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## Traces under water

Exploring and protecting the cultural heritage  
in the North Sea and Baltic Sea

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Fictitious representation of the discovery of a hand wedge using a submersible:  
The exploration of prehistoric landscapes in the sediments of the North Sea and  
Baltic Sea could one day lead to the discovery of traces of human activity or  
campsites.

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# Traces under water

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**Christian Anton | Mike Belasus | Roland Bernecker  
Constanze Breuer | Hauke Jöns | Sabine von Schorlemer**

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The Leopoldina Discussions series publishes contributions by the authors named. With the discussion papers, the Academy offers scientists the opportunity to present thought-provoking ideas and to encourage and guide discussions, flexibly and outside of formal working group processes.

## Preface

In many regions of the world, the seabed contains a fascinating archive of human history. This also applies to the North Sea and Baltic Sea, where there are still remnants of tools, weapons and burial sites to be found in many places that refer to times long past. Such artefacts bear witness to the fact that here, in a place now occupied by mighty waters, there was once land that was inhabited and used by humans. The cultural legacies from this period are of central importance for our understanding of the early history of human settlement in Europe. Under the waves are also testimonies of later times, in the form of thousands of shipwrecks that document the abundant links between historical societies across the North Sea and Baltic Sea. This rich cultural heritage needs to be recorded, explored and protected.

The exploration of the cultural heritage on the seabed is a complex undertaking, with many methodological and technical challenges to overcome. The majority of prehistoric traces are found in the seabed and can only be investigated using special methods. Human activities that change the nature of the seabed can affect or even destroy these relics. These include gravel and sand mining, the construction of wind turbines, cable laying, and fishing. Such massive disturbances similarly endanger shipwrecks at the bottom of the North Sea and Baltic Sea, which are also frequently targets of looting and plunder. Moreover, marine pollution, e.g. from munitions, wastewater discharge and nutrient runoff, as well as the increased temperatures resulting from climate change, also have a negative impact on the underwater cultural heritage.

Against this backdrop, this discussion paper aims to raise awareness of the importance of the cultural heritage in the North Sea and Baltic Sea and draw attention to the fact that the measures taken to protect it to date are far from sufficient. In Germany, effective guidelines and structures for safeguarding cultural heritage exist primarily for objects on land, but there is a lack of effective instruments for the underwater

cultural heritage. This shortcoming should be rectified as soon as possible. Important stages in this process include ratification of the UNESCO Convention on the Protection of the Underwater Cultural Heritage, the designation of an authority responsible for the cultural heritage in the exclusive economic zone and the consistent implementation of the European Convention for the Protection of the Archaeological Heritage, including that underwater. Furthermore, effective protection and successful research require close cooperation between all stakeholders from science, administration and industry who are active in the North Sea and Baltic Sea.

We would like to thank the authors of this paper, as well as all those who have provided advice, for their dedication. This discussion paper is the first in a series of Leopoldina publications on the exploration and protection of cultural heritage. Other publications focus on risk management and emergency preparedness, illegal excavations and trafficking, as well as training and research.

*November 2019*

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## Summary and proposals

There are countless shipwrecks at the bottom of the North Sea and Baltic Sea, from medieval cogs to modern submarines. The seabed also contains traces of the landscape and humans from an age when it was home to hunter-gatherer societies. This material would serve as an important source for our understanding of the cultural, technical and landscape history of northern Central Europe. Despite this, it receives little attention – in science, in politics and among the general public.

At the same time, the pressure for economic exploitation of the North Sea and Baltic Sea is very high and this will further increase, especially in the exclusive economic zone (EEZ). These are the maritime areas in the North Sea and Baltic Sea that are not part of the German territory, but over which the Federal Republic of Germany has extensive economic, scientific and environmental entitlement. It is therefore all the more worrying that the protection of cultural heritage in this zone is much weaker than in the territory of Germany.

Two goals must therefore be pursued in the future: Firstly, Germany must explore comprehensively the cultural heritage of the North Sea and Baltic Sea, to the same high scientific standards as on land. Secondly, the German EEZ must be equipped with protection mechanisms that are just as effective as those long in place on German territory. This discussion paper sets forth proposals on how these two goals can be achieved.

### Exploring the cultural heritage of the North Sea and Baltic Sea to an international standard

#### 1. Expand research and education in underwater archaeology

Archaeology in Germany is largely terrestrial in nature, even when it undertakes research in other countries. No underwater archaeological research is conducted at German scientific institutions that is adequate for the scope and significance of prehistoric landscapes or nautical



archaeology. Very few German scientists are currently active in these fields. Compared to other countries, Germany lags far behind in the development of underwater archaeology. If the cultural heritage of the North Sea and Baltic Sea is to be explored at internationally high standards in the medium term, research capacities and training opportunities (including the professional and research training of divers) in Germany must be significantly expanded in the future.

## 2. Establish cooperation between marine and archaeological research

The cultural heritage of the North Sea and Baltic Sea is a multidisciplinary field of research. Its scientific exploration, especially in greater areas and depths, is extremely challenging and demanding in methodological, technical and logistical respects. It is therefore imperative that those involved in marine science participate in researching this field. Cooperation between marine science and archaeological research should therefore be supported intensively.

## 3. Develop cooperation between science and public authorities

Federal authorities are active in the exploration of the geology and marine biology of the North Sea and Baltic Sea. Their work includes identifying shipwrecks and collecting data on the condition of the seabed. It is therefore of central importance for research into the cultural heritage of the North Sea and Baltic Sea that these authorities cooperate with archaeologists. This includes, for example, providing logistical support for scientific projects or collecting archaeologically relevant data and integrating them into the North Sea and Baltic Sea databases maintained by the authorities.

## 4. Strive for more intensive cooperation between science and industry

Companies that use the North Sea and Baltic Sea commercially, such as for sediment extraction, laying pipelines or generating offshore wind energy, can be important partners in exploring the cultural heritage on the seabed. These companies often operate transnationally and already work closely with scientific institutions in other European countries. They finance scientific activities with special funds, provide existing data and drill cores for archaeological evaluation and consider archaeological issues during their geological investigations into the commercial usability of the sea and the seabed. Furthermore, archaeologists are invited on

board vessels to carry out on-site investigations. In the parts of the North Sea and Baltic Sea that Germany is responsible for, this kind of cooperation has so far only been practised sporadically and should be intensified.

#### 5. Network the research of other countries bordering the North Sea and Baltic Sea

Stronger international networking of the relevant institutions in the countries bordering the North Sea and Baltic Sea is indispensable for an effective expansion of archaeological research. In future, the data and findings should be systematically assembled and exchanged at the international level. Such networking has already been successfully practised within the framework of European pilot projects that German researchers are also involved in. These approaches should be further developed in the future. However, in Germany it requires that underwater archaeology is institutionally anchored.

#### 6. Impart knowledge about the cultural heritage of the North Sea and Baltic Sea

The cultural heritage of the North Sea and Baltic Sea is still largely unknown among the general public, including in the coastal federal states. Conveying knowledge about prehistoric landscape formations and habitats as well as the large number of shipwrecks is primarily the responsibility of these federal states and their municipalities. The many museums (e.g. state museums, maritime and shipping museums, city and local museums, geoparks) can play an important role in this. The public relations work of the municipalities should also take up this topic and inform tourists about it.

### Better use of universal and European rules for the protection of underwater cultural heritage

#### 7. Ratify the Convention on the Protection of the Underwater Cultural Heritage

Germany has not yet ratified the UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001). This should be done as soon as possible to protect the cultural heritage in the German EEZ.

As a Coordinating State within the meaning of the UNESCO Convention, Germany should assume responsibility for the cultural heritage located in the German EEZ. It is therefore necessary to define rules for the assumption of such a function, including the establishment of a competent authority for the underwater cultural heritage in the German EEZ. This authority should have geological, marine and archaeological expertise as well as the appropriate logistics to carry out protective measures and scientific investigations.

#### 8. Implementation of the Valletta Treaty in the exclusive economic zone and on the continental shelf

Like all the other countries bordering the North Sea and Baltic Sea, Germany is party to both UNCLOS, the United Nations Convention on the Law of the Sea (1982), and the European Convention on the Protection of the Archaeological Heritage, also known as the Valletta Treaty (1992). Insofar as the Federal Republic of Germany holds and exercises sovereign rights and sovereign powers in the German EEZ and on the continental shelf pursuant to the Convention on the Law of the Sea, obligations under the Valletta Treaty also arise for this zone. All provisions of this treaty that are compatible with UNCLOS should be implemented. This primarily concerns the establishment of a government-run protection scheme for the underwater cultural heritage.

#### 9. Include archaeological expertise in all regional and sectoral planning

The spatial extent of the cultural heritage across the entire North Sea and Baltic Sea makes it necessary to include archaeological expertise in all regional and sectoral planning and approval processes for commercial uses in the German EEZ.

#### 10. Amend the Environmental Impacts Assessment Act

Traces of prehistoric humans and their former environment (e.g. plant remnants) on the seabed of the German EEZ that have not yet been registered are not covered by the Environmental Impacts Assessment Act (*Gesetz über die Umweltverträglichkeitsprüfung*, UVPG), because they are not included in any official lists or maps. However, this fails to consider that most of the underwater cultural heritage is covered by sediments and is only discovered by excavation. This also applies

to land-based finds, for which the majority of the monument protection laws of the federal states specify that protection of a monument does not depend on its prior entry in the official list of monuments. A corresponding regulation for the underwater cultural heritage would therefore greatly improve its significance in environmental impact assessments.

#### 11. Integration of archaeological standards in approval processes

All approval procedures for commercial use, or other intrusions into marine habitats, must consistently require that archaeological knowledge, methods and techniques are used in order to identify the underwater cultural heritage and describe its specific characteristics. To this end, the relevant authorities should set archaeological standards and make them available to commercial users. The standards would for instance need to be consistently applied in what are known as strategic environmental assessments, planning approval procedures, preliminary area surveys and environmental impact assessments as well as for all intrusions into the seabed. The standards should be continuously developed and updated to reflect scientific and technical progress.

#### 12. Archive scientifically relevant data and samples

All data collected as part of an environmental impact assessment or subsoil investigation and all relevant samples taken to study the cultural heritage on the seabed should be archived in a way that makes them permanently accessible for research.

#### 13. Improve the protection of human remains in marine waters

Shipwrecks on the seabed can possibly contain human remains. Technological progress makes it easier to access shipwrecks at ever greater depths, making them increasingly vulnerable to destruction and looting. This also has a negative impact on the human remains. The shipwrecks in question must be mapped as a matter of urgency, so that the remains are afforded better protection (respect for the dead). The relevant authorities should also make commercial users who disturb the seabed aware of the possible presence of human remains in shipwrecks and provide guidance for appropriate behaviour. Furthermore, the Federal

Republic of Germany should advocate the formulation and application of internationally binding protection standards for the handling of sea graves in marine waters under the aegis of UNESCO.

#### 14. Prevent looting and plundering

With regard to looting and plundering of the seabed, greater public awareness is required, particularly recreational divers and tourists. The dismantling of shipwrecks must be prevented just as consistently as the sale of objects classified as underwater cultural heritage. For this purpose, the option contained in the United Nations Convention on the Law of the Sea to designate a contiguous zone should also be considered, as this would give the Federal Republic of Germany policing and customs control powers beyond its own territorial sea.

#### 15. Set up schemes for reporting chance finds

Following the establishment of a competent authority for cultural heritage in the German EEZ, specific schemes should be established for reporting chance archaeological finds arising from commercial uses of the sea and seabed. In this regard, it is also advisable to train senior staff on commercial vessels to enable them to identify signs of archaeologically significant structures and finds.

#### 16. Strengthen the protection of cultural heritage with nature conservation

Underwater cultural heritage is often exposed to the same stresses as its marine environment. Cultural heritage, which depends on the preservation of its environment, can therefore benefit from nature conservation. Authorities and organisations that are tasked with protecting the marine environment should take greater account of the underwater cultural heritage in their activities. Cooperation with archaeological authorities, institutions and organisations is also a helpful option in this respect.

#### 17. Include cultural heritage in the climate change adaptation strategy

The cultural heritage in the sea is equally affected by climate change as that on land. Protection of the cultural heritage should therefore be included in Germany's climate change adaptation strategy. In addition, in-

ternational cooperation at intergovernmental, scientific and economic levels should be strengthened, in order to identify the precise extent of the existing and expected impact of climate change on the cultural heritage and to jointly develop strategies for solutions. Increased cooperation between archaeology and climate research could be of mutual benefit.

# 1 What is the cultural heritage in the North Sea and Baltic Sea?

The last ice age reached its peak about 20,000 years ago. At that time, the European land mass was about 40 percent larger than today (see Fig. 1). The polar ice sheet held a large volume of water, which meant that the sea level was about 120 metres lower than today and the area between present-day Great Britain and southern Scandinavia was all part of the European mainland. The river Elbe was significantly longer and flowed into the sea south of Norway. At that time, a large part of this area was inhabited by humans and animals.

The end of the last ice age was followed by a phase of successive warming. The ice melted and over the following millennia the landscapes in the area of what are presently shelf seas became more and more submerged. The nomadic people who had settled in this part of Europe during the ice age could no longer use the region and had to leave. Their former campsites slowly became submerged. The waves eventually covered them with water-saturated sediments, which blanketed the settlement tracks like a protective shell and preserved them. Together with the relics of the landscape of that time, today these traces form a unique archive of the settlement history of the North Sea and Baltic Sea region, which so far has been little explored and is hardly known to the public.

However, the flooding did not just create the North Sea and Baltic Sea. As the water rose, the ground relief, shaped by the ice age glaciers, created a rugged coastline. Islands were formed from the masses of shifted earth and scree, whilst the valleys resulting from erosion formed inlets, some reaching far inland. Although the mass of water initially had a separating effect, the development of watercraft by humans transformed them over time into a connecting element: waterways that made trade, encounters, discovery and conquest possible, and without which our world of today would be unthinkable.

The development of boats represented one of the greatest technical challenges for mankind. Simple watercraft were initially used for

fishing, river crossings or trips along the coast lasting several days. As time passed, their structures became more and more complex and it was possible to undertake journeys across the oceans lasting months and years. Many ships were also built specifically for the purposes of war and defence equipped with weapon systems. This was also the motivation behind the development of underwater vessels (submarines).

Many of the vessels that sank in the North Sea and Baltic Sea region are still preserved on the seabed. In addition to such shipwrecks, which document the cultural, political and social transformation of the North Sea and Baltic Sea region, as testimonies of very different periods, there are also various erstwhile flying objects on the seabed with the wrecks of airships, aeroplanes and rockets, which also remind us this maritime space was once a theatre of war.

## 1.1 Traces of prehistoric settlement

In 1931 the crew of fishing trawler *Calinda* made a special discovery to the east of Norfolk (Great Britain): the fishermen found a piece of peat in their net. Encased within it was an object made from the antlers of a red deer that turned out to be a 10,000 year-old decorated harpoon.<sup>1</sup> As early as the first half of the 20<sup>th</sup> century, artefacts such as this tool provided research with evidence that large parts of the North Sea area were not underwater between 10,000 and 5,000 BCE and had been used by hunter-gatherer societies.

Since then, research has shown that the sea levels and coastlines in Europe have undergone major changes in the past. The area that contains the present-day North Sea and Baltic Sea was successively flooded due to the warming that occurred after the ice age.<sup>2</sup> This process slowed around 5,000 BCE and the North Sea and Baltic Sea reached approximately their present size, although the coastlines of the time clearly differed from those of today. The rising sea levels also meant that the remains and evidence there of the prehistoric settlement of Europe were

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1 Godwin & Godwin (1933).

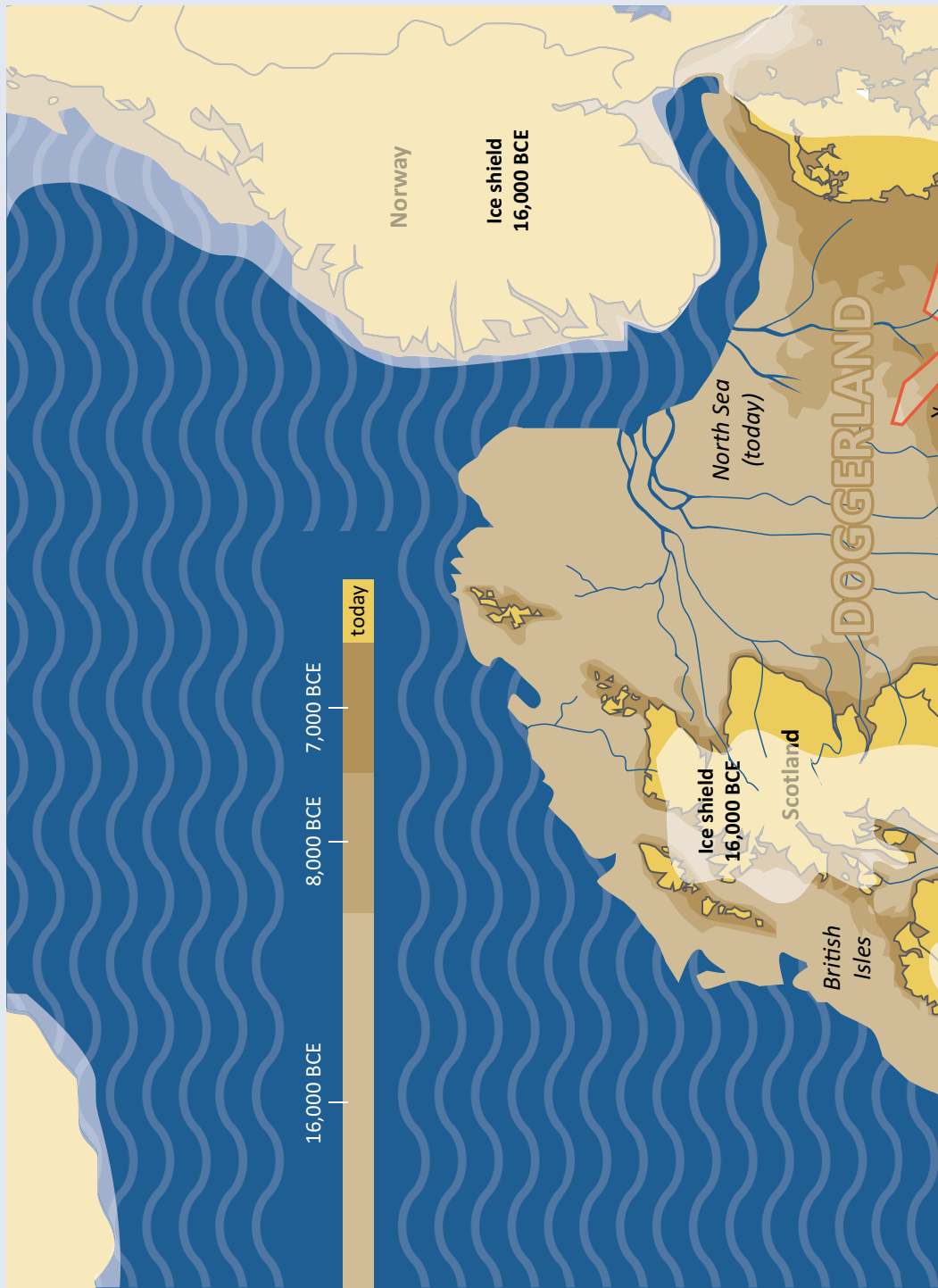
2 Summary Behre (2008).

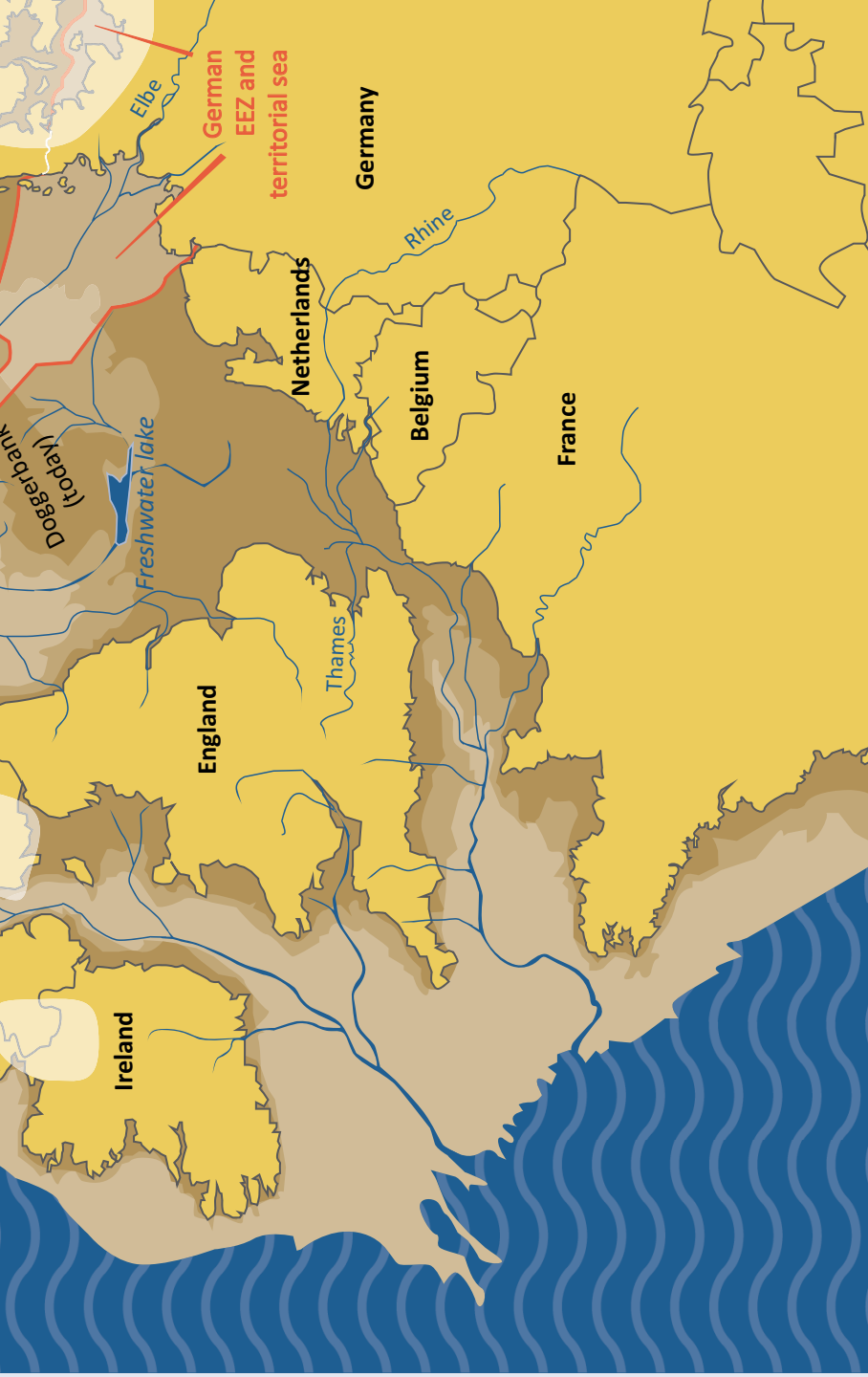


submerged.<sup>3</sup> Those that survived now lie on the seabed, together with their former environment, covered by sediments of varying thickness. Organic materials will also have survived in these sedimentary deposits and they represent valuable prehistoric evidence. When the sediments that have covered and preserved these artefacts over long periods of time are removed or relocated, for whatever reason, the cultural traces and remains become visible and readily accessible on the surface of the seabed. At the same time, they deteriorate from erosion and may disappear after a short time.

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3 Jöns (2015) with further literature.





**Figure 1: Doggerland**  
Hypothetical reconstruction of the genesis of the North Sea region and the coastal shift due to sea-level rise  
(Source: William E. McNulty and Jerome N. Cookson/National Geographic Image Collection).



**Figure 2: Flint bladed knife with handle**

Approx. 4,400-4,100 BCE, found at: Timmendorf-Nordmole I, Poel island, Mecklenburg-Western Pomerania (source: Mecklenburg-Western Pomerania State Authority for Culture and Monument Conservation [*Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern*], State Archaeology, Schwerin, Photographer: Sabine Suhr).

### The seabed provides good preservation conditions

The underwater archaeological evidence has already provided us with many insights into the settlement history of Europe. This is due to the exceptionally good conditions for the preservation of organic materials in the North Sea and Baltic Sea (see Figs. 2 and 4), especially for bones and antlers, but also for wood and other plant matter. While such materials usually decompose after a few years in well-ventilated soils, they can survive for thousands of years in oxygen-poor environments under layers of sediment or on the seabed.<sup>4</sup> In the course of a DFG research project near the Baltic Sea island of Poel in Mecklenburg, a flint-bladed knife was uncovered and salvaged at a depth of four metres. Radiocarbon dating determined it to be from between 4,400 and 4,100 BCE.<sup>5</sup> Un-

4 Klooß (2015).

5 Lübke (2001); Hartz et al. (2014 [2011]).

like on land, where organic components usually decompose quickly, the handle of the knife was made of hazel wood with lime bast wrapping and is well-preserved. For knives where only the stone part has survived, which applies to the majority of such finds on land, there are to date no scientific methods determining their age, e.g. when they were made into, or used as, knives.

However, the seabed is not only an important archive for human cultural history, but also for the study of the genesis of the landscape and vegetation as well as the development of the climate.<sup>6</sup>

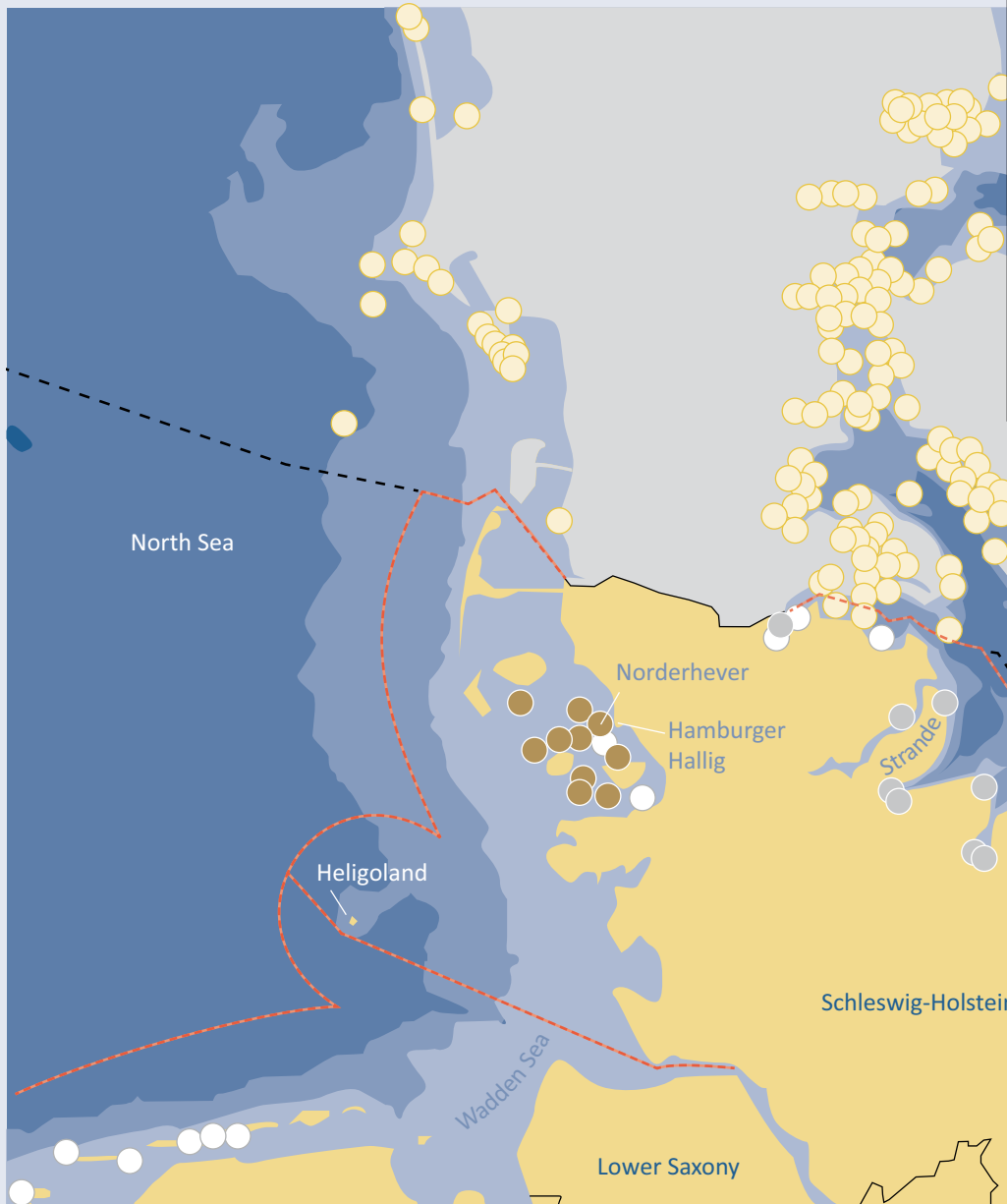
142 sites within the German territorial seas of the North Sea and Baltic Sea<sup>7</sup> are currently known to have been flooded during the post-glacial phase of most rapid sea-level rise between 10,000 and 4,000 BCE (see Fig. 3).<sup>8</sup> The majority of the sites are located at depths of up to ten metres in waters with good visibility. However, these sites do not reflect the expected quantity and extent of the remains of settlements and landscapes in the North Sea and Baltic Sea. Quite the contrary, systematic exploration of underwater cultural heritage in Germany is still in its infancy, in part because the scientific exploration of sediment-covered sites in deeper waters still represents a considerable technical challenge (see Section 2.1).

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6 Flemming et al. (2014).

7 The territorial sea extends 12 nautical miles into the North Sea and into the Baltic Sea.

8 Jöns (2015).



**Figure 3: Prehistoric sites off the European coasts**

More than 2,700 prehistoric sites have already been discovered off European coasts. This detail shows the German and Danish locations of finds (Source: Moritz Mennenga, Lower Saxony Institute for Historical Coastal Research, based on the web-based database SPLASHCOS<sup>9</sup>).

9 See <http://splashcos.maris2.nl/> (retrieved 10/09/2019).

● Mesolithic  
(12,000 – 6,000 BCE)

● Neolithic  
(6,000 – 4,000 BCE)

○ Undated

○ Discovered sites in  
neighbouring countries

Water depth

< 10 m

10 – 20 m

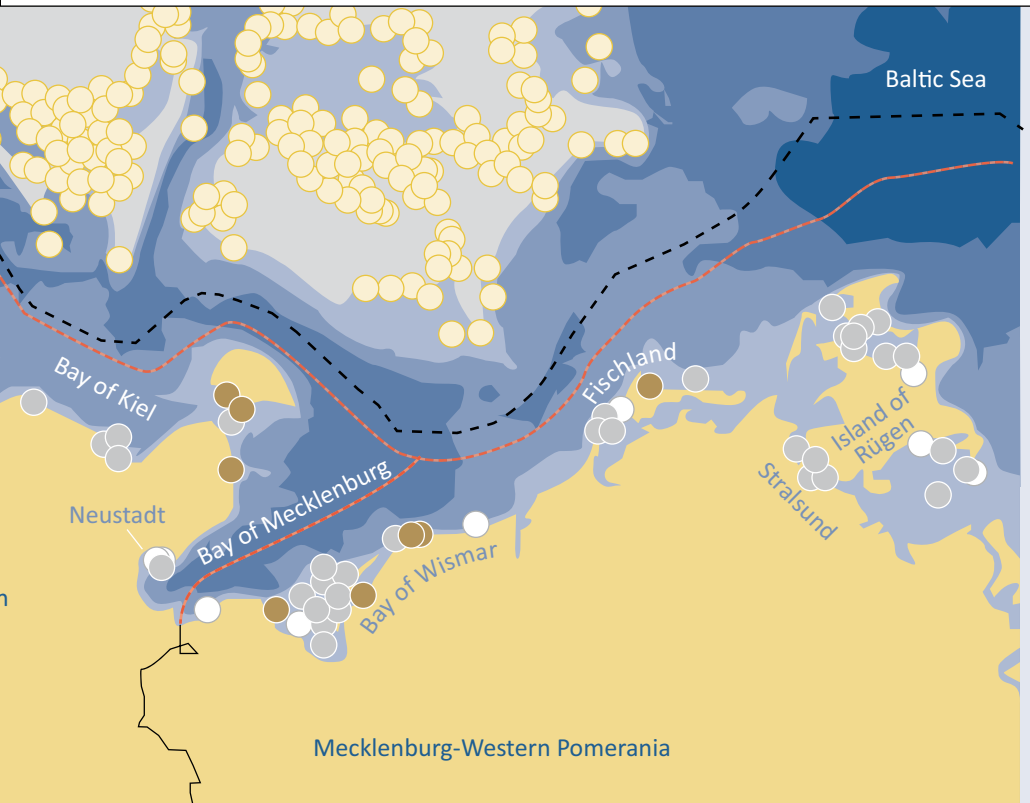
20 – 40 m

> 40 m

— German federal states

- - - Territorial sea

- - - EEZ



This is particularly true of the North Sea, which is characterised by low and high tides. The available knowledge here is mainly based on an analysis of implements and tools that can only be classified as from the Stone Age on account of their shape and condition, but which were discovered without any identifiable context as individual finds in the tidal mudflats of the Wadden Sea. The discovery of a pit in which an aurochs was deposited as an offering about 4,300 years ago (see Fig. 4) is testimony to the fact that archaeological finds of outstanding importance remain preserved in the North Sea.<sup>10</sup>

While the constant movement of sediment in the North Sea caused by the tides often restricts underwater visibility, the southwestern Baltic Sea, which is largely unaffected by tides, offers excellent conditions for finding and exploring submerged landscapes and settlements. The relatively constant conditions ensure that very good visibility prevails, at least in the cold season, allowing artefacts resting on the seabed to be detected from a distance of five to six metres. After fledgling exploration of these sites in the 1990s,<sup>11</sup> the breakthrough came in 2002-2010 with the research project “Sinking Coasts. Geosphere, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea” (SINCOS), which pursued a predominantly geoscientific and archaeological research approach: Nearly all the sites known today were discovered and at least partially investigated as part of this project, establishing their scientific significance.<sup>12</sup>

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10 Kühn (2009).

11 Lüth et al. (2004).

12 Harff & Lüth (2014 [2011]).





**Figure 4: Aurochs skull**

This skull of an aurochs was recovered in autumn 2003 near the Hamburger Hallig (North Frisia) by employees of the State of Schleswig-Holstein Archaeology Department. The animal was deposited as part of a ritual (Source: State of Schleswig-Holstein Archaeology Department).<sup>13</sup>

### **Box 1: Submerged forests in the Baltic Sea**

To the west of the coastal region of Darß (Mecklenburg-Western Pomerania) the remains of a forest have been preserved at the bottom of the Baltic Sea.<sup>14</sup> Hundreds of tree stumps and dozens of tree trunks, some embedded in a layer of peat, can be found here over many kilometres. Dating the wood samples revealed that the sea had reached the forest around 6,500 BCE, which toppled the trees and then inundated them. Corresponding scenarios can still be observed today, especially on the steep coasts of the Baltic Sea.

<sup>13</sup> Kühn (2007).

<sup>14</sup> Westphal et al. (2014 [2011]).

## 1.2 Shipwrecks

In addition to traces of prehistoric settlements, shipwrecks represent the second main group of underwater archaeological finds. The third group consists of aircraft, most of which are aeroplanes. A rarer find are land vehicles, mostly discovered not far from the coast. In the case of the Baltic Sea most are the remains of the motorised vehicles and horse-drawn carts used by large numbers of Germans during the winter of 1944/1945 to flee from the approaching Soviet Army by attempting to cross the ice of the Baltic Sea, with some breaking through the ice.

The number that is often quoted in the media for shipwrecks in the German territorial sea and the German EEZ is around 3,000. This figure is mostly based on the mapping of navigational obstacles by Germany's Federal Maritime and Hydrographic Agency (BSH, see Fig. 5).<sup>15</sup> The actual number is unknown, but is estimated much higher. Without carrying out comprehensive surveys at sea, a total of 900 sites of cultural-historical significance were identified in the BSH database for navigational obstacles just in the North Sea (German territorial sea and the EEZ) as part of the project "The North Sea – a Threatened Cultural Archive" ("*Bedrohtes Bodennarchiv Nordsee*") by the German Maritime Museum in Bremerhaven, funded by the Federal Ministry of Education and Research (BMBWF).<sup>16</sup> In about 70 percent of the cases these are watercraft, most of which are from more recent times and date in particular from the two World Wars. However, the number of undetected cases remains very high due to the lack of systematic searches that employ the appropriate search methods and focus on archaeology and archaeological conservation measures. Even shipping authorities lack comprehensive data on all wrecks in German waters, as the area is too large for a comprehensive investigation. Furthermore, many older wrecks sitting on the bottom of the North Sea are decaying and covered by sediment, thus they are not easily recognisable as such.

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<sup>15</sup> BSH (2018).

<sup>16</sup> Warnke (2015).

Conversely, despite being smaller in area the number of known wrecks in the German Baltic Sea is about twice as high as those in the North Sea. This is primarily due to the active recording of culturally and historically relevant sites, which has been intensively pursued for the Baltic Sea region since the early 1990s. Investigations in the Baltic Sea are also made easier by the absence of tidal currents and relatively sheltered coastlines with many bays. In the North Sea, however, the strength of tidal currents can make diving impossible when the water rises and falls, leaving only a narrow window of time between high and low tide for underwater work. In addition, because the North Sea is directly connected to the Atlantic, its coasts are more exposed than the Baltic Sea coasts.

#### Metal corrodes, wood lasts longer

In the course of history ships were mostly built of wood, a material that has much better preservation conditions under water than in the open air. This is especially true when the wood is covered by a layer of sediment that reduces the oxygen content in its immediate environment to such an extent that most of the microorganisms responsible for the decomposition of wood cannot survive there. The conditions in the northern Baltic Sea and the Black Sea are sometimes so good that even after hundreds or thousands of years, ships still lie completely preserved on the seabed. However, ships made of iron and steel, as used in the last 200 years, do not last as long on the seabed. Rapidly advancing oxidation processes in saline water mean that the metal decomposes relatively quickly. Ships like the legendary RMS Titanic, which sank largely intact to the bottom of the North Atlantic more than 100 years ago and the warships sunk during the First World War in naval battles are already disintegrating, because their steel is increasingly dissolving. By comparison, the oldest known and complete wooden shipwreck is about 2,400 years old.<sup>17</sup>

#### Shipwrecks as time capsules

Good preservation conditions and limited accessibility under the sea make sunken ships a multi-faceted archaeological archive. Shipwrecks not only offer information about technological development, but also

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<sup>17</sup> University of Southampton (2018).

reflect the influence of social, economic, natural and political changes on human societies. As a temporary habitat for all people travelling on board, the sunken ships can also provide insight into behaviours and attitudes in bygone days. If shipwrecks have survived the centuries completely with cargo and inventory, they are therefore time capsules, in which the past lives on to some extent.

#### Nautical archaeology in Germany is still in its infancy

Cutting-edge technology is only slowly finding its way into nautical archaeological research in Germany. However, things like computer-assisted documentation and evaluation procedures do allow more accurate results to be obtained with less effort than conventional methods. Moreover, scientific archaeological research has produced results that allow nautical archaeological research to discard many earlier hypotheses. The evaluation of the nautical archaeological material from more than twenty years of archaeological monument conservation around the German Baltic Sea coast has shown a much greater diversity in medieval seafaring than historians had previously assumed.<sup>18</sup> The digital reconstruction and evaluation of the sailing characteristics of discovered ships now makes it possible, among other things, to calculate their navigational ranges.<sup>19</sup> By evaluating the smallest botanical or zoological remains, conclusions can be drawn about the original cargo and the region of origin of the ship and crew.<sup>20</sup> Chemical analyses can provide information on the paintwork used, the origin of living organisms and the production sites of natural resources. There are almost no limits to linking nautical archaeological research with other disciplines, but it does require suitable structures.

The intensive research of shipwrecks in waters that Germany is responsible for promises considerable insights. Not even a partway systematic recording of sites, which has been carried out in the Baltic Sea for over twenty years,<sup>21</sup> exists so far for the North Sea. Such a catalogue is a precondition for targeted research. The numerous finds of cultural

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18 Belasus (2018).

19 Tanner & Belasus (in print).

20 Nailing & Jones (2014).

21 Schmidt (2011).

and historical significance in the waters under Dutch responsibility<sup>22</sup> also provide a reason to expect shipwrecks of cultural and historical significance in the German North Sea and the German EEZ. A preview of such was for instance provided in Germany by investigations of the former Wreck Research Unit of the State of Schleswig-Holstein Archaeology Department in the late 1990s and early 2000s.<sup>23</sup>

### Shipwrecks are often sea graves

Dealing with the human remains of a ship's crew poses a particular challenge. Ships sink for a variety of reasons, ranging from deliberate sinking to accidents caused by a natural events, technical failure and human activity. According to archaeological estimates, hundreds of hitherto undiscovered shipwrecks still lie in the English Channel off the east coast of England alone. Experts also believe that worldwide there may be up to 10,000 larger shipwrecks from the First World War (1914-1918) on the seabed.<sup>24</sup> This assessment suggests that, despite the numerous files that have already been systematically archived and to some degree scientifically evaluated, extensive research is still required in order to reconstruct the history of marine warfare in detail. The still undiscovered ships and the fate of their crews represent an as yet unexplored field of historical battlefield research, which has gained in importance in the public perception in recent years.<sup>25</sup>

Many of the ships sunk in the wars are also the final resting places of sailors and marines. However, neither the United Nations Convention on the Law of the Sea nor the UNESCO Convention on the Protection of the Underwater Cultural Heritage contain specific provisions on the status of sunken warships or statements on the concept of sea graves.<sup>26</sup> This means that to this day there are no standards for dealing with the

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22 This was recently proven in a further instance when a container lost in a storm sank directly onto a shipwreck from the first half of the 16<sup>th</sup> century, which was carrying a cargo of copper from the Nuremberg branch of the Fugger merchant family (Dutch-News.nl [2019]).

23 Kühn (1999).

24 Schorlemer (2019), pp. 445. See also the database of the 4-year project "Forgotten Wrecks of the First World War" led by the Maritime Archaeology Trust (<https://forgottenwrecks.maritimearchaeologytrust.org/wreck-database>, retrieved 24/09/2019).

25 Brock & Homann (2011).

26 For more details see Pallas (2004), pp. 347.

human remains there.<sup>27</sup> In many countries, the issue of how to deal with the dead on the seabed is a subject of controversial discourse between research, the need for remembrance, and commercial interests.

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<sup>27</sup> For the issue in-depth see Schorlemer (2019).

### Box 2: The Swedish ship blockade of 1715

In 1715, Swedish troops scuttled 14 ships at the eastern entrance to the Bay of Greifswald over a length of almost one kilometre in order to obstruct the Danish fleet's passage to Stralsund. The Swedish ship blockade of 1715 is an important underwater monument at a depth of three to four metres, which can also be seen from the air.

It also serves as an excellent example of the implementation of measures for monument conservation during construction preparations. In this case, a route for the Nordstream 1 pipeline had to be found through the shipwrecks.

The area where the wrecks are located was first surveyed with a side scan sonar in order to determine the exact position and the depth profile around each site. A further geophysical survey was carried out with a sediment echosounder in order to obtain information on possible objects hidden in the seabed. Then the wrecks closest to the possible route were investigated by divers to determine their state of preservation. In consultation with the construction planners, the least preserved wreck was selected to be excavated, documented and salvaged. This created sufficient space for the construction work to proceed. Stones used at the time to weigh down the wreck were returned to their old position after the construction work, so that the overall impression of the underwater monument could be restored.<sup>28</sup>

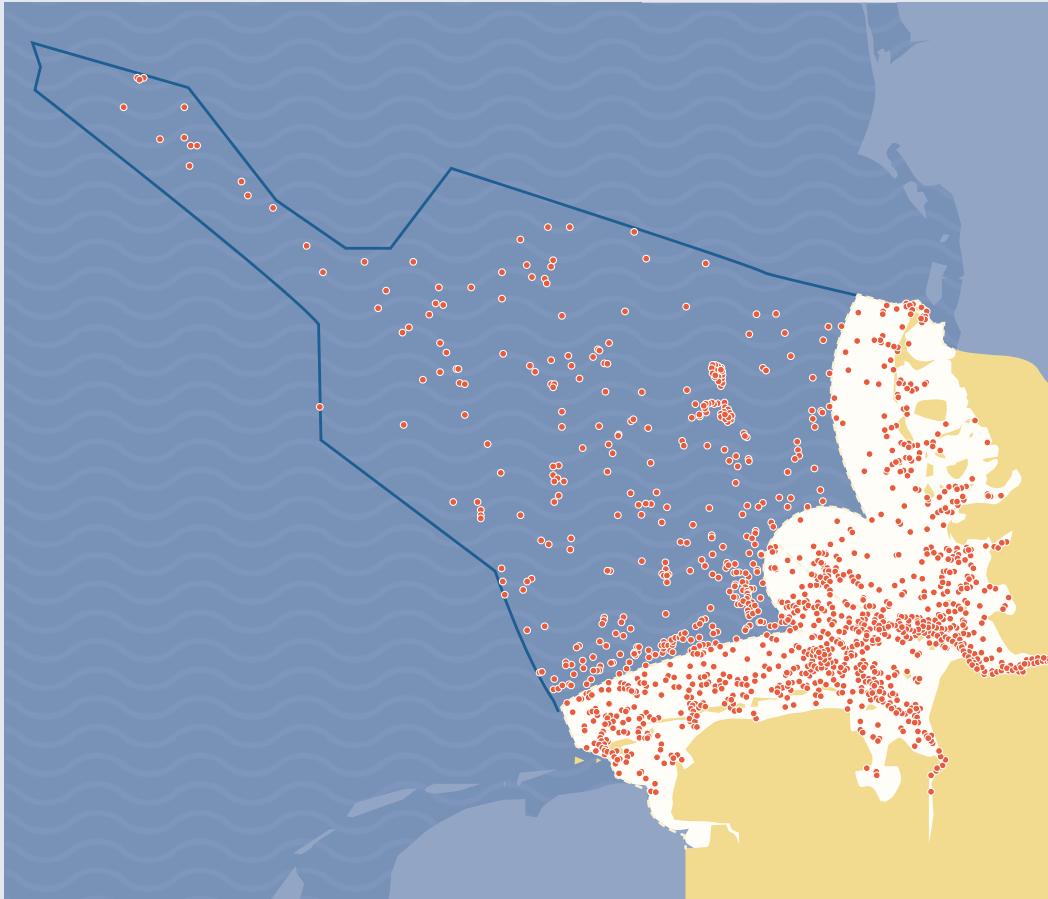
A similar approach was taken a few years later when planning the construction of the Nordstream 2 pipeline.

The costs were borne by the project initiator, who integrated archaeology into its construction planning from the very beginning. This example has played a decisive role in gaining acceptance for archaeological investigations within private-sector construction projects.<sup>29</sup>

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<sup>28</sup> Belasus (2013).

<sup>29</sup> The data obtained were subsequently included in a dissertation at the University of Rostock (Belasus [2014]).



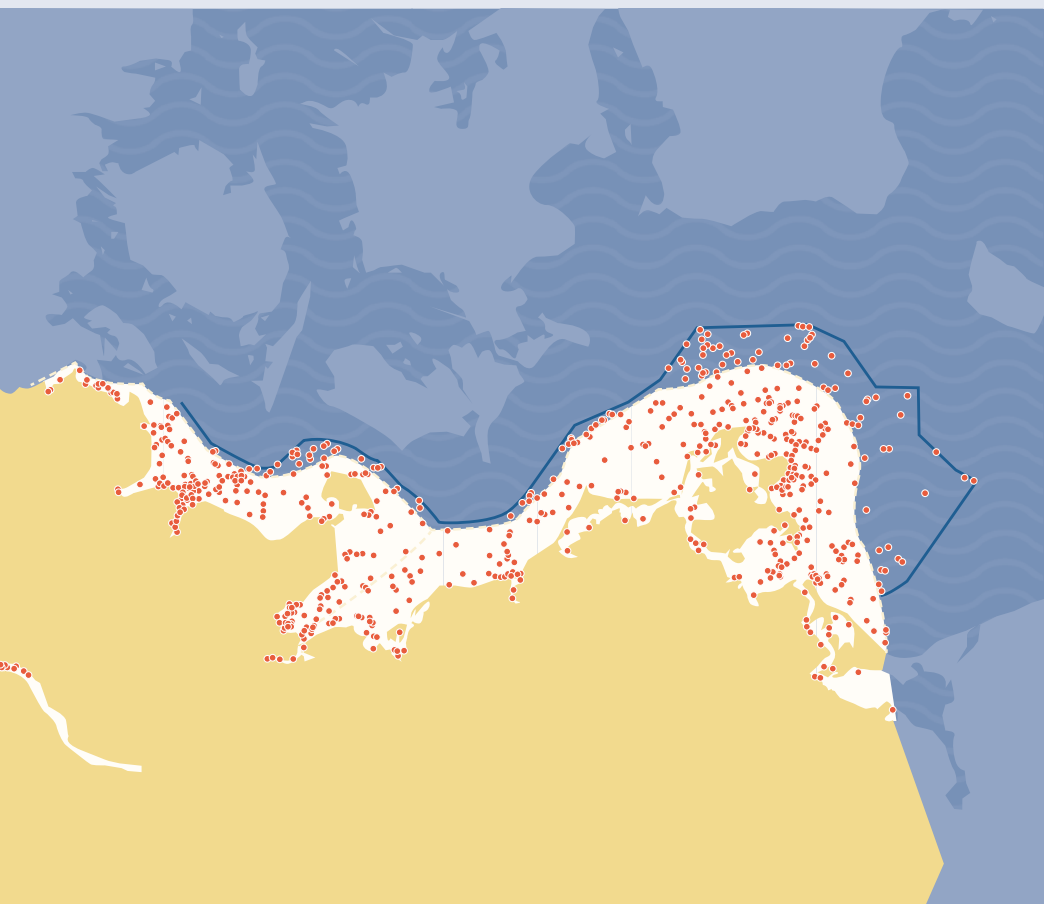
**Figure 5: Shipwrecks in the German territorial sea and the EEZ**

There are numerous shipwrecks in the German territorial sea and the German EEZ of the North Sea and Baltic Sea. The Federal Maritime and Hydrographic Agency records these wrecks in a database for the registration of navigational obstacles. An archaeological assessment of these wrecks has so far only been carried out for the Baltic Sea (Source: Federal Maritime and Hydrographic Agency).<sup>30</sup>

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30 Warnke (2015).





## 2 How is the cultural heritage of the North Sea and Baltic Sea explored?

The study of prehistoric landscapes and historical shipwrecks on the seabed is a complex undertaking, involving a wide range of scientific disciplines that apply specific methods and technologies. One of these involves diving, without which it would be impossible to record the underwater cultural heritage. However, diving expeditions to explore shipwrecks or for underwater excavations invariably pose safety risks for divers and therefore demand considerable training and technical requirements.<sup>31</sup>

In recent years, the development of underwater robots and other programmable diving devices has made great advances that make alternative diving methods possible. Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs) now play an important role in the study of the seabed. This not only allows individual objects, but also the surrounding underwater landscapes to be documented with sonar, echosounder, earth magnetic field measurement and photography.<sup>32</sup> Such an approach is of immense importance for the initial assessment of an underwater archaeological site.

In order to better understand the special challenges of exploring prehistoric landscapes and historical shipwrecks on the seabed, the research methods along with examples of some research projects are presented below.

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31 The Commission for Scientific Diving in Germany (*Kommission Forschungstauchen Deutschland*) is the professional association for subaquatic sciences in Germany. It brings together researchers from all scientific disciplines active in diving, their associations, statutory accident insurance experts and the Federal Ministry of Education and Research as well as training companies recognised by the employers' liability insurance association.

32 These methods are the result of decades of research, for which the European Union and the German Research Foundation have provided extensive funding.

## 2.1 Traces of prehistoric settlement

Scientific findings on the prehistoric landscape in the North Sea and Baltic Sea regions was long dominated by chance finds. For instance, animal bones from prehistoric times, finished stones or hunting weapons were sometimes unearthed by the trawl nets of fishing boats. Archaeological research was therefore long dependent on individual finds when it came to greater water depths in the North Sea and Baltic Sea, which limited the possibilities for reconstructing the prehistoric landscape or the historical context of the finds. However, this has changed with the inclusion of new scientific methods and technologies.

Landscapes, whether terrestrial or marine, are subject to constant change. Erosion by storm surges, tides and ocean currents as well as biological and geochemical processes shape the surface of the seabed and the sequence of sedimentary layers deposited there. The prehistoric landscapes in the North Sea and Baltic Sea regions are therefore not only under a water column up to forty metres in height, but are also covered by heavy deposits up to ten metres thick,<sup>33</sup> which formed under changing conditions over millennia. This means that a study of the stratigraphy is very important, i.e. examination of the layers present at a particular site.<sup>34</sup> A detailed reconstruction of these stratification processes requires the expertise of a large number of disciplines. Pivotal for this are the fields of geology, climate sciences, palaeobotany and marine research. Together with prehistoric archaeology, they are able to reconstruct the development of landscape formations over time and determine the environmental conditions that significantly shaped the living environment of hunter-gatherer communities.<sup>35</sup> Over the past 20 years, prehistoric research of the continental shelf has established itself internationally as an interdisciplinary branch of underwater archaeology, landscape archaeology or geoarchaeology.

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33 Zeiler et al. (2000).

34 Sturt et al. (2018).

35 Wolters et al. (2010).

### Box 3: The SPLASHCOS research network

The importance of international cooperation in the development of research and protection concepts for the remains on the seabed of prehistoric settlements was demonstrated by the SPLASHCOS network (“Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf”), which was funded by the European Union and involved researchers from archaeology, geology, geophysics, botany and computer modelling. The network offered the opportunity for an international and interdisciplinary exchange on research strategies, practical experience and technical equipment. SPLASHCOS also formulated guidelines for managing submarine prehistoric sites for research, monument management, authorities and companies, but also for politicians whose actions are key for preservation and research of the sites. At the same time, the aim was to provide information for the interested public.<sup>36</sup>

As in other scientific contexts, the collection and storage of data represent major challenges in the study of prehistoric landscapes. One of the most important results of the SPLASHCOS project was therefore an online database with basic information on more than 2,700 prehistoric sites in European seas (see Fig. 3).<sup>37</sup> The online SPLASHCOS Viewer is based on the same information technology infrastructure as other European databases that collect environmental data (EMODnet) and geological data (Geo-Seas).

#### Seabed and sediment layers are surveyed and mapped

Modern geophysical methods make it possible to obtain high-resolution images of the surface of the seabed and the sedimentary sequences beneath without direct intrusion. In use since the 1970s, they have enabled great advances in various fields of marine research.

Reflection seismology, for example, is of particular importance for the study of prehistoric landscapes. This method involves first sending seismic waves from a ship, which are reflected by geological obstacles

<sup>36</sup> Flemming et al. (2017).

<sup>37</sup> See <http://splashcos.maris2.nl/> (retrieved 19/09/2019).

at the seabed. The reflected waves are in turn captured and converted into electrical signals. A two or even three dimensional image of the seabed is then created, similar to the ultrasound used in medical diagnostics. This also allows prehistoric landscape structures to be visualised.

### Cores are windows into the past

Cores provide a comprehensive overview of submarine sedimentary sequences and at the same time an insight into the historical development of the seabed. Depending on the technical procedure, different lengths and widths of sediment cores are removed for analysis.<sup>38</sup> If these cores reveal an undisturbed sedimentary sequence, they can be used to reconstruct the local and regional landscape history in detail. Moreover, the analysis data reflect global climate developments, and the combined interpretation of pollen, microfossils and macrofossils along with geochemical analyses allow a reconstruction of the historical vegetation. For example, it was found that with the warming during the Holocene about 11,000 years ago in the area of today's central North Sea the former tundra landscape gave way to extensive birch and pine forests.<sup>39</sup>

Peat layers are a particularly valuable source of information for such reconstructive analyses. Since peat bogs cannot develop underwater or under saltwater conditions, their existence alone proves that there once was moorland at the site. The layers in peat not only contain largely intact fragments of the former vegetation (e.g. pollen, seeds, fruits or leaves) that characterised the landscape before submersion, but the acid milieu of raised bogs also conserves any other organic tissue that ends up in the peat, preserving it for thousands of years.

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38 The multicorer, a device with steel rods and several Perspex tubes, is lowered to the seabed on a steel cable. Once there, the pipes press themselves into the sediment and punch out the seabed, so to speak. As the pipes are rather short, the multicorer is particularly suitable for sampling surface sediment. The Frahm Lot – a device developed at the Leibniz Institute for Baltic Sea Research Warnemünde (IOW) and patented in 2012 – also makes it possible to “pull” short cores of up to 80 centimetres in length. The technology thus closes a gap between the multicorer and the gravity corer, which consists of a single long steel tube that is pressed up to 18 metres deep into the sediment using massive lead weights (IOW [2015]). In the course of subsoil investigations, offshore companies pull cores that are up to 50 metres long.

39 For example see Wolters et al. (2010).

Conversely, if no remains of terrestrial plants can be found in the investigated sedimentary layers and instead evidence of unicellular organisms such as diatoms and foraminifers that are native to the seabed are found, this provides information on the salinity of the water and the course of the initial submersion process.

An example of a comprehensive sediment analysis of this kind was from a core extracted in the nature reserve “Borkum Riff” in the German EEZ. Its sedimentological, geochemical and palaeobotanical investigation enabled a reconstruction of the regional vegetation and landscape development for the period 10,700 to 9,350 years ago.<sup>40</sup>

#### Exploration data are evaluated

Scientists in Great Britain are pioneering research into what are termed submerged landscapes in the North Sea.<sup>41</sup> For the past 15 years, “Doggerland”, a former elevation of the landscape in the southern North Sea, has been investigated in the territorial sea and EEZ of Great Britain (see Fig. 1).<sup>42</sup> The project was made possible by a cooperation between the University of Birmingham and a petrochemical company. This exemplary collaboration of an archaeological team with a Norwegian company has facilitated evaluation of comprehensive geophysical and geotechnical data previously obtained from industrial exploration projects. The exploration data now form the basis for a reconstruction of the Dogger Bank landscape, a shallow area in the North Sea between Great Britain and Germany. Settlement was still possible there until around 7,000 BCE, before the land around it, often referred to as “Doggerland”, became submerged due to rising sea levels.<sup>43</sup> The seismic and geotechnical survey of the southern parts of Dogger Bank (called Brown Bank) is now so far advanced that reconnaissance trips are carried out in order to take specific samples from the seabed (grab sampling). The part of Dogger Bank that lies below the northwestern edges of the German EEZ (see Figs. 1 and 10) is still virtually unexplored.<sup>44</sup>

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40 Wolters et al. (2010).

41 Gaffney et al. (2009).

42 For a clear presentation Filser (2019).

43 Coles (1999).

44 Hepp et al. (2017).

There is therefore enormous research potential to be developed in the coming years.

#### Soil samples can be taken by grab sampling

Compared to land-based archaeological sites, the inspection of potential sites on the seabed is a considerable challenge. New methods for the collection and analysis of samples are therefore being developed and tested. For instance, remote-controlled grabbing technology can be used to take samples of various sizes from the seabed.<sup>45</sup> To achieve this the material is picked up and secured with a kind of excavator shovel. As this destroys the stratification of the soil and therefore prevents investigation of the find context, it is preferable to carry out underwater block excavations in the future. Such a technique is already in use for land-based archaeology and, in addition to preserving the integrity of its context, it allows a detailed investigation of the find and its environment under a controlled atmosphere in the laboratory.

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45 Parveen (2019).

#### Box 4: Reconstruction of the Ems and Elbe glacial valleys

When planning wind farms, offshore companies explore the seabed with reflection seismology and sediment cores. Scientists from the MARUM Research Centre at the University of Bremen were provided with some of this exploration data. While analysing the data, Tobias Mörz and Daniel A. Hepp discovered a former river valley in the subsoil of the North Sea, which once flowed into the glacial valley (*Urstromtal*) of the Elbe. The river valley described with high probability the extended course of the present-day river Ems (see Fig. 6). The data showed that the river Ems was a tributary of the river Elbe until about 9,300 years ago. As sea levels rose, the estuary ultimately shifted inland. Scientific publication of the data was only possible in part, as not all the exploration data of the companies can be made freely accessible for competitive reasons.<sup>46</sup>

The subsoil of the North Sea has already been explored as part of the “Geopotential German North Sea” project and data from construction projects were used to describe the *Urstromtal* of the Elbe (see Section 2.4.3).<sup>47</sup>

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<sup>46</sup> Hepp et al. (2017).

<sup>47</sup> See <https://www.gpdn.de/> (retrieved 19/09/2019).





**Figure 6: The certain and presumed courses of the river Ems**

During the last ice age, the area north of the East Frisian islands was part of the mainland. Cores and reflection seismology made it possible to reconstruct former river courses in the subsoil of the North Sea basin. The data showed that the river Ems was a tributary of the river Elbe until about 9,300 years ago (source: Daniel Hepp/MARUM).

## 2.2 Shipwrecks

For a long time, research into ships and shipping in Germany was a domain of history and not of archaeology. During its infancy at the end of the 19<sup>th</sup> and beginning of the 20<sup>th</sup> century, this type of research was strongly influenced by politics in the German Empire. Many historians endeavoured to provide the German people with an identity-forming image.<sup>48</sup> However, at the beginning of the 20<sup>th</sup> century historians like W. Vogel and B. Hagedorn considered the written and pictorial sources available to them insufficient and criticised the lack of excavated ship finds.<sup>49</sup> Compared with other countries, any attempt to remedy this shortcoming in Germany by means of archaeological research began relatively late and proceeded slowly. This was partly due to the diving technology available at that time, which was difficult and very complex to operate. A far greater hurdle was promoting acceptance for archaeology of medieval and modern times, to which most ship finds in Germany can be attributed.<sup>50</sup> For a long time, the few ship finds that were occasionally excavated in Germany remained isolated specimens and attracted little initial interest for archaeological research.<sup>51</sup> Even the famous find that is now known as the Bremen cog from the 14<sup>th</sup> century, recovered from the river Weser in 1962, was initially regarded in Germany as little more than a technical monument and a symbol of Hanseatic shipping rather than an archaeological object worthy of investigation. The results of nautical archaeology today contrast with the hypotheses of that time and often revise them. The application of new methods has made it possible to evaluate the sites where ships have been found in greater detail and provide data that allow a more precise reconstruction of human activity and the interaction between humans and the sea than was ever possible before.

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48 Belasus (2017).

49 Hagedorn (1914); Vogel (1915).

50 The first of a few existing chairs of medieval and modern archaeology in Germany was established in Bamberg/Bavaria in the 1960s.

51 The ship finds in Baumgarth (formerly in the Stuhm district of East Prussia) of the Viking Age (Conventz [1923]) and Elbing (formerly in West Prussia) of the Late Middle Ages (Ehrlich & Steegmann [1923]) were excavated in silted areas of the Baltic Sea. The fully preserved early 18<sup>th</sup> century cargo ship from Hedwigenkoog in the district of Dithmarschen, Schleswig-Holstein was completely salvaged by the State Archaeology Department in the 1960s, but then decayed from insufficient conservation, due to a lack of interest (Englert [1997]).

### Databases are the basis of modern nautical archaeological research

While underwater archaeology became established in many European countries as a result of the development of lightweight diving equipment in the 1960s, it has only received greater acceptance by German authorities and research institutions since the 1990s. That was when Mecklenburg-Western Pomerania, for example, explicitly included the protection of underwater cultural heritage in its monument protection law for the first time.<sup>52</sup> In recent decades, the systematic recording of ship finds in the databases of the monument authorities has created the basis for submarine heritage protection and nautical archaeological research in Germany. This groundwork has been supported by data from the German shipping authorities and, especially in Mecklenburg-Western Pomerania, by archaeological aerial surveys. In addition, interested recreational divers have made an important voluntary contribution to the creation of the database.

Research into nautical archaeological matters is usually carried out as part of academic dissertations, doctoral theses and, in some cases, third-party financed research projects. The central task of such projects is usually the evaluation of material that was previously secured and documented during preventive archaeological measures. Even though it has been possible to gain numerous new insights into the history of shipbuilding and seafaring in this way, particularly within the scope of international cooperations, it must be noted that due to a lack of research institutions and universities with a corresponding research focus, only a fraction of the material available has actually been investigated.

The use of databases that are based on a geographic information system (GIS) and that can accurately reproduce the sites of finds and areas of particular interest on maps also provide an important basis for research and planning in nautical archaeology. The underwater domain is a large and difficult space to manage. A comprehensive inventory therefore requires access to all data that might contain evidence of possible ship finds, in addition to the currently available archaeological data. The database created by the German Maritime Museum as part of BMBF funded research project “The North Sea – a Threatened Cultural Archive” (*Bedrohtes Bodenarchiv Nordsee*) (2011-2015) was not

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52 Schmidt (2011); Kühn (1999).

only intended to record the finds of ships alone, but also the data on ship losses from written sources to enable cross-checking.<sup>53</sup> Together with other data, for instance on documented trading centres, ports or historical shipping routes, such a database could also provide the basis for archaeological forecasting models, which would allow to draw conclusions about potential archaeological sites. The archaeological sites recorded in such a database mostly do not originate from archaeological wreck searches, as these are rarely carried out at present. They mainly result from chance finds. Any large-scale search for sunken ships is presently carried out in Germany by the shipping authorities, mainly for securing navigable seaways. In some coastal federal states, there is already an exchange with the relevant monument protection authorities that receive reports about finds of potential archaeological interest. Nonetheless, the primary objective of the search is to identify possible obstacles to shipping. Searches are also carried out for construction planning and to exclude possible risks from World War munitions in the run-up to construction work on the seabed. Any finds of ships connected with this are also reported to the relevant monument authorities. Such a dynamically operated database is therefore a decisive basis for the planning of all archaeological protection measures ahead of, and accompanying, any kind of disturbances to the seabed, as well as for the planning of research projects.

#### Targeted use of archaeologically trained divers

In the past, when the use of geophysical measuring instruments was both expensive and complex, it was common to use diving crews to search for ships. They had to search along the seabed on search lines in a fairly laborious process. However, no large scale, systematic search was possible this way. The method is still used when searching for smaller objects, for example in the vicinity of former roadsteads or in ports where ships once lay at anchor waiting for cargo or good winds for sailing. The ships were cleaned there and anything useless was thrown overboard. In general, the aim is to use divers as selectively as possible, because the deployment times for divers are limited for health reasons

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<sup>53</sup> Due to a change in the research focus at the German Maritime Museum, the database was not developed further.

and due to the tidal currents. When investigating larger areas, such as in the run-up to construction work or in areas where natural resources are to be mined, the candidate areas are first narrowed down by other methods and then examined selectively by divers.

On the open sea in particular, dives are extremely dependent on the weather and sea conditions and these can greatly reduce the days of potential deployment. Nevertheless, the use of divers in underwater archaeology is certainly not obsolete. Qualified archaeologists with scientific or professional diver training are absolutely necessary for the specialist assessment of underwater archaeological sites and their excavation. The sole use of divers without qualification in underwater archaeology should be avoided, as archaeological decisions have to be made on the spot, provided objects can be reached by divers at that depth.<sup>54</sup> In Germany, there is admittedly a need to improve the diver training for archaeologists. For example, an internationally recognised training course for using a surface-supplied diving helmet, which so far is not included in the training course for research divers. Appropriate opportunities should be provided for additional training in this field. This would also offer the opportunity for cooperation with neighbouring European countries where such training is already mandatory for underwater archaeology.

### Exploring the seabed

Nowadays, the use of modern geophysical measuring technology over large areas in the run-up to submarine construction work is standard practice. The results of these investigations provide new information for mapping culturally and historically significant sites on the seabed.

Geophysical investigations used in this process make it possible to measure and visualise different conditions of the marine subsoil. For instance, the seabed can be measured using a side scan sonar, in which sound waves are first transmitted on both sides of the device towards the seabed. These sound waves are then echoed off the bottom and detected by the sonar device. The difference in the time required for sound waves to travel to the seabed and back provides information about the surface structure of the seabed, which is then processed and

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54 Professional divers are generally not archaeologists, especially those specialising in nautical or prehistoric archaeology. Research diving is not included in professional diver training.

visualised. The corresponding image therefore consists of acoustic reflections and shadows. A topographic anomaly that protrudes beyond the seabed is recognised as an acoustic shadow. This method is particularly suitable for the investigation of larger areas.

Another measuring device based on the principle of sound is multi-beam sonar. This device works by emitting sound waves in a fan shape and is particularly suitable for detailed surveys of the seabed and already identified sites. The multi-beam sonar makes it possible to capture objects and ground structures from all sides and produces three-dimensional images.

A further measuring method is the sediment echosounder, which uses different sound frequencies to determine the density differences in the seabed, which is very useful when searching for cultural artefacts embedded in the sediment and it also provides a visual representation of the data obtained. However, nautical archaeology faces a problem in that the density of water-saturated wood resembles the density of water-saturated sediment, with the result that the wooden remains of a wreck are usually not visible in the imaging process. Nevertheless, materials with a higher density located inside a shipwreck, such as ballast stones or metal, are reliably identified using the sediment echosounder.

Not only are the surface structures and density measurable for helping to pinpoint archaeological sites on the seabed. Magnetometers can also be used to detect some of the larger metal objects on the seabed, because such objects cause a detectable deviation of the Earth's magnetic field. For this purpose, the magnetometer is towed behind the ship and guided over the area in question. The precision of positioning a magnetic anomaly can be increased by using multiple magnetometers in parallel.

One major advantage of sound-based measurement technologies is that they do not rely on visibility. In addition, such devices can be used in a variety of ways. It is for instance possible to adjust the beam angle or to deploy the device directly on the seabed for a 360° horizontal measurement. All such procedures can not only be controlled manually from the ship, but also mounted on a remotely operated vehicle (ROV) or autonomous underwater vehicle (AUV). The parallel implementation of scanning and evaluation, which is common with these measurement methods, additionally increases the chance of identifying underwater cultural artefacts and recording them as precisely as possible.

The first step when investigating a ship find is to make an initial inventory. This involves determining the building material and construction method, checking possible cargoes and taking samples to determine the age of the find. Where possible, wood samples are taken to determine the age as accurately as possible using dendrochronology.

The use of ROVs with camera technology has proven to be particularly helpful for nautical archaeological analyses in the deeper areas of the northern Baltic. By combining the structure-from-motion technique and photogrammetric computer applications, three-dimensional models can be constructed from multiple images of an entire site or individual objects that were taken from all sides and from different angles. Such documentation technologies have been systematically developed in recent years and now save an enormous amount of time.

#### The unique potential of underwater ship finds

The mostly good conditions for the preservation of organic materials underwater often result in significantly more being preserved in ship discovery sites than those on land. This must be considered during excavations.

The remains of plants and animals, mostly found in the lower parts of a ship, can provide information about the ship's origin, its cargo and the food on board. In many cases, clothing and other items are preserved that would not have survived on land. Human remains play a special role in this context. Anthropological and chemical investigations can provide important insights into life in past times. Unprocessed natural resources such as metal ingots, which are found as cargo almost exclusively in shipwrecks as they would otherwise have been made use of, can be examined for their original chemical composition. The results can provide insights into the trade flows of goods. In this way, the sciences also play a decisive role in nautical archaeology. As much in the inventory of seabed artefacts is fragile, it is advisable to include restorers in excavation teams.

#### Ideal storage conditions are unknown

Nowadays, most shipwreck structures are no longer salvaged, instead they are documented during underwater excavations and left on the seabed. If wrecks have to be removed as part of a construction pro-

ject, they are documented on land. Although a re-sinking is sometimes considered in such cases, such an approach should only be used as an emergency solution, because at present we lack any meaningful studies that define the ideal storage conditions. However, some preliminary experience has already been gained in this context, for example in Canada, where a ship finding was stored in an underwater depot set up on the seabed, after it had been salvaged and its individual parts documented.<sup>55</sup> The aim of such depots is to store ship finds without cost-intensive conservation measures and to preserve them for future generations. In the case mentioned, it was also possible to reconstruct the ship and present it to the public in a museum without incurring major additional costs. There is an urgent need for conservation research in this context, to determine the optimum conservation conditions for the storage of a wooden ship on the seabed and to develop suitable monitoring methods.

#### Computer-aided reconstruction of shipwrecks and presentation of the findings in museums

The wealth of data collected and processed in the interdisciplinary analysis of an optimally documented and sampled ship find not only offers profound insights into how people lived in the past, but also provides sufficient material for presentation of the research results in museums without necessarily displaying an original shipwreck. As well it is now possible to reconstruct ship finds true to the original with computer technology and then analyse the sailing behaviour and hydrostatic properties without having to build towable models or replicas with great effort.<sup>56</sup>

## 2.3 Education at universities

Courses on underwater archaeology are currently offered at the universities of Bremen, Kiel and Rostock. In addition, the universities in Kiel, Rostock, Hamburg, Oldenburg, and the Technical University of Munich

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<sup>55</sup> Waddell (2007).

<sup>56</sup> Tanner & Belasus (in print).



are accredited training providers for research divers.<sup>57</sup> All these offer training in accordance with the standards of the German Commission for Research Diving (*Kommission Forschungstauchen Deutschland*), which provides the basis for optimum safety during diving operations. In Germany, research divers are used in both inland waters and marine coastal areas of the North Sea and Baltic Sea.

Nonetheless, strengthening research into underwater cultural heritage in Germany in the long term requires more than simply instructing archaeologists in the specific regulations of research diving. A specialisation in nautical archaeology or in prehistoric landscapes is also needed. Unfortunately, it is not currently possible to pursue such a specialised degree in Germany. The situation is different in the UK (e.g. at the University of Southampton<sup>58</sup>). In light of the historical significance of the underwater part of our cultural heritage and the scope of measures required to protect and explore it, the situation in Germany needs urgent improvement. This is particularly true as the imminent ratification in Germany of the UNESCO Convention on the Protection of the Underwater Cultural Heritage is expected to sharply increase the demand for qualified archaeologists.

## 2.4 Actors in research

Numerous scientific and governmental institutions with an archaeological, geoscientific or marine focus that is also relevant to the underwater cultural heritage are active in the North Sea and Baltic Sea. Research and protection of the cultural heritage in the North Sea and Baltic Sea would benefit considerably from enhanced cooperation between these actors (see also Fig. 7).<sup>59</sup>

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57 See <http://www.forschungstauchen-deutschland.de/index.php/de/information-de/mitglieder> (retrieved 19/09/2019).

58 University of Southampton (2019).

59 This list does not claim to be exhaustive, but serves to identify the potential.

### 2.4.1 Universities

Due to the scientific cross-cutting nature of underwater archaeology and the multitude of disciplines involved, there are a number of university institutions in Germany that have important competencies in these fields. For example, the **Universities of Kiel, Hamburg, Bremen, Greifswald and Rostock** have institutes, professorships and scientific institutions that each cover important areas, such as marine engineering geology, environmental archaeology, prehistory and ancient history. However, there is not one German university that has its own specialised area for nautical archaeology or for research into prehistoric landscapes.

### 2.4.2 Non-university institutions

Although the underwater cultural heritage is certainly included in the research work of non-university institutions in Germany, it is not usually the main focus of their work. The only exception is the **Lower Saxony Institute for Historical Coastal Research (NIhK)** in Wilhelmshaven, which traditionally deals with climate-induced changes in the landscape of the German coastal regions and the mode of response by local communities. In the past decade, interdisciplinary research into the prehistoric landscape of the mudflats of the Wadden Sea and the seabed of the North Sea and Baltic Sea has been developed into a thematic focus. Together with the Romano-Germanic Commission (RGK) of the German Archaeological Institute (DAI) and the Leibniz Institute for Baltic Sea Research in Warnemünde (IOW), the NIhK was a major participant in the previously mentioned SINCOS project. In addition, together with the DAI and the Marine Research Department in Wilhelmshaven (*Senckenberg am Meer*), it represented Germany's research in the SPLASHCOS network. The NIhK also carries out excavations of settlements in inland lakes and coastal waters at its own initiative and coordinates development of the international web-based SPLASHCOS database and the SPLASHCOS Viewer.

The **German Maritime Museum** in Bremerhaven focuses particularly on historical research into shipping. It is also home to a number of projects with maritime and nautical archaeological focus or references.<sup>60</sup> However, archaeological research into shipwrecks is rare at non-university institutions.

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60 DSM (n. d.).

In addition, there are numerous non-university centres and institutes that do not directly explore underwater cultural heritage on the seabed, but nevertheless have important expertise or the necessary technical infrastructure for investigating prehistoric landscapes on the shelf or documenting ship finds. These primarily include the **Helmholtz Centre for Ocean Research GEOMAR** in Kiel, the **Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research**, the **Alfred Wegener Institute (AWI)** in Bremerhaven that is also a member of the Helmholtz Association, the **Leibniz Institute for Baltic Sea Research Warnemünde**, and the **Centre for Baltic and Scandinavian Archaeology (ZBSA)** at Schloss Gottorf.

### 2.4.3 Federal agencies

A number of federal agencies are of great importance for the exploration and protection of shipwrecks and submerged landscapes. The bodies that deal with such tasks include the **Federal Maritime and Hydrographic Agency (BSH)** in Hamburg. The BSH is a higher federal authority within the portfolio of the Federal Ministry of Transport and Digital Infrastructure (BMVI) and is responsible for maritime tasks and marine regional planning.<sup>61</sup> This also includes construction projects in the North Sea and Baltic Sea. For example, the BSH is responsible for the certification and approval of power generation systems (offshore wind farms) and the associated laying of cables. The BSH also maps navigational obstacles, but does not take any initiative for archaeological analysis of the objects identified or evaluation of their possible cultural-historical significance. The BSH has a number of vessels at its disposal for surveying the sea, searching for wrecks and geoscientific research purposes.

The **Federal Institute for Geosciences and Natural Resources (BGR)** is based in Hanover and another federal government actor that is important for the underwater cultural heritage in Germany. The BGR is a technical-scientific supreme authority accountable to the Federal Ministry for Economic Affairs and Energy and advises both the federal government and German industry on all natural resources and geoscientific

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61 Responsibility for maritime regional planning was shifted in 2017 from the Federal Ministry of Transport and Digital Infrastructure (BMVI) to the Federal Ministry of the Interior (BMI).

issues. It conducts geoscientific research for this purpose and will be responsible for the geological data collection for the exclusive economic zone and the continental shelf within the framework of the forthcoming Geological Data Act (*Geologiedatengesetz*).<sup>62</sup> In cooperation with the Lower Saxony State Office for Mining, Energy and Geology (LBEG) and the Federal Maritime and Hydrographic Agency, the BGR has already collected important data on the history and structural development of the North Sea region within the scope of the “Geopotential of the German North Sea” project.

The **Federal Agency for Nature Conservation** (BfN) is based in Bonn and also relevant for protection of the underwater cultural heritage. The BfN is a supreme federal authority responsible for national and international nature conservation and performs both scientific and executive tasks in this policy area. In this context, the BfN also has the fundamental responsibility for implementing the Federal Nature Conservation Act (BNatSchG) and the Environmental Damage Act (UrschadG) with regard to damage to biodiversity in the German EEZ. The Federal Nature Conservation Act seeks to protect nature and the landscape, including archaeological monuments (see Section 4.4.5). The provisions of this act also apply to the German territorial sea and except for landscape planning to the German EEZ and continental shelf.

In addition, the Karlsruhe-based **Federal Waterways Engineering and Research Institute** (BAW), a technically and scientifically oriented higher federal authority answerable to the Federal Ministry of Transport and Digital Infrastructure, must also be considered. The BAW’s core task is to advise the Federal Waterways and Shipping Administration (WSV) on all issues concerning waterways engineering. The BAW also undertakes research and development in the field of construction engineering, geotechnics and hydraulic engineering in inland and coastal areas. The office of the German Coastal Engineering Research Council (KFKI) is also located there (see Section 2.4.6).

The authorities listed below do not carry out any research work of their own, but as administrative bodies with responsibility for the German coastal and marine areas they are nevertheless important actors for the underwater cultural heritage.

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62 BMWi (2019).

The **Federal Network Agency** (BNetzA) is the supreme federal authority responsible for the German extra-high voltage grid. This also includes the grid connection of offshore wind farms in the North Sea and Baltic Sea to the German mainland. In accordance with the Offshore Wind Energy Act (WindSeeG), the BNetzA is responsible for the preliminary area survey of the seabed within the scope of approvals for energy generation exploitation. For projects within the EEZ the BNetzA delegates this task to the BSH in accordance with a statutory administrative agreement (see Section 4.4.4).

Finally, the **Federal Waterways and Shipping Administration** (WSV) should also be mentioned. The central task of the WSV, which has regional offices in various federal states, is the maintenance and supervision of federal waterways and this also applies to the channels in the German territorial sea and in the German EEZ.

#### **2.4.4 Authorities and ministries responsible for archaeological heritage management in the German federal states**

As is also the case in the other German federal states, in coastal federal states the **State Archaeology Departments** or the archaeology departments of **State Monument Authorities** perform the tasks of a monument authority. The monument protection laws of the federal states define among other things a research mandate for such authorities, which also extends to all archaeologically significant underwater sites within the territory of the federal state. For the maritime states of Bremen, Hamburg, Mecklenburg-Western Pomerania, Lower Saxony and Schleswig-Holstein this includes sites in the territorial sea.

The relevant state authorities are supported in their work by numerous volunteers, who among other things are responsible for the majority of culturally and historically significant finds on beaches and in the Wadden Sea.

The State Archaeology Departments and the archaeology departments of the State Monument Authorities are networked through the Association of State Archaeologists in the Federal Republic of Germany (VLA) and coordinate, for example, the conceptual design of databases.<sup>63</sup> In addition, the VLA has set up a commission for underwater ar-

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<sup>63</sup> See [www.landesarchaeologen.de](http://www.landesarchaeologen.de) (retrieved 19/09/2019).

chaeology (KUWA), which among other things deals with the development of standards.<sup>64</sup>

#### **2.4.5 Federal state approval authorities for the German continental shelf**

The Lower Saxony **State Authority for Mining, Energy and Geology** (LBEG) in Hanover and the **Stralsund Mining Authority** in Mecklenburg-Western Pomerania occupy a special position among state geological agencies. Both authorities process applications for the laying of underwater cables with regard to mining aspects and are responsible for approving exploration measures for the commercial exploitation of mineral resources on the continental shelf. In the course of this they are also responsible for considering archaeological and monument preservation recommendations and conditions as part of the approval procedure.

#### **2.4.6 Federal and state institutions**

The federal and state administrations cooperate in coastal research. In 1973, the **German Coastal Engineering Research Council** (KFKI) was founded for this purpose. The office of the KFKI is located at the Federal Waterways Engineering and Research Institute. The main tasks of the KFKI are the research and forecasting of natural processes with the aim of an environmentally friendly, sustainable use of the coast and the coastal apron. The KFKI operates the North Sea and Baltic Sea Coastal Information System (NOKIS). Metadata from 14 federal and state agencies for coastal protection, nature conservation and water management are published together in this database. In addition, the KFKI is currently developing another database, the Marine Data Infrastructure for Germany (MDI-DE). The KFKI research projects are financed by the Federal Ministry of Education and Research (BMBF) within the framework of the Coastal Research Agenda and the BMBF programme “Research for Sustainable Development” (FONA). However, the underwater cultural heritage in the North Sea and Baltic Sea has yet to play any significant part in the research activities of the KFKI.

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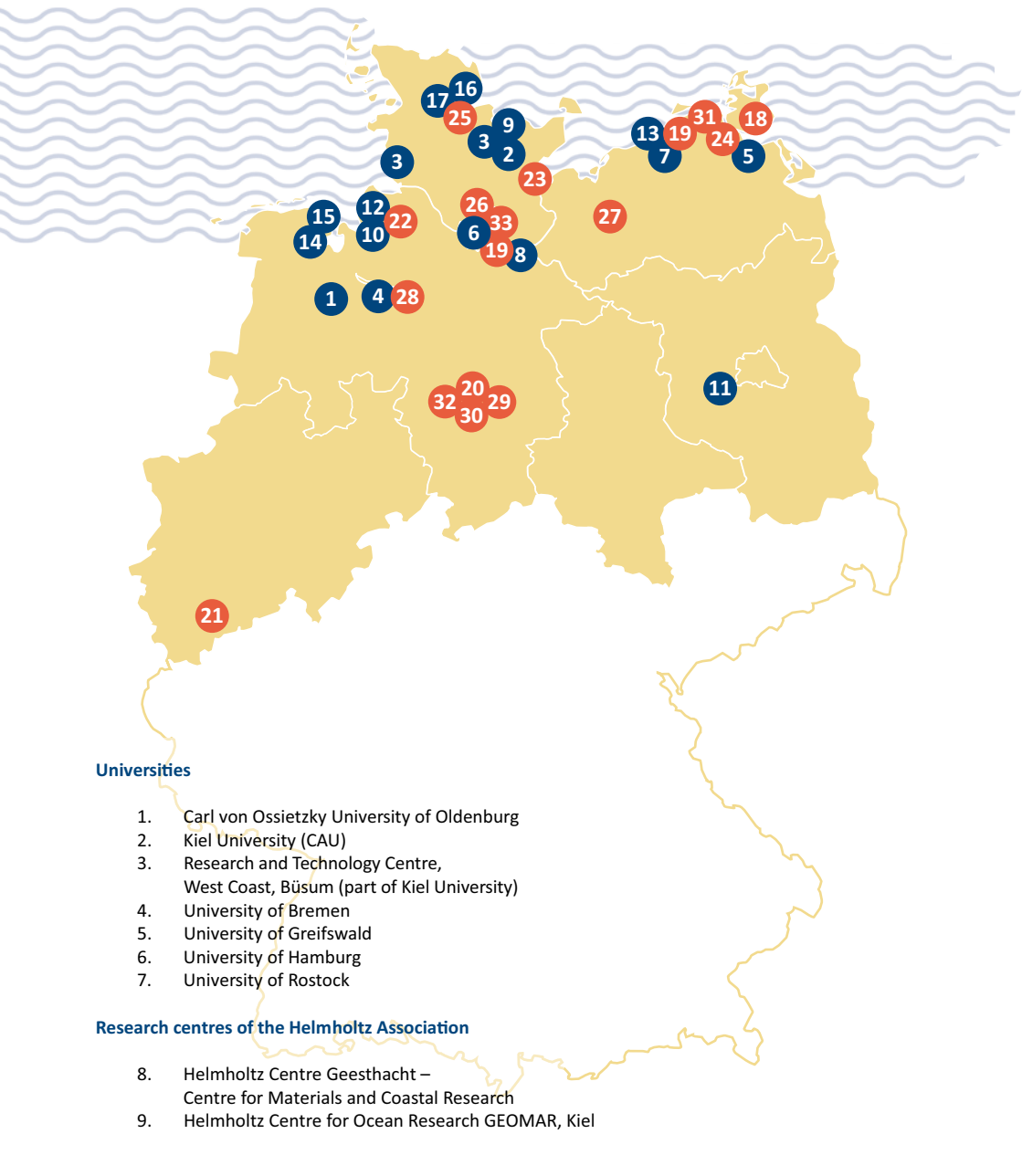
64 Lüth & Jöns (2015).

#### **2.4.7 Companies operating in the offshore sector**

Before companies in the offshore sector implement construction projects, geophysical and geological data on the composition of the subsoil are captured on a large scale. Such datasets can be particularly important for research into the local landscape and settlement history. Experience in the UK has shown that companies that make their prospecting data available to the scientific community can also benefit from such cooperation. It contributes actively towards improving their environmental management and engaging in science, natural history and cultural history as part of their corporate social responsibility. The UK is also an example of how setting up an industrial fund to support archaeological work can strengthen research in the longer term. One example in this regard is the Aggregates Levy Sustainability Fund (ALSF), which provided for each ton of aggregate won by the industry two pounds sterling for research projects, including archaeological projects.<sup>65</sup>

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<sup>65</sup> BMAPA (n. d.). In 2018, the Mineral Products Association (MPA) proposed a new fund for England, the *Aggregates Levy Community Fund (ALCF)* (MPA [2018]).



**Figure 7: Scientific and state actors for the North Sea and Baltic Sea**

Enhanced cooperation of these actors would significantly improve the exploration and protection of the cultural heritage in the North Sea and Baltic Sea.



10. Helmholtz Centre for Polar and Marine Research – Alfred Wegener Institute
11. Helmholtz Centre Potsdam – GFZ German Research Centre for Geosciences

#### **Research institutions of the Leibniz Association**

12. German Maritime Museum – Leibniz Institute for Maritime History (DSM)
13. Leibniz Institute for Baltic Sea Research Warnemünde (IOW)
14. Marine Research Department Senckenberg am Meer, Wilhelmshaven

#### **Research institutions of the federal states**

15. Lower Saxony Institute for Historical Coastal Research (NIHK), Wilhelmshaven
16. Centre for Baltic and Scandinavian Archaeology (ZBSA), Schleswig  
(part of Schleswig-Holstein State Museums Foundation Schloss Gottorf)
17. Archaeological Museum Schloss Gottorf  
(part of Schleswig-Holstein State Museums Foundation Schloss Gottorf)

#### **Federal offices**

18. Federal Agency for Nature Conservation (BfN), Vilm branch
19. Federal Maritime and Hydrographic Agency (BSH), Hamburg and Rostock
20. Federal Institute for Geosciences and Natural Resources (BGR), Hanover
21. Federal Network Agency (BNetzA), Bonn
22. Federal Waterways and Shipping Administration (WSV) Weser-Jade-North Sea, Bremerhaven
23. Federal Waterways and Shipping Administration (WSV), Lübeck
24. Federal Waterways and Shipping Administration (WSV), Stralsund

#### **Authorities and ministries responsible for archaeological heritage management in the federal states**

25. State of Schleswig-Holstein Archaeology Department, Schleswig
26. Archaeological Department of the Archaeological Museum, Free and Hanseatic City of Hamburg
27. Mecklenburg-Western Pomerania State Authority for Culture and Monument Conservation, Schwerin
28. State of Bremen Archaeology Department, Bremen
29. State of Lower Saxony Department for Monument Preservation, Hanover
30. Ministry for Science and Culture of Lower Saxony, Hanover

#### **Approval authorities of the federal states for the continental shelf**

31. Stralsund Mining Authority
32. Lower Saxony State Office for Mining, Energy and Geology (LBEG), Hanover

#### **Federal and state institutions**

33. German Coastal Engineering Research Council (KFKI)

## 3 What endangers the cultural heritage in the North Sea and Baltic Sea?

The underwater cultural heritage is constantly exposed to mechanical, chemical and biological impacts that threaten its survival. Such impacts are often man-made. The threats in the North Sea and Baltic Sea are chiefly from: (1) ground disturbance, (2) marine pollution, (3) climate change, and (4) illegal excavations and looting.

These threats are greater in Germany's exclusive economic zone (EEZ) than in the territorial sea, because there is no effective governmental mechanism to protect the underwater cultural heritage in the EEZ. There is no specialist authority that could integrate the research and protection structurally, as has long been the case for the cultural heritage on land and in the territorial sea. The following section describes the individual threats to the cultural heritage in the entire area under German responsibility in the North and Baltic Sea and also discusses ways of improving the protection of the underwater cultural heritage in the future.

### 3.1 Ground disturbance

All ground disturbance carries the risk that the possibly hidden archaeological finds, features, traces and remains of historical landscapes and settlement areas could be irreversibly destroyed. This applies on land as well as on the sea floor. However, the danger is particularly great under water, as the activities there are usually carried out with mechanised equipment that leave little scope for archaeological observations. Such intrusions take place in the context of commercial use, e.g. in the extraction of sand and gravel, when laying pipelines and submarine cables, for the construction of wind farms, shipping channels, extraction of natural resources, as well as fishing and the management of aquaculture (see Fig. 8).

It is therefore of fundamental importance for the cultural heritage in the North Sea and Baltic Sea that traces of prehistoric landscapes and historical artefacts are detected in advance of such intrusions. Only then is it possible to take measures to ensure their effective protection and scientific documentation. As large parts of today's seabed in the North Sea and Baltic Sea were once land, with its excellent preservation conditions the seabed holds enormous potential for gaining new insights into the settlement history of the northern part of Central Europe and its neighbouring areas. Against this background, the aim must be to identify and study all traces of prehistoric life in or on the seabed before their possible destruction. This applies regardless of whether these traces are visible on the seabed, as is the case with the majority of ship finds, or whether they are covered by sediment, as is the case with prehistoric settlement remains. It is therefore of central importance that the affected areas and objects are recorded and, as far as possible, documented and salvaged already in the course of commercially motivated initial explorations and as part of preliminary investigations required by the authorities. An environmental impact assessment should also include a comprehensive assessment of the impact of the planned commercial use on the cultural heritage. In the German EEZ this currently only happens in exceptional cases, which makes a change in procedural practice urgently necessary. Experience in the UK has shown that integration of archaeological activities and research interests into the Regional Environmental Characterisation (REC) that is carried out by the government can be successful and produce valuable insights.<sup>66</sup>

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66 Ward et al. (2014), pp. 75.

## Ground disturbances

- Construction of foundations for wind turbines
- Laying of submarine pipelines and cables, e.g. for connection to the power grid
- Sand and gravel mining, e.g. for construction material extraction
- Mining of natural resources
- Fishing with trawl nets
- Dredging of navigation channels
- Building tunnels

## Marine pollution

- Contamination by munitions
- Eutrophication

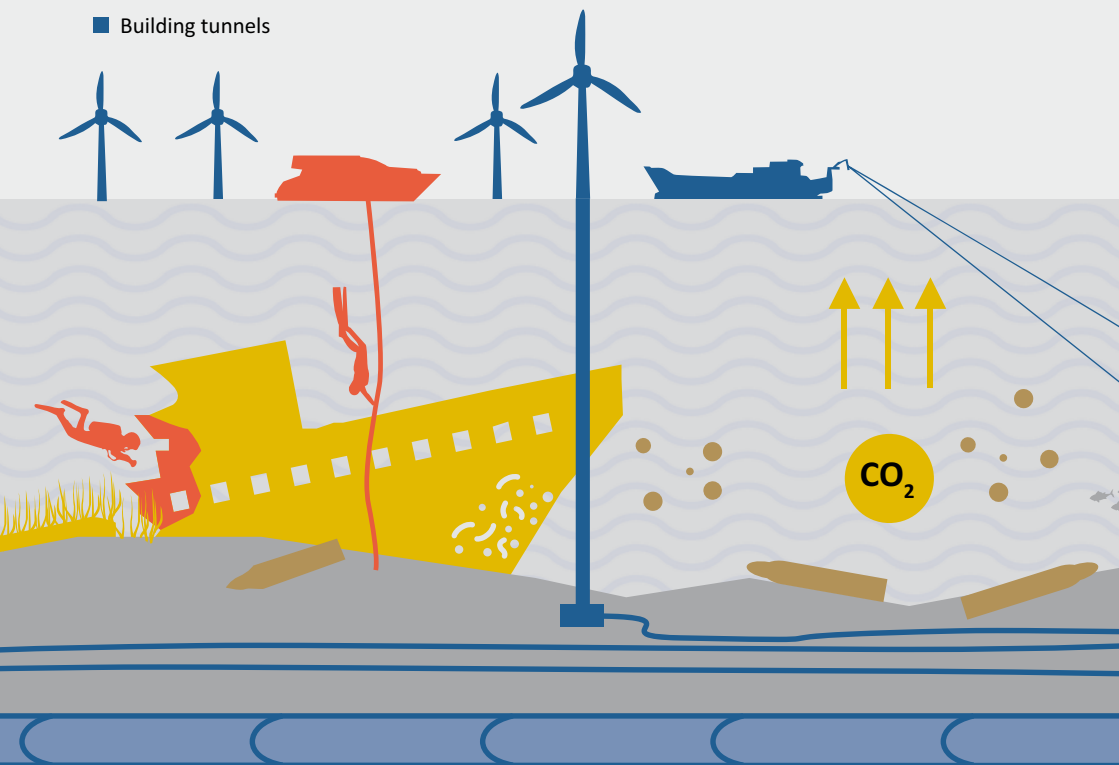


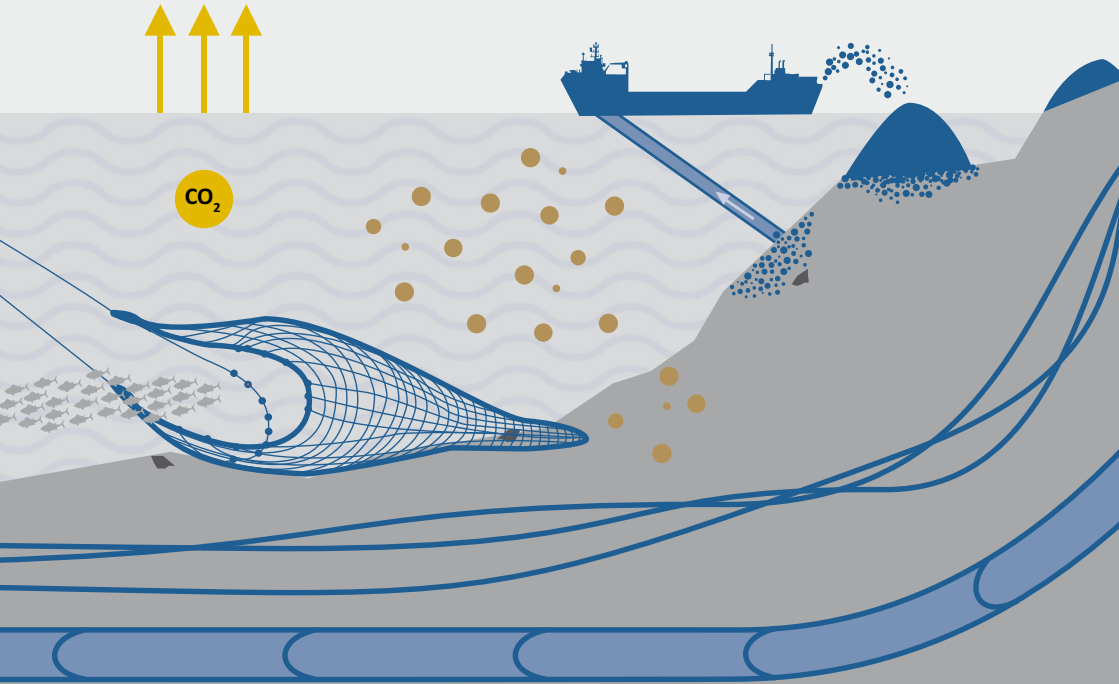
Figure 8: Threats to the cultural heritage on the seabed

## Climate change

- Acidification of seawater and rise in water temperature
- Spread of shipworms as a result of natural adaptation
- Loss of protective eelgrass vegetation

## Predatory excavations, looting and disturbance of sea graves

- Looting of shipwrecks, damage by the removal of parts and objects for subsequent sale
- Predatory excavations on the seabed
- Disturbing the peace of the dead by damage to sea graves, removal and destruction of human remains



### Box 5

#### Sand and gravel extraction

Mechanised equipment for sand and gravel extraction (hopper excavators, suction dredgers) interferes with the seabed, modifies the sequence of layers and thereby potentially impairs or destroys archaeologically relevant evidence. This means that archaeological objects might be scooped up unnoticed at mining sites and therefore destroyed for good. A scientific evaluation becomes much more difficult when an archaeological object is discovered whose original environment has been destroyed by an intrusion, because information about the place of origin and circumstances of the find is indispensable. An example of the difficulties in dealing with relocated artefacts is the discovery of archaeological objects at SBV Flushing Wharf in Belgium. Although it was possible in this case to determine the original mining area, the circumstances of the find were irreversibly destroyed without prior documentation.<sup>67</sup>

#### Wind energy

The first offshore wind turbines were installed in Germany between 2004 and 2008. This was followed in 2010 by “Alpha Ventus”, the first offshore wind farm in the North Sea, with a rated output of 60 megawatts. By the end of 2018, the total capacity of offshore wind farms in operation was over 6,400 megawatts.<sup>68</sup> Further wind farms with a total projected output of 1,400 megawatts are currently under construction. There are also plans at this stage to designate further areas for offshore wind farms, with a total capacity of 15,000 megawatts, which will result in significant numbers of intrusions into the seabed.<sup>69</sup> Anchoring wind turbines in the seabed and laying power transmission cables between the wind farm and the mainland therefore also pose a great threat to the archaeological sites hidden under

67 Tizzard et al. (2015).

68 IWR (2019).

69 Act for the development and promotion of offshore wind energy (Offshore Wind Energy Act) 2016, Section 2 (see Section 4.4.4).

the seabed and its surrounding layers. In addition to direct intrusions into the seabed, the operation of wind farms can also be problematic, because such installations can also affect the tidal currents and consequently the erosion and sedimentation processes, thus also indirectly endangering the cultural assets.<sup>70</sup>

#### Pipelines and submarine cables

The laying of cables for transmission of electricity to the mainland, and their maintenance and repair, as well as the laying of telecommunications cables and pipelines for the transport of oil, gas and condensate, can damage the seabed and cause lasting changes to archaeologically relevant layers in it. At the same time, such construction projects offer opportunities for archaeological investigations of the underwater landscape, for example by means of longitudinal section methods, similar to the practices used when laying gas and cable routes on land.

#### Fishing

Fishing with large trawl nets that scrape the seabed often results in the “bycatch” of archaeological objects. This means that the artefact is ripped out of its find context and is very difficult to classify scientifically.

#### Lack of competent authority for the cultural heritage in the exclusive economic zone

Within the 12 nautical mile zone (see Section 4.4.1), research into and protection of the underwater cultural heritage is ensured by the monument protection laws of the German federal states and the appropriate actions are taken by the state authorities or ministries responsible for heritage protection. These actions include for instance the systematic search for cultural heritage, its cataloguing and its protection against threats from human activities. In addition, all the sites located in the coastal zones are recorded and catalogued in the relevant state-specific monument information systems. As public bodies, the archaeological authorities of the German federal states (State Archaeology Depart-

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70 Jöns (2015).

ments) are responsible for the expert assessment of intrusions at each site, and contribute to evaluation of applications of approval by providing expert opinions for the relevant licensing authorities. This applies to excavations both for research purposes and for archaeological investigations within the scope of construction work, which are therefore often referred to as rescue excavations. Where possible these are carried out in advance of construction work, so that any hold-up of the construction project is avoided and the excavation teams of the specialist authorities, or the specialist excavation companies commissioned by the authorities, have sufficient time to properly conduct their investigations. Protection, documentation, salvage and research are therefore structurally linked to the relevant authorities.

There is no comparable archaeological authority for the German EEZ, which is not part of the territory of the Federal Republic of Germany, and consequently cannot be assigned to one of the federal states. The problem of lack of jurisdiction is particularly pervasive, as the lack of a government initiative cannot be adequately compensated for by other bodies such as research institutes or universities. The protection of the cultural heritage on the seabed requires a level of scientific expertise and infrastructure that is only available in very few institutions in Germany. However, their capacities are far from sufficient to cover such a large area. Consequently, this structural deficit not only endangers the underwater cultural heritage, but also results in there being significantly less scientific knowledge about this important archaeological legacy than about the cultural heritage on land.

Systematic recording has so far only been carried out for those items of cultural heritage that rest on the seabed or clearly protrude from it, such as shipwrecks and aircraft wrecks.<sup>71</sup> They are continuously being recorded as potential obstacles to navigation by the Federal Maritime and Hydrographic Agency (BSH) and are documented in a database and in nautical charts (see Fig. 5).<sup>72</sup> This means that small wrecks or wrecks located distant from sea routes that do not present an obstacle to shipping are not recorded. The BSH database is therefore not equivalent to an inventory compiled by the state monument authorities for

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71 This applies primarily to the federal seaways in the North Sea and Baltic Sea.

72 BSH (n. d.).



land-based monuments. Any such inventory would still have to be developed with regard to monument protection aspects, including for the EEZ, to ensure this information is available when research applications are considered, during preliminary investigations and for planning approval procedures by the BSH, the Lower Saxony State Office for Mining, Energy and Geology (LBEG) in Hanover, the Stralsund Mining Authority and other authorities.

The particular nature of the study of prehistoric landscapes and shipwrecks described above requires new regulatory structures to be created or existing structures to be adapted, in order to link research and protection. Archaeological expertise must be included, in order to ensure professional communication with the companies and the ability to take the actions that are technically necessary in cases of intrusions into the cultural heritage.

#### State of the art methods must always be used

In order to reduce the threat to the underwater cultural heritage from intrusions into the seabed, a future competent authority should ensure that the exploration, documentation and salvage work is always carried out based on current scientific knowledge and that the latest methods and technologies are employed (see Chapter 2). Representative samples should always be reviewed when intrusions are carried out on the seabed.<sup>73</sup>

#### Chance finds can be reported via online tools

All commercial users of the EEZ should be obliged to take sufficient account of protection of the underwater cultural heritage at the planning stage and to report and, if feasible, safeguard objects discovered by chance in the course of their activities. Such handling of chance finds is already regulated in the UK. There are three types of protocol, according to industry sector: one for the aggregate industry (Marine Aggregate Industry Protocol for Reporting Finds of Archaeological Interest, MAI Protocol),<sup>74</sup> one for archaeological finds by the offshore renewable energy industry (Proto-

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73 Tizzard et al. (2015).

74 See <https://www.wessexarch.co.uk/our-work/marine-aggregate-industry-protocol-reporting-finds-archaeological-interest> (retrieved 19/09/2019).

col for Archaeological Discoveries, PAD)<sup>75</sup> and one for the fishing industry (Fishing Protocol for Archaeological Discoveries, FIPAD).<sup>76</sup> For instance, if fishermen find artefacts in their nets, they can report the location and circumstances of the find using a dedicated website. Such online tools for reporting chance finds connected with commercial use should also be set up in Germany, so that corresponding reports can be made to the future competent authority. In this regard, it is advisable to offer training courses for the employees of companies that are active in the EEZ.

### Cooperation with commercial users

The commercial users in the North Sea and Baltic Sea can also be important actors for cultural heritage research. In other European countries, the scientific community and companies, which often operate transnationally, are already working together. Experience in the UK has shown that the integration of archaeological activities and research interests into non-archaeological exploration of the seabed can be successful and produce valuable insights. COWRIE, a not-for-profit organisation established as part of the expansion of UK offshore wind energy, has formulated comprehensive technical guidance for all commercial users and decision-makers on how to deal with the archaeological heritage and the historical environment when exploring the seabed.<sup>77</sup> For example, data and cores obtained in the course of planning and using wind farms are made available for evaluation by archaeology. Archaeological considerations are also taken into account during the geological exploration of an underwater area. And finally, archaeologists are taken on board the exploration ships to examine the cores.<sup>78</sup>

Such cooperation should also be pursued for the German parts of the North Sea and Baltic Sea. All large-scale or linear projects should therefore be accompanied by archaeological monitoring, as has long been common practice with such projects on land.

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75 The Crown Estate (2014). See <https://www.wessexarch.co.uk/our-work/offshore-renewables-protocol-archaeological-discoveries> (retrieved 19/09/2019).

76 See <https://fipad.org/> (retrieved 19/09/2019).

77 Gribble & Leather (2011). COWRIE stands for Collaborative Offshore Wind Research into the Environment (<https://tethys.pnnl.gov/institution/collaborative-offshore-wind-research-environment-cowrie>, retrieved 19/09/2019). See also Wessex Archaeology (2007).

78 Gribble & Leather (2011), p. 24.

### Integration of archaeological standards in approval procedures

Archaeological investigation standards for underwater excavations should be integrated into all approval processes related to commercial activities in the North Sea and Baltic Sea, when these involve seabed intrusions. The standards at present available in Germany were primarily developed for underwater archaeological investigations in inland lakes, rivers and coastal waters, but must be further developed for the offshore sector, taking into account established international standards.<sup>79</sup> In the future, consideration of these standards should be routinely integrated as a requirement for the respective permits. This will allow commercial activities in the EEZ to be combined with archaeological investigations, which would considerably expand scientific knowledge and thus provide a valuable contribution to the study of human history.

## 3.2 Marine pollution

For a long time the seas have been treated carelessly. For instance, refuse and munitions were dumped and wastewater was discharged. Many oceans therefore suffer from considerable pollution with plastics and chemical contamination.<sup>80</sup> The remnants of munitions on the seabed pose a particular danger.

### Contamination by munitions

After the Second World War, munitions were disposed of in the North and Baltic Sea. A large number of ships had been sunk with their munitions. In addition, there are unexploded bombs from bombing raids that missed their target. The Federal Maritime and Hydrographic Agency states that there are around 1.6 million metric tons of munitions in German waters alone.<sup>81</sup> Chemical warfare agents were dumped

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<sup>79</sup> *Verband der Landesarchäologen* (2006), pp. 48 and *Verband der Landesarchäologen* (2011/2012), subsection 16.14 Underwater excavations and subsection 16.15 Nautical archaeology. The Underwater Archaeology Commission (KUWA) is working within the association to develop these standards. Such standards are also available internationally (*Wessex Archaeology* [2007] and *Gribble & Leather* [2011]).

<sup>80</sup> WBGU (2013).

<sup>81</sup> Böttcher et al. (2011).

mainly south of the Little Belt in the Baltic Sea and to a small extent off Heligoland. While the information available on the dumping of chemical weapons provides a comprehensive and detailed picture of the situation, there is considerably less knowledge about disposals of conventional munitions.<sup>82</sup> It is suspected that conventional munitions are widely dispersed throughout the Baltic Sea, including coastal waters.

The salt content, the temperature of the water and the water pressure in general affect the corrosion of metal casings that contain explosive ordnance. Investigations of munitions remnants in the region around Bornholm concluded that the stocks disposed of there are “completely corroded”.<sup>83</sup>

Old munitions pose a threat to shipping traffic and offshore installations that in addition to the direct safety risk to humans also endangers the marine environment.<sup>84</sup> The explosive trinitrotoluene (TNT) and in particular its conversion products (metabolites) are carcinogenic and are absorbed by marine organisms such as mussels. In this way these substances can also enter the human food chain. The dangers associated with old munitions are only slowly coming to the attention of countries bordering the North Sea and Baltic Sea. For this reason, all research activities on the seabed should be accompanied by intensive cooperation between archaeology, toxicology, geophysics and munitions experts. It is also essential to ensure precise localisation, mapping and risk assessment with a view to protecting the marine environment, both under the Convention on the Law of the Sea and with regard to occupational health and safety.

### Eutrophication

Eelgrass vegetation provides protection for juvenile fish, stores large quantities of carbon dioxide, releases oxygen into the water and consolidates the sediment on the seabed. However, the effects of eutrophication, rising temperatures and water turbidity are currently causing a dramatic decline in the eelgrass vegetation worldwide.<sup>85</sup> Although the negative popu-

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82 Böttcher et al. (2011).

83 Sanderson & Fauser (2015).

84 Beck et al. (2018).

85 90 per cent of the eelgrass vegetation below the tidal line in the North Sea and Baltic Sea died in the 1930s, due to an epidemic of a unicellular organism (*Labyrinthula zosterae*), and have not recovered in the sublittoral of the North Sea (Den Hartog [1987]).

lation trend of the two species of eelgrass on the German coasts seems to have stopped, there is still no noticeable recovery, because the nutrient input from rivers (agricultural eutrophication) remains too high.

Since the 1990s, it can be observed that the remains of numerous Stone Age settlements are no longer covered by eelgrass. This means there is no vegetation to protect the fragile archaeological structures from erosion by ocean currents.<sup>86</sup> Danish archaeologists have already been able to establish a clear link between the loss of eelgrass vegetation and the erosion of Mesolithic settlements and Neolithic fishing facilities in the Baltic Sea.<sup>87</sup>

### Conclusion

Generally it should be noted that the underwater cultural heritage is usually exposed to the same stresses as the marine environment. As the cultural heritage depends on preservation of its environment, it will obviously benefit from nature conservation. Authorities or organisations tasked with protecting the marine environment should consider the underwater cultural heritage more in their activities. Their cooperation with archaeological authorities, institutions and organisations is also a helpful option in this respect.

## 3.3 Climate change

In addition to seabed intrusions and marine pollution, climate change also has a negative impact on cultural heritage. The acidification of seawater resulting from the global rise in CO<sub>2</sub> causes increased corrosion of objects made of iron or steel, such as shipwrecks from the 19<sup>th</sup> and 20<sup>th</sup> centuries.

Nutrient input, rising water temperatures, altered salinity and global shipping traffic<sup>88</sup> allow organisms that have long been unknown in these waters to settle in the North Sea and Baltic Sea. An example of this are shipworms, which migrated to the Baltic Sea in the 1990s and break down

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86 Fischer (2011).

87 Malm (1995); Fischer (2007).

88 Ships can also introduce organisms such as neophytes (plants), neozoans (animals) and neomyces (fungi) that can permanently change the local environmental conditions.

wood in the water. This is not only a problem for coastal protection; shipworms can also destroy oak logs that have been on the seabed since the Mesolithic (9,000-5,000 BCE). As a result of climate change, their habitat has expanded in recent years within the Baltic Sea in an easterly direction as far as Zingst (Mecklenburg-Western Pomerania).<sup>89</sup> Even in 1997, a merchant ship subsequently dated as from the 18<sup>th</sup> century had to be salvaged off Hiddensee to save it from being destroyed by shipworms.<sup>90</sup>

In light of the risks outlined above, protection of the cultural heritage should therefore become an integral part of the German climate change adaptation strategy. Furthermore, international cooperation at scientific, governmental and economic levels should be strengthened, in order to identify the extent of the existing and expected impacts of climate change on the underwater cultural heritage and to jointly develop strategies for solutions.

### 3.4 Illegal excavation and looting

The looting of archaeological sites is not only a problem on land, but also under water. Wrecks are opened, welded apart and looted, the individual parts are sold or swapped between collectors. The European Parliament considers the underwater archaeological heritage to be especially vulnerable to plundering, as the authorities have difficulty in controlling maritime areas.<sup>91</sup> There are therefore no precise figures or any systematic overview of the number of such lootings available.<sup>92</sup>

Technological improvements in the field of underwater detection, for example using seismology and sonar, are now making new discoveries possible and also make it easier to access archaeological objects and sites located underwater or on the seabed. Although such methods

<sup>89</sup> Lippert et al. (2017).

<sup>90</sup> Lüth & Förster (1999); see also Gjelstrup Bjoerdal & Gregory (2011) and Daly & Belasus (2016) for more information on dealing with shipworms.

<sup>91</sup> European Parliament (2015).

<sup>92</sup> The UNESCO/INTERPOL expert meeting held in September 2017 spoke of “daily” challenges for the underwater cultural heritage through plunder, trade, fishing and the extraction of natural resources (<https://www.interpol.int/fr/Actualites-et-evenements/Actualites/2017/Protecting-underwater-cultural-heritage-focus-of-INTERPOL-meeting>, retrieved 24/09/2019).

are indispensable for research today, they can pose an acute threat to underwater cultural heritage in the hands of looters.

The monument protection laws of the German federal states already stipulate an obligation to report archaeological finds. This reporting obligation also applies to objects washed up on the beach, which are sometimes taken away by private individuals who are unaware of this duty. There is therefore an urgent need to communicate this information to the public in general and tourists in particular.<sup>93</sup>

If diving is carried out at underwater sites located in the territorial sea with the aim of exploring them or even removing objects from them, a permit must be applied for in advance from the relevant monument authority. The objectives and methods must then be disclosed, as well as the planned retention of documentation and if applicable where any finds removed are to be kept. This is the only way to prevent intrusions into the usually extremely fragile substrate from causing damage to the cultural heritage. This threat is particularly acute for shipwrecks, which are visited and often looted by souvenir hunters. More attention should therefore be paid to the damage that can be caused to the cultural heritage when shipwrecks are used as a diving destination or even entered without specialist knowledge. To date, there is no corresponding obligation to apply for a permit in the German EEZ, which means that the cultural heritage located there is largely left unprotected against looting and illicit excavations.

Effectively combating the looting and pillaging of underwater archaeological monuments requires improvements to the protection status of these sites and at the same time greater public awareness. To this end, the targeted search for objects (e.g. using metal detectors) and their misappropriation or sale must be prevented, as must any unauthorised interference with shipwrecks. In order to effectively prevent the dismantling and looting of these sites beyond the 12-mile zone, consideration should be given to the option contained in the United Nations Convention on the Law of the Sea of designating a contiguous zone adjacent to the German territorial sea, in order to expand the enforcement powers applicable in the coastal waters to this zone.

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93 For the Wadden Sea region of Lower Saxony, special information leaflets on specific topics were printed to encourage locals and tourists to report archaeologically significant finds.

## 4 What legal framework must be observed?

The legal framework established by the 1982 United Nations Convention on the Law of the Sea (UNCLOS) for the cultural heritage within exclusive economic zones and continental shelves<sup>94</sup> is fundamentally different from that for national territories and the territorial seas. This has consequences for the research and protection of the underwater cultural heritage in all EEZs and on all continental shelves, including the German EEZ and the German continental shelf in the North Sea and Baltic Sea.

Within the German national territory, research and protection of the cultural heritage are enshrined as statutory responsibilities in monument protection laws of the federal states. Accordingly, there are authorities whose responsibility it is to implement these laws, so that research and protection are structurally linked. Any interference with the cultural heritage is subject to approval by those authorities. According to the Convention on the Law of the Sea, German territory also includes the territorial sea, which extends from the low-water baseline to 12 nautical miles into the North Sea and into the Baltic Sea. The monument protection laws of the coastal federal states accordingly apply within this zone, thereby ensuring protection and research of the underwater cultural heritage located there.

The German EEZ in the North Sea and Baltic Sea is adjacent to the national territory. The EEZ extends up to 200 nautical miles into the North Sea and Baltic Sea. Unlike the territorial sea, the EEZ and the continental shelf are not part of German territory. The Federal Republic of Germany enjoys certain sovereign rights and powers within its EEZ and on the continental shelf. However, the exploration and comprehensive protection of the underwater cultural heritage has not yet been explic-

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<sup>94</sup> The EEZ comprises the seabed up to a maximum width of 200 nautical miles, and thus the continental shelf. This is included in the EEZ when such a zone is designated by a state.



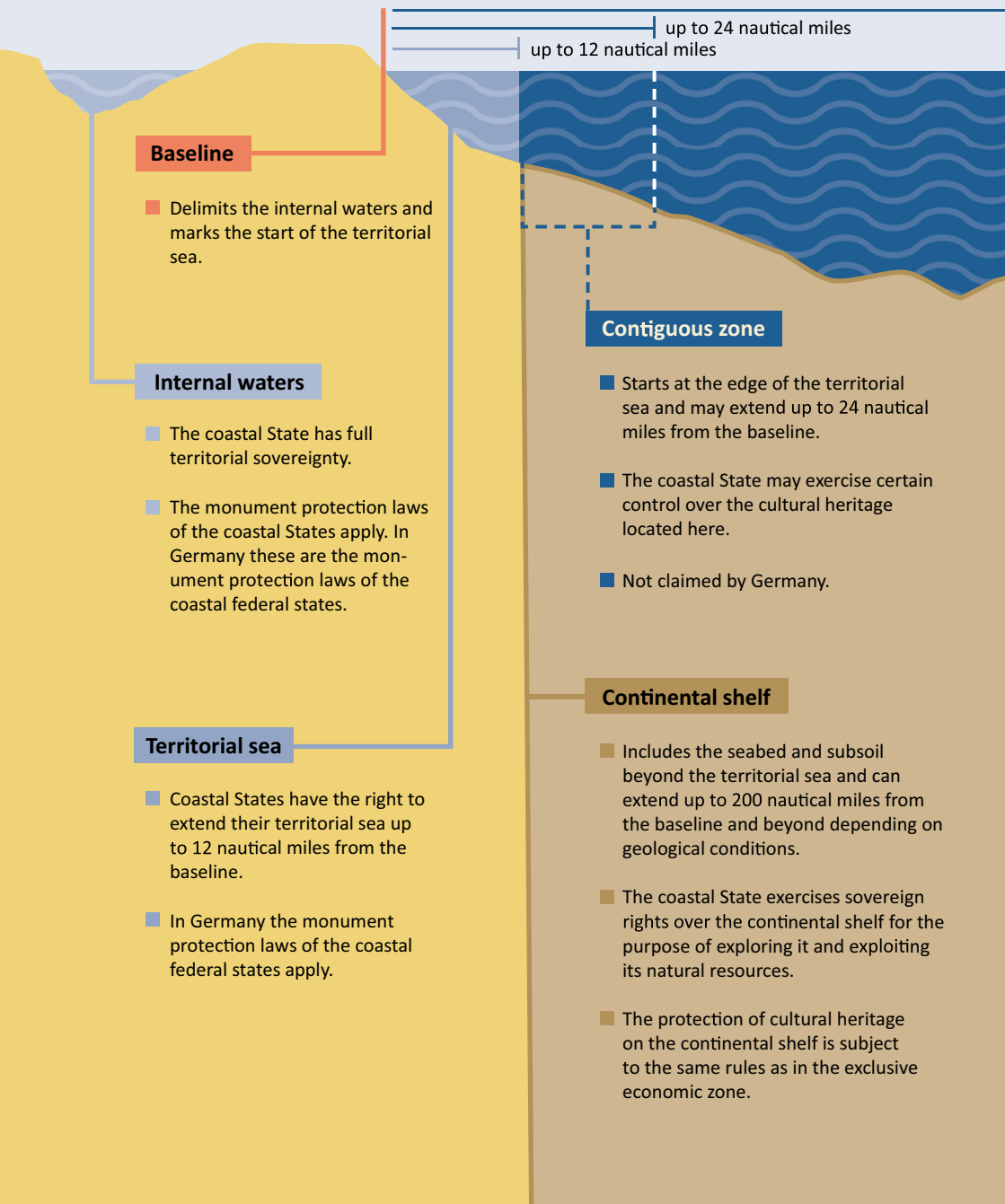
itly included among these sovereign rights and powers. UNCLOS Article 303 (1) merely provides that states have the duty to protect objects of an archaeological or historical nature that are found in the sea and to cooperate towards this end.

As a result, the heritage in the German EEZ has so far been much less explored and is significantly less protected than that within the German territorial sea. This precarious situation illustrates the importance of the 1992 European Convention for the Protection of the Archaeological Heritage (known as the Valletta Treaty) and the 2001 UNESCO Convention for the Protection of the Underwater Cultural Heritage. However, the Valletta Treaty, ratified by Germany in 2003, has so far been implemented only tentatively in the German EEZ and on the continental shelf. Germany has also not yet ratified the UNESCO Convention.<sup>95</sup> The present discussion paper makes a strong plea for ratification of the UNESCO Convention as soon as possible and for a significant improvement in the implementation of the Valletta Treaty. A competent authority specifically responsible for the cultural heritage in the EEZ and on the continental shelf should also be designated.

The following section outlines some of the legal instruments that are relevant to the cultural heritage at international, European and national level.

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95 The coalition parties at the time, CDU, CSU and SPD, agreed in their 2013 coalition agreement to take the initiative to join the UNESCO Convention: CDU, CSU & SPD (2013), p. 122.



**Figure 9: Marine zones under the Convention on the Law of the Sea**

Schematic diagram of marine zones according to the United Nations Convention on the Law of the Sea.

### Exclusive economic zone (EEZ)

- Starts at the edge of the territorial sea and may extend up to 200 nautical miles from the baseline.
- The coastal State exercises sovereign rights in the EEZ for the purpose of exploring it and exploiting its natural resources. This includes, for example, the construction of oil platforms and wind turbines, fishing, marine scientific research and the protection of the marine environment.
- The rights of other States remain otherwise unaffected. This applies for instance to the freedom of navigation and the laying of submarine cables and pipelines.
- The monument protection laws of coastal States do not apply.
- However, the underwater cultural heritage can be protected, for instance through (transboundary) environmental impact assessments.
- When a coastal State is Party to the European Convention on the Protection of the Archaeological Heritage, the State is obliged to apply the Convention in the exercise of its sovereign rights and its jurisdiction under the Convention on the Law of the Sea.

### International waters / high seas

- Starts beyond the exclusive economic zone.
- Is open to all States.
- The freedom of the seas applies.

## 4.1 Universal international law

### 4.1.1 The United Nations Convention on the Law of the Sea

#### The seas are divided into different zones

UNCLOS divides the sea into zones (see Fig. 9). Starting from the low-water baseline delimiting the internal waters and marking the beginning of the territorial sea, thus the territory of a coastal State extends up to 12 nautical miles into the sea. The laws of the coastal State in question apply within this 12-mile zone. Beyond this the EEZ begins. The EEZ is not part of the territory of the respective coastal State, but the coastal State in question has certain sovereign rights and powers conferred by UNCLOS within the zone. The EEZ can extend up to 200 nautical miles from the baseline. The international waters, also known as the high seas, begin beyond that border. The freedom of the seas applies in these waters. The coastal States have the option of designating a contiguous zone adjacent to the territorial sea and up to the 24<sup>th</sup> nautical mile at most.

The Federal Republic of Germany acceded to UNCLOS in 1994. The Implementing Act to UNCLOS<sup>96</sup> extended the German territorial sea to up to 12 nautical miles from the baseline. However, a possible contiguous zone was not specified. Additionally, the German EEZ in the North Sea and Baltic Sea was established in coordination with the neighbouring countries concerned (see Fig. 10).

With 33,100 square kilometres the German EEZ and the continental shelf are roughly the size of North Rhine-Westphalia. Exploration of an area of this size and depth poses an enormous scientific challenge.

The EEZ and the continental shelf are subject to different regimes pursuant to UNCLOS and are therefore discussed separately below.

#### Sovereign rights and jurisdiction of Germany in the EEZ

The Federal Republic of Germany has certain sovereign rights and powers in the German EEZ. The sovereign powers include the construction and use of artificial islands, installations and structures, marine

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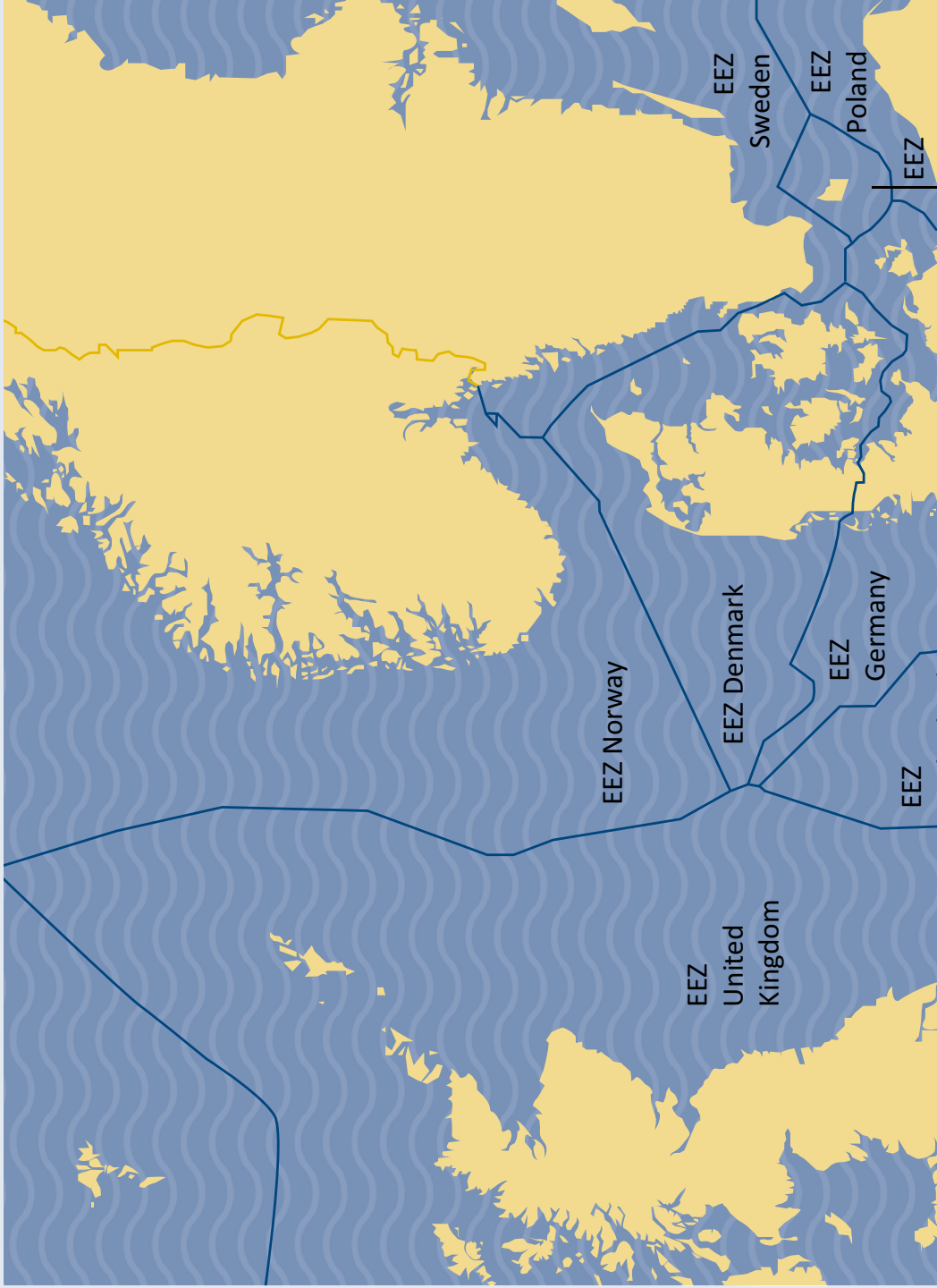
<sup>96</sup> Implementing Act to the United Nations Convention on the Law of the Sea of 10 December 1982 and the Agreement of 28 July 1994 on the implementation of Part XI of the Convention on the Law of the Sea (Implementing Act 1982/1994 Convention on the Law of the Sea, BGBl. 1995 I p. 778).

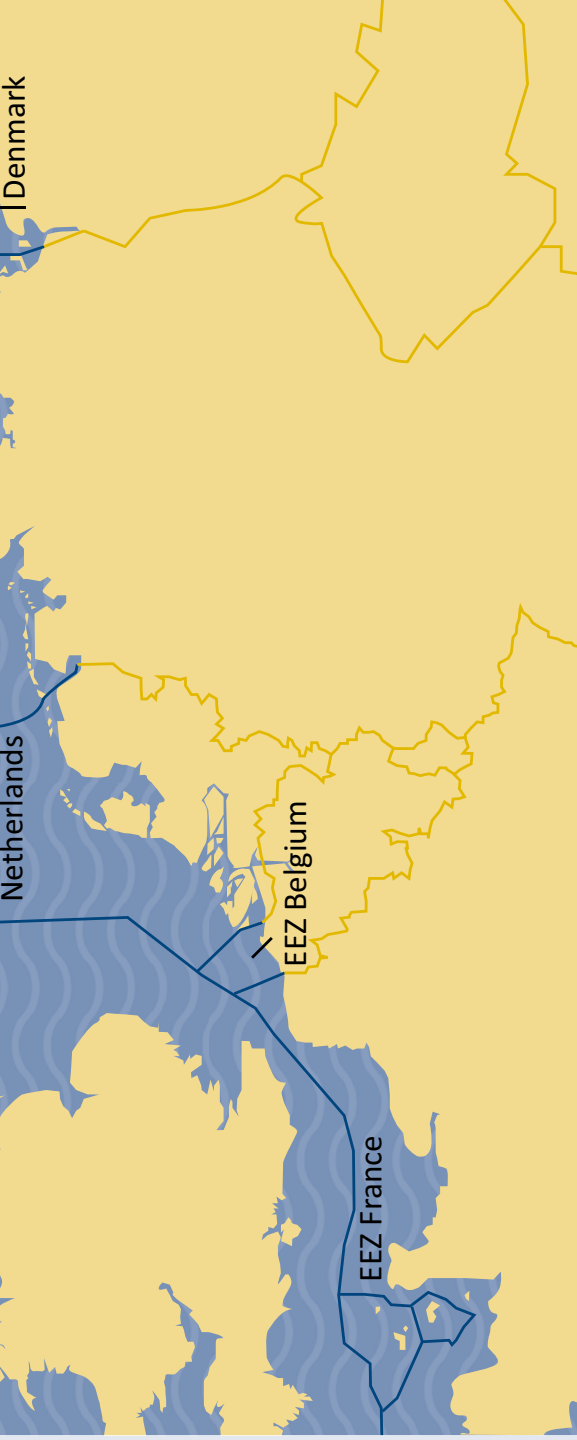
scientific research and the protection and preservation of the marine environment (see Box 6). This means that Germany may adopt regulations for these purposes. For instance, no one is permitted to construct facilities, conduct marine scientific research or take measures for the protection and preservation of the marine environment in the German EEZ without the approval of the Federal Republic of Germany. In other respects, the rights of third countries (e.g. navigation, cable and pipeline laying, overflight rights) remain unaffected within the EEZ in accordance with the principle of the freedom of the seas.

Exploration and protection of the underwater cultural heritage does not fall under the sovereign powers pursuant to UNCLOS. Furthermore, the prevailing legal opinion is that the underwater cultural heritage is not part of marine scientific research.<sup>97</sup> This is not surprising given that when the Convention was concluded in 1982, underwater cultural heritage research was still in its infancy and therefore this particular field of research was not perceived part of marine scientific research due to its limited presence. The Convention thus reflects an object-centred understanding of the underwater cultural heritage, based on individual finds, for which it provides only a general protection obligation that must be observed cooperatively: “States have the duty to protect objects of an archaeological and historical nature found at sea and shall cooperate for this purpose.” (UNCLOS Article 303 (1)). The focus was on shipwrecks or accidental finds, not on the discovery context that is equally important for research, let alone the large areas of submerged landscapes. Further fields of research that deal with the reconstruction of prehistoric landscapes, such as continental shelf prehistoric research and seabed prehistory, have emerged later.

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97 For a different opinion see Boesten (2002), pp. 69 and Dromgoole (2013), p. 271.





**Figure 10: The location of the exclusive economic zones in the North Sea and Baltic Sea**

The North Sea consists of the territorial seas and exclusive economic zones of Germany, France, Belgium, the United Kingdom, Norway, Sweden, Denmark and the Netherlands. The German EEZ in the Baltic Sea is directly bordered by the EEZs of Denmark and Poland. The diagram does not specifically demarcate the territorial seas, as the focus is on the relative positions of the EEZs.

Research activities in the EEZ and on the continental shelf targeting the cultural heritage are therefore not subject to approval, neither in the German area of responsibility nor anywhere else. Exploration of cultural heritage in the EEZ and on the continental shelf can, in principle, be carried out by any interested party who does not need a licence for this purpose, as long as it does not contravene the other regulations in force in the EEZ or on the continental shelf, such as protection of the marine environment. In addition, there is a widespread view in jurisprudence and State practice that the search and recovery of shipwrecks within the EEZ and on the continental shelf are in principle also permitted to other States, in particular the flag State<sup>98</sup> of the wreck in question.<sup>99</sup> In the absence of corresponding legal provisions, there is moreover no guarantee for professional documentation of the respective underwater situation, for the preservation of objects in their find context or for professional salvage and conservation of the finds on land. Conflicts of interest must be settled on the basis of equity in accordance with UNCLOS Article 59, balancing the various interests of the States involved, but also those of the international community as a whole must be considered and balanced in the light of all the circumstances, so that injustices are avoided.

Protection of the underwater cultural heritage is not so far covered by protection of the marine environment, although there are many overlapping issues, as many impacts on the marine and submarine environment also affect the cultural heritage. These include fishing, offshore wind power, sand and gravel extraction, oil and gas exploration and production, pipelines, submarine cables, shipping, nutrient inputs, marine aquaculture, and invasive plant, animal and fungal species.<sup>100</sup> Legal protection in this regard has so far only been provided indirectly and partially by the 1991 Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) and the implementation of Directive 2001/42/EC of the European Parliament and of the Council

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98 Flag State is the State that grants a ship its nationality, registers it within its territory and grants it the right to fly its flag.

99 Schorlemer (2019), pp. 449 states that the Convention provides that “salvage law is applicable if the salvage is approved by the competent authorities, if it is in full compliance with the UNESCO Convention and, in addition, if it is ensured that each salvage operation provides maximum protection.”

100 For explanations of the individual environmental impacts see BfN (n. d.).



of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. Strategic environmental assessments and environmental impact assessments are also used to identify and evaluate the potential impact of a project on the cultural heritage. If the cultural heritage is actually affected by environmental impacts, the situation can be positively influenced by taking appropriate actions.

### **Box 6: Provisions of the United Nations Convention on the Law of the Sea (UNCLOS) for the exclusive economic zone**

Excerpt from UNCLOS Article 56 – Rights, jurisdiction and duties of the coastal State in the exclusive economic zone

- (1) In the exclusive economic zone, the coastal State has:
- a) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds;
  - b) jurisdiction as provided for in the relevant provisions of this Convention with regard to:
    - i) the establishment and use of artificial islands, installations and structures;
    - ii) marine scientific research;
    - iii) the protection and preservation of the marine environment [...]

### The sovereign rights and jurisdiction of Germany with regard to the continental shelf

In addition to regulations that concern the EEZ, the cultural heritage of the North Sea and Baltic Sea may also be affected by regulations of the United Nations Convention on the Law of the Sea with regard to the continental shelf (see Box 7).

This concerns first of all the extraction of natural resources and sediment (UNCLOS Article 77 (1)) as well as the consent of the coastal State for delineation of the course for the laying of cables and pipelines (UNCLOS Article 79 (3)). It also concerns all installation work in connection with the operation of facilities (e.g. offshore wind turbines) (UNCLOS Article 79 (4)). Lastly, it affects all cables or pipelines that lead into German territory, including the territorial sea.

The Federal Republic of Germany has the exclusive right under UNCLOS to authorise and regulate all drilling operations on the continental shelf (UNCLOS Article 81). This applies, for example, to boreholes drilled prior to the construction of installations or for the laying of cables and pipelines for the purpose of subsoil assessment (for information about preliminary area surveys, see Section 4.4.4).

### **Box 7: Provisions of the United Nations Convention on the Law of the Sea for the continental shelf**

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Excerpt from UNCLOS Article 77 – Rights of the coastal State over the continental shelf

- (1) The coastal State exercises over the continental shelf sovereign rights for the purpose of exploring it and exploiting its natural resources.

Excerpt from UNCLOS Article 79 – Submarine cables and pipelines on the continental shelf

- (1) All States are entitled to lay submarine cables and pipelines on the continental shelf, in accordance with the provisions of this article.
- (2) Subject to its right to take reasonable measures for the exploration of the continental shelf, the exploitation of its natural resources and the prevention, reduction and control of pollution from pipelines, the coastal State may not impede the laying or maintenance of such cables or pipelines.
- (3) The delineation of the course for the laying of such pipelines on the continental shelf is subject to the consent of the coastal State.
- (4) Nothing in this Part affects the right of the coastal State to establish conditions for cables or pipelines entering its territory or territorial sea, or its jurisdiction over cables and pipelines constructed or used in connection with the exploration of its continental shelf or exploitation of its resources or the operations of artificial islands, installations and structures under its jurisdiction.

UNCLOS Article 81 – Drilling on the continental shelf

The coastal State shall have the exclusive right to authorize and regulate drilling on the continental shelf for all purposes.

### Designation of a contiguous zone

UNCLOS contains an option for a coastal State to designate a contiguous zone. This zone is adjacent to the territorial sea and may not extend more than 24 nautical miles beyond the baseline. In the contiguous zone, the coastal State may exercise the control necessary to prevent infringement of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea (UNCLOS Article 33). The designation of a contiguous zone would enhance protection of the underwater cultural heritage by extending it beyond the territorial sea. The following rules apply in a contiguous zone with regard to illicit trafficking in archaeological or historical objects, which is central to the issue of protecting the underwater cultural heritage: “In order to control traffic in such objects, the coastal State may, in applying article 33, presume that their removal from the seabed in the zone referred to in that article without its approval would result in an infringement within its territory or territorial sea of the laws and regulations referred to in that article.” (UNCLOS Article 303 (2)).

Opinions differ on the normative content of this provision: One view assumes that the provision creates an “archaeological zone” with State regulatory powers similar to those in the territorial sea.<sup>101</sup> In view of the general obligation to protect archaeological and historical objects found in the sea, it could be deduced that the coastal State can extend its cultural heritage laws to the contiguous zone.<sup>102</sup> This would mean that both archaeologically significant objects and human remains there would be better protected. However, a different view rejects such an allocation of competence to the coastal State.<sup>103</sup> Accordingly, although archaeological protection zones could also be established in the EEZ in accordance with the Valletta Treaty, these would not be binding for third countries under general international law.<sup>104</sup> In light of recent developments in the European Union (Maritime Protected Areas) and na-

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101 For the complete issue, see Lagoni (2006) and Treves (2015), p. 41.

102 According to this interpretation, the exercise of coastal State rights in the archaeological zone is independent of the declaration of a contiguous zone (Herzog [2002], p. 16).

103 Rau (2002), p. 399; Hayashi (1996), p. 292; Vitzthum & Talmon (1998), pp. 38ff; Oxman (1988), p. 363.

104 Lagoni (2006), p. 337.

tional practice elsewhere (e.g. USA), the designation of a contiguous zone is nevertheless recommended.<sup>105</sup>

#### **4.1.2 The UNESCO Convention on the Protection of the Underwater Cultural Heritage**

An important element of modern cultural asset protection for preservation of the underwater cultural heritage is the Convention on the Protection of the Underwater Cultural Heritage, which was adopted in 2001, entered into force on 2 January 2009 and has so far been ratified or accepted as binding by 61 States.<sup>106</sup> Germany has not yet ratified the Convention.

According to Article 3 of this Convention, it must be interpreted and applied in the context of and in a manner consistent with international law, and therefore does not affect the rights and obligations of the States Parties as they result from UNCLOS. This means that any legal loopholes cannot be closed if and to the extent that jurisdictional provisions of UNCLOS contradict this.

The UNESCO Convention applies to “all traces of human existence having a cultural, historical or archaeological character which have been partially or totally under water, periodically or continuously, for at least 100 years”, including “artefacts and human remains, together with their archaeological and natural context” and “objects of prehistoric character” (Article 1 (1)).

The Convention builds on the division of the sea into different zones, further specifying management of the underwater cultural heritage. It explicitly assigns to each State Party in the EEZ and on the continental shelf the right to “prohibit or authorize any activity directed at such heritage to prevent interference with its sovereign rights or jurisdiction as provided for by international law including the United Nations Convention on the Law of the Sea.” (Article 10 (2)).

According to the UNESCO Convention, it is also the “duty of all States Parties to protect underwater cultural heritage by way of all prac-

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<sup>105</sup> EEA (2015) and IEEP & NRDC (2008).

<sup>106</sup> See <http://www.unesco.org/eri/la/convention.asp?KO=13520&language=E> (retrieved 24/10/2019). The Convention is supplemented by a technical annex drafted by the International Council on Monuments and Sites (ICOMOS) with a total of 36 rules and by the Operational Guidelines, which are intended to facilitate implementation.

ticable measures taken in accordance with international law to prevent immediate danger to the underwater cultural heritage, including looting” (Article 10 (4)).

Based on the assumption that all States Parties have a responsibility to protect the underwater cultural heritage in the EEZ and on the continental shelf, the UNESCO Convention also imposes comprehensive reporting and information obligations on the States Parties, which must report the objects located and identified to the Director-General of UNESCO (Article 9 (3)). This means that all archaeological sites and shipwrecks known within the German EEZ and on the continental shelf must be notified to UNESCO.

The Convention also provides some basic principles for management of the underwater cultural heritage. This includes preservation of cultural assets *in situ* (at the discovery site in the water) as the preferred but not the only possible solution. In the North Sea and Baltic Sea, this principle is particularly relevant for shipwrecks. Translocations or salvage operations carried out correctly and authorised by the relevant authorities are permitted, provided such operations respect the principles of the Convention and ensure maximum protection of the cultural assets. There is also an obligation to cooperate in order to preserve underwater cultural heritage in the interest of mankind (Article 2 (3) and (4)). However, there are no clear rules on property rights, although these are often disputed between flag States and coastal States and this can lead to legal disputes.<sup>107</sup> It should also be noted that each State Party is required to take measures to seize underwater cultural heritage in its territory that has been recovered in a manner not in conformity with this Convention (Article 18 (1)).

In this regard, the role of what is referred to as the Coordinating State in waters beyond its territorial sovereignty such as the EEZ and the continental shelf deserves special attention. Where there is a discovery of underwater cultural heritage or an activity is intended to target the underwater cultural heritage, such a State Party must coordinate the consultations for the protection of the respective heritage (Article 10

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107 For example, Colombia, Spain and the private archaeology company Sea Search Armada are in dispute over the question of who owns the sunken ship “San José” and its valuable cargo. The galleon sank off the coast of Cartagena (Colombia) in the Atlantic Ocean in 1708.

(3)) with those States that have declared an interest and for which there is a “verifiable link” to the underwater cultural heritage concerned (Article 9 (5)).

The Coordinating State implements measures of protection that have been agreed by the consulting States and issues all necessary authorisations for such agreed measures in conformity with the Convention (Article 10 (5)). Furthermore, it may conduct any necessary preliminary research on the underwater cultural heritage throughout the entire EEZ and the continental shelf and must promptly inform the Director-General of the results, who in turn will make such information promptly available to other States Parties (Article 10 (5)). This could also serve as a basis for the official or officially ordered and controlled exploration of the underwater cultural heritage.

In general, the coastal State has the role of the Coordinating State, unless it expressly declines (Article 10 (3)). However, the discovery of underwater cultural heritage in its EEZ or on its continental shelf in any case imposes an obligation on the coastal State to protect the underwater cultural heritage, even if no other State has declared an interest in its coordinated protection.

The Coordinating State acts on behalf of all States Parties concerned when performing its tasks. As a Coordinating State, the coastal State in question has an important role to play in the protection of the underwater cultural heritage.<sup>108</sup> This potential, particularly with regard to cataloguing, documentation and research, should be harnessed. The Federal Republic of Germany should therefore strive to ratify the UNESCO Convention and take the described aspects into account when adopting a German implementing law. Regulations should also be put in place for Germany to assume the role of a Coordinating State, including a competent authority for the underwater cultural heritage in the EEZ.

With its provisions for a Coordinating State the UNESCO Convention creates a cooperative jurisdictional regime that provides for the protection of the underwater cultural heritage even outside the territorial sea without inadmissibly extending the sovereign powers of UNCLOS, which are binding under international law.

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<sup>108</sup> Dromgoole (2013), p. 291, where Article 10 (2) is assessed as a “potentially powerful provision”.

#### 4.1.3 Protection standards for human remains in marine waters

The warships and merchant ships destroyed in the First and Second World Wars often sank with their entire crews, which is why the human remains of seamen, soldiers and passengers can still be found at many culturally and historically significant sites at the bottom of the North Sea and Baltic Sea. Human remains in maritime waters must be accorded due respect in accordance with Article 2 (9) of the UNESCO Convention on the Protection of the Underwater Cultural Heritage. In contrast to archaeological finds, for which a minimum duration of 100 years applies according to the UNESCO Convention (Article 1 (1) (a)), the amount of the time the remains have spent under water makes no difference.

The dead should be allowed to rest in peace. This applies both to the victims of war and to the victims of peacetime ship accidents. Problems can arise in this respect if a wreck is explored, salvaged or accessed by the public.<sup>109</sup>

Neither UNCLOS nor the UNESCO Convention on the Protection of the Underwater Cultural Heritage contain specific provisions concerning the status of maritime graves, which makes it difficult to deal with these sites and the human remains found there in a dignified manner.<sup>110</sup> To date there is neither a binding definition nor details of applicable protection standards, a fact that has met with criticism: “[...] the treatment of human remains within the Convention does not amount to any recognition of these sites as graves as such. The human remains are part of the archaeological record and are treated as such.”<sup>111</sup>

Continuing technological progress is making it possible to explore shipwrecks at ever greater depths. This not only increases the risk of shipwrecks being looted or dismantled, but also of human remains being removed from their final resting places. Such illegal activities make it increasingly urgent to find answers on how to handle human remains properly.

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109 Delgado & Varmer (2015), p. 115, with reference to the wreck of the “USS Arizona” in Pearl Harbor (Hawaii/USA), which is considered one of the “most sensitive war graves” and has become a highly frequented memorial site.

110 For more detail see Pallas (2004), pp. 347.

111 Forrest (2015), p. 131.



In this regard, it is crucial that all wrecks in the German territorial sea and the German EEZ are officially mapped. It should not only be decisive whether an object is an obstacle to navigation, but also whether it contains human remains and is therefore a sea grave. It is also important to use this as the basis for initiating a public discourse on how to deal with marine memorials.

Archaeologists should take the lead in searching for wrecks and participate in monitoring. Furthermore, all those who legally disturb the seabed should also be made aware by the relevant authorities of the possible presence of human remains in shipwrecks and should be given appropriate behavioural guidance.

It would also be advisable for the international community, under the aegis of UNESCO, to develop international standards for the protection of maritime graves. A recommendation should be drawn up for the handling of maritime graves, taking into account the rights and obligations of both coastal and flag States and the relatives or descendants of the victims, in order to provide dignified remembrance and to ensure that the dead can rest in peace, including underwater.<sup>112</sup>

## 4.2 Regional international law

### 4.2.1 The European Convention for the Protection of the Archaeological Heritage

The European Convention for the Protection of the Archaeological Heritage, also known as the Valletta Treaty of the Council of Europe,<sup>113</sup> signed in Valletta (Malta) in 1992, applies not only to terrestrial, but also to maritime cultural heritage. The Federal Republic of Germany signed the treaty in 1992 and ratified it in 2003.<sup>114</sup>

A distinctive feature of the Valletta Treaty is that it connects research and protection as a matter of principle (see Box 8). Although these are basically mutually dependent, research activities can also

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112 For details about the issue see Schorlemer (2019).

113 See <https://www.coe.int/en/web/conventions/full-list/--conventions/rms/090000168007bd25> (retrieved 16/04/2019).

114 BGBl. 2002 II p. 2079.

contribute to at least partial destruction of a monument. Protecting the cultural heritage is necessary to ensure that historical traces will still be found in the future and can be explored with the aim of a comprehensive reconstruction of human history.

The Treaty also takes account of the dynamic development of research, which is continually advanced above all by new technical possibilities. Nowadays it is already possible to carry out investigations that were not feasible when UNCLOS was adopted in 1982. Moreover, it is reasonable to expect that future generations of researchers will have methods that are not available at present.

The Council of Europe stresses that the Treaty's rules also apply to the EEZ and the continental shelf,<sup>115</sup> as Article 1 (2) (iii) requires a State to exercise jurisdiction in an area. Pursuant to UNCLOS, this is the case within the German EEZ and the German continental shelf.

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115 Council of Europe (1992), p. 3.

### Box 8: Aim, object and scope of the Valletta Treaty

#### Article 1

- (1) The aim of this (revised) Convention is to protect the archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study.
- (2) To this end shall be considered to be elements of the archaeological heritage all remains and objects and any other traces of mankind from past epochs:
  - i) the preservation and study of which help to retrace the history of mankind and its relationship with the natural environment;
  - ii) for which excavations or discoveries and other methods of research into mankind and the related environment are the main sources of information; and
  - iii) which are located in any area within the jurisdiction of the Parties.<sup>116</sup>
- (3) The archaeological heritage shall include structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water.

116 In the official French language version, jurisdiction also clearly relates to the area as such and not to the subject matter in question: “[...] l’implantation se situe dans tout espace relevant de la juridiction des Parties”. This would also fit in with the purpose of the Treaty, which is the (greatest possible) protection of archaeological heritage (Article 1(1)).

UNCLOS grants the States Parties certain sovereign rights and sovereign powers within the EEZ and on the continental shelf (see Section 4.1.1). In this context, all States which are both States Parties to the Convention on the Law of the Sea as well as the Valletta Treaty<sup>117</sup> also have obligations under the Valletta Treaty.<sup>118</sup> It follows from this that the Federal Republic of Germany has to explore and protect the cultural heritage in accordance with the Valletta Treaty, as it has sovereign rights and sovereign powers in the EEZ and on the continental shelf according to the Convention.

For instance, Article 2 obliges the States Parties to the Valletta Treaty to establish a government-run protection scheme. This means that protection of the cultural heritage in the EEZ and the continental shelf must not remain unregulated in view of the sovereign rights and powers that derive from the Convention. For each contractual party, this primarily concerns the creation and maintenance of an “inventory of its archaeological heritage”. Furthermore, provision should be made for the creation of “archaeological reserves”, “for the preservation of material evidence to be studied by later generations” even in places where “there are no visible remains on the ground or under water”.

It would have to be legally assessed whether the monument protection laws of the coastal federal states could be extended to the German EEZ and the continental shelf in order to close the current regulatory gap in the EEZ.

Article 3 regulates approval procedures for excavations, Articles 4, 5 and 6 standardise protection and conservation measures involving archaeologists, and Article 10 serves to prevent the illegal transfer of artefacts.

A central element of the Treaty also concerns the funding of archaeological investigations. Article 6 of the Treaty states that each Party undertakes to increase the material resources for rescue archaeology “by taking suitable measures to ensure that provision is made in major

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117 The current list is available here: [https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143/signatures?p\\_auth=dg2WfyCT](https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143/signatures?p_auth=dg2WfyCT) (retrieved 19/09/2019). All countries bordering the North Sea and the Baltic Sea have signed both the Treaty and the Convention, but three countries have territorial restrictions regarding the validity of the Valletta Treaty.

118 The Netherlands explicitly takes this into account in its North Sea Policy: Netherlands (2015). Reference is made to the Valletta Treaty on pp. 8 and 21.

public or private development schemes for covering, from public sector or private sector resources, as appropriate, the total costs of any necessary related archaeological operations". As is the case on land, large infrastructure projects should be accompanied by archaeological surveys as standard practice. This is the only way to achieve a comparable level of knowledge for the underwater cultural heritage in the medium term.

As the Valletta Treaty was already ratified by Germany in 2003, the Federal Republic of Germany should fulfil its obligations that arise from it within the German EEZ and the seabed on the continental shelf as quickly and comprehensively as possible.

#### **4.2.2 The Convention on Environmental Impact Assessment in a Transboundary Context**

In 2002, the Federal Republic of Germany ratified the Convention on Environmental Impact Assessment in a Transboundary Context, known as the Espoo Convention.<sup>119</sup> This Convention, which was concluded in 1991, stipulates that environmental impact assessments must be carried out for transboundary measures. The Parties to the Convention are also required to take "measures to prevent, reduce and control significant adverse transboundary environmental impact from proposed activities" (Article 2 (1)), which includes "effects on cultural heritage" (Article 1 (vii)). Appendix III of the Espoo Convention further specifies that one criterion for determining environmental impact can be location, for example in cases of "sites of archaeological, cultural or historical importance". The Espoo Convention is implemented in Germany by the Environmental Impacts Assessment Act (see Section 4.4.3).

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<sup>119</sup> BGBl. 2002 II pp. 1406. For the English language version see United Nations (1991).

### 4.3 EU Environmental Impact Assessment Directives

At the European legislative level, a certain degree of protection for the underwater cultural heritage has so far been achieved by the EU Directives on environmental impact assessments, most recently Directive 2014/52/EU of the European Parliament and Council of 16 April 2014<sup>120</sup> amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Article 3 of the Directive designates land, soil, water, air and climate as well as material assets, cultural heritage and the landscape as objects of environmental protection. Annex III of the Directive lists the selection criteria which are used to decide on a case-by-case basis whether an environmental impact assessment must be carried out. The location of the respective project is one essential criterion. In its preamble (No 16), the Directive also refers to the European Convention on the Protection of the Archaeological Heritage (Valletta Treaty). Germany has implemented the Directive in the Environmental Impacts Assessment Act, but with certain restrictions (see Section 4.4.3).

### 4.4 Coastal State law

#### 4.4.1 Monument protection laws of the German federal states

In the Federal Republic of Germany, the federal states are responsible for protection of the cultural heritage. However, the statutory duty to protect the cultural heritage is not limited to monuments on land, but also applies to all monuments located in inland waters (rivers, lakes), internal waters (e.g. Wadden Sea, bays, fjords, lagoons) and within the 12-mile zone of the territorial sea (see Figs. 9 and 11). The state monument protection laws therefore afford cultural heritage in the territorial sea the same protection as the cultural heritage on land.

The definitions of the monument protection laws of the three German federal states with coastal and sea access explicitly include the remains of prehistoric landscapes. For example, the Monument Protec-

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120 See <https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=celex%3A32014L0052> (retrieved 19/09/2019).

tion Law of the State of Schleswig-Holstein explicitly protects not only historical artefacts as monuments, but also “material evidence such as changes and discolourations in the natural soil texture as well as evidence of plant and animal life, if knowledge of the human past can be gained from such using archaeological methods” (DSchG SH 2015 Section 2 (2.2)).<sup>121</sup>

In most state monument protection laws, the protection status of a monument does not depend on its entry in an inventory, list or map.<sup>122</sup> This is paramount for archaeological monuments, as they are hidden in the ground and often immediately endangered when discovered. The protection status must therefore take effect immediately. Such an arrangement must also be established for the EEZ.

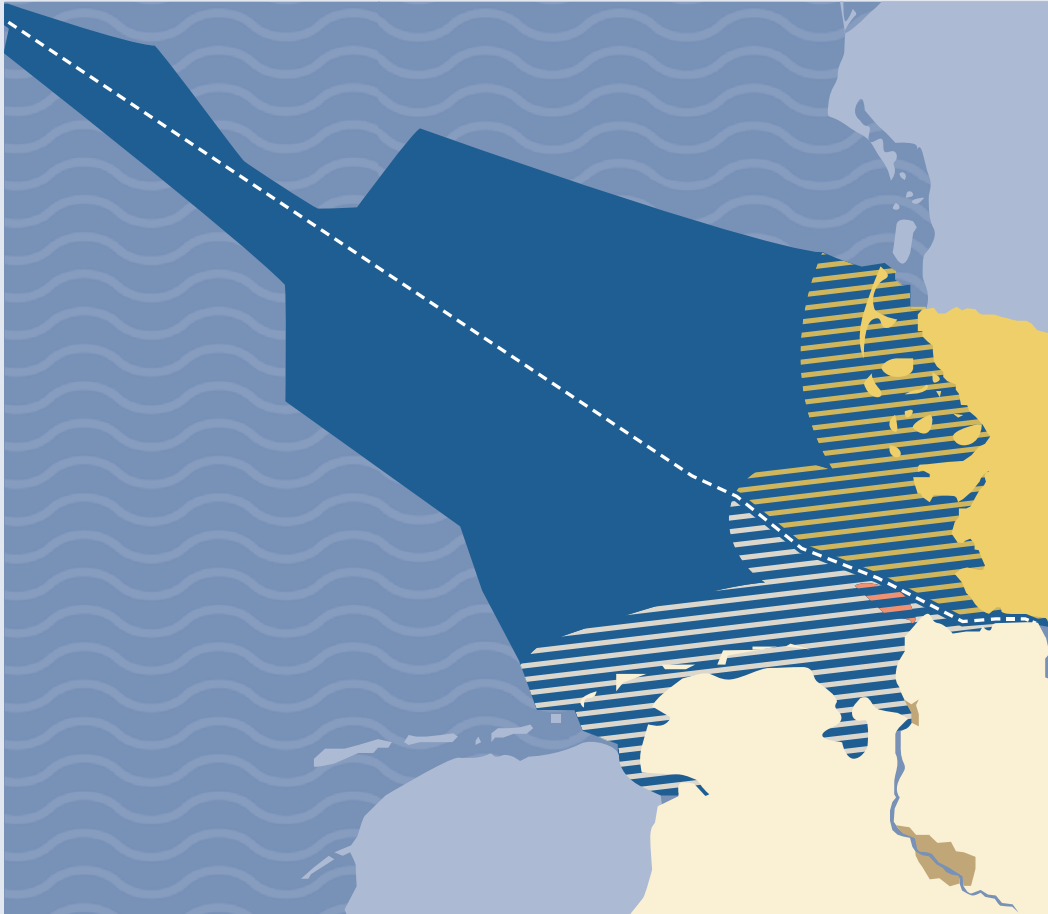
The monument protection laws of the federal states contain specific regulations to prevent endangering cultural monuments. These include the general obligation to obtain a permit to search for archaeological artefacts, including the use of technical aids such as metal detectors. The permit requirement also extends to scientific excavations, as these too represent irreversible interference with archaeological artefacts. An additional reporting obligation applies if archaeological artefacts are actually discovered.

Furthermore, the ‘polluter pays’ principle applies in the majority of the federal states for intrusions that affect or may affect archaeological artefacts. Archaeological investigations may be necessary in the run-up to construction projects. If significant artefacts are discovered in this context or during the subsequent construction work, the project sponsors are obliged to bear all reasonable costs of professional investigation, documentation and salvage.

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121 Comparable content can be found in the monument protection laws of Mecklenburg-Western Pomerania and Lower Saxony.

122 For example, Section 3 BbgDSchG (Brandenburg), Section 5 DSchG ND (Lower Saxony), Section 5 DSchG M-V (Mecklenburg-Western Pomerania) and Section 8 DSchG SH 2015 (Schleswig-Holstein).



**Territories:**



Lower Saxony



Hamburg



Schleswig-Holstein

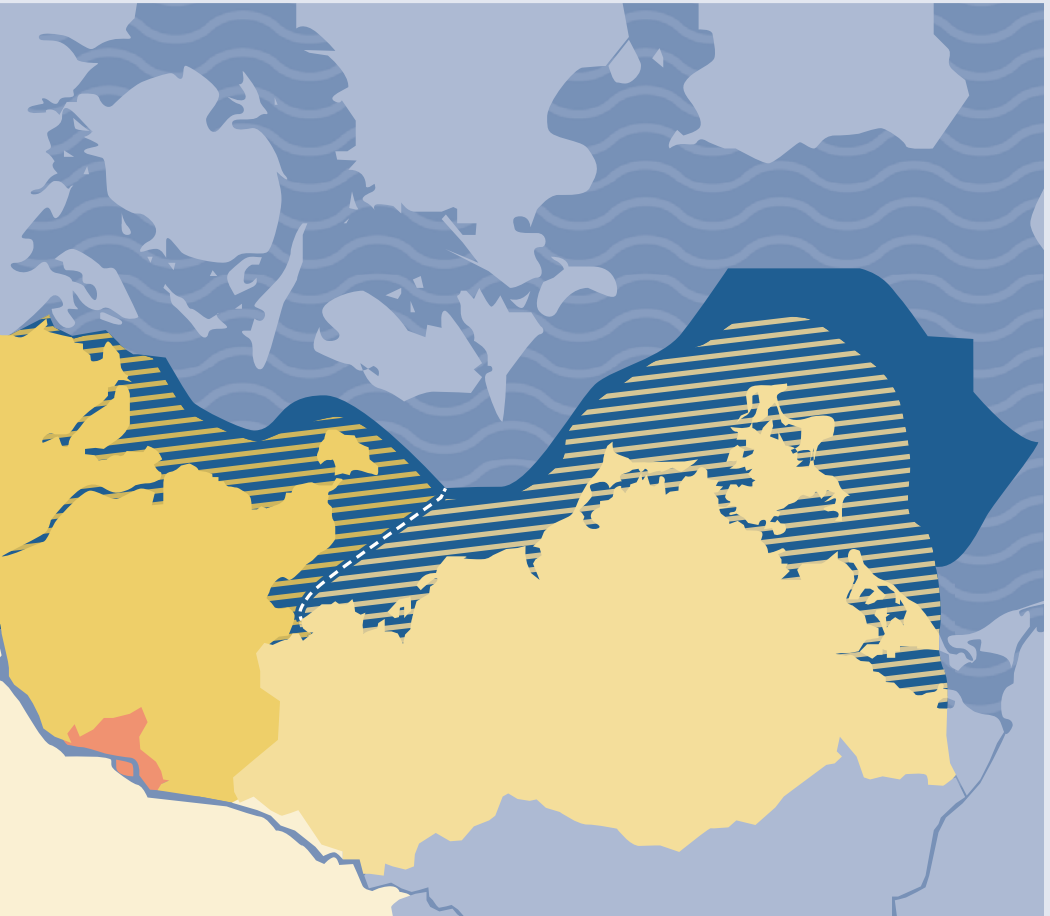


Mecklenburg-Western  
Pomerania

**Figure 11: German territorial sea and EEZ**

Extent of the German territory in the territorial sea, presented separately by federal state, and the extent of the German exclusive economic zone (EEZ). The federal state of Bremen also has a share of the territorial sea near Bremerhaven. Due to the small size of this area it is not shown on this map. Where rivers form the border between federal states, it usually runs down the middle of the river (not shown here). It is shown how the borders between the federal states would continue into the EEZ (source: Buchholz [2005]).





EEZ



Federal state border

#### 4.4.2 Regional planning, regional development plans and sectoral planning

Regional planning seeks to ensure with an integrative approach the sustainable development of individual regions at the interface of economy, society and environment. Regional development plans are the instruments used in regional planning to regulate differing or conflicting utilisation claims within a defined zone. Such regional development plans can also be drawn up for the North Sea and Baltic Sea in order to coordinate the utilisation claims and protection requirements arising from UNCLOS from a German perspective.

The German coastal federal states are drafting corresponding regional development plans for the territorial sea in the North and Baltic Sea. For the North Sea and Baltic Sea EEZs, on the other hand, the federal government issued two regional development plans, in the form of ordinances in 2009: the Ordinance on Regional Planning in the German exclusive economic zone of the North Sea (*Verordnung über die Raumordnung in der deutschen ausschließlichen Wirtschaftszone in der Nordsee*, AWZ Nordsee-RoV) and the Ordinance on Regional Planning in the German exclusive economic zone of the Baltic Sea (*Verordnung über die Raumordnung in der deutschen ausschließlichen Wirtschaftszone in der Ostsee*, AWZ Ostsee-RoV).

The regional development plans for the German EEZ, just as UNCLOS does, present an object-centred view of the cultural heritage. Consequently, only the discovery sites of the cultural heritage – known and unknown – are considered, but not the contexts that allow the identification of potential sites: “When selecting a location for the extraction of natural resources, known sites where cultural assets have been found should be taken into account. If previously unknown cultural assets located in the seabed are discovered during exploration or extraction of natural resources, appropriate measures must be taken to secure the cultural asset.”<sup>123</sup> The same care must be taken when laying pipelines and submarine cables, generating power, especially from wind energy, and in fishing and mariculture (aquaculture). It also applies to marine scientific research, which from a legal

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123 Regulation on regional planning in the German EEZ of the North Sea (AWZ Nordsee-RoV 2019), explanatory note to 3.2 “natural resources extraction”.

standpoint still does not include the scientific disciplines that study underwater cultural heritage.

The Spatial Offshore Grid Plan (*Bundesfachplan Offshore*), which was drawn up in 2016/2017 and updated as the spatial development plan 2019, is an instrument for energy-focused sectoral planning. This means that it sets out provisions for the expansion of the electricity grid in the EEZ. In this way the Federal Republic of Germany exercises its rights and powers under UNCLOS. The specifications in this context include for instance priority areas for wind energy and cable routes, with both known and unknown underwater cultural heritage sites being taken into account in accordance with the provisions of UNCLOS and the regional development plans for the German North Sea and Baltic Sea EEZs: "When selecting a location or route, known sites where cultural assets have been found should be taken into account. If previously unknown cultural assets located in the seabed are discovered during the planning or construction of wind turbines, platforms or submarine cable systems, appropriate measures must be taken to secure the cultural asset."<sup>124</sup>

The environmental report on the spatial development plan specifies the cultural assets in more detail: "Indications of possible material assets or cultural heritage are present insofar as the spatial location of a large number of wrecks is known on the basis of the evaluation of existing hydroacoustic recordings and the BSH's wreck database and is recorded in the BSH's nautical charts. No further information is available on archaeological artefacts, such as settlement remains, in the EEZ".<sup>125</sup> That is because, as explained above, there has been no systematic research in this area that would generate any reliable information. Within the scope of commercial use, the implemented method is therefore unsuitable for determining the existence of submarine micro traces of former prehistoric landscapes, their vegetation and population of animals and humans. These extremely delicate, scientifically valuable traces are for instance hidden in the North Sea under layers of sediment with varying thickness, which can easily be affected and destroyed by natural and human environmental influences. The structures of the prehis-

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124 BSH (2019b), p. 42 (Section 4.4.1.7 "Consideration of cultural assets").

125 BSH (2019c), p. 152 (Section 2.16 "Cultural heritage and other material assets").

toric landscape can only be reconstructed through a geoarchaeological analysis of the seabed, the organic micro traces can only be evaluated through an environmental and bioarchaeological analysis of specifically taken samples of sediment layers (e.g. multi-proxy analyses, radiocarbon analyses, sedaDNA analyses), which requires the involvement of specialised archaeologists and adequately technologically equipped laboratories.

In summary, it can be concluded that the regional development plans for the German EEZ and the corresponding sectoral plans should in future include investigations to identify prehistoric landscapes in the North Sea and Baltic Sea.

A promising project in this context is the “Baltic Sea Region Integrated Maritime Cultural Heritage Management” (BalticRIM), funded by the European Union 2017-2020.<sup>126</sup> The project aims to integrate the Baltic Sea’s cultural heritage into the spatial planning of several bordering countries.

When incorporating landscape analyses into spatial development plans, the scientific methods and technological procedures currently used to identify prehistoric landscapes should also be described and communicated to all relevant actors (including businesses) in the official documents, similar to those for the localisation of shipwrecks. An archaeological standard for the investigation of the seabed, including the investigation of shipwrecks in the context of commercial activities, should also be established as soon as possible and made available to authorities and businesses (see Chapter 3).

#### **4.4.3 Environmental impact assessments**

Within the German EEZ apply the environmental impact assessment regulations, which include an assessment of impacts on the cultural heritage, such as those caused by infrastructure or construction projects. Germany has implemented the EU Directives governing environmental impact assessments (EIA) with the Environmental Impacts Assessment Act (*Gesetz über die Umweltverträglichkeitsprüfung, UVPG*), last amended on 8 September 2017.

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126 See <https://projects.interreg-baltic.eu/projects/balticrim-133.html> (retrieved 19/09/2019).

However, a restriction was made with regard to the cultural heritage in that only “monuments, monument ensembles, archaeological artefacts or areas listed in official lists or maps that have been classified as archaeologically significant landscapes by the monument protection authority designated by the federal states” (UVPG Annex 3 “Criteria for the preliminary assessment in the context of an environmental impact assessment”, 2.3.11.) need to be considered when selecting a site. However, as there is no authority responsible for the underwater cultural heritage in the German EEZ and on the continental shelf to date, there are no official lists and maps for this area that could influence the choice of location in favour of a discovery site. Furthermore, this provision excludes undiscovered archaeological heritage from the assessment. This discussion paper therefore proposes a change in the law so that unrecorded heritage is afforded the same protection under water as it is on land. Such an approach would not only contribute to protection of the underwater cultural heritage, but also promote research into prehistoric landscapes in the German EEZ.

With regard to the information to be assessed in an EIA and used as the basis for decision-making, it is the responsibility of the respective project initiator, such as the developer of an offshore wind turbine construction project, to provide this information for both conservation and archaeological purposes. On this basis, it should be clarified whether, for example, cultural heritage on the seabed might be harmed during the construction of a wind farm foundation. Under UVPG Article 16 (5), the assessment report to be submitted must “take account of the current state of knowledge and current assessment methods”.

Such an investigation is comparatively simple in the case of a shipwreck, providing the wreck in question lies on the seabed or protrudes from the sediment, i.e. it can be recorded relatively quickly. Sonar measurements normally suffice to identify a hull as an anomaly on the seabed. The subsoil investigations for offshore installations in the EEZ currently do not include any analyses beyond the geophysical and geological investigations that would allow information to be gained about the respective landscape’s history and thus indications of layers containing archaeological artefacts hidden in the sediment. The official documents so far do not contain any information about the investiga-

tion methods that project developers are required to apply. They need to be supplemented in this respect as a matter of urgency.

In order to be able to adequately assess the information obtained by the project developer using modern methods and procedures, the relevant authorities should draw on appropriate archaeological expertise at an early stage. In addition, archaeologically relevant data generated in the course of such an environmental impact assessment should be made available to research. This would mean that the environmental impact assessment would not only provide a valuable contribution to protection of the underwater cultural heritage in the North Sea and Baltic Sea, but also to the advancement of archaeological knowledge.

#### **4.4.4 Preliminary area surveys for offshore wind turbines**

The use and further expansion of offshore wind energy in German waters predominantly takes place in the EEZ. The project developer therefore requires a permit from the Federal Maritime and Hydrographic Agency (BSH) for the construction of offshore wind turbines.

The Offshore Wind Energy Act (*Windenergie-auf-See-Gesetz*, WindSeeG), adopted in 2016, provides the legal basis for marine sector planning, which follows on from the regional planning procedure.<sup>127</sup>

The construction of wind turbines and transformer platforms is usually applied for and approved as an individual project. The Offshore Wind Energy Act also requires the applicant to undergo a planning approval procedure (WindSeeG Sections 45, 46). Such a planning approval procedure usually requires an assessment of environmental impacts to be carried out in accordance with the UVPG (WindSeeG Section 47 (1) (4)), which also takes the cultural heritage into account.

In order to accelerate the planning approval procedure, the Offshore Wind Energy Act provides for government-sponsored preliminary investigations of sites (WindSeeG Part 2, Division 2). The information obtained in this way is then made available to bidders.<sup>128</sup> Such a procedure is very useful, because it means that studies of the marine environment that are required for an environmental impact assessment can be

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127 Before the Offshore Wind Energy Act came into force, approval was granted on the basis of the Offshore Installations Ordinance (*Seeanlagenverordnung*).

128 These are the potential project developers.

carried out and documented in good time before the auction process, the award of contracts and the erection of wind turbines. In addition, a “preliminary investigation of the subsoil shall be carried out and documented” (WindSeeG Section 10 (1) (2)). The implementation of a Strategic Environmental Assessment (SEA) and the preliminary investigation of sites therefore make it much easier for successful bidders to assess the environmental impact of their projects.

The BSH, which is responsible for approving offshore wind farms in the EEZ, usually does not carry out the preliminary investigation itself, but commissions specialist companies to do so. Such companies carry out the preliminary investigation in accordance with statutory standards.<sup>129</sup> For this purpose, a subsoil exploration and investigation is carried out on at least 10 percent of the area,<sup>130</sup> including drilling work and laboratory analyses.

However, the preliminary area survey explicitly excludes the cultural heritage<sup>131</sup> and leaves any such assessment to the project developer. This is regrettable, especially as the preliminary area survey that the authorities are responsible for provides a suitable framework for identifying prehistoric landscapes and historically significant objects on the seabed and for recording their characteristics.

Cores, especially from unimpaired layers, are an important archaeological object of investigation. Arrangements should be made with the institutions responsible for the long-term archiving of cores to ensure that these are stored permanently and will remain available for scientific use by future generations.

Archaeological standards are available in Germany for research and protection of the underwater cultural heritage (see Chapter 3).<sup>132</sup> These must be further developed for the specific conditions of the offshore sector, taking into account international standards. In addition to ar-

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129 BSH (2013, 2014).

130 BSH (2014), p. 23 f.

131 BSH (2019a), p. 8. Also German Bundestag (2016), p. 284: “No separate official investigation of the area for obstacles, wrecks, explosive ordnance, cultural and material assets and other objects is carried out during the preliminary survey. The absence of these objects from the surface is therefore not covered by the determination of suitability. Such an exploration is – as in current practice – the responsibility of the future owner when implementing the project to erect wind turbines.”

132 *Verband der Landesarchäologen* (2011/2012).

archaeological methods, they should include scientific methods such as pollen analyses, sedimentological grain size analyses, diatom and foraminifera analyses, radiocarbon analyses, geochemical analyses as well as application of the latest remote sensing technologies, which are of central importance for prospecting (for a detailed description of research methods, see Chapter 2).

However, if the responsibility for the investigation remains with the project developer,<sup>133</sup> it must be ensured that the archaeological investigations in the EEZ are carried out by highly qualified archaeological staff with adequate technical equipment, as is already the case with land-based archaeological sites. Furthermore, the samples obtained during the preliminary survey should be archived permanently so that they are also accessible for later scientific investigations. In order to be able to assess whether an investigation was conducted according to the latest scientific and technical standards, the assessing and licensing authority should also structurally integrate the necessary archaeological expertise.

#### **4.4.5 Archaeological artefacts in the Federal Nature Conservation Act**

The Federal Nature Conservation Act (*Bundesnaturschutzgesetz*, BNatSchG) aims to protect nature and the landscape, which also includes the cultural heritage: “natural landscapes, and cultural landscapes that have developed over time, and including their cultural, structural and soil monuments, are to be protected against defacement and disfigurement, urban sprawl and other adverse effects” (BNatSchG Article 1 (4) (1)). This also means that “extensive, largely unfragmented landscape areas are to be protected from further fragmentation” (BNatSchG Article 1 (5)). By dint of the sovereign powers granted under UNCLOS for the protection and preservation of the marine environment, it is possible to extend certain parts of the BNatSchG to the EEZ. The federal government and states are to the same extent responsible for implementation of the applicable provisions of the BNatSchG: the respective federal states for the 12-mile zone and the federal govern-

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133 *Deutscher Bundestag* (2016), p. 284.



ment for the EEZ.<sup>134</sup> As the Federal Nature Conservation Act also takes the cultural heritage into account in principle, it should be examined whether and to what extent the underwater cultural heritage in the EEZ can also be protected within the scope of this extension, on the basis of the Valletta Treaty.

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134 BfN (2017), p. 5. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Agency for Nature Conservation are both responsible.

## List of abbreviations

<b>ALSF</b>	Aggregates Levy Sustainability Fund
<b>AWI</b>	<i>Alfred-Wegener-Institut für Polar- und Meeresforschung</i> – Helmholtz centre for polar and marine research
<b>AUV</b>	Autonomous Underwater Vehicle
<b>EEZ</b>	Exclusive economic zone
<b>BalticRIM</b>	Baltic Sea Region Integrated Maritime Cultural Heritage Management
<b>BAW</b>	<i>Bundesanstalt für Wasserbau</i> – Federal Waterways Engineering and Research Institute
<b>BbgDSchG</b>	<i>Gesetz über den Schutz und die Pflege der Denkmale im Land Brandenburg</i> – Law on the Protection and Care of Monuments in the State of Brandenburg (Brandenburg Monument Protection Law)
<b>BfN</b>	<i>Bundesamt für Naturschutz</i> – Federal Agency for Nature Conservation
<b>BGBl.</b>	<i>Bundesgesetzblatt</i> – Federal Law Gazette
<b>BGR</b>	<i>Bundesanstalt für Geowissenschaften und Rohstoffe</i> – Federal Institute for Geosciences and Natural Resources
<b>BMBF</b>	<i>Bundesministerium für Bildung und Forschung</i> – Federal Ministry of Education and Research
<b>BMVI</b>	<i>Bundesministerium für Verkehr und digitale Infrastruktur</i> – Federal Ministry of Transport and Digital Infrastructure
<b>BNatSchG</b>	<i>Bundesnaturschutzgesetz</i> – Federal Nature Conservation Act
<b>BNetzA</b>	<i>Bundesnetzagentur</i> – Federal Network Agency
<b>BSH</b>	<i>Bundesamt für Seeschifffahrt und Hydrographie</i> – Federal Maritime and Hydrographic Agency
<b>COWRIE</b>	Collaborative Offshore Wind Research into the Environment
<b>DAI</b>	<i>Deutsches Archäologisches Institut</i> – German Archaeological Institute
<b>DSchG M-V</b>	<i>Denkmalschutzgesetz Mecklenburg-Vorpommern</i> – Mecklenburg-Western Pomerania Monument Protection Law
<b>DSchG ND</b>	<i>Niedersächsisches Denkmalschutzgesetz</i> – Lower Saxony Monument Protection Law

<b>DSchG SH 2015</b>	<i>Gesetz zum Schutz der Denkmale (Denkmalschutzgesetz) Schleswig-Holstein – Act on the Protection of Monuments (Monument Protection Law) Schleswig-Holstein</i>
<b>DSM</b>	<i>Deutsches Schifffahrtsmuseum – German Maritime Museum</i>
<b>EMODnet</b>	European Marine Observation and Data Network
<b>FIPAD</b>	Fishing Protocol for Archaeological Discoveries
<b>FONA</b>	<i>Forschung für nachhaltige Entwicklung – Research for Sustainable Development</i>
<b>GEOMAR</b>	<i>Helmholtz-Zentrum für Ozeanforschung</i> GEOMAR – Helmholtz Centre for Ocean Research
<b>GIS</b>	Geographical Information Systems
<b>ICOMOS</b>	International Council on Monuments and Sites
<b>IOW</b>	<i>Leibniz-Institut für Ostseeforschung – Leibniz Institute for Baltic Sea Research</i>
<b>KFKI</b>	<i>Kuratorium für Forschung im Küsteningenieurwesen – German Coastal Engineering Research Council</i>
<b>KUWA</b>	<i>Kommission für Unterwasserarchäologie des VLA – Underwater Archaeology Commission of the VLA</i>
<b>LBEG</b>	<i>Landesamt für Bergbau, Energie und Geologie Niedersachsen – Lower Saxony State Office for Mining, Energy and Geology</i>
<b>MAI Protocol</b>	Marine Aggregate Industry Protocol for Reporting Finds of Archaeological Interest
<b>MDI-DE</b>	Marine Data Infrastructure Germany
<b>NIHK</b>	<i>Niedersächsisches Institut für historische Küstenforschung – Lower Saxony Institute for Historical Coastal Research</i>
<b>NOKIS</b>	<i>Nord- und Ostsee Küsten-Informationen-System – North Sea and Baltic Sea Coastal Information System</i>
<b>PAD</b>	Protocol for Archaeological Discoveries
<b>REC</b>	Regional Environmental Characterisation
<b>RGK</b>	<i>Römisch-Germanische Kommission des DAI – Romano-Germanic Commission of the DAI</i>
<b>ROG</b>	<i>Raumordnungsgesetz – Regional Planning Act</i>
<b>RoV</b>	<i>Raumordnungsverordnung – Regional Planning Ordinance</i>
<b>ROV</b>	Remotely Operated (Underwater) Vehicle
<b>SINCOS</b>	Sinking Coasts. Geosphere, Ecosphere and Anthroposphere of the Holocene Southern Baltic Sea (research project)
<b>SPLASHCOS</b>	Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf (research project)

<b>UNCLOS</b>	United Nations Convention on the Law of the Sea
<b>SEA</b>	Strategic Environmental Assessment
<b>TNT</b>	Trinitrotoluene
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>USchadG</b>	<i>Gesetz über die Vermeidung und Sanierung von Umweltschäden (Umweltschadensgesetz)</i> – Law on the prevention and remedying of environmental damage (Environmental Damage Act)
<b>EIA</b>	Environmental Impact Assessment
<b>UVPG</b>	<i>Gesetz über die Umweltverträglichkeitsprüfung</i> – Environmental Impacts Assessment Act
<b>VLA</b>	<i>Verband der Landesarchäologen in der Bundesrepublik Deutschland</i> – Association of State Archaeologists in the Federal Republic of Germany
<b>WindSeeG</b>	<i>Gesetz zur Entwicklung und Förderung der Windenergie auf See</i> – Act for the development and promotion of offshore wind energy (Offshore Wind Energy Act)
<b>WSV</b>	<i>Wasserstraßen- und Schifffahrtsverwaltung des Bundes</i> – Federal Waterways and Shipping Administration
<b>ZBSA</b>	<i>Zentrum für Baltische und Skandinavische Archäologie</i> – Centre for Baltic and Scandinavian Archaeology

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