of DT by GG suggests a literal approach aimed at terminological precision, potentially catering to technically adept audiences while risking readability for general readers. This pattern highlights a key challenge for AI in scientific translation: the ability to balance technical accuracy with cultural adaptation.

GPT's closer alignment with HT suggests a promising capacity for AI to approximate human translation practices in specialized domains, particularly in using culturally adaptive strategies like SU. The Transformer architecture, introduced by Vaswani et al. in 2017, underpins models like GPT. Its self-attention mechanisms allow for the modeling of contextual relationships within sequences, enabling the generation of coherent and contextually relevant text without relying on sequential processing. Despite these advancements, NMT systems, including those based on the Transformer architecture, continue to face challenges in accurately translating idiomatic expressions and culturally nuanced content. Recent studies have highlighted that NMT models often default to literal translations of idioms, leading to outputs that may be semantically incorrect or culturally inappropriate. For instance, Baziotis et al. (2022) introduced a metric to automatically evaluate the frequency of literal translation errors in idioms, revealing that NMT systems frequently misinterpret idiomatic phrases. Similarly, Dankers et al. (2022) analyzed the processing of idioms in Transformer-based models and found a tendency to overgeneralize, treating idiomatic expressions as compositional rather than recognizing their non-literal meanings. These limitations are evident in GG's lower SU rate, which indicates a lack of information processing flexibility that enables human translators to adapt specialized terms.

Recent studies continue to highlight the challenges AI systems face in translating culturally rich terms. While models like GPT have advanced in contextual understanding, they often struggle with idiomatic expressions and cultural references. For instance, Bukovčanová (2024) notes that while large language models (LLMs) possess embedded cultural knowledge, they frequently require manual corrections to address cultural differences accurately. This represents the limitations of AI in fully grasping and adapting cultural nuances. Human translators remain essential in contexts requiring nuanced interpretation, especially when adapting culturally loaded terminology to resonate with the target audience. Zaid and Bennoudi (2023) emphasize that, despite advancements in AI translation tools like ChatGPT and Google Translate, human translation consistently outperforms machine translations in maintaining depth, cultural relevance, and nuanced understanding, particularly in complex and culturally rich texts. Studies have shown that AI translation tools often lack the ability to recognize and preserve cultural nuances, leading to homogenization of linguistic diversity (Shahmerdanova, 2025). Human translators bring a deep understanding of cultural context, ensuring that translations are not only linguistically accurate but also culturally sensitive and appropriate. This is emphasized by the results discussed above whereby HT deployed more TO and CS strategies than GPT or GG.

5. Conclusions

This study has highlighted essential distinctions between human and AI translation strategies when handling oceanographic terminology from English to Arabic. GPT's closer approximation of HT's strategy choices demonstrates its ability to handle culturally adaptive translations, making it more suitable for audiences needing both technical precision and cultural familiarity. By contrast, GG's tendency toward DT suggests it may be better suited for specialized technical texts but lacks the flexibility needed for culturally embedded content.

The findings illustrate the strengths and limitations of AI in scientific translation, indicating that, while AI tools can replicate human-like translation patterns to some degree, challenges remain in translating context-sensitive information and terminology. Enhancing AI translation quality for specialized domains will require improvements in training models with datasets that include both technical and cultural nuances (Khan and Usman, 2019). As AI technology advances, incorporating training methods focused on domain-specific language and cultural adaptation could help bridge these gaps. Nevertheless, as Baker (2018) and Newmark (1988) suggest, human translators provide an irreplaceable layer of cultural insight to ensure that AI translations are appropriate and resonate meaningfully within the target context.

To further improve AI-based techno-scientific translation, future research should explore hybrid translation models that integrate human post-editing with AI-generated drafts, ensuring both efficiency and appropriateness. Additionally, collaboration between linguists, scientists, and AI developers could lead to the creation of specialized translation databases tailored for specific fields, thereby enhancing the contextual and cultural relevance of AI translations. AI models should also be trained on corpora that include real-world bilingual terminologies, ensuring a more nuanced understanding of domain-specific discourses.

Moreover, AI developers should incorporate adaptive learning mechanisms where AI translation tools refine their outputs based on user corrections and expert feedback over time. This improvement process can significantly enhance AI translation accuracy. Governments, academic institutions, and industry stakeholders should consider funding and supporting initiatives that promote AI-driven translation research in specialized fields, fostering a more refined and adaptable AI translation ecosystem. Finally, user feedback mechanisms in AI translation platforms should be refined to allow domain experts to contribute corrections, helping AI models learn and adapt more effectively over time. This collaborative approach between AI and human expertise can pave the way for more reliable, context-sensitive translations in scientific and technical disciplines such as oceanography.

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Note:

On a personal level, this research reflects a legacy of bridging scientific and linguistic knowledge within my family (author 1). My grandfather's dedication to translating scientific material into Arabic to facilitate knowledge transfer and my father's commitment to the field of science (biology) inspired this study's exploration of AI's potential to support similar goals.

Appendix (raw data).

Arabic translations (HT, GPT and GG) and strategies employed.
Abbreviations for translation strategies (1-6 from Pedersen (2011), and 7 added specifically for this study).

1) **R** = Retention
2) **SP** = Specification
3) **DT** = Direct translation
4) **G** = Generalization
5) **SU** = Substitution
6) **O** = Omission
7) **CS** = Combined strategies

STR = strategy

No.	English Source Text	HT		GPT		GG	
		Translation	**STR**	**Translation**	**STR**	**Translation**	**STR**
1	Nutrients	المواد الغذائية	SU	العناصر الغذائية	SU	العناصر الغذائية	DT
2	Phytoplankton	العوالق النباتية	DT	العوالق النباتية	DT	العوالق النباتية	DT
3	Picoplankton	Picoplankton	R	العوالق الدقيقة	G	البيكوبلانكتون	R
4	Diatoms	الدایاتومات	R	الدياتومات	R	الدياتومات	R
5	Dinoflagellates	دوامية السياط	DT	الدينوفلاجيلات	R	الدينوفلاجيلات	R
6	upwelling	الامواج المتقلبة	DT	التي يحدث فيها تيارات صاعدة	SP	التي يحدث فيها الارتفاع	SP
7	Copepods	المجدافيات	SU	القشريات	SU	الكوبيبود	R
8	Salps	Salps	R	السلابس	R	السالف	R
9	Herbivores	عوالق الأعشاب	SU	العواشب	SU	العواشب	DT
10	Photosynthesis	التركيب الضوئي	DT	التمثيل الضوئي	DT	التمثيل الضوئي	DT
11	Marine	المحيط	SU	البحرية	SU	البحرية	DT
12	Arctic	خطوط العرض العليا	SU	القطب الشمالي	DT	القطب الشمالي	DT
13	Currents	التيارات	SU	التيارات	SU	التيارات	DT
14	Hermaphrodite	حنثوي	DT	خنثى	DT	omitted	O
15	Larvae	يرقة	SU	يرقات	SU	omitted	O

16	Whales	الحيتان	SU	الحيتان	SU	الحيتان	DT
17	Seabirds	الطيور البحرية	SU	الطيور البحرية	SU	الطيور البحرية	DT
18	Surface waters	المياه السطحية	DT	المياه السطحية	DT	المياه السطحية	DT
19	Ocean basins	أحواض المحيطات	DT	أحواض المحيطات	DT	أحواض المحيطات	DT
20	prey	التي تتغذى عليها	SP	التي تفترسها	SP	التي تتغذى عليها	SP
21	Sessile	الأحياء اللاعنقية	SU	الحيوانات الثابتة	SU	omitted	O
22	juveniles	صغارها	SU	صغارها	SU	صغارها	SU
23	Cross-fertilization	التلقيح الهجين	DT	التلقيح المتبادل	DT	التلقيح المتبادل	DT
24	Dispersal	الانتشار	SU	الانتشار	SU	للتشتت	SU
25	Echinoderms	شوكيات الجلد	DT	شوكيات الجلد	DT	شوكيات الجلد	DT
26	Crustacea	القشريات	SU	القشريات	SU	omitted	O
27	Locomotion	حركة	SU	حركة	DT	حركة	SU
28	Groupers	الهامور	SU	الهامور	SU	أسماك المجموعة	SU
29	arrow worms	الديدان السهمية	DT	الديدان السهمية	DT	ديدان السهام	DT
30	Reef dwellers	omitted	O	سكانًا للشعاب	DT	الشعاب المرجانية	DT
31	island environments	بيئات الجزر	DT	البيئات الجزرية	DT	البيئات الجزرية	DT
32	Sediment	الرواسب	SU	الرواسب	SU	الرواسب	DT
33	Buoyancy	الطفو	SU	الطفو	SU	الطفو	DT
34	skeletons	هياكل	SU	هياكل عظمية	SU	omitted	O
35	fins	الزعانف	SU	الزعانف	SU	الزعانف	DT
36	Sedentary	غير متحركة	DT	مستقرة	SU	مستقرة	DT
37	Physalia	Physalia	R	فيزاليا	R	فيساليا	R
38	Gastropods	omitted	O	omitted	O	omitted	O
39	Cilia	الأهداب	SU	الأهداب	SU	الأهداب	DT
40	Teleost	العظميات	SU	التليوست	R	التليوست	R
41	Pectoral fins	الزعانف الزوجية الصدرية	DT	الزعانف الصدرية	DT	الزعانف الصدرية	DT
42	Crevices	شقوق	SU	شقوق	SU	شقوق	DT
43	crabs	السرطانات	SU	السرطانات	SU	السرطانات	DT
44	Burrowing animals	الحيوانات الحفارة	DT	الحيوانات الحفارة	DT	الحيوانات الحفارة	DT
45	Circular muscles	العضلات الدائرية	DT	العضلات الدائرية	DT	العضلات الدائرية	DT
46	Torpedo-shaped	شاكلة التوربيد	SU	يشبه الطوربيد	SP	طوربيدي	SU
47	Reptile-like	الشبيهة بالزواحف	SU	الزاحف الأحفوري	SU	الشبيه بالزواحف	SU
48	Heterocercal	غير متماثل	SU	غير متماثل	SU	متباين	SU
49	Lchthyosaurs	الاكثيصورز	R	الإكثيوصور	R	الإكثيوصور	R
50	Biomass	الكتلة الحيوية	DT	الكتلة الحيوية	DT	الكتلة الحيوية	DT
51	Autotrophs	المنتجات الذاتية	DT	المؤتلفات الذاتية	DT	الكائنات ذاتية التغذية	DT
52	Ecosystems	النظم البيئية	DT	الأنظمة البيئية	DT	النظم البيئية	DT
53	Sea squirts	زقاق البحر	SU	الزقيات البحرية	SU	الأسماك البحرية	SU
54	Inorganic	المعدني	SU	غير عضوي	DT	غير عضوي	DT
55	Bacteria	البكتيريا	R	البكتيريا	R	البكتيريا	R
56	Interstitial	البينية	SU	omitted	O	البينية	DT
57	Mucus	مخاطا	SU	مخاطًا	SU	مخاطًا	DT
58	Surfaces	الأسطح	SU	الأسطح	SU	الأسطح	DT

59	Algae	الطحالب	SU	الطحالب	SU	الطحالب	DT
60	gastropod	بطنيات الأقدام	DT	بطنية الأقدام	DT	الرخويات	DT
61	elongated	طويلة	SU	ممدود	SU	ممدود	DT
62	predators	المفترسات	SU	المفترسات	SU	المفترسات	DT
63	noxious	السامة	SU	سام	SU	السامة	DT
64	swim	السباحة	SU	السباحة	SU	السباحة	DT
65	evolution	التطور	SU	تطور	SU	تطور	DT
66	mammals	الثدييات	SU	الثدييات	SU	الثدييات	DT
67	moisture	الرطوبة	SU	الرطوبة	SU	الرطوبة	DT
68	subcutaneous	تحت الجلد	DT	تحت الجلد	DT	تحت الجلد	DT
69	insulation	العزل	SU	عزل	SU	عزل	DT
70	coastal seas	البحار الساحلية	DT	البحار الضحلة	SU	المياه الساحلية	DT
71	breathe	تتنفس	SU	للتنفس	SU	للتنفس	DT
72	estuarine	مصبات الأنهار	SU	omitted	O	omitted	O
73	carapace	درع القرني	SU	قوقعة	SU	درقة	SU
74	excavated	محفورة	SU	محفورة	SU	محفورة	DT
75	tortoises	سلاحف البحر	SU	السلاحف البرية	SU	السلاحف البرية	DT
76	beaches	الشواطئ	SU	الشواطئ	SU	الشواطئ	DT
77	Amblyrhynchus	Amblyrhynchus الاغوانا البحرية	CS	الإغوانا البحرية (Amblyrhynchus)	CS	إغوانا غالاباغوس البحرية، Amblyrhynchus	CS
78	nostrils	منخاريها	SU	أنوفها	SU	الأنف	SU
79	ovoviviparous	بيوضة ولودة	DT	بيوض ولودة	DT	بيوض حية	DT
80	venomous	السامة	SU	السمية	SU	السمية	SU
81	species	الأنواع	SU	الأنواع	SU	الأنواع	DT
82	intensities	omitted	O	omitted	O	omitted	O
83	albatrosses	طيور القطرس	SU	طيور القطرس	SU	الألباتروس	R
84	estuarine	المصبات	SU	المصبية	SU	الشاطئية	SU
85	graze	يتغذى	SU	يتغذى	SU	يتغذى	DT
86	saltmarsh	المستنقعات المالحة	DT	المستنقعات المالحة	DT	المروج المالحة	DT
87	vegetation	نباتات	SU	النباتات	SU	نباتات	DT
88	sonar	السونار	R	السونار	R	السونار	R
89	razorbills	razorbills	R	الرايزربيل	R	الريزوبيلز	R
90	cormorants	الغاق cormorants	CS	الغاق	R	الغاقات	R
91	pelicans	البجع	SU	البجع البني	SU	البلكان البني	SU
92	migrations	الهجرة	SU	هجرة	SU	الهجرات	DT
93	latitudes	خطوط العرض	SU	خطوط العرض	SU	خطوط عرض	DT
94	subarctic	شبه القطبية	SU	القطبية الشمالية	SU	شبه القطبية	DT
95	reproduction	التكاثر	SU	التكاثر	SU	التكاثر	DT
96	nesting	تعشيش	SU	تعشيش	SU	العش	DT
97	Spawning	التفريخ	SU	التكاثر	SU	التفريخ	DT
98	gravel banks	ضفاف النهر الصخرية	DT	ضفاف الحصى	DT	ضفاف الحصى	DT
99	degradation	omitted	O	تدهورها	SP	التدهور	DT
100	pollution	التلوث	SU	التلوث	SU	التلوث	DT
101	larval	يرقة	SU	اليرقات	SU	اليرقات	DT
102	lobsters	الكركند	SU	الجرادين	SU	جراد	SU

103	mangroves	شجر المنغروف	SU	أشجار المانغروف	SU	أشجار المانغروف	SU
104	offshore	بعيدة عن الشاطيء	SU	المياه الساحلية	SU	قبالة الساحل	SU
105	salinity	الملوحة	SU	الملوحة	SU	الملوحة	DT
106	mesopelagic zone	منطقة البحر متوسطة العمق	DT	المنطقة الوسطى	DT	لمنطقة الوسطى السطحية	SU
107	tubeworms	ديدان أنبوبية	DT	الديدان الأنبوبية	DT	ديدان الأنبوب	DT
108	abundant	الوفيرة	SU	وفرة	SU	وفرة	SU
109	abyssal	العمق السحيق	SU	الأعماق السحيقة	SU	الأعماق السحيقة	SU
110	lantern	الفانوس	SU	الفانوس	SU	الفانوس	DT
111	bioluminescent	الوميض البيولوجي	DT	الإضاءة الحيوية	DT	الضوء المنتج من خلال التوهج الحيوي	SP
112	beams	شعاع	SU	الحزم المستمرة من الضوء	SP	حزم الضوء المستمرة	SP
113	Swordfishes	سمك ابو سيف	SU	أسماك السيف	SU	سمك أبو سيف	SU
114	Symbiotic	تكافلية	SU	تكافلية	SU	تكافلية	DT
115	chemotrophic	الطاقة الكيميائية	DT	كيميائية التغذية	DT	الكيميائية	DT
116	Midoceanic ridges	الحدود الوسطية للمحيطات	DT	الجبال المحيطية الوسطى	DT	التلال الوسطية المحيطية	DT
117	Mid waters	المياه الوسطية	DT	الأعماق المتوسطة	DT	المياه الوسطى	DT
118	Crustacea	قشريات	SU	القشريات	SU	الروبيان	SU
119	emissions	المصارف	SU	انبعاثات الفتحات الحرارية	SP	انبعاثات الفتحات	SP
120	ammonia	الأمونيا	R	الأمونيا	R	الأمونيا	R
121	Chiasmodon niger	Chiasmodon niger	R	السمكة البالعة الكبيرة (Chiasmodon niger)	CS	لمبتلع العظيم، Chiasmodon niger	CS
122	Tripod fish	السمكة ثلاثية القوائم tripod fish	CS	سمكة الحامل الثلاثي	DT	سمك الثلاثي القوائم	DT
123	Ratfishes	سمكة الفار	SU	الجرذان	SU	سمكة الفار	SU
124	Gulper eels	الثعبان المبتلع	SU	ثعابين السمك	SU	ثعابين الغولفر	SU
125	Intertidal	المد والجزر	SU	المد والجزر	SU	المد والجزر	DT
126	barnacles	البرنقيل	SU	البرنقيل	SU	البرنقيلين	SU
127	Laminaria	Laminaria	R	اللاميناريا	R	Laminaria	R
128	zonation	الحيز	SU	التوزيع	SU	تقسيم	SU
129	Chthamalus stellatus	Chthamalus stellatus	R	Chthamalus stellatus	R	Chthamalus stellatus	R
130	desiccation	جفاف	SU	جفاف	SU	جفاف	DT
131	thalamus	thalamus	R	المهاد	DT	thalamus	R
132	coral reefs	الشعاب المرجانية	SU	الشعاب المرجانية	SU	الشعاب المرجانية	DT
133	microscopic	ميكروسكوبية	R	مجهرية	SU	مجهرية	DT
134	sunlight	ضوء الشمس	SU	أشعة الشمس	SU	ضوء الشمس	DT
135	zooxanthelle	zooxanthellae	R	زوكسانيلاي	R	الزوكسانتيل	R
136	Colonies	مستعمرات	SU	مستعمرات	SU	مستعمرات	DT
137	budding	التبرعم	SU	التبرعم	SU	التبرعم	DT
138	Indowest Pacific	المحيط الهندي	SU	المحيط الهندي-الهادي	SU	منطقة الهند الغربية	DT
139	Microhabitats	المواطن الصغيرة	DT	البيئات الدقيقة	DT	الموائل الصغيرة	DT
140	Feather stars	نجمة الريشة	DT	نجوم الريش	DT	نجوم الريش	DT
141	Sperm	الحيوانات المنوية	SU	الحيوانات المنوية	SU	الحيوانات المنوية	DT

142	eggs	البيوض	SU	بيضها	SU	البيض	DT
143	Sponges	الإسفنج	SU	الإسفنج	SU	الإسفنج	DT
144	Filter feed	تتغذى بالترشيح	DT	تتغذى بالترشيح	DT	تتغذى بالترشيح	DT
145	Sea cucumbers	خيار البحر	SU	خيار البحر	SU	خيار البحر	SU
146	detritus	الرواسب	SU	الحطام السطحي	SU	الحطام السطحي	SU
147	Mollusks	الرخويات	SU	الرخويات	SU	الرخويات	DT
148	Algal turf	خصلات الطحلب	DT	العشب الطحلبي	DT	العشب الطحالب	SU
149	Moray eels	سمك العربيد	SU	ثعبان الموراي	SU	ثعبان الموراي	SU
150	Sea snake	أفعى البحر	SU	ثعبان البحر	SU	الأفعى البحرية	SU