Natural England Evidence Information Note EIN028

# Marine recreation evidence briefing: non-motorised watercraft including paddlesports


**This briefing note provides evidence of the impacts and potential management options for marine and coastal recreational activities in Marine Protected Areas (MPAs). This note is an output from a study commissioned by Natural England and the Marine Management Organisation to collate and update the evidence base on the significance of impacts from recreational activities. The significance of any impact on the Conservation Objectives for an MPA will depend on a range of site specific factors. This note is intended to provide an overview of the evidence base and is complementary to Natural England's *Conservation Advice* and *Advice on Operations* which should be referred to when assessing potential impacts. This note relates to non-motorised watercraft including paddlesports. Other notes are available for other recreational activities, for details see *Further information* below.**

**First edition 27 November 2017**

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NATURAL ENGLAND

# Non-motorised watercraft including paddlesports

## Definition

Non-motorised watercraft is a generic term which includes both small sailing boats (without a motor) and also paddlesports. Small sailing boats include dinghies, day boats or other small keelboats which area usually taken out of water at end of use.

Paddlesports is a term for a range of watersports which involve the use of a paddle for propulsion. This includes sea kayaking, surf kayaking, sit-on-top kayaking, Canadian canoeing and stand up paddle boarding (SUP).

## Distribution of activity

Most small sail boat activity occurs in relatively sheltered areas. Vessels are launched from slipways or sheltered beaches using a trailer or trollies. Activity is centred around sailing clubs, activity centres, harbours and marinas.

Paddlesports are generally undertaken close inshore (typically within 1-2 km of the coast). Watercraft that are used for paddling activities have a shallow draught. This allows access to shallow areas of the coast (which are often inaccessible to larger vessels or humans on foot). The focuses of these activities is generally centred around beaches and exploring interesting coastal features such as rock formations (sea caves, arches, cliffs etc), inlets, estuaries and wildlife. Kayaks are also increasingly used as a platform for recreational fishing. Safety issues and a lack of interesting features prevent paddling further offshore. However, open crossings between two points such as a headland and an island more than 2 km offshore are undertaken by more experienced paddlers (particularly sea kayakers).

Non-motorised watercraft activity has the potential to be undertaken along much of the UK coast and is only constrained by the availability of suitable launching spots (eg public slipways). While non-motorised watercraft activity is undertaken widely along the UK coast, popular areas in England include the South East, South and South West Coasts.

## Levels of activity

Non-motorised watercraft activities is undertaken year round although participation is much higher during the warmer summer months. In 2015, 418,000 people participated in small sail boat activity, 1,408,000 people participated in kayaking/canoeing and 210,000 in SUP (Arkenford, 2015). SUP is rapidly growing in popularity across the UK (British Canoeing website). Dinghy cruising is also a big growth area (Emma Barton, RYA, pers. comm. 20.01.17)

## Pressures

This note summarises the evidence on the pressures and impacts of the activity related to launching watercraft/accessing the areas where the activity occurs and through participating in the activity in the marine environment.

The direct pressures considered to arise from each functional aspect of the activity are shown in Table 1 and the potential biological receptor groups affected by the pressures are shown in Table 2. The

information presented on pressures associated with the activity builds upon, and is complementary to, Natural England's Conservation Advice and Advice on Operations which should be referred to for MPA specific information and sensitivities of specific MPA features to those pressures[1].

### The main pressure-receptor impact pathways arising from this activity are considered to be:

- Abrasion of intertidal and shallow subtidal habitats (surface of substratum) from trampling during launch/recovery of non-motorised watercraft.
- Visual disturbance of fish (sensitive features such as basking shark) related to the presence of watercraft during the activity.
- Above water noise disturbance of hauled out seals and birds related to people noise during launch or activity (where relatively large groups of participants).
- Visual disturbance of marine mammals and birds related to the presence of people and watercraft.

For some of the activities considered in this Information Note (eg canoeing, kayaking, paddleboarding), any surface abrasion/disturbance to intertidal and shallow subtidal habitats arising from participants entering the sea with their equipment has been considered to be negligible (expert judgement). This is based on participants generally carrying their equipment into the sea if there is no slipway and any contact of the equipment with the seabed in the intertidal or shallow subtidal (eg if dragging the equipment into or out of the sea) being minimal in terms of weight, duration and frequency. Abrasion pressure arising from these participants walking across the shore and into the seas has also been considered to be negligible, for example, compared to the larger numbers of people undertaking general leisure activities at a beach (see *General beach life* note).

However, small dinghies may be carried or dragged across the beach, or larger/heavier dinghies launched using a trailer, either via a slipway or from the beach. Where watercraft are launched from established slipways, any abrasion pressure is likely to be negligible (expert judgement; see also UK CEED, 2000). Where dinghies are launched from the beach, it has been considered that abrasion/disturbance of intertidal or shallow subtidal habitats may arise from trampling and/or the equipment used.

Underwater noise associated with non-motorised watercraft (such as turbulence created through the craft or paddle slicing through the water) will be below natural ambient levels caused by hydrodynamic processes such as tidal or wave movement. Hence, this pressure is considered to be negligible and not considered further. Similarly, most above water noise changes caused by the activity (such the movement of a paddle through the water) will be barely audible against background sources such as wind. However, groups of people undertaking these activities could create noise sources (such as people shouting) which could elicit a disturbance response in species, hence this pressure has been included.

**For Tables 1 & 2 see page 15**

[1] https://www.gov.uk/government/collections/conservation-advice-packages-for-marine-protected-areas

# Impacts

Where an impact pathway has been identified between the pressures arising from the activity and a biological receptor group, a summary of the evidence of impacts has been presented below. Most literature relates to either kayaks or canoes rather than other types of non-motorised watercraft such as dinghies or SUPs.

## Intertidal and shallow subtidal habitats

### Surface abrasion/disturbance – from launch of small watercraft from beach

In general, damage may accrue through trampling and/or erosion (eg use of trailers/vehicle) at access points (UK CEED. 2000). However, where craft are launched from established slipways and launch points, it is unlikely that significant additional impacts will occur from the launching itself.

No specific evidence was found relating to the effects of launching non-motorised watercraft off beaches. However, in general it is considered that this pressure would only occur on sandy/sediment beaches (as opposed to soft sediment habitats or rocky habitats for safety reasons and to prevent damage to watercraft). ABPmer (2013) assessed fine sand and muddy sand as being not sensitive to trampling by foot (low confidence), while Tillin *et al* (2010) assessed intertidal sand and muddy sand as having low sensitivity to surface abrasion.

## Fish

### Visual disturbance

In general, fish species are generally not considered sensitive to visual disturbance. Basking sharks are the only species of fish in UK waters with the potential to be disturbed through the presence of recreational surface activities such as non-motorised watercraft. This is because the foraging and courtship behaviour of this species occur at the surface in UK waters (particularly South West England, the Isle of Man and Hebrides) seasonally in the spring and summer (Sims, 2008).

Specific research on the impacts of non-motorised watercraft on basking sharks is limited. It is generally accepted that the stationary viewing of basking sharks in watercraft is unlikely to elicit a disturbance response. However, intentionally paddling very close to a basking shark (particularly at angles which block the path of a shark) could cause a startle response (often involving the shark thrashing the tail or diving) (The Shark Trust, 2007; Kelly *et al*., 2004). The effects will be most severe for repeated disturbance events which could cause a temporary displacement and a disruption in foraging activity.

Large aggregations of sharks (particularly those involved in courtship) are considered particularly vulnerable (The Shark Trust, 2007).

## Marine mammals

### Above water noise changes and visual disturbance

It is very difficult to separate out the relative contribution of noise and visual stimuli in causing a disturbance response in marine mammals due to non-motorised watercraft and the available literature generally makes no distinction. Therefore, these pressures are reviewed collectively.

Cetaceans (whales and dolphins) have been observed showing behavioural responses to the presence of kayaks and other non-motorised craft. Given that cetaceans are highly mobile and can travel at much

faster speeds than people undertaking the activity, changes in behaviour typically involve short term, minor responses. This includes altering travel direction or speed and shifting from feeding or resting behaviour to travelling (Williams *et al.,* 2013; Lusseau, 2006; Lusseau, 2003). For example, monitoring of bottlenose dolphins in Cardigan Bay, Wales found that 57 % of observations of kayaks resulted in dolphins moving away to avoid this type of craft (Gregory and Rowden, 2001). Occasional disturbance stimuli caused by non-motorised watercraft is unlikely to cause long-term impacts although persistent disturbance, particularly within critical habitat has the potential to cause longer term effects.

Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Hoover-Miller *et al*., 2013; Wilson, 2014). The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source.

Non-motorised watercraft have been found to cause a strong visual disturbance stimulus to hauled out seals (Wilson, 2014). Individuals have been recorded flushing into the water as a result of kayaks at distances of up to 150 m although most responses have been found to be less than 50-100 m (Johnson and Acevedo-Gutiérrez, 2007; Suryan and Harvey, 1999; Henry and Hammill, 2001).

Although motorised vessels can affect seal behaviour at greater distances than smaller vessels, the engine noise of motorised vessels provides warning of the vessel's presence. In contrast, non-powered watercraft are able to quietly approach resting seals and elicit a more sudden, panicked response (Hoover-Miller *et al.,* 2013). This is because kayaks tend to travel near shore and approach seals closer than motorised vessels and may have a more predator-like appearance to seals (such as orcas or sharks) (Wilson, 2014, Gunvalson, 2011). In this respect, several studies have found visitors in kayaks and canoes to cause higher levels of disturbance than those in powerboats (Hoover-Miller *et al*., 2013; Henry and Hammill, 2001; Fox, 2008). For example, both Lelli and Harris (2001) and Suryan and Harvey (1999) both found that 55% of paddled craft caused flushing into the water compared with only approximately 10% of motor boats approaching common seals.

## Birds

### Above water noise changes and visual disturbance

It is very difficult to separate out the relative contribution of noise and visual stimuli in causing a disturbance response in birds due to non-motorised watercraft and the available literature generally makes no distinction. Therefore, these pressures are reviewed collectively.

In general, regular and defined human movements are less disturbing than erratic and random movements to waterbirds (Smit & Visser, 1993). In this respect, non-motorised watercraft often produce unpredictable, but relatively high intensity visual disturbance stimuli caused by a quiet approach (which can delay the development of early warning cues and responses). Once finally alerted any response is therefore usually abrupt and dispersive. The distance at which birds typically initiate a flight response and flush from an area as a result of paddling activities is typically < 40 m (Avocet Research Associates, 2004; Glover, 2004; Chatwin, 2013).

Research has found that a single kayak could approach closer than a motorboat without disturbing seabirds (a 12% probability of agitation to birds at 30 m compared with 24% for motorboats). However, kayakers generally travel in groups and seabirds are likely to perceive a group of kayakers as a larger

threat than a single kayak and might become agitated at greater distances (Chatwin, 2013). Another study found that due to the ability to approach closely to high-tide roosts, kayaks and small sailing boats recorded a higher disturbance frequency than motorboats or windsurfers (Koepff and Dietrich, 1986). Other research found that canoes flushed birds at distances less than walkers (means of 32.9 m compared with 47.5 m, respectively) (Glover *et al*., 2015).

The level of response will vary depending on a range of factors including the frequency of disturbance and the level of habituation as a result of existing activity (IECS, 2009). Some disturbance effects may have more direct negative impacts (loss or failure of eggs or chicks leading to decreased breeding productivity) to birds than others (temporary displacement from feeding or roosting areas leading to increased but non-lethal energetic expenditure).

Repetitive disturbance events can result in possible long-term effects such as loss of weight, condition and a reduction in reproductive success, leading to population impacts (Durell *et al.,* 2005; Gill, 2007; Goss-Custard *et al*., 2006; Belanger and Bedard, 1990).

## Assessment of significance of activity-pressure

The following assessment uses the evidence base summarised above, combined with generic information about the likely overlap of the activity with designated features and the sensitivity range of the receptor groups, to provide an indication of the likelihood of:

i) an observable/measurable effect on the feature group; and

ii) significant impact on Conservation Objectives based on the effect on the feature group.

The assessment of significance of impacts has been based on the potential risk to the achievement of the conservation objectives for the features for which a site has been designated. The assessment is made using expert judgement and is designed to help identify those activities that are likely to be of greatest or least concern, and, where possible, suggest at what point impacts may need further investigation to determine potential management requirements within MPAs to reduce the risk of an adverse effect on the integrity of the site. Note, the assessment only considers the impact pathways considered in the evidence section (pressures which were considered negligible in Tables 1 and 2 are not considered in this assessment).

The outputs are shown in Table 3. The relative ratings of likelihood of significant impact on Conservation Objectives (COs) are defined as:

- Low – possible observable/measurable effect on the feature group but unlikely to compromise COs.
- Medium – observable/measurable effect on the feature group that potentially could compromise COs.
- High – observable/measurable effect on the feature group that almost certainly would compromise COs.

The relative risk ratings are based on the activity occurring without any management options, which would be considered current good practice, being applied. The influence that such management may have on the risk rating is discussed in the *Management options* section below.

It must be noted that the above assessment only provides a generic indication of the likelihood of significant impacts, as site-specific factors, such as the frequency and intensity of the activity, will greatly influence this likelihood. As such, further investigation of the risk to achieving COs will need to be done on a site specific basis, considering the following key site-specific factors:

- The spatial extent of overlap between the activity/pressure and the feature, including whether this is highly localised or widespread.
- The frequency of disturbance eg rare, intermittent, constant etc.
- The severity/intensity of disturbance.
- The sensitivity of specific features (rather than the receptor groups assessed in Table 3) to pressure, and whether the disturbance occurs when the feature may be most sensitive to the pressure (eg when feeding, breeding etc).
- The level of habituation of the feature to the pressure. And
- Any cumulative and in-combination effects of different recreational activities.

**For Table 3 see page 16**

## Management options

Potential management options for marine recreational activities (note, not specific to non-motorised watercraft and paddlesport activity), include:

### On-site access management, for example:

- designated areas for particular activities (voluntary agreements or underpinned by byelaws);
- provision of designated access points eg slipways, in locations likely to be away from nature conservation access (voluntary or permit condition or underpinned by byelaw).

### Education and communication with the public and site users, for example:

- signs, interpretation and leaflets;
- voluntary codes of conduct and good practice guidance;
- wardening;
- provision of off-site education/information to local clubs/training centres and/or residents.

### Legal enforcement of, for example:

- byelaws which can be created by a range of bodies including regulators, Local Authorities and landowners (collectively referred to as Relevant Authorities); and
- permitting or licence conditions.

Specific examples of management measures which have been applied to non-motorised watercraft and paddlesport activities are described further in a Management Toolkit which can be accessed from **Marine evidence > Marine recreational activities** and include:

- codes of conduct;
- voluntary zonation – for example, exclusion zones, specified activity zones and defined landing areas;
- signage; and
- permit systems – for example, managing access to slipways, often supported by byelaws.

Based on expert judgement, it is considered that where management measures, which would be considered current good practice, are applied to non-motorised watercraft activities, adhered to and enforced, the likely risk of significant impact on a site's Conservation Objectives would be **Low** in relation to all activity/pressure impact pathways.

For further information and recommendations regarding management measures, good practice messaging dissemination and uptake, refer to the accompanying project report which can be accessed from **Marine evidence > Marine recreational activities**.

## National governing body and good practice messages for non-motorised watercraft activities including paddlesports

### National Governing Body

The Royal Yachting Association (RYA) is the National Governing Body for all forms of boating, including dinghy and yacht racing, motor and sail cruising, rigid inflatable boats and sports boats, powerboat racing, windsurfing, canal and river boat cruising, and personal watercraft.

The RYA works closely with The Green Blue, an environmental charity part funded by the RYA and British Marine (the membership organisation for the leisure, superyacht and small commercial marine industry), which produces good practice guidance and environmental education, including in relation to wildlife and disturbance for marine recreational boat users. Good practice resources relating to abrasion, noise and visual disturbance produced by The Green Blue are:

- The Green Wildlife Guide for Boaters: a guidance document which educates participants regarding what disturbance is, what may cause it, signs of disturbance and what to do/not to do in certain situations. The guidance also includes signposting to information about legislation and reporting wildlife sightings. **http://thegreenblue.org.uk/~/media/TheGreenBlue/Files-and-Documents/Leaflets/The-Green-Wildlife-Guide-for-Boaters.ashx?la=en** .
- A guide to Writing a Green Wildlife Guide for Boaters: an accompanying leaflet with guidance on how to produce local guidance that is specific to the local audience and area. **http://thegreenblue.org.uk/~/media/TheGreenBlue/Files-and-Documents/Leaflets/Writing-a-Green-Wildlife-Guide-for-Boaters.ashx?la=en** .

There are a number of other national level Codes of Conduct relating specifically to the activity of wildlife watching (Scottish Natural Heritage and the WiSe Scheme) and these are summarised in the *Wildlife watching* note.

British Canoeing is the National Governing Body for all paddlesports (canoeing, kayaking, stand up paddleboarding, dragon boating). However, there are 3 other bodies which represent Stand Up Paddleboarders: the commercial coach education group, the racing group and the association of surf-life

saving. British Canoeing have a guidance document '*You, your canoe and the marine environment'*, which was developed in collaboration with the RSPB. Includes principles for 'caring for the environment' as well as information on wildlife (birds, seals, cetaceans, habitats) and how to avoid the transfer of non-native species. This guidance document is available here: **https://www.britishcanoeing.org.uk/guidance-resources/waterways-environment/environmental-good-practice/**.

### Good practice messaging

The guidance documents above promote conduct to minimise all of the main pressures arising from non-motorised watercraft and paddlesports. Key messages from the Green Blue guidance document to minimise impacts include (note the guidance does not distinguish between motorised and non-motorised craft. All relevant key messages left in for completeness):

**Abrasion/disturbance of habitats:**

- use designated launch and landing spots;
- keep a depth of water under the boat;
- keep wake to a minimum.

**Noise (airborne primarily) and visual disturbance:**

- for wildlife over 100 m away in the water, stay on course at a steady speed, but be prepared to slow down and let it move out of the vessel path;
- for wildlife less than 100 m away in the water, stay on course and slow down, but be prepared to stop to avoid collision;
- stay at least 50m away from wildlife on cliffs and rocks and consider slowing to a speed that reduces noise;
- do not chase, change course, steer directly towards animals, overcrowd, box them in, split or steer through a group;
- do not follow marine animals that appear alongside your vessel; and
- if observing animals at distance that minimises disturbance, spend no more than 15 minutes observing quietly; leave immediately if you notice any sign of distress.

### Key messages from the British Canoe and RSPB document to minimise impacts include:

**Abrasion/disturbance of habitats:**

- keep to designated paths or launching points where possible;
- don't damage plants and other habitats that animals depend upon;
- float your canoe for launching and lift out when landing so as not to cause damage along natural banks/beaches.

**Noise (airborne) and visual disturbance - general:**

- paddle at a safe distance from wildlife, keeping noise and sudden movements to a minimum;
- never surround animals and don't block them in from their escape route;
- look then move on.

**Noise (airborne) and visual disturbance – birds (key points, some text summarised):**

- stay a safe distance from cliffs with nesting birds during the breeding season (ideally at least 50 m);
- be vigilant for nests on the ground and move out of any breeding area as soon as you realise you are in or close to it;
- avoid panicking seabirds on the water into flight;
- keep a low paddle angle where possible;
- avoid high tide roosts of shorebirds and feeding concentrations of waterbirds on estuaries.

**Noise (airborne) and visual disturbance - seals:**

- never land on a beach where seals are hauled out or are with their pups;
- always observe their reaction to your presence;
- back away and remain still, avoiding eye contact if seals repeatedly look at you in an alert way and move towards the water's edge;
- maintain a slow, steady, predictable rhythm as you paddle past seals;
- leave the seal with an obvious escape route, do no harass them and exercise caution if they approach you in the water.

**Noise (airborne) and visual disturbance - cetaceans:**

- always approach at an oblique angle;
- move steadily and predictably, do not get too close, especially to dolphins with young; avoid coming between individuals,
- never chase after cetaceans; and
- do not swim with, feed or touch dolphins.

## Further information

Further information about the National Governing Body for non-motorised watercraft and paddlesports, good practice messaging resources, site specific conservation advice and management of marine recreational activities can be found through the following links:

- The Royal Yachting Association: **http://www.rya.org.uk/pages/home.aspx**
- The Green Blue: **http://thegreenblue.org.uk/**
- British Canoeing: **https://www.britishcanoeing.org.uk/**
- conservation advice - advice on operations
- for site specific information, please refer to Natural England's conservation advice for each English MPA which can be found on the designated sites system **https://designatedsites.naturalengland.org.uk/** this includes advice on operations which identifies pressures associated with the most commonly occurring marine activities, and provides a broad scale assessment of the sensitivity of the designated features of the site to these pressures.

- for further species specific sensitivity information a database of disturbance distances for birds (Kent et al, 2016) is available here: **http://www.fwspubs.org/doi/abs/10.3996/082015-JFWM-078?code=ufws-site**
- some marine species are protected by EU and UK wildlife legislation from intentional or deliberate disturbance. For more information on the potential requirement for a wildlife licence: **https://www.gov.uk/guidance/understand-marine-wildlife-licences-and-report-an-incident**
- the Management Toolkit which can be accessed from **Marine evidence > Marine recreational activities**.

Notes for other marine recreational activities which can be accessed from **Marine evidence > Marine recreational activities** and include the following activities:

- boardsports with a sail (windsurfing and kitesurfing)
- boardsports without a sail (surfing)
- coasteering
- diving and snorkelling
- drones (recreational use at the coast)
- general beach leisure
- hovercraft
- motorised and non-motorised land vehicles
- motorised watercraft
- light aircraft
- personal watercraft
- wildlife watching

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ISBN 978-1-78354-458-5



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## References

ABPMER (2013). Tools for Appropriate Assessment of Fishing and Aquaculture Activities in Marine and Coastal Natura 2000 Sites. Report II: *Intertidal and subtidal sand*. Report for the Marine Institute, Ireland. October 2013.

ARKENFORD (2015). *Watersports Participation Survey* 2015.

AVOCET RESEARCH ASSOCIATES. (2004). Aquatic park, Berkeley, California: *Waterbird population and disturbance response study.*

BELANGER, L. & BEDARD, J., (1990). Energetic cost of man-induced disturbance to staging snow geese. *Journal of Wildlife Management, 54, 36-41*.

CHATWIN, T.A., JOY, R., BURGER, A.E. 2013. Set-back distances to protect nesting and roosting seabirds off Vancouver Island from boat disturbance. *Waterbirds,* 36(1): 43-52.

DURELL, S.E.A. LE V. DIT, STILLMAN, R.A., TRIPLET, P., AULERT, C., BIO, D.O. DIT, BOUCHET, A., DUHAMEL, S., MAYOT, S. & GOSS-CUSTARD, J.D. (2005). Modelling the efficacy of proposed mitigation areas for shorebirds: a case study on the Seine estuary, France. *Biol. Conserv*. 123:67–77.

GILL, J. A. (2007). Approaches to measuring the effects of human disturbance on birds. *Ibis,* 149(s1), 9-14.

GOSS-CUSTARD, J. D., TRIPLET, P., SUEUR, F., & WEST, A. D. (2006). Critical thresholds of disturbance by people and raptors in foraging wading birds. *Biological Conservation,* 127(1), 88-97.

IECS (2009). *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Institute of Estuarine and Coastal Studies Report* to Humber INCA.

FOX, KS. (2008). *Harbor seal behavioural response to boaters at Bair Island refuge.* Master's theses, paper 3591, San Jose State University

GLOVER, H. K., GUAY, P. J., & WESTON, M. A.,(2015). Up the creek with a paddle; avian flight distances from canoes versus walkers. *Wetlands Ecology and Management*, 1-4.

GREGORY, P. R., & ROWDEN, A. A. (2001). Behaviour patterns of bottlenose dolphins (Tursiops truncatus) relative to tidal state, time-of-day, and boat traffic in Cardigan Bay, West Wales. *Aquatic Mammals, 27(2), 105-113.*

GUNVALSON, M. M. (2011*). Reducing disturbances to marine mammals by kayakers in the Monterey Bay.* MSc thesis.

HENRY E & HAMMILL MO. (2001). Impact of small boats on the haul out activity of harbour seals (Phoca vitulina) in Métis Bay, St Lawrence Estuary, Québec, Canada. *Aquatic Mammals 27(2):* 140–148.

HOOVER-MILLER, A., BISHOP, A., PREWITT, J., CONLON, S., JEZIERSKI, C., & ARMATO, P. (2013). Efficacy of voluntary mitigation in reducing harbor seal disturbance. *The Journal of Wildlife Management*.

JOHNSON, A., & ACEVEDO-GUTIÉRREZ, A., (2007). Regulation compliance by vessels and disturbance of harbour seals (Phoca vitulina). *Can. J. Zool.* 85: 290–294.

KELLY, C., GLEGG, G. A., & SPEEDIE, C. D. (2004). Management of marine wildlife disturbance. *Ocean & coastal management,* 47(1), 1-19.

KENT B. LIVEZEY, ESTEBAN FERNÁNDEZ-JURICIC, & DANIEL T. BLUMSTEIN (2016) Database of Bird Flight Initiation Distances to Assist in Estimating Effects from Human Disturbance and Delineating Buffer Areas. *Journal of Fish and Wildlife Management: June 2016*, Vol. 7, No. 1, pp. 181-191.

KOEPFF, C. & DIETRICH, K. (1986). Storungen von Kostenvogeln durchWasserfahrzeuge. *Vogelwarte* 33: 232-248

LELLI B & HARRIS DE. (2001). Human disturbances affect harbour seal haul out behaviour: can the law protect these seals from boaters? In *Viewing marine mammals in the wild*. Fisheries.noaa.gov.

LUSSEAU, D .(2003). Male and female bottlenose dolphins Tursiops spp have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. *Marine Ecology Progress Series* 257, pp. 267–274.

LUSSEAU, D., (2006). The short-term behavioral reactions of bottlenose dolphins to interactions with boats in Doubtful Sound, New Zealand. Mar. *Mammal Sci*. 22, 802–818.

ROLDÁN, S. M (2013). Water-based recreation disturbance on coastal bird populations. A canoeing/kayaking case study in Langstone Harbour, UK. MSc *Coastal and Marine Resource Management*

SIMS, D. W. (2008). Sieving a Living: A Review of the Biology, Ecology and Conservation Status of the Plankton-Feeding Basking Shark Cetorhinus Maximus. *Advances in marine biology*, 54, 171-220.

SMIT, C.J. & VISSER, J.M., (1993). Effects of disturbance on shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta area, In: *Disturbance to Waterfowl on Estuaries, August* 1993.

SURYAN RM & HARVEY JT. (1999). Variability in reactions of Pacific harbour seals, Phoca vitulina richardsi, to disturbance. Fish. *Bull*. 97: 332–339.

THE SHARK TRUST (2007). *The Basking Shark Code of Conduct.*

TILLIN H.M., HULL S.C. & TYLER-WALTERS H. (2010). Development of a sensitivity matrix (pressures-MCZ/MPA features). Report to the Department of the Environment, Food and Rural Affairs from ABPmer, Southampton and the Marine Life Information Network (MarLIN) Plymouth: *Marine Biological Association of the UK*. 145 pp. Available from: **http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=16368**

WILLIAMS, R., ASHE, E., SANDILANDS, D., LUSSEAU, D. (2011). Stimulus-dependent response to disturbance affecting the activity of killer whales. *The Scientific Committee of the International Whaling Commission. Document*: SC/63/WW5 1–27.

WILSON, S.C (2014). The impact of human disturbance at seal haul-outs. *A literature review for the Seal Conservation Society*

## Table 1 Potential direct pressures arising from non-motorised watercraft including paddlesports

| | Abrasion/disturbance of the substrate surface | Abrasion/disturbance below substrate surface | Underwater noise changes | Above water noise changes | Visual disturbance |
|---|---|---|---|---|---|
| **Access** to sea (on foot, equipment carried) | Negligible | X | Negligible | ✓[2] | ✓[3] |
| **Launch/recovery (**on foot, equipment on small trailer) | ✓[1] | X | Negligible | ✓[2] | ✓[3] |
| **Activity** (in sea) | X | X | Negligible | ✓[2] | ✓[3] |

X - No Impact Pathway

1 – Pressure relates to abrasion/disturbance of intertidal and shallow subtidal surface through launch of watercraft (dinghy) from beach (dragged or via trailer)

2 – Pressure relates to air-borne noise created by people and/or vehicles during launch/recovery of vessel and from engine operation and the vessel moving through waves (craft striking waves or 'hull slap') during the activity

3 - Pressure relates to the presence of person and equipment during activity

## Table 2 Biological receptors potentially affected by the pressures arising from non-motorised watercraft including paddlesports

| | Abrasion/disturbance of the substrate surface | Abrasion/disturbance below substrate surface | Underwater noise changes | Above water noise changes | Visual disturbance |
|---|---|---|---|---|---|
| **Intertidal Habitats** | ✓ | Impact pathways scoped out | Impact pathways scoped out | Impact pathways scoped out | Impact pathways scoped out |
| **Subtidal Habitats** | ✓ (shallow subtidal) | | | | |
| **Fish** | Impact pathways scoped out | | Negligible | | ✓ (basking sharks only) |
| **Marine Mammals** | | | | ✓ (hauled out seals) | ✓ |
| **Birds** | | | | ✓ | ✓ |

## Table 3 Assessment of indicative likelihood of significant impacts from non-motorised watercraft activity including paddlesports

| Pressure | Likely overlap between activity and feature (confidence) | Evidence of impact (confidence) | Sensitivity of feature to pressure (confidence) | Likelihood of observable/measurable effect on the feature | Likelihood of significant impact on Conservation Objectives |
|---|---|---|---|---|---|
| **Abrasion/disturbance of surface of intertidal and shallow subtidal habitats (launch of small watercraft from beach)** | **Medium –** small watercraft (e.g. dinghies) may be launched from the beach (i.e. rather than requiring an established slipway) | No direct evidence relating to launching small non-motorised watercraft via trailer/dragging<br>Evidence of general trampling impacts, the magnitude of which vary depending on the habitat, intensity and duration of trampling (i.e. impacts will be site-specific) (high) | **Not sensitive – Low**<br>Pressure considered likely to occur on sandy shores. Intertidal sand and muddy sand assessed as not sensitive to trampling (low) | **Low –** based on the relative lack of sensitivity of sandy beaches to the pressure | **Low** |
| **Visual disturbance – Fish (basking shark)** | **Low-Medium** depending on location and season (high). Likelihood of overlap highest in South West England, Isle of man and Scotland in spring and summer when foraging and courtship behaviour occurring at sea surface | Direct literature evidence of impact on feature limited. However, based on expert opinion startle responses are expected to occur due to the very close approach of a non-motorised watercraft to a basking shark. The effects are expected to be most severe for repeated disturbance events (expert judgement) | **Medium** (during sensitive periods) (low) | **Medium –** based on the potential of overlap between pressure and feature (in some locations) during periods of important feature behaviour | **Low** |
| **Above water noise changes and visual disturbance (cetaceans an seals at sea)** | **Low-Medium** depending geographical location of activity (high) | Avoidance responses to kayaks and other non-motorised watercraft recorded (high)<br>Occasional disturbance stimuli caused by non-motorised watercraft is unlikely to cause long-term impacts although persistent disturbance, has the potential to cause longer term effects (expert judgement) | **Medium–High (medium)** | **Medium–** based on high confidence in evidence base showing disturbance effects and sensitivity to pressure | **Low** |

| Pressure | Likely overlap between activity and feature (confidence) | Evidence of impact (confidence) | Sensitivity of feature to pressure (confidence) | Likelihood of observable/measurable effect on the feature | Likelihood of significant impact on Conservation Objectives |
|---|---|---|---|---|---|
| **Above water noise changes and visual disturbance – seals (hauled out only)** | **Low–High** depending on geographical location of activity i.e. if the activity is undertaken in close proximity to established seal colonies (high) | Strong visual disturbance stimulus to hauled out seals observed in non-motorised watercraft with most responses recorded occurring at distances of less than 50-100 m (high). The level of response is typically dependent on a range of factors, such as the species at risk, age, weather conditions and habituation | **High** - hauled out seals sensitive to visual disturbance (medium)<br>Evidence suggests common seals more sensitive to pressure than grey seals (high) | **Medium–** based on wide range of likely overlap between pressure and feature. Where overlap occurs, strong evidence base for impact and high feature sensitivity | **Low-Medium** |
| **Above water noise changes and visual disturbance – Birds** | **Low–High** depending on geographical location of activity (high) | Non-motorised watercraft often produce unpredictable but relatively high intensity visual disturbance stimuli caused by a quiet approach (which can delay the development of early warning cues and responses).<br>Flight responses in birds as a result of non-motorised activities typically occur at distances of less than 40 m<br>In some studies kayaks and small sailing boats recorded a higher disturbance frequency than motorboats or windsurfers (high) | **Low-High** Sensitivity will differ between species. Some species e.g. red-throated diver, curlew, are highly sensitive to disturbance; other species e.g. gulls, have high thresholds (low sensitivity) to disturbance (high)<br>Certain behavioural activities are considered more susceptible to disturbance e.g. nesting seabirds or breeding birds (expert judgement)<br>Limited evidence of sensitivity of diving seabirds to pressure | **Medium–High** based on the wide range of overlap between pressure and features and the high sensitivity of some species/behaviours | **Low-Medium** |