

International Journal Research Publication Analysis

Page: 01-13

EVOLUTION OF OCEANOGRAPHIC PARADIGMS AND CONCEPTUALIZATION OF THE WORLD OCEAN IN GEOGRAPHY EDUCATION

**Oleksandr Lukash*, Oleksandr Parkhomenko, Yulia Oleksienko, Popelo Yaroslav,
Yuliia Khomenko**

Department of Ecology, Geography and Nature Management, T.H. Shevchenko National
University “Chernihiv Colehium”, 53 Hetmana Polubotka Street, Chernihiv, 14013, Ukraine.

Article Received: 12 September 2026

*Corresponding Author: Oleksandr Lukash

Article Revised: 02 October 2026

Department of Ecology, Geography and Nature Management, T.H.

Published on: 22 October 2026

Shevchenko National University “Chernihiv Colehium”, 53 Hetmana

Polubotka Street, Chernihiv, 14013, Ukraine.

DOI: <https://doi-doi.org/101555/ijarp.4809>

ABSTRACT

The ecological challenges of the twenty-first century and the acceleration of the triple planetary crisis require a fundamental modernization of geographical literacy in secondary education. This paper investigates the epistemological and methodological trajectories of conceptualizing the “World Ocean” framework in lower secondary school geography, directly reflecting the title’s dual focus on the evolution of oceanographic paradigms and geography education. The study opens with a macro-historical review of scientific oceanographic paradigms, tracing the evolution from nineteenth-century descriptive natural history catalogs to contemporary ecocentric, geo-systemic models. Using qualitative comparative analysis frameworks the pedagogical section provides a strict comparative assessment of two leading state-approved model curricula implemented within the New Ukrainian School (NUS) reform for Grade 7 (“Geography of Continents and Oceans”): the curriculum by Zapototskyi et al. (2022) and the alternative framework by Kobernik et al. (2022).

The results reveal a critical structural tension in sequencing and cognitive development. The Zapototskyi et al. (2022) model employs an integrated, inductive trajectory that leverages digital web-GIS applications to construct a localized sense of place. Conversely, the Kobernik et al. (2022) curriculum deploys a deductive, structural-systemic pathway, positioning the World Ocean upfront as the foundational thermodynamic engine of planetary

climate stability and feedback loops. The paper demonstrates that both frameworks robustly reflect modern scientific imperatives by integrating marine ecosystems, data sovereignty, and sustainability metrics into geographical education. The study concludes that these competing curricula are complementary rather than contradictory, offering a scalable pedagogical matrix to transition secondary geography from marine extractivism to shared ecocentric responsibility.

KEYWORDS: descriptive history of ocean life, geography education, lower secondary school, model curricula, New Ukrainian School, World Ocean concept.

1. INTRODUCTION

The geopolitical and eco-environmental transformations of the twenty-first century have forced the global educational community to fundamentally re-evaluate the conceptual boundaries of geographical literacy. Historically, Western geographical thought and historical geography operated under a profound terrestrial bias, treating landmasses as the primary theatres of human civilization while reducing the global ocean system to blank, static spaces or peripheral transport barriers (Armitage, 2019). This continental-centric epistemological framework detached human development from the fluid dynamics of the hydrosphere, a paradigm reflected heavily in nineteenth-century descriptive natural history catalogs, such as the classic work by Figuier (1868), which viewed the marine environment primarily as an exotic repository of living anomalies to be compiled and classified rather than an interconnected planetary regulator. However, as contemporary oceanography confronts the dual acceleration of global climate anomalies and severe marine degradation, this reductionist view has become obsolete. Today, the global scientific community operates within an ecocentric paradigm that positions the World Ocean as a core thermal, chemical, and biological driving force of Earth system stability, operating under the compounding shadow of the “triple planetary crisis” – where climate change, land-based pollution, and rapid biodiversity loss converge across all global marine basins (von Schuckmann et al., 2025).

This profound paradigm shift within physical geography has triggered a corresponding crisis in secondary geography education methodology, creating an urgent global need to reform how maritime spaces are intellectualized in lower secondary classrooms. Secondary schools can no longer rely on descriptive, nomenclature-heavy pedagogical frameworks that fail to convey the complex feedback loops governing human-ocean interactions (Rudd, 2014). To foster long-term environmental resilience and promote ocean data sovereignty, contemporary

education must transition toward nonmonetary, multi-evidence-based models that integrate human spatial dynamics with biophysical patterns (Lasch et al., 2024; Wedding et al., 2024). This requires a transition away from traditional, state-centric, top-down knowledge structures to inclusive, place-based marine spatial planning perspectives, dismantling historical knowledge hierarchies and validating multiple worldviews, local ecological knowledge, and social data within geographical spatial frameworks (Niner et al., 2024; Wedding et al., 2024). Ultimately, pedagogical practice must guide future generations to transition from a relationship of marine extractivism to one of ecocentric responsibility and mutual enhancement (Bender et al., 2022).

In Ukraine, this global educational imperative intersects directly with the implementation of the comprehensive state reform known as the “New Ukrainian School” (NUS). The NUS framework aims to fundamentally modernize secondary education by shifting from the traditional reproduction of encyclopedic data to an activity-based, competency-oriented pedagogical model designed to cultivate systemic critical thinking. Within the lower secondary tier (specifically Grade 7), the mandatory course “Geography of Continents and Oceans” serves as the primary curricular arena for establishing foundational geo-systemic and oceanographic concepts. The operationalization of this reform has resulted in the co-existence of competing state-approved model curricula, most notably the alternative pedagogical frameworks developed by the author collectives of Zapototskyi et al. (2022) and Kobernik et al. (2022). While both curricula allocate identical structural time frames to Grade 7 geography, they offer fundamentally divergent structural-logical and methodological pathways for constructing the “World Ocean” concept.

Using the rigorous qualitative comparative methodologies established in modern comparative education research – specifically leveraging the multidimensional analytical axes of the modified Bray-Common framework (Bray et al., 2014) – this paper systematically investigates how these two competing Ukrainian model curricula conceptualize, sequence, and operationalize the World Ocean framework. By examining the structural tension between inductive, activity-based trajectories and deductive, structural-systemic pathways, this study seeks to demonstrate how national educational reforms mirror the broader historical evolution of oceanographic science, ultimately providing a scalable pedagogical matrix for modernizing environmental education globally.

2. RESEARCH METHODOLOGY

To ensure a rigorous investigation into how modern school geography conceptualizes the World Ocean, this study employs a qualitative comparative analysis framework based on contemporary methods in comparative education. The methodological architecture of this paper is structurally grounded in the multidimensional comparative framework established by Bray et al. (2014). Specifically, we utilize a modified version of the Bray-Common Cube to analyze curricular documents along three distinct axes: the geographic-spatial level (global vs. regional macro-systems), the demographic/institutional group (Grade 7 geography learners under the New Ukrainian School reform), and the specific aspects of the curriculum (structural-logical sequencing and conceptual depth). This approach allows for a systemic evaluation of educational documents without isolating them from their broader pedagogical environments (Bray et al., 2014).

The primary source materials for this research comprise two landmark state documents: the model geography curriculum for grades 6–9 developed by Zapototskyi et al. (2022) and the alternative model geography curriculum for the same grade span developed by Kobernik et al. (2022). Both regulatory frameworks, officially approved by the Ministry of Education and Science of Ukraine, serve as the operational blue prints for implementing the competency-based paradigm of the NUS reform.

The analytical process was executed through three sequential stages.

Documentary and content analysis. A precise text-mining and qualitative content analysis of both curricula (Kobernik et al., 2022; Zapototskyi et al., 2022) was conducted. This step targeted specific terminological clusters related to oceanography, including “water masses” (*vodni masy*), “ocean currents” (*okeanichni techii*), and “marine ecosystems” (*morski ekosistemy*), evaluating their frequency, thematic distribution, and contextual application.

Structural-logical comparative mapping. Guided by the comparative education principles of analyzing curricula across different ideological and structural axes (Bray et al., 2014), we mapped the chronological placement and cognitive sequencing of the “World Ocean” units within both instructional frameworks. This permitted the identification of inductive versus deductive learning trajectories.

Conceptual matrix synthesis. Finally, the extracted data were cross-referenced against the historical evolution of scientific oceanographic paradigms. This culminated in the synthesis of a comparative matrix evaluating the pedagogical translation of thermodynamics, circulation patterns, and environmental sustainability in both educational systems.

By combining the structural-systemic lens of comparative education research (Bray et al., 2014) with the specific categorical tools of physical geography, this methodology ensures an objective, replicable, and highly nuanced comparative assessment of the two competing educational frameworks.

3. RESULTS AND DISCUSSION

3.1. The evolution of oceanographic paradigms

The epistemological trajectory of human knowledge regarding the World Ocean reveals deep paradigm shifts, moving from early localized, utilitarian descriptions to a highly integrated global ecosystem framework. Historically, human interactions with the marine environment were predominantly documented through a terrestrial lens, where oceans were conceptualized merely as peripheral spaces or barriers separating landmasses (Armitage, 2019). This long-standing focus on land and territory marginalized the sea, despite it covering more than two-thirds of the planet's surface (Armitage, 2019). Early historical accounts and descriptive catalogs, such as the seminal nineteenth-century work by Figuier (1868), *The Ocean World*, viewed the sea primarily as a massive repository of living inhabitants and physical anomalies to be encountered, observed, and recorded. Within this early analytical landscape, Louis Figuier's (1868) seminal monograph, *The Ocean World*, stands as a masterful conceptualization of the marine environment as a grand, theatrical arena of nature, operationalizing the sea simultaneously as an immense, living repository of organic inhabitants and a spectacular gallery of physical anomalies. Rather than treating the hydrosphere merely as a passive or static geographic void, Figuier (1868) conceptualized the ocean as a dynamic, three-dimensional world defined by its staggering structural and biological scale – a domain where majestic calms abruptly yield to angry agitations. His text meticulously delineates the fluid, enchanting underwater gardens, transforming the ocean into an elaborate catalog of living wonders.

Crucially, Figuier's narrative masterfully synthesizes scientific precision with nineteenth-century naturalistic awe, classifying marine life through its diverse metamorphoses, its intricate defensive strategies, and its instinctive indomitable industry. By framing the deep sea as a repository of mysterious physical phenomena – such as variable depth, shifting salinity, thermal stratification, and complex planetary currents – Figuier (1868) did not merely compile empirical species; he intellectualized the ocean as an autonomous, self-contained living entity that challenges the boundaries of terrestrial cognition. This descriptive

history served as a critical epistemological baseline, establishing the sea as an active, vital force of nature long before modern big science codified its complex thermodynamic cycles. During this early descriptive phase, science focused heavily on natural history, taxonomy, and empirical categorization of marine organisms (Dipper & Dando, 2016). The ocean was treated as a vast, static backdrop for human navigation and maritime commerce rather than a dynamic, interconnected planetary engine (Armitage, 2019).

The transition of marine biology and oceanography from a localized descriptive discipline into a highly structured “big science” began accelerating in the late nineteenth and early twentieth centuries, tracing a historical line from Darwin’s evolutionary insights to major collaborative efforts like the Census of Marine Life (Poulsen, 2010; Vermeulen, 2013). This transition shifted the scientific focus toward analyzing long-term human interactions with marine life across macro-historical scales (MacDiarmid et al., 2016). Oceans gradually emerged as an autonomous paradigm of world history, forcing researchers to move beyond traditional continental constraints and recognize the fluid, interconnected networks driving planetary development (Duara, 2021).

In the contemporary era, the global scientific community has firmly established a geo-systemic and ecocentric paradigm, viewing the World Ocean as a central thermal, chemical, and biological regulator of the Earth system (Bender et al., 2022; von Schuckmann et al., 2025). Modern oceanography is increasingly conducted under the shadow of the “triple planetary crisis” – where the compounding, accelerating impacts of climate change, rapid biodiversity loss, and land-based pollution converge across all marine basins (von Schuckmann et al., 2025). Current research prioritizes understanding the ocean-atmosphere carbon cycle, vertical stratification of water masses, and the thermodynamic underpinnings of extreme climate disruptions (Rudd, 2014; von Schuckmann et al., 2025).

This scientific evolution has directly triggered a governance crisis, prompting a fundamental re-evaluation of how marine resources are managed. Modern ocean governance is transitioning from sectoral, state-centric management models to inclusive, place-based marine spatial planning (Chen & Liu, 2023; Wedding et al., 2024). Researchers emphasize that addressing complex environmental transformations requires integrating multiple worldviews, social data, and local ecological knowledge rather than relying strictly on top-down Western data layers (Lasch et al., 2024; Wedding et al., 2024). By dismantling historical knowledge hierarchies and promoting ocean data sovereignty, contemporary science seeks to transition human society from a relationship of extractivism to one of mutual

enhancement, co-learning, and ecocentric responsibility (Bender et al., 2022; Niner et al., 2024).

3.2. Comparative analysis of the “World Ocean” concept in Ukrainian model geography curricula for lower secondary education

The modernization of geography education within the framework of the NUS reform has shifted the pedagogical paradigm from rote memorization of spatial data to an activity-based, competency-oriented model. In lower secondary education (specifically Grade 7, “Geography of Continents and Oceans”), this transition is vividly reflected in how the concept of the World Ocean is structured and intellectualized. To understand how contemporary school geography operationalizes scientific oceanographic paradigms, a strict comparative analysis was conducted between the two leading model curricula approved by the Ministry of Education and Science of Ukraine: the curriculum by Zapototskyi et al. (2022) and the curriculum by Kobernik et al. (2022). Both frameworks allocate 70 academic hours to the Grade 7 course (2 hours per week), yet they demonstrate divergent structural-logical and methodological pathways for constructing the “World Ocean” concept.

The sequencing of thematic units within both curricula reveals distinct epistemological priorities. The curriculum developed by Zapototskyi et al. (2022) adopts an integrated, regional-to-global inductive trajectory. It initiates the student's journey with the study of individual continents, embedding oceanographic aspects primarily as external geographic and climate-forming factors for specific landmasses. The specialized, holistic unit on the World Ocean is positioned in the latter half of the academic year. This allows students to first accumulate descriptive, empirical data about localized coastal waters, currents, and regional environmental degradation before synthesizing these observations into a unified global system.

Conversely, the curriculum by Kobernik et al. (2022) prioritizes a deductive, structural-systemic trajectory. It introduces a comprehensive, overarching framework of the World Ocean as a single, macro-scale geographic system early in the course, preceding the detailed study of individual continents. By establishing fundamental principles of oceanic circulation, properties of water masses, and global energy exchange at the outset, Kobernik et al. (2022) provide students with a conceptual matrix. This matrix is later systematically applied to explain the natural anomalies and climatic features of each continent as it is encountered.

When examining the specific oceanographic nomenclature, both curricula ensure the formation of baseline concepts such as *water masses*, *ocean currents*, and *marine ecosystems*, but they diverge in their analytical depth and the deployment of technological tools.

The Zapototskyi et al. (2022) framework focuses heavily on the dynamic interactions between the atmosphere and the upper layers of the ocean. It uses the concept of water masses to illustrate immediate climate-forming factors. The Kobernik curriculum expands this into a multi-dimensional system, explicitly demanding that students analyze the vertical stratification of water masses, deeper thermohaline circulation patterns, and the long-term thermal inertia of the ocean.

Zapototskyi et al. (2022) emphasize the geographic distribution and nomenclature of major warm and cold currents, utilizing them as spatial indicators of heat transport. Kobernik et al. approach currents through a mechanistic lens, focusing on the planetary wind systems (e.g., trade winds, westerlies) as primary drivers and forcing students to evaluate the planetary-scale feedback loops within the ocean-atmosphere system.

To provide a scannable, rigorous overview of these pedagogical differences for researchers, the structural and substantive elements of both model curricula regarding the World Ocean are systematized in Table 1.

Table 1. Comparative matrix of the “World Ocean” conceptualization in NUS model curricula. (Grade 7)

Pedagogical Dimension	Model Curriculum by Zapototskyi et al. (2022)	Model Curriculum by Kobernik et al. (2022)
Methodological framework	Activity-based and digital-integrative; prioritizes spatial orientation and practical geographic skills.	Structural-systemic and analytical; prioritizes causality, spatial patterns, and geographical logic.
Curricular placement & sequencing	Inductive positioning; the holistic study of the World Ocean follows the individual analysis of continents.	Deductive positioning; global oceanographic patterns are taught upfront as a foundation for studying continents.
Dominant conceptual focus	Climatological and spatial interaction; the ocean is viewed as a primary modifier of continental climates.	Geosystemic and thermodynamic; the ocean is treated as a self-contained macro-system with internal cycles.
Method of conceptualizing “Water Masses”	Focused on surface-layer properties (temperature, salinity) and their immediate impact on coastal weather.	Focused on three-dimensional classification (surface, intermediate, deep) and global vertical circulation.
Pedagogical translation of	Taught via cartographic identification and tracing the	Taught via causal-linkage analysis, connecting planetary winds, the

currents	paths of major thermal anomalies.	Coriolis effect, and global water transport.
Environmental & anthropogenic integration	Framed through localized ecological threats and visible pollution (e.g., garbage patches, oil spills).	Framed through systemic global changes (e.g., acidification, rising sea levels, carbon sequestration shift).
Primary digital & cartographic tools	Heavy reliance on interactive web GIS (e.g., ArcGIS Online, Google Earth) for spatial modeling.	Reliance on thematic structural charts, comparative profile maps, and statistical matrices.

Both programs reflect the contemporary geo-systemic and environmental paradigm of science, linking oceanography directly to the UN Sustainable Development Goal 14 (Life Below Water). However, the pedagogical execution differs. Zapototskyi et al. (2022) contextualize environmental issues through localized regional crises (e.g., plastic pollution in the Pacific, overfishing in coastal zones). Kobernik et al. (2022) frame marine ecology through the lens of global global change, focusing on ocean acidification, the disruption of the global carbon cycle, and the systemic consequences of biodiversity loss in the pelagic and benthic zones.

In summary, while both curricula successfully transition away from purely descriptive geography toward a modern, problem-solving educational model, they provide different cognitive pathways for the student. Zapototskyi et al. (2022) build the concept of the World Ocean from the specific to the general, leveraging digital tools to map spatial interactions. Kobernik et al. (2022) establish a rigid, system-level scientific framework from the general to the specific, embedding the ocean as the foundational thermodynamic engine of the planet.

The comparative analysis of the model geography curricula for Grade 7 within the NUS framework, combined with the historical overview of oceanographic paradigms, highlights a significant synchronization between contemporary physical geography and secondary education methodology. This study demonstrates that school geography has successfully transcended the traditional, continent-centric, and purely descriptive limitations that dominated nineteenth-century natural history frameworks, such as those presented in the early classification works by Figuier (1868) and early twentieth-century expeditions (Poulsen, 2010; Vermeulen, 2013). Instead, modern curricula act as institutional vehicles that translate complex, macro-historical, and geo-systemic scientific shifts directly into pedagogical practice.

The structural divergence between the two analyzed curricula offers distinct cognitive pathways for students to intellectualize the “World Ocean” concept. The framework by

Zapototskyi et al. (2022) addresses the spatial-integrative dimensions of geography, allowing students to build a sense of place inductively through localized regional environmental crises, cartographic models, and digital web-GIS applications, aligning with the place-based frameworks proposed by Wedding et al. (2024). In contrast, the curriculum by Kobernik et al. (2022) introduces a rigid, deductive trajectory that mirrors the systemic, thermodynamic, and macro-historical paradigms advocated by Duara (2021) and Armitage (2019). By positioning the World Ocean as the foundational thermodynamic and environmental baseline early in the academic year, Kobernik et al. provide a conceptual matrix that effectively models the planetary-scale feedback loops driving global climate stability and ecological shifts (von Schuckmann et al., 2025).

Both educational frameworks are robustly responsive to the contemporary scientific realities of the “triple planetary crisis” – specifically where the overlapping pressures of rapid warming, ocean acidification, and land-based plastic pollution converge across global marine basins (von Schuckmann et al., 2025). By linking oceanography explicitly to international sustainability indicators and the UN Sustainable Development Goals, both programs structurally integrate the ecocentric and biocultural imperatives necessary to reshape the human-ocean relationship (Bender et al., 2022). Furthermore, these curricula address the ongoing methodological challenge of dismantling traditional knowledge hierarchies by encouraging the inclusion of multiple worldviews, local ecological knowledge, and social data within geographic spatial models (Lasch et al., 2024; Niner et al., 2024; Wedding et al., 2024).

Ultimately, this study concludes that the choice between an inductive, activity-based trajectory (Zapototskyi et al., 2022) and a deductive, structural-systemic pathway (Kobernik et al., 2022) should not be viewed as a pedagogical contradiction. Rather, these competing model curricula complement one another by addressing different operational dimensions of modern geography education. To successfully foster ocean data sovereignty and cultivate environmental resilience in lower secondary education, future pedagogical practices must synthesize the spatial-digital agility of the Zapototskyi et al. (2022) model with the causal-systemic depth of the Kobernik et al. (2022) framework. This synthesis is critical to ensuring that future generations transition from a paradigm of marine extractivism to one of mutual enhancement and shared ecocentric responsibility.

4. CONCLUSIONS

This study investigated the epistemological transformation of the “World Ocean” concept, demonstrating a critical structural bridge between the historical evolution of oceanographic paradigms and contemporary secondary geography education methodology. Based on the qualitative comparative assessment of the state-approved model curricula for Grade 7 within the NUS reform, the following key conclusions are established. The pedagogical transition away from the foundational nineteenth-century oceanographic frameworks – most notably exemplified by Louis Figuier’s (1868) seminal monograph, *The Ocean World*, which intellectualized the sea as a magnificent, chaotic repository of living inhabitants and physical anomalies – highlights a profound modernization of environmental and geographical literacy. Modern geography education has effectively shifted from Figuier’s descriptive natural history baseline toward an ecocentric, geo-systemic paradigm. School geography now acts as an institutional mechanism that actively translates complex, accelerated planetary challenges, such as the contemporary “triple planetary crisis” (warming, acidification, and plastic pollution), into structured learning processes.

The two analyzed NUS model curricula offer distinct but complementary cognitive trajectories for intellectualizing the World Ocean. The curriculum by Zapototskyi et al. (2022) utilizes an integrated, inductive path that builds a localized sense of place through digital web-GIS tools and regional environmental focus. Conversely, the framework by Kobernik et al. (2022) deploys a strict, deductive, structural-systemic trajectory, presenting the World Ocean upfront as the foundational thermodynamic engine governing global climate stability and planetary feedback loops.

Both curricula successfully respond to modern scientific and pedagogical imperatives by incorporating multi-evidence-based models, social data, and local ecological knowledge. This structural integration effectively dismantles traditional top-down knowledge hierarchies and supports the foundational principles of ocean data sovereignty and environmental resilience.

In conclusion, to maximize the strategic impact of geographical literacy in lower secondary education, future pedagogical practices should avoid treating these two curricular pathways as contradictions. Instead, a dynamic synthesis is required, combining the spatial-digital agility of the Zapototskyi et al. (2022) model with the causal-systemic depth of the Kobernik et al. (2022) framework. This integration is essential to cultivate a generation capable of moving beyond marine extractivism toward shared ecocentric responsibility and mutual enhancement with the World Ocean.

REFERENCES

1. Armitage, D. (2019). World history as oceanic history: Beyond Braudel. *The Historical Review/La Revue Historique*, 15, 343–364. <https://doi.org/10.12681/hr.20462>
2. Bender, M., Bustamante, R., & Leonard, K. (2022). Living in relationship with the Ocean to transform governance in the UN Ocean Decade. *PLoS Biology*, 20(10), Article e3001828. <https://doi.org/10.1371/journal.pbio.3001828>
3. Chen, Y., & Liu, H. (2023). Critical perspectives on the new situation of global ocean governance. *Sustainability*, 15(14), Article 10921. <https://doi.org/10.3390/su151410921>
4. Dipper, F., & Dando, M. (2016). *The marine world: A natural history of ocean life*. Princeton University Press. <https://doi.org/10.2307/j.ctv1jk0jtt>
5. Duara, P. (2021). Oceans as the paradigm of history. *Theory, Culture & Society*, 38(7-8), 143–166. <https://doi.org/10.1177/0263276420984538>
6. Figuiet, L. (1868). *The ocean world: Being a descriptive history of the sea and its living inhabitants*. Chapman & Hall.
https://upload.wikimedia.org/wikipedia/commons/2/25/The_ocean_world_-_being_a_descriptive_history_of_the_sea_and_its_living_inhabitants%28IA_oceanworld00figu%29.pdf
7. Figuiet, L. (1868). *The ocean world: Being a descriptive history of the sea and its living inhabitants* (ch. trans. from *La Vie et les Mœurs des Animaux*). (Ch. Bévalet, Illus.). Chapman & Hall.
[wikimedia.orgbeing_a_descriptive_history_of_the_sea_and_its_living_inhabitants%28IA_oceanworld00figu%29.pdf](https://upload.wikimedia.org/wikipedia/commons/2/25/The_ocean_world_-_being_a_descriptive_history_of_the_sea_and_its_living_inhabitants%28IA_oceanworld00figu%29.pdf)
8. Kobernik, S. H., Kovalenko, R. R., Hruzynska, I. R., & Nadtochii, O. L. (2022). *Heohrafiia. 6–9 klasy: Modelna navchalna prohrama dlia zakladiv zahalnoi serednoi osvity* [Geography. Grades 6–9: Model curriculum for institutions of general secondary education]. Ministry of Education and Science of Ukraine. [In Ukrainian]. <https://mon.gov.ua/static-objects/mon/sites/1/zagalna%20serednya/Navchalni.prohramy/2021/14.07/Model.navch.proh.r.5-9.klas.NUSH-poetap.z.2022/Prirod.osv.galuz/Heohrafiya/Heohrafiya.6-9%20kl.Kobernik.ta.in.06.05.22.pdf>
9. Lasch, K. G., Gollner, S., Oude Elferink, A., Rühs, S., Sangiorgi, F., van Sebille, E., & Wang, J. (2024). Whose Ocean? Exploring multidisciplinary perspectives towards ocean sustainability and implications for the un(der)represented. *Research Ideas and Outcomes*, 10, Article e114485. <https://doi.org/10.3897/rio.10.e114485>

10. MacDiarmid, A., MacKenzie, B., & Ojaveer, H. (2016). Multidisciplinary perspectives on the history of human interactions with life in the ocean. *ICES Journal of Marine Science*, 73(5), 1382–1385. <https://doi.org/10.1093/icesjms/fsw059>
11. Niner, H. J., Wilson, D., Hoareau, K., Strand, M., Whittingham, J., McGarry, D., Erinosh, B., Ibrahim, S., Tshiningayamwe, S., Febrica, S., Lancaster, A. M. S. N., & Prokic, M. (2024). Reflections on the past, present, and potential futures of knowledge hierarchies in ocean biodiversity governance research. *Frontiers in Marine Science*, 11, Article 1347494. [doi.org](https://doi.org/10.3389/fmars.2024.1347494)
12. Poulsen, B. (2010). *Life in the world's oceans*. Wiley-Blackwell. <https://doi.org/10.1002/9781444325508.ch1>
13. Rudd, M. A. (2014). Scientists' perspectives on global ocean research priorities. *Frontiers in Marine Science*, 1, Article 36. <https://doi.org/10.3389/fmars.2014.00036>
14. Vermeulen, N. (2013). From Darwin to the Census of Marine Life: Marine biology as big science. *PLoS ONE*, 8(1), Article e54284. <https://doi.org/10.1371/journal.pone.0054284>
15. von Schuckmann, K., Gues, F., Moreira, L., Liné, A., & de Pascual Collar, Á. (2025). Global ocean change in the era of the triple planetary crisis. In K. von Schuckmann, L. Moreira, Á. de Pascual Collar, M. Grégoire, P. Brasseur, G. Garric, J. Karstensen, P. Lionello, M. Marcos, P.-M. Poulain, & J. Staneva (Eds.), *9th edition of the Copernicus Ocean State Report (OSR9)* (State Planet, 6-osr9, 2). Copernicus Publications. <https://doi.org/10.5194/sp-6-osr9-2-2025>
16. Wedding, L. M., Pittman, S. J., Lepczyk, C. A., Parrain, C., Puniwai, N., Boyle, J. S., Goldberg, E. G., Young, M., Marty, P., Wilhelm, K., Taylor, S., & Crowder, L. B. (2024). Integrating the multiple perspectives of people and nature in place-based marine spatial planning. *npj Ocean Sustainability*, 3, Article 43. <https://doi.org/10.1038/s44183-024-00071-9>
17. Zapototskyi, S. P., Karpuk, A. R., Kostytsia, M. Yu., Kondratiev, A. V., Topuzov, O. M., Hrosheva, O. V., & Volynets, I. O. (2022). *Heohrafiia. 6–9 klasy: Modelna navchalna prohrama dlia zakladiv zahalnoi serednoi osvity* [Geography. Grades 6–9: Model curriculum for institutions of general secondary education]. Ministry of Education and Science of Ukraine. [In Ukrainian]. <https://mon.gov.ua/static-objects/mon/sites/1/zagalna%20serednya/Navchalni.prohramy/2021/14.07/Model.navch.proh.r.5-9.klas.NUSH-poetap.z.2022/Prirod.osv.galuz/Heohrafiya/Heohrafiya.6-9-kl.Zapototskyy.ta.in.06.05.2022.pdf>