



Marine
Management
Organisation

**Marine Non-
Licensable Activity
Impacts Evidence:
Grey Seals, Harbour
Seals and Eurasian
Otters (DRAFT)**

September 2026



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Marine Non-Licensable Activity Impacts Evidence: Grey Seals, Harbour Seals and Eurasian Otters (DRAFT)

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Executive Summary

This document collates and analyses the best available evidence on the impacts of marine Non-Licensable Activities (mNLA) on marine protected area (MPA) features and will inform site level assessments of the impact of mNLA on MPAs as part of the Marine Management Organisation's (MMO's) work to manage MPAs. MNLA have the potential to impact seals and otters, therefore management of these activities may be required within an MPA. For each MPA, a site level assessment considering the site conservation objectives, spatial and temporal activity levels and exposure to natural disturbance will be completed to determine whether management will be required.

Evidence shows that motorised watercraft, motorised personal watercraft and wildlife watching from the sea (commercial) may impact grey seals and harbour seals through above water noise, underwater noise, and visual disturbance. Non-motorised watercraft and sailing impact grey seals and harbour seals through visual disturbance and underwater noise. Noise levels, vessel behaviour, vessel size, and distance from haulout all affect the level of disturbance, but habituation may occur in areas with high activity levels. For Eurasian otters, research suggests that motorised vessels have larger impacts than non-motorised vessels, triggering more defensive responses.

The impact of wildlife watching from the sea (commercial) on grey seals and harbour seals is similar to the impacts of motorised and non-motorised vessels, with disturbance possibly more likely due to specific targeting of seal habitats. The impacts on Eurasian otters may depend whether the wildlife watching activity targets otters.

The available evidence suggests that diving and snorkelling may impact grey seals and harbour seals through above water noise, underwater noise, and visual disturbance. Some tolerance of human presence in the water column has been observed, but disturbance can manifest in subtle behavioural shifts and risk human injury. Limited available evidence suggests that Eurasian otters are not impacted by diving and snorkelling, due to visual disturbance not being a significant pressure, and the lower temporal overlap with human and otter use of the marine environment.

With the exception of diving and snorkelling on Eurasian otters, all assessed mNLA may impact grey seals, harbour seals, and Eurasian otters. Among the activities assessed, motorised watercraft, motorised personal watercraft, non-motorised watercraft, sailing and Wildlife watching at sea (commercial) pose the greatest risk to grey seals, harbour seals, and Eurasian otters, but the level of impact depends on the behaviour of the vessels.

1 Introduction

The Marine Management Organisation (MMO) is the principal regulator for England's seas, including leading the assessment and management of marine Non-Licensable Activities (mNLA) for marine protected areas (MPAs) inshore of 12 nautical miles (nm).

This document forms part of MMO's work to achieve the government's aim of identifying and implementing appropriate management measures in place for all inshore MPAs in English waters by the end of 2030. It is one of a suite of documents which focus on the interaction of designated features with mNLA, and it will support the delivery of site level assessments.

The potential for pressures resulting from mNLA and their impacts on designated features within MPAs have been assessed by gathering and analysing the available evidence for activity-feature interactions.

This document describes the pressures resulting from mNLA that can negatively impact the UK's two resident seal species, grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) as well as the Eurasian otter (*Lutra lutra*).

The Marine Non-Licensable Activity Impacts Evidence: Summary¹ provides further background information and details of other documents produced and the features and activities included within the scope of the mNLA programme of works.

1.1 Key definitions

A separate glossary in Marine Non-Licensable Activity Impacts Evidence: Methodology¹ includes the important terms used in this document. Wherever possible these are taken from [Natural England's Glossary of terms used within conservation advice packages \(CAPs\)](#)². The following terms are particularly important when reading this document:

Designated feature ('feature') - A species, habitat, geological or geomorphological entity for which an MPA is identified and managed.

Sensitivity - The sensitivity of a feature (species or habitat) is a measure that is dependent on the ability of the feature (species or habitat) to resist change and its ability (time taken) to recover from change (**Figure 1**).

¹ Marine Non-Licensable Activity Impacts Evidence documents are available: www.gov.uk/government/calls-for-evidence/marine-non-licensable-activities (last accessed 30 September 2026)

² Natural England MPA Conservation Advice - Glossary of Terms: designatedsites.naturalengland.org.uk/pdfs/MPA_CAGlossary_March2019.pdf (Last accessed 3 July 2026).

Pressure - the mechanism through which an activity has an effect on a feature.

Impact - the consequence of a pressure/pressures (such as habitat degradation) where a change occurs that is different to that expected under natural conditions.

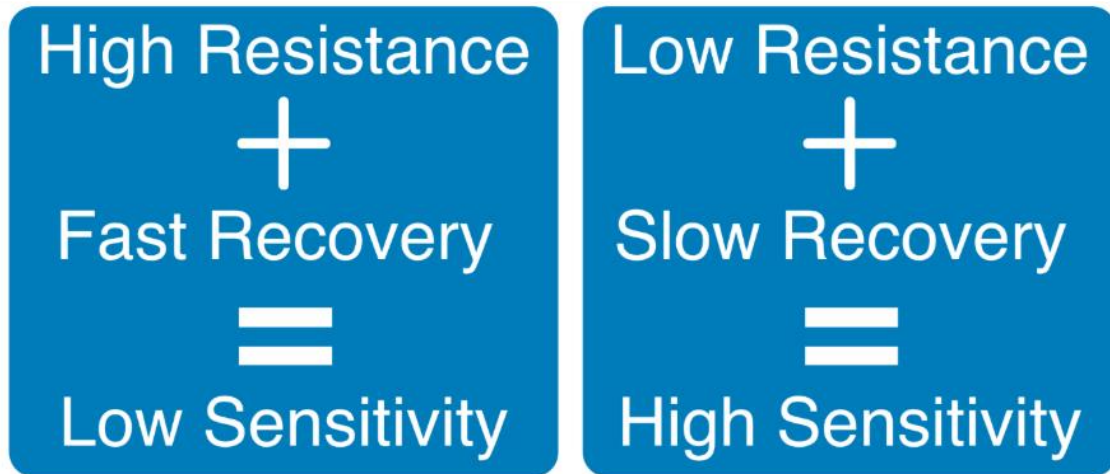


Figure 1: The approach to determine sensitivity from pressures for each feature and activity interaction.

1.2 Structure of this document

Section 2 describes the types of mNLA considered in this document.

Section 3 lists the MPA features considered and references the evidence sources used in this document.

Section 4 describes the behavioural and physiological impact of disturbance on the MPA features in this document.

Sections 5 to 9 describe the available evidence of the pressures resulting from the mNLA and impacts on the designated features. Where a feature is potentially sensitive to mNLA (based on its resistance to the pressure and ability to recover) the interaction is considered. Each section lists the pressures to which the features may be sensitive, using Natural England's conservation advice packages and MMO judgement. It also lists those pressures which have not been assessed or where insufficient evidence has been found to assess sensitivity. Each section also details available evidence about the designated feature, its ability to resist and recover from change, and its resultant sensitivity.

Section 10 summarises the conclusions of the assessed pressure feature interactions within this review.

Annex 1: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#) describes how feature-pressure interactions have been identified;

and provides a table of all the potential pressure-feature interactions and the sensitivity assessment for each.

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2 mNLA detail of activities

Within MMO remit there are eight types of mNLA which are listed and defined below. This literature review considers five of these activities. This literature review considers all of these activities. Each has the potential to impose one or more pressures on grey seal, harbour seal and Eurasian otter features.

1. Anchoring
2. Diving and snorkelling
3. Hovercraft
4. Motorised personal watercraft
5. Motorised watercraft
6. Non-motorised watercraft
7. Sailing
8. Wildlife watching from the sea (commercial)

Non-motorised watercraft and sailing without an engine have been grouped together in this literature review due to their comparable potential to disturb seals and otters. Motorised personal watercraft and motorised watercraft have also been grouped together in this literature review due to their comparable potential to disturb seals and otters through noise and visual disturbance.

There may be additional activities or categories of activities identified at a site level, which would be considered and included in a site assessment.

2.1 Anchoring

This activity involves the dropping of an anchor by any vessel (with or without an engine) to secure the vessel to the seabed temporarily, in order to prevent it drifting with the wind or current (Griffiths et al., 2017). Anchors are generally heavy metal objects designed to dig into, or hook onto, the seabed. To create hold, the anchor is dropped and a length of chain is laid out on the seabed (Griffiths et al., 2017). The anchor is 'set' (fixed in position) as some pulling force is exerted on the chain (Griffiths et al., 2017). As the vessel drifts, the dragging anchor carves furrows into the seabed, or scrapes on the surface of firm seabed, or the anchor may move sideways along the benthos (Griffiths et al., 2017). In addition, vessels at anchor in the intertidal area will impact the seabed when the hull/keel rests on the seabed as the tide goes out, also known as beaching.

The non-physical disturbance impacts whilst a boat is at anchor will be covered by motorised watercraft and sailing sections below. Anchoring activity has been scoped out of this review as the interactions with the seabed are unlikely to have significant

impact on seals and otters. Vessel activity and position are considered within **Sections 5 to 9** within this review.

2.2 Diving and snorkelling

Diving and snorkelling refer to swimming, either underwater or on the surface, using self-contained underwater breathing apparatus (scuba) or snorkelling equipment. This activity excludes the extraction of any sea fisheries resources during the activity (such as spearfishing).

Diving and snorkelling may interact with seals and otters through underwater noise changes and visual disturbance.

2.3 Hovercraft

A hovercraft, also known as an air-cushion vehicle (ACV), is a craft capable of travelling over land, water, mud or ice and other surfaces. Hovercraft are primarily used in sheltered environments, typically with large expanses of flat, intertidal areas such as mudflats or sandflats (Natural England, 2017). Hovercraft has the potential to interact with seals and otters both at the surface and beneath the surface, through above and underwater noise and visual disturbance.

2.4 Motorised personal watercraft

A motorised personal watercraft (MPW) is a recreational watercraft that the rider rides or stands on. Some models have an inboard engine driving a pump jet that has a screw-shaped impeller to create thrust for propulsion and steering. These craft are often referred to by the brand names such as Jet Ski. The MPW category includes e-foils, 'jet ski' and electric powered vessels. This can also include hydroflying. A hydroflyer is a water sports device that allows a person to 'fly' above the water, propelled by the force of water jets. It connects to a motorised personal watercraft, like a jet ski, via a long hose, and the rider controls the thrust and direction by shifting their weight. The high-pressure water jets propel the person on the hydroflyer above the water and below. MPW have the potential to interact with seals and otters both at the surface and beneath the surface, through above and underwater noise, collisions and visual disturbance.

2.5 Motorised watercraft

The use of motorised vessels, including motorboats (powerboats), sailing vessels and yachts with a motor in marine and estuarine waters. The motorised watercraft category includes watersports that involve being towed behind a motorised vessel, such as wakeboarding, waterskiing, parasailing and parasailing as well as the impact of vessels carrying participants for other mNLA such as diving and snorkelling. Motorised watercraft, have the potential to interact with seals and otters

both at the surface and beneath the surface, through above and underwater noise, collisions and visual disturbance.

2.6 Non-motorised watercraft

Non-motorised watercraft covers a wide variety of paddle- or wind-propelled sports. This includes canoeing (all types), kayaking (all types), kitesurfing, kite boarding, kite foiling, windsurfing, wingsurfing, wingfoiling, winging, kite winging, dinghies, stand-up foil boarding and stand-up paddle boarding. Non-motorised watercraft have the potential to interact with seals and otters both at the surface and beneath the surface, through above and underwater noise, collisions and visual disturbance.

2.7 Sailing

This category includes sailing boats without a motor as well as sailing vessels with motors that remain unused while under sail. Sailing boats include dinghies, day boats, keelboats or yachts which may or may not be taken out of water at end of use. Sailing has the potential to interact with seals and otters at the surface, through above water noise, collisions and visual disturbance.

2.8 Wildlife watching from the sea (commercial)

This category covers wildlife watching from any commercial organised trip at sea from any vessel, this includes organised trips and excursions and refers to paid-for activities undertaken for the purpose of observing, photographing, or experiencing marine and coastal wildlife in its natural environment. These activities are typically delivered by a commercial operator using a motorised or non-motorised vessel and may target species such as cetaceans, seabirds, seals, basking sharks or other marine fauna.

These trips can often access remote locations such as offshore islands or remote cliffs where birds and seals seek sanctuary from disturbance. Repeated wildlife watching tours can impact seals and seabirds especially through disturbance, particularly when vessels approach too closely, visit colonies frequently, or operate during sensitive periods such as breeding, pupping, moulting or overwintering.

Wildlife watching has the potential to interact with seals especially, both at the surface and beneath the surface, through above and underwater noise, collisions and visual disturbance. Wildlife watching includes organised trips which target seals for viewing from vessels or take divers to interact with seals at specific sites, as well as the activity of diving with seals itself.

3 Overview of grey seals, harbour seals and Eurasian otters

This section describes grey seals, harbour seals also referred to as common seals, and Eurasian otters. These features have been identified as potentially sensitive to mNLA.

Table 1 provides links to more detailed descriptions of the features. Information in **Table 1** and the descriptions below draw on information taken from the Marine Life Information Network (MarLIN, 2024). **Annex 1** summarises the pressures resulting from mNLA and the sensitivities of the features described in this document to those pressures. These sensitivities were derived using advice from the Joint Nature Conservation Committee (JNCC) and Natural England; Natural England's Conservation Advice Packages for sites designated for grey seal, harbour seal and Eurasian otters; and a review of the available scientific literature.

Table 1: Feature descriptions.

Feature name	Feature description
Harbour (common) seal	Common or Harbour seal (<i>Phoca vitulina</i>) ³
Grey seal	Grey seal (<i>Halichoerus grypus</i>) ⁴
Otter	Eurasian river otter (<i>Lutra lutra</i>) ⁵

The coastal and freshwater ecosystems of the British Isles support a diverse assemblage of semi-aquatic mammals, notably for this review Eurasian otters, grey seals, and harbour seals (also known as true seals or phocids). Each species plays a critical ecological role and serves as an indicator of environmental health and biodiversity.

Pinnipeds (comprising seals, sea lions, and walruses) and otters are both semi-aquatic members of the order Carnivora, yet they diverge significantly in their evolutionary lineage, morphology, and ecological strategies (Taszus et al., 2023). While both groups have adapted to life in aquatic environments, seals exhibit more profound morphological specialisations, such as fully developed flippers, hydrodynamic body shapes, and a thick layer of blubber for insulation and buoyancy in cold marine habitats (Liwanag et al., 2012). Otters retain more terrestrial traits, relying on dense, water-repellent fur for thermoregulation and maintaining greater agility on land (Weisel, Nagaswami and Rolf O. Peterson, 2005)

³ MarLIN - Common or Harbour seal (*Phoca vitulina*):
www.marlin.ac.uk/species/detail/2088 (Last accessed 16 April 2026).

⁴ MarLIN - Grey seal (*Halichoerus grypus*):
<http://www.marlin.ac.uk/species/detail/1995> (Last accessed 16 April 2026).

⁵ MarLIN - Eurasian river otter (*Lutra lutra*):
<http://www.marlin.ac.uk/species/detail/2317/1000> (Last accessed 16 April 2026).

Behaviourally, seals often display complex social structures, particularly during breeding seasons, with some species forming large colonies and exhibiting polygynous mating systems. Eurasian otters are generally solitary with social interactions primarily occurring between mothers and their dependent cubs (Kruuk, 2006; (Lélias, Lemasson and Lodé, 2021)

The harbour seal is the smaller of the two native UK seal species. It has a rounded head with eyes positioned midway between the nose and ears. Its nostrils form a distinctive 'V' shape when viewed from the front. Adults typically measure between 1.2 and 2 metres (m) in length, with males being slightly larger than females. Harbour seals can live for 20 to 30 years (SCOS, 2003). In Britain and Ireland, harbour seals are distributed along the coastline, except in areas dominated by steep cliffs. They are most frequently observed along the east coast of England, western Scotland, and the northern isles. Harbour seals inhabit shorelines and estuaries and are often seen resting on sandbanks, beaches, reefs, and tidal rocks. They are non-migratory and tend to stay in coastal areas, exhibiting a daily haul-out pattern. The UK population represents about 5% of the world population of harbour seal, approximately 50% of the EU population, and 45% of the European subspecies (Joint Nature Conservation Committee, 2026b).

The grey seal is the larger of the native UK seal species a medium-sized pinniped characterized by a robust body and a distinctive rectangular, horse-like head. Adult males are significantly larger and heavier than females, reaching lengths of up to 2.3m, while newborn pups are approximately 1m long (Edwards, 2008). Grey seals primarily forage in inshore benthic environments, preying on a diverse assemblage of bony fish and marine invertebrates. Grey seals can be found all around the UK, with their populations concentrated in Scotland but increasing in England (Edwards, 2008). Grey seals move further offshore than harbour seals for foraging (SCOS, 2024). The UK population represents approximately 34% of the world population of grey seals (SCOS, 2025). Terrestrial haul-out sites, including remote islands, secluded bays, and coastal caves, are used for resting, mating, and pupping. Once the pups are born, they depend on their mothers' rich, high-fat milk to gain weight rapidly, enabling them to leave the nursery grounds after only a few weeks of nursing (Bonner, 1994).

Eurasian otters are semi-aquatic mustelid mammals found in a variety of freshwater and coastal habitats, including lakes, rivers, streams, estuaries, and salt marshes (Wilson, 2017). In coastal habitats, they use shallow inshore areas for feeding but also require access to freshwater for bathing and terrestrial areas for resting and breeding (Wilson, 2017). In England, their populations are concentrated in the South West (JNCC, 2021). While in freshwater habitats otters are generally nocturnal, coastal otters can be active during the day and hunt when tidal conditions are most favourable. Otters are carnivorous, and their diets can include both freshwater and marine species of fish, invertebrates and at times amphibians (The Woodland Trust,

2026). Most otter cubs are born between May and August (The Woodland Trust, 2026). Eurasian otters are solitary, except for adult females raising cubs.

3.1 Proxy species

Limited direct research on the behaviour and disturbance responses of harbour and grey seals and Eurasian otters means that proxy species have been used in some cases to provide essential insight where species-specific information is lacking.

True seal (phocid) data can be challenging to collect; the animals are hard to observe underwater, are sensitive to disturbance which can make research ethically challenging, and they generally reside at remote haul-out sites which can restrict access. By comparison, long term data sets are far more abundant for eared seals (otariids), including both fur seals and sea lions and these have therefore been used as proxies within this review.

True seals and eared seals share ecological and morphological traits like predator–prey dynamics and social structure. Both species also have highly developed vibrissae (whiskers), used to detect objects by direct touch and by analysing the water column for movement, known as hydrodynamic perception. Studies have shown that they are highly sensitive to local water movement and are capable of following hydrodynamic trails left by moving objects, such as vessels and watercraft relevant to mNLA (Hanke et al., 2013).

Although very similar in many respects, several important differences need to be considered throughout this review. A key distinction relates to their auditory sensitivity. True seals detect higher underwater frequencies than eared seals, while eared seals are more sensitive to higher airborne frequencies. Both groups are overall more sensitive to sound underwater than airborne (Schusterman, 1981). True seals have a hearing range of 40 hertz (HZ) to 90 kilohertz (kHz) in water compared to eared seals, which have a hearing range of 60Hz to 68kHz (NMFS (National Marine Fisheries Service), 2025). These differences are expected to produce different responses across frequencies and sound levels.

Movement is another significant difference. Eared seals, like fur seals have enlarged forelimbs allowing them to move using all four limbs on land whereas true seals have reduced forelimbs and have to undulate their bodies, pulling them forward putting them at a greater risk of abrasion related injury. Research conducted by Kerr et al. (2022), found that eared seals had lower energetic costs and therefore were more energy efficient when they moved compared to true seals. Consequently, disturbance on land is not only more energetically demanding for a true seal but also carries a higher risk of injury, meaning disturbance from mNLA will have a more significant impact on the animal.

Most of the available data for the impact of mNLA on otters is focused on the sea otter (*Enhydra lutris*). There are some limitations to how well research on sea otters

can be applied to Eurasian otters that must be considered when consulting this literature review. Compared to sea otters, Eurasian otters spend up to 4.5 times less time per day hunting (Nolet and Kruuk, 1989) and therefore have less opportunity to interact with human activities in the water. This limits the extent to which human impacts on behaviours can be compared. Eurasian otters also exhibit different behaviours in the water compared to sea otters; for example, Eurasian otters do not raft like sea otters. Another barrier to comparison between the two otter species is that, for Eurasian otters, activity on the coast is tidally influenced but still mostly nocturnal (Quaglietta, Mira and Boitani, 2018), whereas sea otters are mostly diurnal in their activities (Esslinger et al., 2014). This may lead to sea otters being more present during times of human activity.

3.2 Conservation status

Grey seals are among the rarest seals globally, though they are listed as a species of 'Least Concern' on the IUCN Red List of Threatened Species (Bowen, 2016). There are three reproductively isolated populations recognised: a West Atlantic population, a Baltic population and an East Atlantic population. The primary breeding area for the East Atlantic population is around Great Britain and Ireland (Joint Nature Conservation Committee, 2026a). Harbour seals are also listed as of 'Least Concern' on the IUCN Red List of Threatened Species (Lowry, 2016) and have a near circumpolar distribution in the Northern Hemisphere.

Seals are protected in England under multiple pieces of legislation and are also identified as a protected biological feature within numerous sites of special scientific interest (SSSIs) across the UK. These sites are designated on the basis of their importance in supporting key life stage requirements of seals. Under Section 28P(6) of the Wildlife and Countryside Act 1981⁶, it is an offence to intentionally or recklessly damage or disturb any protected natural feature of a SSSI, which includes designated seal populations.

The Eurasian otter is listed as 'Near Threatened' on the IUCN Red List of Threatened Species (Loy, 2025). They are protected under the Wildlife and Countryside Act 1981⁶ and as a European Protected Species (EPS) under Annex IV of the Habitats Directive, which is implemented by the Conservation of Habitats and Species Regulations 2017⁷ in the UK. Otters are also recognised as a protected and priority species in the UK, which is directly relevant to the objectives of the UK Biodiversity Framework (JNCC, 2024), as its continued recovery reflects progress toward species recovery, ecosystem integrity in line with the Kunming–Montreal Global Biodiversity Framework (CBD Secretariat, 2022).

⁶ For more information: www.legislation.gov.uk/ukpga/1981/69/section/28.

⁷ For more information: www.legislation.gov.uk/uksi/2017/1012/part/3.

3.3 Spatial Preferences

Seals display regular and well-defined haul-out patterns, coming ashore for purposes such as recuperation, social interactions within colonies, and moulting. Grey seals also use haul-outs for breeding, whereas harbour seals breed in shallow water (Boyd, Lockyer and Marsh, 1999). These predictable behaviours make pinnipeds among the most frequently observed marine species by tourists, and disturbance-induced vigilance can conflict with essential haul-out activities, potentially disrupting breeding and foraging (Tadeo, Gammell and O'Brien, 2021)

Both grey and harbour seals exhibit haul-out behaviour in groups; however, their spatial preferences and behavioural patterns differ notably. Grey seals typically select exposed, rocky coastlines and offshore islands, favouring environments with minimal human disturbance and strong wave action. In contrast, harbour seals demonstrate a preference for more sheltered habitats, such as sandy beaches, tidal flats and estuarine zones, which offer protection from environmental stressors and facilitate easier access to foraging grounds (Thompson et al., 1989). Both species will use sea caves for protection and pupping (Marriott, 2023). Seals favour undisturbed areas of land to rest, give birth and consequentially, terrestrial haul-out habitat is essential year round (Davies et al., 2001).

Eurasian otters use holts (a den or burrow for shelter) for resting, breeding, and raising cubs. They can be found throughout the UK, both inland and coastally. In coastal environments, holts are found close to the shoreline but near to sources of freshwater. While otters can forage in shallow seawater, they require freshwater for grooming behaviours (Kruuk, H. Balharry, 1990).

Eurasian otter habitat use can be impacted by human recreational activities, with otter presence negatively impacted by the accessibility of the environment to humans and recreational activities (roads, paths and riverbed access) (Tolrà, Ruiz-Olmo and Riera, 2024). High levels of human accessibility may also prevent otter reproduction due to their perception of risk (Tolrà, Ruiz-Olmo and Riera, 2024).

3.4 Rest, metabolism and thermoregulation

Seals live in the marine environment and rely on metabolic and thermoregulatory functions to survive; therefore, the ability to haul out on land and rest is crucial. Seals need to manage body temperature efficiently: hauling out allows them to warm up after prolonged exposure to cold water or cool down in certain conditions, reducing energy expenditure compared to doing this in water. Studies have shown that both sea lions and seals use postures on land to regulate their body temperatures, hiding flippers to reduce surface area exposed to the cold air (Gentry, 1973). After diving and foraging, seals accumulate carbon dioxide and lactate in their muscles (Kooyman, 2009). Resting on land helps them clear these byproducts and restore oxygen levels (Kooyman, 2009).

Seals use both land and the water column for rest, digestion and conserving energy. When resting or sleeping at the water surface, particularly during high tide or when haul-out sites are limited, seals often adopt a posture known as 'bottling' (Gili, Meijer and Lacave, 2018). In this position, most of the body remains submerged while only the face is held above the water, allowing the seal to breathe regularly while remaining largely at rest (Kastelein et al., 2025).

Eurasian otters that hunt in the marine environment need time on land to groom, spending up to 6% of the day grooming their fur (NOLET and KRUUK, 1989). Without access to freshwater to groom in, salt can build up on the otters fur hindering the otters furs ability to retain air underwater, which can lead to hypothermia (Kruuk, H. Balharry, 1990).

3.5 Reproduction and pupping

Grey seals mate during the pupping season, which varies by area but generally takes place between August and January. A female will mate again when her pup is weaned, three to four weeks after birth (Bonner, 1994). Harbour seals typically mate during the summer months, from June to August, the mating period follows the pupping season, with females becoming receptive to mating approximately six weeks after giving birth (Davies et al., 2001). Both grey and harbour seals return to land to bear and suckle their young (Davies et al., 2001).

Grey seals have reactive and proactive maternal types meaning they differ in how they respond to environmental and social stimuli. Reactive females, which respond more strongly to such stimuli, show greater variability in daily maternal energy expenditure compared to proactive females (Twiss et al., 2012). As a result of this inconsistent energy allocation, pups of reactive mothers' experience fluctuating growth rates. In contrast, proactive mothers maintain more stable energy investment, producing more uniform pup growth (Twiss et al., 2012). These behavioural differences likely represent alternative strategies for coping with environmental uncertainty and disturbance (Twiss et al., 2012).

After weaning, grey seal pups spend time on land to undergo a postweaning fast (PWF), during which the energy reserves accumulated during the suckling period are depleted, ultimately driving them to begin feeding at sea. Flexibility in PWF duration may ensure that pups of variable body condition depart for sea with adequate energy reserves (Noren et al., 2008). However, disturbance during this period may force pups to enter the water prematurely, before they are ready to feed successfully, potentially resulting in reduced energy reserves, impaired physiological development, poorer foraging success, and ultimately lower survival (Noren et al., 2008). Pups with higher body fat have greater energy reserves, enabling them to prolong the PWF, conserve protein, and support proper physiological development, thereby improving their likelihood of survival (Noren et al., 2008).

Osinga et al. (2012) monitored harbour seals in the Dollard estuary of the Wadden Sea and found disturbance from human activity can seriously affect seals during the pupping season, when mothers and pups are most vulnerable. Disturbance often caused seals to flee into the water, risking separation of pups from their mothers, which contributed to high numbers of orphaned pups and can reduce pup condition if disturbances happen repeatedly (Osinga et al., 2012).

Seals are particularly vulnerable to disturbance during their pupping and moulting seasons, when their residency at haul-out sites and in surrounding waters increases local densities of each species (Seal Conservation Society, 2026). Having access to safe and undisturbed haul-out areas is essential for successful reproduction and for maintaining pup health. Disturbance during these periods can have significant negative impacts on individual seals and may ultimately affect pup survival (Seal Conservation Society, 2026).

Eurasian otter females are non-seasonally polyoestrous (experiencing recurring, regular reproductive cycles continuously throughout the year), with no set breeding seasons across England. Instead, breeding timings are linked to prey availability (Beja, 1996; Ruiz-Olmo et al., 2002).

3.6 Moulting

As with all mammals, seals undergo an annual pelage (coat) replacement cycle, commonly referred to as moulting. This process involves the shedding and regeneration of fur and is associated with increased time spent hauled out, as individuals spend extended periods on land to facilitate thermoregulation and skin renewal (Paterson et al., 2021). Grey seals typically moult between February and April, whereas harbour seals undergo this process later in the year, around August (Ling, 1970; Paterson et al., 2021).

Moulting is physiologically demanding, requiring substantial metabolic and circulatory adjustments. One key adaptation is a marked increase in cutaneous blood flow, which supports the regeneration of hair follicles and epidermal tissue (Bonner, 1994). This enhanced peripheral circulation also causes elevated heat loss, necessitating prolonged haul-out durations to maintain thermal balance (Bonner, 1994).

Research has shown that harbour seals exhibit elevated metabolic rates during the moulting period compared to post-moult phases, underscoring the physiological demands of this process (Paterson et al., 2021). Human disturbance that disrupts haul-out behaviour during moulting can increase energy expenditure and potentially prolong the duration of the moult, with implications for individual health and population-level welfare, demonstrating the importance of undisturbed haul-out sites (Paterson et al., 2021).

Eurasian otters moult continuously through the year, with no set season. Continuous moulting and grooming help to maintain their waterproof and insulated coat (Kruuk, H. Balharry, 1990).

3.7 Water column as a supporting habitat

The water column is the vertical profile of a body of water, from the surface to the bottom. As marine species, seals and otters spend some time within the water column. Seals and otters predominantly use the water column for resting, foraging, socialising and travelling (Russell et al., 2015). Natural England guidance for otters emphasises the importance of maintaining water quality and flow regimes, as these species depend on stable aquatic conditions for feeding and breeding (Natural England, 2007).

There can be interspecies variation in the use of the water column. For example, female grey seals are more likely to be observed foraging than males, due to their high energy requirements for breeding (Nowak et al., 2020), and female harbour seals spend more of their time in the sea after lactation (Thompson et al., 1989). Adult males sea otters spend 9% of their time patrolling as part of their territoriality behaviour (Finerty, Wolt and Davis, 2009).

While the uses of the water column vary between members of the species, it is an essential habitat for all of them, and the impacts of mNLA on the water column will be assessed.

4 Disturbance

Disturbance in this context refers to any anthropogenic influence activity, including mNLA, which alerts or disrupts natural behaviour and causes behavioural deviations, physiological stress, or displacement from critical habitats (Wilson, 2014). In marine and coastal environments, such disturbances are not always overt; even subtle or infrequent interactions can have significant negative consequences for animal welfare and potential population level impacts (de Vere, Lilley and Frick, 2018).

Disturbance may be temporary or permanent, and can affect an animal's ability to survive, breed, or rear young (Osinga et al., 2012). The impacts of disturbance are cumulative, with the effects of individual disturbance events adding up over time and have a combined effect alongside other disturbance events and environmental stressors. Disturbance can be caused by acoustic sources, visual sources, or both, for example, drones, vessels, people, and dogs, as well as repeated recreational activity (Henry and Hammill, 2001). These stressors can lead to a range of impacts, including altered haul-out behaviour, increased energy expenditure, physiological stress responses, and, in severe cases, reduced reproductive success and even population level declines in both seals and otters (de Vere, Lilley and Frick, 2018).

Current Defra guidance in the Marine and Coastal Wildlife Code recommends maintaining a distance of at least 100m from marine wildlife (Defra, 2023). For the purposes of this review, only disturbances occurring from human activities taking place in the marine environment are being assessed. All interactions in which a seal or an otter has noticed human presence has been assumed to constitute disturbance in this review.

4.1 Behavioural impacts

Disturbance events for seals can be observed through behavioural changes. Behavioural disturbance can be categorised differently depending on the source material, but is generally divided into the following three levels (Bellman, 2019b):

- level 1: alert, where an animal raises its head and looks towards the activity;
- level 2: retreat, where the animal moves in response to the activity; and
- level 3: escape, where the animal dives or flushes into the water.

Flushing is a common term used to describe seal disturbance; it refers to the rapid movement of seals from a haul-out site into the water in response to a disturbance. This often involves seals moving across uneven terrain, such as boulders or rocky ledges, which can increase the risk of injury due to slips or falls (Bellman et al., 2019a).

Seals alerting (looking at the source of the disturbance, raising their head, then sitting up), is considered to be of lower impact than flushing, when seals go into the water from being hauled out in response to a disturbance (Wilson, 2014). Flushing is

considered a high impact response, associated with greater energy costs and lower pup survival (Allen, Ainley and Page, 1984; Pirodda et al., 2018). Foraging behaviour may also be disrupted and reduce feeding efficiency (Henry and Hammill, 2001).

Any level of disturbance can lead to variations in habitat use and avoidance behaviours may emerge, with animals abandoning preferred foraging sites or haul-out sites for seals (Bishop, Pomeroy and Twiss, 2015). Highly mobile species may be displaced from essential habitats, reducing access to resources and increasing vulnerability (Booth, Sinclair and Harwood, 2020). Ultimately, continued disturbance can reduce population resilience, lead to habitat degradation (trampling), and alter the local distribution and abundance of species (Booth, Sinclair and Harwood, 2020).

Vigilance behaviours that would usually act as a defence mechanism against threats, such as predators and competitors, can be induced by disturbance events. In human dominated landscapes, wildlife can be more vigilant of human disturbance than of disturbances from their habitat or predators (Ciuti et al., 2012). Staying vigilant leads to vigilance decrement, where the animal's ability to process information gradually decreases, which can result in a reduced ability to carry out attention-based tasks such as locating cryptic prey or detecting hidden predators (Dukas and Clark, 1995).

When hauled out, being alert and vigilant instead of resting has energetic impacts. For example, for female adult grey seals there is a trade-off between resting to reserve resources, and expending energy to stay alert, which can impact pup development in pregnant females (Shuert, Pomeroy and Twiss, 2020).

Seasonal patterns influence disturbance responses. Harbour seals are less likely to flush during moulting (Henry and Hammill, 2001) and breeding (Andersen et al., 2012) but are more reactive when pups are present (Henry and Hammill, 2001).

In 2010, Natural England commissioned a number of surveys around the Isles of Scilly to monitor grey seal populations (Sayer, Hockley and Witt, 2012). During these surveys, to minimise disturbance, the motorised survey vessel maintained a considerable distance from hauled out seals, approaching more closely only after the animals had acclimatised to its presence and when their behaviour and safety allowed. Despite these precautions, an average of 10% of observed seals entered the water while the boat was nearby, with disturbance levels peaking in October, the primary pupping season, and reaching their lowest in December (Sayer, Hockley and Witt, 2012). Disturbance was found to be most pronounced at sites with large aggregations, where the reaction of a single startled seal often triggered a chain response, causing others to move seaward (Sayer, Hockley and Witt, 2012). It was thought that the reduced disturbance observed in December may relate to the onset of the moulting period, during which time seals appear more reluctant to enter the water, even though they occur in greater numbers and may be less habituated to vessel activity (Sayer, Hockley and Witt, 2012).

Group size of seals at haul-outs may influence reactions to disturbance events. The initial scanning time of newly-hauled out harbour seals decreases as group size increases (Terhune and Brilliant, 1996), but overall vigilance increases with group sizes of harbour seals (Da Silva and Terhune, 1988). Similar patterns have been seen for grey seals, as increased haul-out group size also raised disturbance levels (Baker, Sayer and Allen, 2026). Because vigilance increased for group sizes of harbour seals, larger groups were able to detect possible threats at a greater distance, while solitary seals could miss potential threats (Da Silva and Terhune, 1988). This is because an individual may not initially notice a human activity, while within a group, individuals may respond to a neighbouring animal detecting a disturbance event and will trigger a cascading panic response (Andersen et al., 2012). Because larger groups may exhibit higher rates of vigilance which makes them more susceptible to mass flushing, they may therefore suffer higher energetic cost and increased frequency of interrupted rest (Ruiz-Mar et al., 2022).

Harbour seals are more susceptible to human disturbance during the day as this is when they are hauled out. Foraging is nocturnal, but rest and nursing are diurnal, putting harbour seals more at risk of human disturbance during the daytime (Trumble, 1995). In contrast, grey seal females and pups are found to rest more during the nighttime (Culloch, Pomeroy and Twiss, 2016; Fraser, Culloch and Twiss, 2019). Daily patterns of habituation to human disturbance have been observed in grey seals, with high levels of disturbance seen in reaction to the first disturbance events of the day and falling levels of disturbance with subsequent events (Baker, Sayer and Allen, 2026). This behaviour was more pronounced in adult grey seals, but juveniles showed more vigilance throughout the day, suggesting that the intra-day pattern of lowering disturbance levels may be learnt (Baker, Sayer and Allen, 2026).

Anthropogenic disturbance impacts on otters are harder to assess, as Eurasian otters are generally nocturnal hunters, though foraging behaviour can be influenced by the tides in coastal areas, with otters showing preference for hunting at low tide (Hans Kruuk, 1995). Increased nocturnality is observed when human presence increases (Penteriani et al., 2025), but literature exploring specific disturbance impacts to otters is limited. They typically remain in their holts during the day, therefore are less likely to interact with humans. They have nearsighted vision on land, as the lenses on their eyes function primarily for dimly lit underwater conditions (Strobel, 2019). So even when humans and otters are present at the same time, such as when tidal conditions are favourable for hunting, visual disturbance is unlikely to impact otter behaviour except at a close range (Lesage, Kross and Turner, 2025).

4.2 Physiological responses

Disturbance triggers stress responses, including elevated cortisol levels and increased metabolic demands, which can impair immune function and reduce overall

fitness (Kershaw and Hall, 2016). Elevated cortisol responses have been documented in harbour seals during capture, with cortisol concentrations increasing significantly during the event due to stress. Cortisol plays a key role in regulating fat metabolism, gluconeogenesis and energy metabolism meaning that repeated disturbance can elevate metabolic demand and potentially compromise immune function and overall fitness (Kershaw and Hall, 2016).

Models have been created to determine the population impacts of disturbance, for example, the Population Consequences of Disturbance (PCoD) framework models how individual-level stress responses can scale up to affect population dynamics. This tool could be used in site level assessments if required (Dunlop et al., 2021). For example, in modelling offshore windfarm disturbance, increased days of disturbance decreased pup survival for both harbour and grey seals (Harwood, Chudzinska and Booth, 2023).

Models also exist to determine specifically the impact of underwater noise on marine mammals. The Population Consequences of Acoustic Disturbance (PCAD) framework (National Research Council et al., 2005) can be used to assess the behavioural and physiological responses of marine mammals, and how these can lead to population effects. For example, using the PCAD framework, elephant seals (*Mirounga leonina* and *M. angustirostris*) were resilient to disturbance, showing no population level effects (Costa et al., 2016). In contrast, whale watching boat tours caused an estimated 28% increase in energy expenditure in minke whales (*Balaenoptera acutorostrata*), due to stress and increased swimming speed (Christiansen, Rasmussen and Lusseau, 2014).

Seal heart rates increase during disturbance events, leading to greater energy expenditure and potential health impacts (Karpovich et al., 2015). These stress responses may lead to population-level effects, such as reduced pup survival, altered site fidelity, and long-term displacement (Chudzinska et al., 2023). A study found that harbour seal pups in Alaska suffered thermal stress if they spent more than 50% of their time in the water illustrating that frequent flushing out occurrences may therefore reduce pup survival (Jansen et al., 2010).

Disturbance can have knock-on effects to a population's metabolic demands. Disturbance disrupts foraging or resting opportunities, which is energy lost. Less energy to dedicate to offspring can lead to reduced natality (birth rate) and increased offspring mortality (Costa, 2012).

4.3 Noise impacts

Pinnipeds, including harbour and grey seals, possess highly sensitive in air and underwater hearing abilities that reflect their semiaquatic lifestyle. Their underwater hearing is most acute between 0.5 and 40kHz, meaning that broadband vessel noise, particularly from cavitating propellers on high-speed craft, overlaps strongly

with their hearing range and constitutes a significant anthropogenic stressor (Southall et al., 2009).

Underwater sound emissions have the potential to cause physical injury or disturbance to seals if they fall within their generalised hearing range of 40Hz to 90kHz underwater and 42Hz to 52kHz in air (National Marine Fisheries Service, 2024). Where this leads to an animal avoiding their main feeding and breeding grounds, this may have longer term effects on the health and breeding ability of that animal (Wright et al., 2007). However, contemporary data suggests that even with very intense sound emissions, such as those from pile driving activity, harbour seals are likely to return to the region of the sound source soon after the sound has ceased (Russell et al., 2016). High frequency sonar is now common place in the marine environment, grey seals have been shown to have significant impacts to the noise including increased haul-out periods, reducing the time they have to feed (Hastie et al., 2014). Grey seals have also been shown to balance risk and reward, they will tolerate the noise disturbance when food is good but avoid the noisy area when food is scarce meaning the impact of the noise disturbance will depend on the quality of the feeding area (Hastie et al., 2021).

Another impact of underwater noise is masking, which is the reduction in an organism's ability to detect, interpret, and respond to biological noises in their environment (Tanner Jr, 1958). These noises could be communications from other seals, noises that indicate the presence of predators and prey, and other biological auditory signals. Masking can occur when the masking noise and the biological auditory signals overlap in time and have similar frequencies (National Research Council, Division on Earth *et al.*, 2003). For example, juvenile contact vocalisations are emitted at frequencies that can be subject to masking by human activities (Southall et al., 2000).

Noise disturbance has multi-level impacts, including behavioural, physiological, and population-scale effects. Flushing (for seals) is the most energetically costly response and is associated with reduced pup survival, therefore noise stimuli remain significant stressors.

Underwater sound can impact the diving and hunting behaviour of Eurasian otters, with increased time spent diving for food as sound intensity increases, due to startle responses (Stepien et al., 2024). Otters use a range of vocalisations to communicate, which could be disrupted by above water noise, including twittering to communicate with cubs, and long-distance whistle calls (Gnoli and Prigioni, 1995). The in-air auditory range of Eurasian otters (at 80dB) is 200Hz to 32kHz (Voigt et al., 2019), but no research on the underwater auditory range has been found through this literature review.

5 Motorised watercraft and motorised personal watercraft

This section brings together and analyses the available evidence on how powerboating or sailing with an engine activities affect grey seal, harbour seals and otters. Motorised personal watercraft and motorised watercraft are considered together due to these activities having similar impacts on marine mammal features.

Natural England's Advice on Operations was used to identify potential pressures from motorised watercraft and motorised personal watercraft and inform the understanding of feature sensitivity to the pressure. Where a sensitivity assessment has not been undertaken or the evidence base is insufficient to assess sensitivity, the activity-pressure-feature combination has also been included in the list below to capture all possible evidence that may impact the feature. **Marine Non-Licensable Activity Impacts Evidence: Methodology**¹ details the process of how MMO judgement refined pressures for assessment.

High risk pressures associated with this activity with the potential to impact grey seals and harbour seals are:

- above water noise;
- collision below water with static or moving objects not naturally found in the marine environment;
- underwater noise change; and
- visual disturbance.

High risk pressures associated with this activity with the potential to impact Eurasian otters are:

- above water noise; and
- underwater noise change.

High risk pressures associated with this activity have been identified using Natural England conservation advice package (**Annex 1: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#)**) and MMO judgement. These high risk pressures have been included in this review as they have been determined to be pressures commonly induced by motorised watercraft and motorised personal watercraft at a level that has the potential to cause significant impacts on the features.

The following pressures were identified as low risk and are therefore not included in this document:

- hydrocarbon and PAH contamination;
- introduction of light;
- INIS;
- litter;
- synthetic compound contamination; and

- transition elements and organo-metal contamination.

Low risk pressures associated with this activity have been identified using Natural England conservation advice package (**Annex 1: mNLA pressures on sensitive features - grey seals, harbour seals and Eurasian otters**) and MMO judgement. Should site level factors increase the risk of these pressures, these would be considered in an individual site assessment.

5.1 Summary of the effects of motorised watercraft and motorised personal watercraft on seals

Observational work in Cornwall found grey seals were disturbed at least once per hour in summer, with trip boats responsible for 40.6% of disturbance events and 47.4% of individual reactions (Bellman, 2019b). Similar patterns have been seen elsewhere with other species of pinnipeds. Research conducted in South America found tourist vessel presence negatively affects South American sea lion behaviour, with stronger responses observed during longer visits, closer vessel proximity, and more intrusive tourist actions (Pavez et al., 2015). Behavioural sensitivity in the South American sea lions varied by age, sex, site, and year; subadult males were most affected, and it was suggested that their heightened responsiveness may relate to the absence of territorial or mating constraints (Pavez et al., 2015).

Female South American sea lions in non-breeding sites showed a larger disturbance response to tourist vessel activities than those in breeding sites (Pavez et al., 2015). It is thought that, as they do not have pups, they are not constrained to land and are free to flee (Muñoz et al., 2014). When approached by boats, most harbour seals return to haul-out sites within 30 minutes, but it can take over four hours for 94% of the colony to return (Paterson et al., 2019).

The proximity of motorised vessels to seal haul-out impacts the seal responses. In Alaska, cruise ships within 100m made harbour seals 25 times more likely to flush compared to ships 500m away. Ships passing closer than 200m caused about 75% of seals to enter the water, while passes beyond 600m caused disturbance in under 10% of seals (Jansen et al., 2006). However, these ships were large (up to 305m), and smaller vessels may evoke different responses. For example, motorboats triggered alert behaviour from as far as 800m and typically caused harbour seals to flush at around 190m (Henry and Hammill, 2001). In comparison, sea lions flushed when vessels came within 25m of a colony (Pavez et al., 2011). 64.9% of grey seals in a colony were found to flush into the sea when approached by motorised vessels 5 to 25m from the haul-out, compared to 11% when the motorised vessels were 50 to 100m from the haul-out (Curtin, Richards and Westcott, 2009).

While Defra recommends keeping a distance of at least 100m away from seals to reduce the risk of disturbance, a survey in West Cornwall found that the average minimum distance kept by motorised tripper boats from seal haul-outs was 48.2m (Baker, Sayer and Allen, 2026). At this distance, there was a 46.87% chance of

disturbance. This dropped to a 25% risk of disturbance when boats stayed at least 141m away from seal haul-outs (Baker, Sayer and Allen, 2026). Analysis of the risk of impacts that cause seal disturbance events found that distance of the boat from the seals had a statistically significant impact on the likelihood of seal disturbance events. Of the recorded disturbance events, 88.3% were level 1, 5.1% were level 2, and 6.6% were level 3 (Baker, Sayer and Allen, 2026).

Responses also depend heavily on vessel behaviour. The Wildlife Safe (WiSe) Scheme (The WiSe Scheme, 2026) recommends certain behaviours that vessels near marine animals should follow, such as not approaching animals straight on, and not changing speed quickly. In the West Cornwall surveys, analysis found that boat behaviour had a statistically significant impact on the likelihood of seal disturbance events. (Baker, Sayer and Allen, 2026).

On Yellow Island, harbour seals flushed when powerboats stopped within 371m, yet were unaffected by boats simply passing by, even at 39m (Johnson and Acevedo-Gutiérrez, 2007). Harbour seals were also found to be four times more prone to flush into the water when ships were approaching directly rather than passing abeam (Jansen et al., 2010).

Controlled disturbance trials showed that activity by a 4.3m rigid inflatable boat (RIB) at a speed of five knots caused hauled out harbour seals to temporarily leave haul-out sites, but most returned relatively quickly (Paterson et al., 2019). When the boat repeatedly approached the seals until all seals had entered the water, it was found that seal numbers recovered to 52% of pre disturbance levels within 30 minutes and 94% had returned within four hours. This suggests that short term disturbance will lead only to temporary displacement unless disturbance is prolonged (Paterson et al., 2019).

Noise intensity further influences responses, with Australian fur seals (*Arctocephalus pusillus doriferus*) moving away at 75 to 85 decibel (dB) but not below 74dB (Taylor et al., 2024). This suggests benefits of maintaining vessel noise below this threshold.

The underwater noise created by motorised vessels can also cause the underwater vocalisations of harp seals (*Pagophilus groenlandicus*) to decrease (Terhune, Stewart and Ronald, 1979). Increases in above water noise can also impact the vocalisation behaviour of Australian fur seals, with barks becoming faster as boat noise increases (Tripovich et al., 2012). For walruses, vocalisation rates drop during vessel transits, but resume when the vessel encounter has finished (Coppolaro et al., 2025).

Personal watercraft pose additional risk due to shallow-water operation. The rapid movements of the craft and the reduced ability of seals to detect or localise approaching vessels in shallow water increases the likelihood of collision (Nowacek, Wells and Solow, 2001; Koschinski, 2008).

A study by Dans, Crespo and Coscarella (2017) recommends avoiding contact and managing vessel disturbance, as boat approaches may disrupt haul-out patterns, underscoring the need for strict guidelines and operator compliance. (Curtin, Richards and Westcott, 2009) found that voluntary codes of conduct in South Devon did reduce levels of disturbance to grey seals, with tour guides causing less disturbance events than private vessel owners who are less aware of wildlife guidance.

mNLA can exert both direct pressures (for example vessel wake) and indirect pressures (for example underwater noise) that significantly alter the physical and acoustic properties of the water column, thereby influencing the behaviour of seals. Motorised and non-motorised watercraft are capable of generating a wake that produce hydrodynamic forces which can penetrate the water column, resuspending sediments and disrupting thermal stratification (Riesgraf et al., 2025).

Field studies demonstrate that propeller wash and wake turbulence can reach depths of 2 to 3m, increasing turbidity and reducing visibility for foraging (Riesgraf et al., 2025). As seals rely on both acoustic cues and their highly sensitive vibrissae (whiskers) to detect prey movement, noise masking can interfere with this integrated sensory system (Riesgraf et al., 2025). When foraging in shallow estuarine waters, sediment plumes and elevated noise levels can reduce their ability to locate prey, leading to lower capture success and forcing individuals to expend additional energy searching for food (Kastelein et al., 2023).

Repeated boat passages can disrupt thermal layering and oxygen distribution in stratified systems, particularly in lakes and sheltered estuaries (Nylund et al., 2023). Such changes may indirectly affect seals and otters by altering fish behaviour and distribution. Increased mixing can displace benthic prey species and reduce the predictability of foraging grounds, increasing energetic costs for top predators (Nylund et al., 2023).

In contrast, a report by (Wachter and Volckaert, 2016) evaluated motorised recreation to have no or negligible impacts on waves and currents or turbidity in the water column. This lack of consensus shows the difficulty in quantifying impacts to the water column. Hard water recreation (with motors) was evaluated to have no visual disturbance impacts at a low intensity, but considered to have potential impacts beyond a high intensity threshold (Wachter and Volckaert, 2016). Motorised recreation was evaluated to have a small noise impact to the water column (Wachter and Volckaert, 2016).

The evidence shows that seal disturbance is strongly influenced by both noise levels and vessel type. Noise above roughly 75dB increases the likelihood of disturbance and fast, unpredictable personal watercraft pose additional risks. Seasonal factors also play a role as seals tend to be less reactive during moulting and breeding but become more sensitive when pups are present, as discussed in **Section 3.5**.

Distance is another key factor, the risk of disturbance rises sharply when vessels come within 200m. Stopping or lingering near haul-outs is more disruptive than simply passing by, even at greater distances. Larger vessels can trigger responses from farther away than smaller craft. While seals may become alert at long distances, flushing usually occurs at closer ranges or when vessel behaviour changes, such as slowing or stopping. While seals may return quickly after flushing into the sea, the disturbance has disrupted their natural behaviour. The widely recommended distance of 100m for powered vessels to maintain from seals is therefore not sufficient.

Overall, motorised vessels and personal watercraft can substantially affect seal behaviour, with disturbance shaped by noise level, proximity, vessel size, and how the vessel approaches. Some of the variances could be explained by the differences between species, and possible habituation in high vessel-traffic areas.

MMO conclude that impacts from motorised watercraft and motorised personal watercraft on grey seals and harbour seals are likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of above water noise, underwater noise, collision below water with static or moving objects not naturally found in the marine environment, and visual disturbance caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

5.2 Summary of the effects of motorised watercraft and motorised personal watercraft on otters

Due to limited studies on disturbance impacts on Eurasian otters being available, a proxy species is used here.

A study of the behavioural responses of giant otters in Peru compared the impacts of unpowered vessels in regulated ecotourism lakes to lakes with fishing and extraction activities using engine-powered vessels. In the areas with management, the giant otters showed no avoidance to unpowered research vessels, and reduced defensive behaviour compared to unprotected lakes (Barocas et al., 2022), suggesting that unpowered vessels had less impacts on otter behaviour than powered vessels. Barrett et al. (2025) showed that small, motorised craft trigger measurable behavioural responses that increase otters' energetic expenditure, with disturbance risk rising sharply when vessels come within 20 to 30m, declining to less than 10% when vessels are over 54m away.

mNLA can exert both direct (for example vessel wake) and indirect (for example underwater noise) pressures that significantly alter the physical and acoustic properties of the water column, thereby influencing the behaviour of otters. Motorised and non-motorised watercraft are capable of generating a wake that produce

hydrodynamic forces which can penetrate the water column, resuspending sediments and disrupting thermal stratification (Riesgraf et al., 2025).

Field studies demonstrate that propeller wash and wake turbulence can reach depths of 2 to 3m, increasing turbidity and reducing visibility for tactile foragers such as otters (Riesgraf et al., 2025). Elevated levels of suspended sediment can impair prey detection and foraging efficiency, particularly for otters, which rely on clear water to locate fish and crustaceans (Riesgraf et al., 2025).

Repeated boat passages can disrupt thermal layering and oxygen distribution in stratified systems, particularly in lakes and sheltered estuaries (Nylund et al., 2023). Such changes may indirectly affect otters by altering fish behaviour and distribution. Increased mixing can displace benthic prey species and reduce the predictability of foraging grounds, increasing energetic costs for top predators (Nylund et al., 2023).

In contrast a report by De Wachter and Volckaert (2005) evaluated motorised recreation to have no or negligible impacts on waves and currents or turbidity in the water column. This lack of consensus shows the difficulty in quantifying impacts to the water column. Hard water recreation (with motors) was evaluated to have no visual disturbance impacts at a low intensity, but may have an impact beyond a high intensity threshold (Wachter and Volckaert, 2016). Motorised recreation was evaluated to have a small noise impact to the water column (Wachter and Volckaert, 2016).

The research available suggests that motorised vessels have greater impacts on otters than non-motorised vessels, with motorised vessels triggering more defensive responses than un-powered vessels (**Section 6.2**), and impacting ability to forage in the water column. Based on literature from a proxy species, disturbance risk may have an inverse correlation with distance between Eurasian otters and powered vessels.

MMO conclude that motorised watercraft and motorised personal watercraft around Eurasian otters is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of above water noise and underwater noise caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

6 Non-motorised watercraft and sailing

This section brings together and analyses the available evidence on how non-motorised watercraft and sailing affects grey seals, harbour seals and otters. Non-motorised watercraft and sailing are considered together due to these activities having similar impacts on seals and otters.

Natural England's Advice on Operations was used to identify potential pressures from non-motorised watercraft and sailing and inform the understanding of feature sensitivity to the pressure. Where a sensitivity assessment has not been undertaken or the evidence base is insufficient to assess sensitivity, the activity-pressure-feature combination has also been included in the list below to capture all possible evidence that may impact the feature. **Marine Non-Licensable Activity Impacts Evidence: Methodology**¹ details the process of how MMO judgement refined pressures for assessment.

High risk pressures associated with this activity with the potential to impact grey seals and harbour seals are:

- above water noise;
- underwater noise change; and
- visual disturbance.

High risk pressures associated with this activity with the potential to impact Eurasian otters are:

- above water noise; and
- underwater noise change.

High risk pressures associated with this activity have been identified using Natural England conservation advice packages (**Annex 1: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#)**) and MMO judgement. These high risk pressures have been included in this review as they have been determined to be pressures commonly induced by non-motorised watercraft and sailing at a level that has the potential to cause significant impacts on the features.

The following pressures were identified as low risk and are therefore not included in this document:

- collision below water with static or moving objects not naturally found in the marine environment;
- hydrocarbon and polycyclic aromatic hydrocarbons (PAH) contamination;
- introduction of light;
- introduction or spread of invasive non-indigenous species (INIS);
- litter;
- synthetic compound contamination (including pesticides, antifoulants, pharmaceuticals); and

- transition elements and organo-metal (such as tributyltin, (TBT)) contamination.

Low risk pressures associated with this activity have been identified using Natural England conservation advice package (**Annex 1**: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#)) and MMO judgement. Should site level factors increase the risk of these pressures, these would be considered in an individual site assessment.

6.1 Summary of the effects of non-motorised watercraft and sailing on seals

Studies have found that non-motorised watercraft such as kayaks are a particularly strong stimulus that can cause seals to flush into the water. Henry and Hammill (2001) found that during a five-month behavioural study in Canada, kayaks and canoes caused 33.3% of the observed harbour seals disturbances, followed by motorboats (27.8%) and sailboats (18%). The strongest reaction was observed in response to kayaks and canoes, which caused 86% of seals to flush into the water. In a study of the impact of vessels on the haul-out activity of harbour seals, kayaks and canoes caused flushing events at a mean distance of 178m (Henry and Hammill, 2001). In this study sailboats caused no flushing events but did create alert behaviours in the seals (Henry and Hammill, 2001).

A study in California found harbour seals flushed into water on 28% of the 112 boat events recorded in the study, whereas kayaks or canoes caused 55% of flushes, motorboats 35% and rowboats 10% (Fox, 2008). Harbour seals were also found to flush more in response to kayaks than motorised vessels in a study of seal tourism in Alaska (Hoover-Miller et al., 2013). Studies around Cornwall found that non-motorised boats and swimmers and divers were identified as causing high levels of the most severe disturbance responses from grey seals (Bellman, 2019b). However, the opposite was found on Yellow Island in Washington State, where disturbed harbour seals would flush when motorboats stopped within up to 314.8m of their haul-out location, compared to when kayaks stopped within up to 127.3m (Johnson and Acevedo-Gutiérrez, 2007).

The more frequent flight responses of seals to slow-moving disturbances, such as kayaks and canoes, may be due to their quiet, low-profile approach, resembling natural predators and triggering a surprise reaction (Henry and Hammill, 2001). In comparison, motorised vessels are audible to the seals before visual contact is made, which provides a warning (Osborn, 1985).

mNLA can exert both direct (for example vessel wake) and indirect (for example underwater noise) pressures that significantly alter the physical and acoustic properties of the water column, thereby influencing the behaviour of seals. Non-motorised watercraft are capable of generating a wake that produce hydrodynamic forces which can penetrate the water column, resuspending sediments and

disrupting thermal stratification (Riesgraf et al., 2025). In contrast, no or negligible impacts were evaluated for waves and currents or turbidity by non-motorised recreation in a report by (Wachter and Volckaert, 2016). This lack of consensus shows the difficulty in quantifying impacts to the water column.

In the same report, soft water recreation (without motors) was evaluated to have no noise or visual disturbance impacts to the water column at a low intensity, but may have an impact beyond a high intensity threshold (Wachter and Volckaert, 2016).

Across multiple regions both grey and harbour seals show a stronger, more frequent flight response to low profile craft, as they are able to effectively 'sneak up' on the animals and startle them more, leading to a stronger disturbance response. The distance of non-motorised watercraft and non-motorised sailing vessels to seal haul-outs has the most impact on seal disturbance and behaviour as seals often detect these craft only at close range, leading to abrupt reactive behaviours and more frequent flushing than is typically triggered by motorised vessels. Responses may vary depending on the activity intensity.

MMO conclude that non-motorised watercraft and sailing around grey seals and harbour seals is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of visual disturbance and above water noise caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

6.2 Summary of the effects of non-motorised watercraft and sailing on

There are limited studies on Eurasian otters and the impact of non-motorised watercraft and sailing in the UK. Therefore, other otter species have been used as a proxy as described in **Section 3.1**.

When hunting in shallow waters, otters on the coast can encounter human activities at the surface of the water when hunting according to the tidal conditions. As otters have a high metabolic rate, they are therefore at risk of increased energetic costs due to human disturbance. **Section 4.2** discusses physiological responses to disturbance).

Barrett et al. (2025) conducted a five-year study across three different locations in California, USA, studying how southern sea otter behaviour varies in response to the occurrence and proximity to disturbance stimuli such as kayaks or personal boats. One of the key observations that emerged from the study was that when small watercraft remained over 29m away, the likelihood of disturbing the otters was less than 10% (Barrett et al., 2025).

A study of the behavioural responses of giant otters (*Pteronura brasiliensis*) in Peru compared the impacts of unpowered vessels in regulated ecotourism lakes to lakes

with fishing and extraction activities that use engine powered vessels. In the areas with management the giant otters showed no avoidance to unpowered research vessels, and reduced defensive behaviour compared to unprotected lakes (Barocas et al., 2022), suggesting that unpowered vessels had less impact on otter behaviour than powered vessels.

In an investigation on the impacts of recreation on North American sea otters, kayaks caused disturbance events that resulted in short term behavioural changes such as alerts and flushing from the area (Benham, 2006). However, less than 25% of these approaches by kayaks caused any change in otter behaviour, possibly due to the habituation of otters to disturbance events in areas with high levels of recreational activity (Benham, 2006). Benham (2006) does not share the details of which other sea otter behaviour is changed by the presence of different human activities.

In areas with high levels of recreational activity otters may have become more tolerant to disturbance than otters in less disturbed areas (Benham, 2006). Non-motorised watercraft can get closer to otters in shallow waters than boats and may approach otters more frequently. Another study found that sea otters in areas with human disturbance, including kayaks, spent more of their time travelling (12%) compared to sea otters in areas without disturbance (5%) (Curland, 1997).

mNLA can exert both direct (for example vessel wake) and indirect (for example underwater noise) pressures that significantly alter the physical and acoustic properties of the water column, thereby influencing the behaviour of otters. Non-motorised watercraft are capable of generating a wake that produce hydrodynamic forces which can penetrate the water column, resuspending sediments and disrupting thermal stratification (Riesgraf et al., 2025). In contrast, no or negligible impacts were evaluated for waves and currents or turbidity in the water column by non-motorised recreation in a report by (Wachter and Volckaert, 2016). This lack of consensus shows the difficulty in quantifying impacts to the water column. In the same report (Wachter and Volckaert, 2016), soft water recreation (without motors) was evaluated to have no noise impacts to the water column at a low intensity, but may have an impact beyond a high intensity threshold.

The evidence indicates that an otters' high metabolic demand (as explained in **Section 3.4**) makes them particularly vulnerable to the energetic impacts of human disturbance. Maintaining appropriate distances is important for reducing behavioural disruption in proxy species, which could apply to Eurasian otters. Studies across species also show that vessel type significantly influences disturbance levels, with unpowered vessels triggering fewer defensive responses than motorised. Although otters in heavily visited areas may show some habituation, kayaks still trigger alert or flushing behaviours in a notable minority of encounters, indicating that disturbance remains a relevant pressure even in habituated populations.

MMO conclude that impacts from non-motorised watercraft on Eurasian otters may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of above water noise caused by this activity. These studies suggest non-motorised watercraft and sailing vessels can cause disturbance to otters, but that populations in highly disturbed areas may become habituated. A site level assessment will determine whether the activity is hindering the achievement of MPA conservation objectives.

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7 Wildlife watching from the sea (commercial)

This section brings together and analyses the available evidence on the impacts of wildlife watching from the sea (commercial) on harbour seal, grey seal, and Eurasian otter features.

Natural England's Advice on Operations was used to identify potential pressures from wildlife watching from the sea (commercial) and inform the understanding of feature sensitivity to the pressure. Where a sensitivity assessment has not been undertaken or the evidence base is insufficient to assess sensitivity, the activity-pressure-feature combination has also been included in the list below to capture all possible evidence that may impact the feature. **Marine Non-Licensable Activity Impacts Evidence: Methodology**¹ details the process of how MMO judgement refined pressures for assessment.

High risk pressures associated with this activity with the potential to impact grey and harbour seals are:

- above water noise;
- underwater noise change;
- visual disturbance; and
- collision above water with static or moving objects not naturally found in the marine environment.

High risk pressures associated with this activity with the potential to impact Eurasian otters are:

- above water noise;
- underwater noise change; and
- collision above water with static or moving objects not naturally found in the marine environment.

These high-risk pressures have been included in this review as they have been determined to be pressures commonly induced by wildlife watching from the sea at a level that has the potential to cause significant impacts on the features. This is because a single wildlife watching vessel is likely to result in these pressures at a damaging level, regardless of any site specific factors.

High risk pressures associated with this activity have been identified using Natural England's conservation advice package (**Annex 1: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#)**) and MMO judgement.

The following pressures were identified as low risk and are therefore not included in this section:

- hydrocarbon and PAH contamination;
- INIS;

- litter;
- synthetic compound contamination; and
- transition elements and organo-metal contamination.

Low risk pressures associated with this activity have been identified using Natural England's conservation advice package (**Annex 1**: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#)) and MMO judgement. These low risk pressures have not been included in this review as these pressures generally do not occur at a level of concern, as a result of wildlife watching from the sea. Should site level factors increase the risk of these pressures, these would be considered in an individual site assessment.

7.1 Summary of the effects of wildlife watching from the sea (commercial) on seals

Commercial wildlife watching from the sea can involve motorised vessels such as tripper boats, and non-motorised vessels such as kayaks or canoes. As the intention is to view wildlife, these vessels approach seal haulouts and seal foraging areas. As a result, the principal mechanisms of disturbance are visual disturbance associated with vessel approach and presence, the potential for collision above water with static or moving objects not naturally found in the marine environment, and above water and underwater noise.

Despite sharing the same disturbance mechanisms associated with motorised watercraft, wildlife watching from sea is considered separately because the activity involves intentionally seeking out seals and other wildlife. This increases the likelihood of close approaches to seals and their haulouts and, consequently, the potential for disturbance through visual presence, collision, and noise. As a result, the frequency and intensity of disturbance may be greater than for recreational boating activities where seals are encountered incidentally.

As discussed in **Section 6.1**, kayaks and canoes can cause strong responses in seals. Tourists that in kayaks, due to the ability of non-motorised vessels to remain undetected by seals until they are close enough to cause a flush reaction from visual disturbance. For motorised vessels, the underwater and above water noise are more likely to cause disturbance from a greater distance (**Section 5.1**).

Observational work in Cornwall found grey seals were disturbed at least once per hour in summer, with trip boats responsible for 40.6% of disturbance events and 47.4% of individual reactions (Bellman, 2019b). Research conducted in South America found tourist vessel presence negatively affects South American sea lion behaviour, with stronger responses observed during longer visits, closer vessel proximity, and more intrusive tourist actions (Pavez et al., 2015). Behavioural sensitivity in the South American sea lions varied by age, sex, site, and year (Pavez et al., 2015). Subadult males were most affected, and it was suggested that their

heightened responsiveness may relate to the absence of territorial or mating constraints (Pavez et al., 2015).

While Defra recommends keeping a distance of at least 100m away from seals to reduce the risk of disturbance, a survey in West Cornwall found that the average minimum distance kept by motorised tripper boats from seal haul-outs was 48.2m (Baker, Sayer and Allen, 2026). At this distance, there was a 46.87% chance of disturbance. This dropped to a 25% risk of disturbance when boats stayed at least 141m away from seal haul-outs (Baker, Sayer and Allen, 2026). Analysis of the risk of impacts that cause seal disturbance events found that distance of the boat from the seals had a statistically significant impact on the likelihood of seal disturbance events ($p < 0.001$). Of the recorded disturbance events, 88.3% were level 1, 5.1% were level 2, and 6.6% were level 3 (Baker, Sayer and Allen, 2026). Dans et al. (2017) recommends avoiding contact and managing vessel disturbance, as boat approaches may disrupt haul-out patterns, underscoring the need for strict guidelines and operator compliance. (Curtin, Richards and Westcott, 2009) found that voluntary codes of conduct in South Devon did reduce levels of disturbance to grey seals, with tour guides causing less disturbance events than private vessel owners who are less aware of wildlife guidance.

Responses also depend heavily on vessel behaviour. The WiSe Scheme recommends certain behaviours that vessels near marine animals should follow, such as not approaching animals straight on, and not changing speed quickly. In the West Cornwall surveys, analysis found that boat behaviour had a statistically significant impact on the likelihood of seal disturbance events ($p = 0.025$) (Baker, Sayer and Allen, 2026).

Vessels that stop to look at wildlife may have greater impacts than vessels that carry on. For example, in Washington State harbour seals were observed to flush when powerboats stopped within 371m, yet were unaffected by boats simply passing by, even at 39m (Johnson and Acevedo-Gutiérrez, 2007).

Tourist activities can vary throughout the year, and activities that target specific events such as pupping may have different impacts. Female South American sea lions in non-breeding sites showed a larger disturbance response to tourist vessel activities than those in breeding sites (Pavez et al., 2015). It is thought that, as they do not have pups, they are not constrained to land and are free to flee (Muñoz et al., 2014).

As discussed in **Sections 5.1** and **6.1**, motorised and non-motorised vessels can impact the water column through suspended sediment and elevated noise levels that impact seals ability to forage and manoeuvre.

Tourist vessels are frequently reported to disturb both grey and harbour seals, and distance maintained from haulouts is a determining factor in the potential for disturbance. The efficacy of voluntary codes of conduct for tourist vessels is varied, potentially depending on the exact guidelines suggested and each particular area.

MMO conclude that wildlife watching from the sea (commercial) for grey seals and harbour seals is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of visual disturbance, above water noise, and underwater noise, and collision above water with static or moving objects not naturally found in the marine environment caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

7.2 Summary of the effects of wildlife watching from the sea (commercial) on otters

As discussed in Section 5.2 and Section 6.2, non-powered vessels were found to have lower impacts on Eurasian otters and other otters species than motorised vessels.

Barrett et al. (2025), conducted a five-year study across three different ecotourism locations in California, USA, studying how southern sea otter behaviour varies in response to the occurrence and proximity to disturbance stimuli such as kayaks or personal boats. One of the key observations that emerged from the study was that when small watercraft remained over 29m away, the likelihood of disturbing the otters was less than 10% (Barrett et al., 2025). Similarly, unpowered vessels in lakes with managed ecotourism giant otters showed no avoidance to unpowered research vessels, and reduced defensive behaviour compared to unprotected lakes (Barocas et al., 2022).

In an investigation on the impacts of recreation on North American sea otters, kayaks caused disturbance events that resulted in short term behavioural changes such as alerts and flushing from the area (Benham, 2006). However, less than 25% of these approaches by kayaks caused any change in otter behaviour, possibly due to the habituation of otters to disturbance events in areas with high levels of recreational activity (Benham, 2006).

In areas with high levels of recreational activity otters may have become more tolerant to disturbance than otters in less disturbed areas (Benham, 2006). Non-motorised watercraft can get closer to otters in shallow waters than boats and may approach otters more frequently.

While Eurasian otters in coastal areas can show modified patterns for hunting according to the tides (Section 3), the generally nocturnal activity patterns would impact the ability of wildlife watchers to witness otters during daylight hours of peak to tourist activity. Specific tours for spotting otters may have greater impacts than general tours for all marine wildlife.

mNLA can exert both direct (for example vessel wake) and indirect (for example underwater noise) pressures that significantly alter the physical and acoustic

properties of the water column, thereby influencing the behaviour of otters. Non-motorised watercraft are capable of generating a wake that produce hydrodynamic forces which can penetrate the water column, resuspending sediments and disrupting thermal stratification (Riesgraf et al., 2025). In contrast, no or negligible impacts were evaluated for waves and currents or turbidity in the water column by non-motorised recreation in a report by De Wachter and Volckaert (2005). This lack of consensus shows the difficulty in quantifying impacts to the water column. De Wachter and Volckaert (2005) found soft water recreation (without motors) to have no noise impacts to the water column at a low intensity, but found that it could have an impact beyond a high intensity threshold.

Both powered and unpowered vessels can cause disturbance to Eurasian otters during wildlife watching and other recreational activities. Management measures in tourist areas may reduce disturbed behaviour.

MMO conclude that wildlife watching from the sea (commercial) for Eurasian otters is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of visual disturbance, above water noise, and underwater noise, and collision above water with static or moving objects not naturally found in the marine environment; caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

8 Hovercraft

This section brings together and analyses the available evidence on how hovercraft affect grey seals, harbour seals and otters.

Natural England's Advice on Operations was used to identify potential pressures from hovercraft and inform the understanding of feature sensitivity to the pressure. Where a sensitivity assessment has not been undertaken or the evidence base is insufficient to assess sensitivity, the activity-pressure-feature combination has also been included in the list below to capture all possible evidence that may impact the feature. **Marine Non-Licensable Activity Impacts Evidence: Methodology**¹ details the process of how MMO judgement refined pressures for assessment.

High risk pressures associated with this activity with the potential to impact grey and harbour seals are:

- above water noise;
- underwater noise change; and
- visual disturbance.

High risk pressures associated with this activity with the potential to impact Eurasian otters are:

- above water noise; and
- underwater noise change.

High risk pressures associated with this activity have been identified using Natural England conservation advice package (**Annex 1: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#)**) and MMO judgement. These high-risk pressures have been included in this review as they have been determined to be pressures commonly induced by non-motorised watercraft and sailing at a level that has the potential to cause significant impacts on the features.

The following pressures were identified as low risk and are therefore not included in this document.

- hydrocarbon and PAH contamination;
- introduction of light;
- INIS;
- litter;
- synthetic compound contamination; and
- transition elements and organo-metal contamination.

Low risk pressures associated with this activity have been identified using Natural England conservation advice package (**Annex 1: mNLA pressures on [sensitive features - grey seals, harbour seals and Eurasian otters](#)**) and MMO judgement.

Should site level factors increase the risk of these pressures, these would be considered in an individual site assessment.

8.1 Summary of the effects of hovercraft on seals

Noise from anthropogenic activities has been shown to have both physical and behavioural effects on marine mammals (Wilson, 2014). With the increasing number of recreational and commercial vessels, especially in coastal and tourist-heavy regions, above-water noise (like engine sounds and human activity) is becoming more prevalent. Hovercraft are not limited to use over water and can therefore get closer to seals hauled out on soft sediment habitats such as sandbanks, alerting seals and disturbing crucial resting time.

Seals at haul-out sites can be exposed to airborne noise from hovercraft, which may affect both their behaviour and hearing. Using the appropriate M-weighting (a filter to adjust underwater sounds to reflect the sensitivity of different marine mammal functional hearing groups) for phocids in air (PCA), guidance indicates that temporary hearing effects may occur around 134dB Sound Exposure Level (SEL), and permanent auditory injury may occur from approximately 154dB SEL (National Marine Fisheries Service, 2024).

According to the National Marine Fisheries Service (2025), pinnipeds may experience behavioural harassment when exposed to airborne noise above 90dB RMS for phocid seals.

The Hovercraft Club of Great Britain limits craft noise to 87dB measured at a distance of 25m from the hovercraft, and new development in manufacturing can reduce above water noise from the craft to the range of 74 to 78dB, which is similar to the noise of power boats (Natural England, 2017).

The noise generated by hovercraft may have the potential to disturb seals hauled out at coastal sites. However, there is no published evidence indicating that hovercraft noise levels typically reach the thresholds required to cause permanent auditory injury in pinnipeds. While hovercraft noise is likely to fall below these injury thresholds, it may still exceed the behavioural disturbance threshold of around 100dB, especially during close approaches or repeated exposure. Therefore, while auditory injury is unlikely, behavioural disturbance remains a valid concern, particularly in sensitive haul-out areas.

Underwater anthropogenic noise has increased significantly over the past few decades partially due to the continuous growth in the number of ships used for logistical tasks (Smith and Rigby, 2022). The measured and estimated maximum levels of underwater noise of hovercraft are considerably lower than noises from conventional vessels (Vedenev et al., 2024).

mNLA can exert both direct (for example vessel wake) and indirect (for example underwater noise) pressures that significantly alter the physical and acoustic

properties of the water column, thereby influencing the behaviour of seals. Motorised and non-motorised watercraft are capable of generating a wake that produce hydrodynamic forces which can penetrate the water column, resuspending sediments and disrupting thermal stratification (Riesgraf et al., 2025), which suggests that hovercraft may have the same effects.

Field studies demonstrate that propeller wash and wake turbulence can reach depths of 2 to 3m, increasing turbidity and reducing visibility for foraging (Riesgraf et al., 2025). Seals rely on both acoustic cues and their highly sensitive vibrissae (whiskers) to detect prey movement, and noise masking can interfere with this integrated sensory system (Riesgraf et al., 2025). When foraging in shallow estuarine waters, sediment plumes and elevated noise levels can reduce their ability to locate prey, leading to lower capture success and forcing individuals to expend additional energy searching for food (Kastelein et al., 2023).

Repeated boat passages can disrupt thermal layering and oxygen distribution in stratified systems, particularly in lakes and sheltered estuaries (Nylund et al., 2023). Such changes may indirectly affect seals and otters by altering fish behaviour and distribution. Increased mixing can displace benthic prey species and reduce the predictability of foraging grounds, increasing energetic costs for top predators (Nylund et al., 2023).

In contrast, a report by De Wachter and Volckaert (2005) evaluated motorised recreation to have no or negligible impacts on waves and currents or turbidity in the water column. This lack of consensus shows the difficulty in quantifying impacts to the water column. Hard water recreation (with motors) was evaluated to have no visual disturbance impacts at a low intensity, but may have an impact beyond a high intensity threshold (Wachter and Volckaert, 2016). Motorised recreation was evaluated to have a small noise impact to the water column (Wachter and Volckaert, 2016), which suggests that hovercraft may have the same effects.

While underwater noise caused by hovercraft may not reach the same levels as other powered vessels, based on the potential for hovercraft to produce above water noise and disturbance to the water column, there is still a disturbance risk to grey and harbour seals.

MMO conclude that hovercraft around grey seals and harbour seals is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of above water noise caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

8.2 Summary of the effects of hovercraft on otters

As discussed in **Section 8.1**, hovercraft can be manufactured to reduce the noise produced in-air to a range similar to those of powerboats (Natural England, 2017). **Section 8.1** also describes how the impacts of motorised vessels (**Section 5**) may be similar to the impacts of hovercraft due to the creation of above water noise, underwater noise, and vessel wake or air thrust. These impacts on otters includes impaired prey detection and foraging efficiency, increasing energetic costs for predation.

While underwater noise caused by hovercraft may not reach the same levels as other powered vessels, based on the potential for hovercraft to produce above water noise and disturb the water column, there is still a disturbance risk to Eurasian otters.

MMO conclude that hovercraft around Eurasian otters is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of above water noise caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

9 Diving and snorkelling

This section brings together and analyses the available evidence on how diving and snorkelling activities affect grey seal, harbour seals and Eurasian otters.

Natural England's Advice on Operations was used to identify potential pressures from diving and snorkelling and inform the understanding of feature sensitivity to the pressure. Where a sensitivity assessment has not been undertaken or the evidence base is insufficient to assess sensitivity, the activity-pressure-feature combination has also been included in the list below to capture all possible evidence that may impact the feature. **Marine Non-Licensable Activity Impacts Evidence:**

Methodology¹ details the process of how MMO judgement refined pressures for assessment.

High risk pressures associated with this activity with the potential to impact grey seals and harbour seals are:

- above water noise;
- underwater noise change; and
- visual disturbance.

High risk pressures associated with this activity with the potential to impact Eurasian otters are:

- above water noise; and
- underwater noise change.

High risk pressures associated with this activity have been identified using Natural England conservation advice package (**Annex 1: mNLA pressures on sensitive features - grey seals, harbour seals and Eurasian otters**) and MMO judgement. These high risk pressures have been included in this review as they have been determined to be pressures commonly induced by non-motorised watercraft and sailing at a level that has the potential to cause significant impacts on the features.

The following pressures were identified as low risk and are therefore not included in this document:

- collision below water with static or moving objects not naturally found in the marine environment;
- hydrocarbon and PAH contamination;
- introduction of light;
- INIS;
- litter;
- synthetic compound contamination; and
- transition elements and organo-metal contamination.

Low risk pressures associated with this activity have been identified using Natural England conservation advice package (**Annex 1: mNLA pressures on sensitive features - grey seals, harbour seals and Eurasian otters**) and MMO judgement. Should site level factors increase the risk of these pressures, these would be considered in an individual site assessment.

9.1 Summary of the effects of diving and snorkelling on seals

There is limited literature on the impact of diving and snorkelling on grey and harbour seals. Therefore, the conclusions made are based on the inclusion of other marine mammal species as proxies.

In a study of grey seal interactions with swimmers off Heligoland, Germany, risky behaviours occurred towards humans during 73% of the surveyed swims. This included initiating contact, grabbing with their mouths, and scratching with their fore flippers (Scheer, 2020). The seals also showed non-risky alerting behaviours. This change in seal behaviours around humans shows disturbance. The seals did not always react to swimmers in the water, and spent approximately the same amount of time interacting with swimmers (53%) as they did ignoring them (47%) (Scheer, 2020).

Cowling et al. (2014) examined the sustainability of seal-swimming tourism with New Zealand fur seals (*Arctophoca australis forsteri*) in the Bay of Plenty. Across 16 swim events, seals were mostly neutral (54%), occasionally interactive (41%), and only rarely avoidant of humans (5%). Interactions peaked in December during the pupping season, when juveniles spend more time in the water. Adults interacted less with swimmers than juveniles. Tour operators demonstrated high compliance with regulations, minimising vessel disturbance (Cowling et al., 2014). These findings suggest swimming with seals has minimal injurious impact on the animals, though vessel activity may pose disturbance pressure, highlighting the need for strict operator compliance.

Dans, Crespo and Coscarella (2017) studied underwater interactions between swimmers and South American sea lions (*Otaria flavescens*) at Punta Loma, Argentina. Sea lions mainly swam around or looked at swimmers, but physical contact often led to biting, posing a safety risk despite no serious injuries (Dans, Crespo and Coscarella, 2017). These behaviours varied by season and were linked to the animals either approaching or avoiding swimmers rather than habituation. Most sea lion interactions were juveniles. The authors stress that sea lions do not habituate to humans and that long-term effects are uncertain. However, in other species, such as Cape fur seals, it is thought that higher neutrality in seal responses may be a consequence of higher levels of habituation (Heide, 2020).

Management of human behaviour when in the water has the potential to reduce seal disturbance. Boren et al. (2008) found that the presence of guides during commercial swims reduced the number of avoidance responses among New Zealand fur seals

as the commercial swim guides managed any inappropriate swimmer behaviours, such as chasing or touching seals. This would also reduce the risk of seals injuring humans.

Australian fur seals were found to increase haul-out events in response to swimmers (Stafford-Bell, Scarr and Scarpaci, 2012). Other marine mammals show can also show habituation habits to swimmers approaching, such as bottlenose dolphins (*Tursiops truncatus*) increasing avoidance to humans in the water (Constantine, 2001).

Seals react more to larger groups of swimmers, than small or lone swimmers (Boren, Gemmell and Barton, 2008), suggesting that management of activities with humans in the water could potentially focus on limiting the amount of swimmers at a time.

The group size of the seals also matters. Individuals or small groups of seals may interact more frequently with swimmers, whereas large groups of seals may prefer to interact with each other as part of a social group (Cowling et al., 2014).

There is limited literature available on the impact of humans within the water column. It can be presumed that as humans are smaller and slower than vessels, the impacts will be smaller.

These studies show that while seals may often appear tolerant or neutral towards swimmers, human presence still constitutes a disturbance that can manifest in subtle behavioural shifts or risky interactions. Juveniles are particularly likely to engage in physical, sometimes unsafe, behaviours, which could be managed by seasonal restrictions. Strict management, including swims with guides that share knowledge and enforce codes of conduct, and limits on group size can minimise disturbance and improve safety for both animals and humans.

MMO conclude that diving and snorkelling around grey seals and harbour seals is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of above water noise, underwater noise, and visual disturbance caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

9.2 Summary of the effects of diving and snorkelling on otters

A study on the impacts of tourism in Alaska found that North American sea otters showed no changes in their presence and distribution when humans were in the water (Seiler, 2025). No other research on the impacts of leisure (for example swimming, rock pooling) on Eurasian otters was found. There is limited literature available on the impact of humans within the water column. It can be presumed that as humans are smaller and slower than vessels, the impacts will be smaller.

As visual disturbance is not a significant pressure for otters according to Natural England's Advice on Operations⁸, and otters are not consistently overlapping with human temporal use of the marine environment due to being dependent on tide times for hunting (**Section 3**), the paucity of available research is likely due to few observed instances of humans in the water disturbing otters. It could be concluded therefore that diving and snorkelling do not impact otters.

MMO conclude that diving and snorkelling around Eurasian otters is not likely to result in a significant risk of hindering achievement of the conservation objectives of an MPA at any level of activity. This is because the impacts of visual disturbance caused by this activity, even at high levels, are unlikely to present a significant risk of hindering achievement of MPA conservation objectives.

10 Conclusion

This document has reviewed and synthesised the available evidence on the impacts of mNLA and their pressures on grey seals, harbour seals, and Eurasian otters designated within MPAs. The review considered evidence relating to disturbance caused by non-motorised watercraft and sailing activities, motorised watercraft and motorised personal watercraft, hovercraft, diving and snorkelling, and wildlife watching from sea.

The evidence indicates that disturbance is the primary pressure through which mNLA may affect seal and otter features. The principal pressures identified include above water noise, underwater noise changes, and for seals, visual disturbance.

The available evidence demonstrates that grey seals, harbour seals, and Eurasian otters are sensitive to noise disturbance, both above and underwater. Environmental factors such as the season can vary disturbance responses, as well as possible habituation in high traffic areas.

Disturbance can result in a range of behavioural responses, including defensive behaviours and flushing. Vigilance and displacement from resting and feeding areas leads to depletion of energy, resulting in reduced breeding success which may have consequences for the overall designated population of the MPA, which may result in a significant risk of hindering achievement of the conservation objectives. However, responses are highly species-specific and context-dependent. Consequently, evidence from this review should be interpreted alongside site specific information.

The evidence base varies considerably between features and activities. The evidence base is strongest for watercraft-related disturbance and generally supports the conclusion that vessels can cause disturbance to both seals and otters. While motorised vessels cause disturbance from greater distances, non-motorised vessels create disturbances by getting closer unnoticed. Noise levels, vessel behaviour, vessel size, and distance from haulout all affect the level of disturbance. In contrast, activities such as hovercraft lack available evidence, and as a result analogous evidence has been used for interpretation of possible impacts. There is also a paucity of evidence for Eurasian otters, and a greater dependency on proxy species has been used in those sections. Consequently, the interpretations used to support assessment in such cases is precautionary, and relies on the ecology and sensitivity assessments for the features.

This review provides the evidence base to support site level assessment of activity-feature interactions and should be considered alongside information relating to feature condition, conservation objectives, activity levels, spatial overlap, natural variability and the availability of suitable habitat.

Overall, the evidence indicates that mNLA have the potential to impact grey seals, harbour seals, and Eurasian otters where activities result in direct or indirect

disturbance through proximity, frequency, or intensity of activity. Whether these impacts represent a risk of hindering the achievement of conservation objectives can only be determined through consideration of site specific circumstances.

DRAFT

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Annex 1: mNLA pressures on sensitive features - grey seals, harbour seals and Eurasian otters

This annex summarises the pressures resulting from mNLA and their potential impact on grey seals, harbour seals and Eurasian otter features.

Natural England's Conservation Advice packages provide generic information on pressures that may be exerted by all marine industries and their potential impact on designated features within the Advice on Operations (AoO) section. Natural England's AoO is an evidence-based product which can be used to guide MPA assessments, together with bespoke advice from JNCC and Natural England. This is explained further in [Natural England's conservation advice guidance](#)⁸.

The sensitivities of designated features to mNLA pressures were derived using a staged approach.

Stage 1:

Natural England's conservation advice packages (CAP), including Natural England's AoO have been used by MMO to determine the sensitivities of each feature to the potential pressures from mNLA, based on actual or representative sites to highlight subject areas for evidence gathering. This has been done by identifying the 4 MPAs that are in scope for this mNLA programme of work that contain seal and otter features and reviewing the AoO available for each site. The information from the AoO was collated (**Table A1.2 1**), with the highest sensitivity for each pressure-feature interaction being recorded (the key in shows the sensitivity categories). Natural England also provided additional guidance about pressure/feature interactions that should be considered.

Stage 2:

An evidence-gathering activity was then carried out. Evidence gathering and analysis was focussed on interactions that were deemed sensitive (**Table A1.2 1**) and high risk (highlighted in red in the AoO table), as these are likely to be the most relevant interactions to be considered at each site level assessment (**Table A1.1 1**). Interactions where there is insufficient evidence (IE) are not considered further here, but these interactions will be considered in site level assessments. In addition, site level sensitivities for each pressure-feature interaction will be used at the site level assessment stage.

All the pressures from the mNLA categories described in **Section 0** and the potential sensitivity of grey seals, harbour seals, otters and the water column are displayed in

⁸ Natural England MPA Conservation Advice - Guidance and Supporting Material: designatedsites.naturalengland.org.uk/MarineGuidance.aspx#advice (last accessed 14 September 2026).

Table A1. 2. This summarises all the interactions according to the key in **Table A1.1**. The pressures listed in **Table A1. 2** are defined in within Natural England's AoOs.

Table A1.1 1: Interaction sensitivity key for mNLA and designated features/supporting habitats.

Key	
S	Indicates the feature is sensitive
IE	Indicates there is insufficient evidence to make sensitivity conclusions, or a sensitivity assessment has not been made for this feature to this pressure
NS	Indicates feature is not sensitive to pressure
NR	Indicates the pressure is not relevant for the activity. There is no interaction between the pressure and species and/or no association between the activity and the pressure

Table A1.2 1: Summary of the sensitivities of designated features to potential pressures from mNLA.

Pressure	Feature			Supporting habitat
	Harbour seal (<i>Phoca vitulina</i>)	Grey seal (<i>Halichoerus grypus</i>)	Eurasian otter (<i>Lutra lutra</i>)	Water column
Above water noise	S	S	IE	NR
Collision BELOW water with static or moving objects not naturally found in the marine environment	S	S	IE	NR
Introduction of light	IE	IE	IE	NS
Introduction or spread of invasive non-indigenous species	IE	IE	IE	S
Litter	S	S	NS	S
Underwater noise changes	S	S	IE	S
Visual disturbance	S	S	NS	S