Briefing paper

The ocean in the National Curriculum

Executive Summary

This briefing paper examines the evolution of ocean literacy in the National Curriculum, tracing its progress from the initial inclusion of marine environments in the 2013/14 curriculum review to the present day. While these early changes marked a significant step forward, particularly in geography and science programmes of study, the current state of ocean literacy in education still faces several challenges. These include a lack of coherence in teaching Earth System science, a disconnect between knowledge and action, limited development of ocean topics in upper key stages, and a tendency to view the ocean as a single habitat rather than a diverse array of ecosystems.

Recent years have seen an increased urgency in addressing climate and nature crises, alongside the development of ocean literacy in international contexts and a broader conception of environmental literacy. In response to these trends, this paper proposes a framework that integrates ocean literacy throughout the science and geography curricula. This approach emphasises an Earth System perspective, highlights ecosystem goods and services, promotes equality between terrestrial and marine ecosystems, and enhances overall environmental literacy.

To illustrate this approach, the paper presents worked examples for Key Stage 2 and Key Stage 3. The KS2 unit focuses on blue carbon habitats such as mangroves and seagrass meadows, while the KS3 unit explores climate change within the context of Earth's interconnected systems. These examples demonstrate how the proposed framework can be practically implemented in the classroom.

The benefits of this integrated approach are manifold. It aligns the curriculum with current Earth System science and international frameworks, offers increased flexibility in case studies, and provides opportunities to address climate anxiety through nature-based solutions. Furthermore, it enhances critical thinking skills, leverages new technologies to bring distant ecosystems into the classroom, and lays a foundation for exploring green and blue careers.

By adopting this approach, the National Curriculum can provide students with a more holistic understanding of environmental challenges and their role in addressing them. This not only updates the curriculum to reflect current scientific understanding but also prepares students to engage with global environmental priorities in meaningful ways.

Background

During the curriculum review process in 2013/14 curriculum drafts for all subjects were published without a single mention of the ocean. A coalition was created to address this gap, and worked successfully with learned societies, subject associations, educators and academics. This resulted in the first explicit mentions of the marine environment in the National Curriculum programmes of study, chiefly the inclusion of the phrase 'globally significant places - both terrestrial and marine' and the topic of hydrology to geography, and the ocean as an alternative habitat to the teaching of biological processes in science[1].

With a new curriculum review in place in 2024, this paper highlights the main currents in teaching about the environment through the core curriculum and proposes how a revised National Curriculum can build on this previous work.

Reflections on current status of ocean literacy in the National Curriculum

The changes made to include the ocean in the National Curriculum during the 2013/14 review were a good starting point and may have been a contributing factor to more widespread teaching of ocean topics in classrooms. This has been especially evident at the key stage 2 level across the curriculum and in the teaching of geography at key stage 3. Evidence for this includes ocean resources produced by Encounter Edu which rose from 13,456 downloads in the period 2011-2014 to 166,338 in the period 2015-2018. This higher level has been sustained with annual averages of 83,634 downloads from 2019 to 2023. Alongside, other ocean literacy initiatives such as World Ocean Day for schools.[2]

The two main curricular changes that contributed to this growth were:

1. The addition of the phrase globally significant places - both terrestrial and marine' in the aims of the geography programmes, with a more explicit range of human and physical terminology within the geography programmes of study from key stage 1 to 3;
2. And the addition of the ocean as an alternative habitat for study within the primary science programmes of study.

Irrespective of adding specific curriculum content regarding the ocean, ocean literacy is still hampered by:

- A lack of coherence around teaching the Earth System and living things and habitats, viz. Alexander von Humboldt's insistence that Earth and life must be studied together in order to be properly understood.
- A divorcing of the connection between knowledge and action (and the intervening development of connectedness to environments, values, attitudes, and competences).
- A lack of concerted development of ocean topics from this base into upper key stages.
- The perpetuation (especially in science) of the view that the ocean is one habitat rather than a plurality of habitats. For example, within the key stage 2 science programme of study the ocean is currently on a par with the tropical rainforest rather than terrestrial habitats as whole.

Major trends

Since the publication of the last National Curriculum programmes of study there have been three major trends to note.

1. The increased urgency of the climate and nature crises
2. The development of ocean literacy in the international context

[1] See Ocean Literacy UK Final Report.pdf for further details
[2] See World Ocean Day for Schools

3. The development of a broader conception of environmental literacy

The climate and nature crises

Since the last curriculum review, the climate and nature crises have grown in urgency. The UK government has responded through the Sustainability and climate change: a strategy for the education and children's services systems[3]. This includes a drive to include nature and climate throughout the curriculum, including the science and geography programmes of study, alongside the creation of a new Natural History GCSE. The strategy also notes the importance of developing 'green skills' and preparing young people for 'green jobs'. These changes are in the context of UNESCO's Education for sustainable development for 2030 strategy[4].

The development of ocean literacy

Within the ocean community, the establishment of the UN Decade of Ocean Science for Sustainable Development[5] (the UN Ocean Decade) has created an international impetus for ocean literacy. Within this work, UNESCO has advocated for greater ocean literacy through the taught curriculum through A new blue curriculum: a toolkit for policy-makers[6]. This policy work has been buoyed by increased public consciousness of the ocean through landmark television programmes such as the Blue Planet series, and concomitant media campaigns around marine plastic pollution.

Broader conception of environmental literacy

The 2013/14 curriculum review saw the reduction of the citizenship curriculum to a narrower civics focus, losing the curriculum space for the development of values, attitudes and actions pertaining to impact topics from identity to climate change. The understandable rationale was that environmental action should be taught by subject specialists from e.g. science and geography departments. However, there was no direct curriculum space created in these associated programmes of study.

A growing research base[7] points to the fact that knowledge and awareness of environmental topics are not sufficient to drive behaviour change. This points to the need to include the development of nature-connectedness, values and attitudes, as well as competences to bring about sustained pro-environmental behaviours and actions.

Proposed framework for ocean literate curriculum development

This briefing paper does not argue for a separate ocean topic to be introduced into the revised curriculum, instead, it argues for the ocean to be integrated fully throughout the science and geography curricula alongside a broader conception of environmental literacy.

At this point, it is worth restating the primacy of the ocean in the Earth's natural systems and biosphere as well as the ocean's importance to human wellbeing.

The importance of the ocean

[3] See Sustainability and climate change: a strategy for the education and children's services systems - GOV.UK
[4] See Education for sustainable development: a roadmap
[5] See Ocean Decade
[6] See A new blue curriculum: a toolkit for policy-makers
[7] See for example Pro-Environmental Behavior, Connectedness to Nature, and Wellbeing Dimensions among Granada Students and A Change of Mind: Applying Social and Behavioral Research Methods to the Assessment of the Effectiveness of Ocean Literacy Initiatives

It is worth restating that in addressing the crises outlined above, the critical role of the ocean in sustaining a healthy planet, including human health and livelihoods.

- The ocean covers 70% of the world's surface.
- The ocean provides 97% of the living space on the planet.
- The ocean provides protein for 3 billion people.
- The ocean currently absorbs 40% of the carbon emissions from human activities,
- The ocean has absorbed 90% of the excess heat caused by human carbon emissions.
- The ocean stores 60 times more carbon than the atmosphere and 16 times more carbon than the terrestrial biosphere.

This paper has identified four broad areas where the ocean can be made more prominent to enhance not only ocean literacy but also a more coherent and current curriculum offer.

The Earth System

Current conceptions of the Earth System are at the heart of professional and academic science and drive a fuller and more robust understanding of how the Earth is being altered by human activity.

Points to consider:

- How can we move towards an Earth System approach to teaching how the planet works, and creating this as a fundamental building block with equal parity to other? This would include a study of how the biosphere, atmosphere, hydrosphere, and geosphere interact (open for debate as to whether the cryosphere is included separately).
- Earth systems play a large role in environmental science because the connections between Earth systems is at the heart of some of our most pressing nature-societal issues, such as global climate change, water availability, and the loss of biological diversity.

For climate education, this would bring the importance of protecting and enhancing Earth's natural carbon sinks, moving beyond the current sole focus on decarbonisation.

Ecosystem goods and services

The value of ecosystems for human wealth and wellbeing reaches beyond the climate crisis. The teaching of ecosystem goods and services is touched upon through topics such as food, weather, insect pollination, and storm protection at higher key stages, but there is no systematic development and inclusion of this them throughout the curriculum.

- How can ecosystem goods and services be included fully throughout the curriculum and appropriately scaffolded?
- How can the impact of human activity on the environment be included alongside the benefits of natural systems to human wealth and wellbeing?
- Within the topic of food, how can overfishing (as the main example of wild harvest) and the pros and cons of aquaculture be made more accessible and explicit?

Equality between terrestrial and marine ecosystems

The introduction of the phrase 'globally significant places - both terrestrial and marine' in the aims of the geography programmes of study gave more prominence to the teaching of ocean topics. This gave explicit 'permission' for teachers to include more ocean topics and case studies in their teaching.

- How can this foundation be developed into the science programme of study, in particular through living things and their habitats?

- How can the 'ocean' be introduced into teaching not as a homogeneous habitat but with the same wealth and diversity as habitats on land? For example, the ocean is not comparable to the rainforest but contains many distinct habitats including rocky and sand shores, seagrass meadows, kelp forests, saltmarshes, mangrove forests, kelp forests, coral reefs, seamounts, hydrothermal vents, and abyssal plains, just to mention a few.

Environmental literacy

As noted above, the idea of environmental literacy needs to be enhanced to give young people the opportunity to engage properly with a changing planet.

- How will young people's nature connectedness to a wide range of critical environments be created? What role does technology play in this?
- How will the curriculum develop values and attitudes?
- How can the DfE Sustainability Strategy's focus on skills and jobs be aligned with the knowledge areas of the curriculum?
- How can a new learning taxonomy such as the one below assist in this?

Awareness	Values & connections			Skills & behaviours		
Knowing	**Connecting**	**Reflecting**	**Influencing**	**Planning**	**Advancing**	**Reviewing**
Know	Communicate	Reflect	Raise	Plan	Improve	Discuss
Define	Empathise	Recognise	Encourage	Promote	Innovate	Evaluate
Understand	Connect	Question	Argue	Apply	Challenge	Analyse
Be aware of	Empower	Feel	Affect	Develop	Demand	Contact
		Relate	Negotiate	Debate	Implement	

Worked examples

In light of the above review of the current status of ocean literacy in the National Curriculum and the proposed framework for ocean literate curriculum development, it is evident that new teaching approaches are crucial for conservation and climate change education, particularly in the context of enhancing ocean literacy.

The following worked examples for Key Stage 2 and Key Stage 3 demonstrate how these new approaches can be implemented, addressing the identified gaps and building on the progress made since the 2013/14 curriculum review.

Key Stage 2 example - (ocean) conservation

The Key Stage 2 unit could focus on blue carbon habitats, such as mangroves and seagrass meadows. By exploring these crucial yet often overlooked ecosystems, students will gain a deeper understanding of the ocean's role in climate regulation and biodiversity. This unit addresses the current limitation of viewing the ocean as a single habitat and highlights the importance of marine ecosystems in climate change mitigation.

This approach aligns with the need for a more integrated understanding of the natural world, moving beyond single-issue focuses to help students appreciate the multifaceted value of healthy ecosystems. It also provides a foundation for understanding global environmental challenges and the importance of conservation efforts at local, national, and international levels.

Key [colour text tags used in case of formatting errors]

[green]Current geography curriculum coverage

[yellow]Current science curriculum coverage

[blue]Current numeracy or literacy opportunities

[purple]Current non-statutory PSHE guidance

[red]Current DfE Climate Change strategy links[/red]

[cyan]Additional suggestions for curricular content[/cyan]

<table>
<tr><th></th><th>Knowledge & Awareness</th><th>Connectedness & Attitudes</th><th>Skills & Behaviours</th></tr>
<tr><td>Context
Ensure that ocean habitats are given an equal billing with terrestrial habitats and perhaps more so if students are using their school grounds as a comparison</td><td colspan="3">[green]Clarity from the geography programme of study to include both terrestrial and marine places[/green]
[yellow]Option out of e.g. rainforest, oceans, desert areas, and prehistoric times[/yellow]
[cyan]Curricular provision to study at least one ocean habitat per key stage, placing the ocean on the same basis as land[/cyan]</td></tr>
<tr><td>Habitat geography
Focus on the location and features of habitats, with the potential to include comparative studies and experiential learning</td><td>[green]Locational & place knowledge
Climate zones, biomes, etc.
Use of maps and atlases[/green]
[yellow]Living things & their habitats[/yellow]</td><td>[red]Increase opportunities for all children and young people to spend time in nature as part of education[/red]
[cyan]Use of VR / virtual field trips and other immersive technologies[/cyan]
[yellow]Local field trips or school</td><td>[green]Use of GIS and other mapping tools[/green]</td></tr>
</table>

		grounds studies to provide a comparison[/yellow]	
Habitat processes Covers the ecological aspects of habitats, interactions within habitats, and the scientific methods used to study them	[yellow]Living things & their habitats Animals including humans Evolution & inheritance[/yellow] [green]Climate zones, biomes and vegetation belts[/green]	[cyan]Live-stream by a practising scientist Understanding of the use of science in conservation[/cyan]	[yellow]Science and investigation skills Use of models such as food webs to describe interdependencies[/yellow]
Human interactions Addresses the impact of human activity on habitats, our dependence on ecosystem services, and conservation efforts	[green]Human & physical geography[/green] [yellow]Recognise that environments can change[/yellow] [cyan]Ecosystem goods and services and dependence of humanity on a thriving natural world[/cyan]	[purple]Shared responsibilities for caring for other people and living things[/purple] [cyan]Debate topical issues including stakeholder groups Engagement with the issues around environmental justice[/cyan]	[red]Support lifelong awareness of green careers and skills[/red] [blue]Numeracy skills (data interpretation] Literacy skills (debate)[/blue]
Taking action Emphasises an understanding of conservation, showcasing potential for positive impacts, and develops advocacy skills, with the potential to lead to green careers	[cyan]Understand the roles of NGOs and government in protecting the environment Understand the role and limitations of individual behaviour change Nature-based solutions[/cyan]	[cyan]Live stream or recording from NGO or policy world Highlight examples of positive impacts on the environment[/cyan]	[red]Support lifelong awareness of green careers and skills[/red] [purple]Carry out shared responsibility for protecting the environment[/purple] [cyan]Develop group work and, communications, and advocacy skills[/cyan] [blue]Numeracy skills (use of data in advocacy and policy Literacy skills (communications and oracy skills)[/blue]

The Key Stage 3 unit focuses on climate change within the broader context of Earth's interconnected systems. This approach moves beyond viewing climate change as an isolated phenomenon, instead presenting it as a complex issue that interacts with and influences various aspects of our planet's physical, biological, and human systems.

By exploring climate change through this holistic lens, students will gain a deeper understanding of the intricate relationships between the atmosphere, hydrosphere, geosphere, and biosphere. This unit emphasises the central role of the ocean in climate regulation and global environmental processes, addressing the current gap in ocean literacy within climate education.

This integrated approach aligns with the need for a more comprehensive understanding of global environmental challenges. It helps students appreciate the far-reaching impacts of climate change on biodiversity, ecosystems, human societies, and economies. Moreover, it provides a foundation for exploring the interconnected nature of environmental issues, from local to global scales, and the importance of multi-faceted solutions that consider these complex relationships.

Key [colour text tags used in case of formatting errors]

[green]Current geography curriculum coverage[/green]

[yellow]Current science curriculum coverage[/yellow]

[blue]Current numeracy or literacy opportunities[/blue]

[purple]Current non-statutory PSHE guidance[/purple]

[red]Current DfE Climate Change strategy links[/red]

[cyan]Additional suggestions for curricular content[/cyan]

	Knowledge & Awareness	**Connectedness & Attitudes**	**Skills & Behaviours**
Context	[cyan]The influence of human activity on carbon levels has a system-wide effect and is not limited to terrestrial systems or atmospheric warming. This approach demonstrates that climate change has warmed the atmosphere, ocean, and land, with widespread and rapid changes affecting the atmosphere, ocean, cryosphere and living systems./cyan]		
Carbon basics Explaining the carbon cycle, sources and sinks, the greenhouse effect, and how human activity influences carbon levels	[yellow]The carbon cycle Production of carbon dioxide by human activity and the impact on the climate[/yellow] [cyan]Teaching the carbon cycle should include reference to the relative sizes of the main carbon stores and fluxes[/cyan]	[cyan]Develop a sense of natural carbon cycles through local ecosystem exploraiton[/cyan]	[cyan]Critical thinking with specific reference to evaluating the evidence for climate change and addressing climate myths Potential for virtual meeting with climate scientist to dispel myths[/cyan]
Climate changes	[yellow]Production	[cyan]Developing	[yellow]Interpreting

Differentiation between weather and climate, understanding of historical climate change, analyse current trends, and explore future projections	of carbon dioxide by human activity and the impact on the climate[/yellow] [green]Change in climate from the Ice Age to the present[/green] [cyan]Ocean acidification and its impacts Heat storage in different parts of the Earth system[/cyan]	emotional connections to local environments affected by climate change[/cyan]	climate data and graphs[/yellow]
System impacts How changes in climate and the carbon cycle affect various interconnected systems (physical, biological, and human)	[green]Human & physical geography[/green] [yellow]The interdependence of organisms in an ecosystem[/yellow] [cyan]Connection of Earth System changes to human and the biosphere with a reference to biodiversity loss[/cyan]	[purple]Shared responsibilities for caring for other people and living things[/purple] [cyan]Fostering a sense of global interconnectedness including aspects of climate justice[/cyan]	[red]Support lifelong awareness of green careers and skills[/red] [blue]Numeracy skills (data interpretation] Literacy skills (debate)[/blue]
Taking action Focuses on solutions, from individual actions to global cooperation, including the role of innovation and technology	[cyan]In-depth study of decarbonisation and nature-based mitigation strategies, including climate policy at a range of scales from the local to the international Understanding personal and collective impacts on climate change[/cyan]	[cyan]Developing a personal connection to local natural environments Acknowledgement and strategies to address climate anxiety Exploration of how personal values relate to climate action[/cyan]	[red]Support lifelong awareness of green careers and skills[/red] [purple]Carry out shared responsibility for protecting the environment[/purple] [cyan]Develop group work and, communications, and advocacy skills Potential for involving NGOs working in this space of debate on the role of technologies in climate adaptation and mitigation[/cyan] [blue]Numeracy skills (use of data in advocacy and policy

			Literacy skills (communications and oracy skills) [/blue]

Framework benefits

The approaches shown above seek to integrate national and international frameworks in education and beyond:

- The integrated approach aligns with the growth in Earth System science, moving away from a siloed understanding of environmental change.
- Highlighting the role and importance of the ocean addresses the UNESCO New Blue Curriculum and the UN Decade of Ocean Science for Sustainable Development.
- The broader conceptual framework for climate and ocean literacy draws from UNESCO frameworks on ocean literacy and UN Sustainable Development Goals.
- Aspects of global citizenship are addressed through connections to the DfE's Climate Strategy and non-statutory PSHE guidance.

Beyond bringing the curriculum up-to-date with these wider trends, this approach also offers:

- Increased flexibility in case studies, tied to current research and local-to-global environmental issues.
- Opportunities to address climate anxiety by emphasising nature-based solutions and conservation efforts.
- Enhanced critical thinking skills through data analysis and understanding of complex systems.
- Effective use of new technologies to bring distant ecosystems into the classroom and engage students with real-world environmental data.
- A foundation for exploring green(blue) careers and developing skills needed for a sustainable future.

This integrated approach not only updates the curriculum but also provides students with a more holistic understanding of environmental challenges and their role in addressing them.