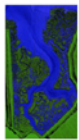


Waterbird Disturbance Mitigation Toolkit

Informing Estuarine Planning & Construction Projects



Click on the Photograph to Enter



UNIVERSITY OF Hull
Institute of Estuarine and Coastal Studies

Produced by the Institute of Estuarine &
Coastal Studies (IECS) University of Hull, 2013



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Version 3.2, March 2013
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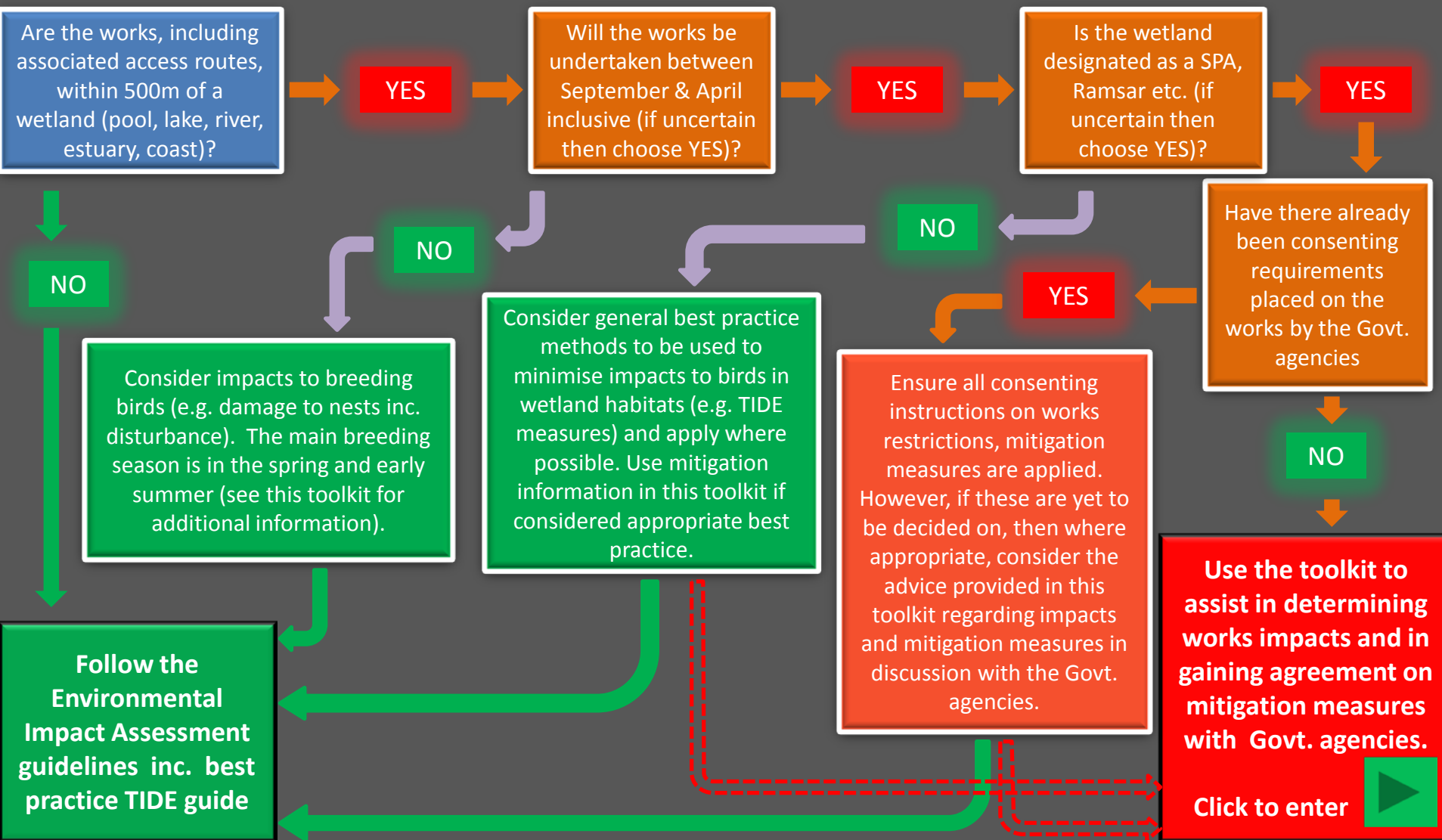


In what situation would the Waterbird Disturbance Mitigation Toolkit be of value to me?

Click Here to Enter



This flow chart describes the basic context for situations where the Waterbird Disturbance Mitigation Toolkit will be of value. It is designed for use by works planners & site managers to initially assess whether impacts to migrating and wintering waterbirds are likely to arise from a proposed project, and to identify additional information requirements to meet consenting needs. It can also be of value during operations to gauge the level of impact from works operations.



Toolkit Contents & Navigation



Click on the 'buttons' on the left to go to individual pages or use the arrows at the bottom of page to navigate sequentially (top right to get back to the first page).

Species Account colour on the 'buttons' to the left indicates the sensitivity of individual species to works disturbance (**green** less sensitive, **red** more sensitive).



	Toolkit Description & Context
	Background - Birds
	Background - Disturbance
	Noise Disturbance
	Visual Disturbance
	Disturbance Summary
	Seasonality
	References
	Species Accounts
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	Shelduck <i>Tadorna tadorna</i>
	Mallard <i>Anas platyrhynchos</i>
	Oystercatcher <i>Haematopus ostralegus</i>
	Ringed Plover <i>Charadrius hiaticula</i>
	Golden Plover <i>Pluvialis apricaria</i>
	Grey Plover <i>Pluvialis squatarola</i>
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	Knot <i>Calidris canutus</i>
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	Bar-tailed Godwit <i>Limosa lapponica</i>
	Curlew <i>Numenius arquata</i>
	Redshank <i>Tringa totanus</i>
	Turnstone <i>Arenaria interpres</i>





What is the Waterbird Disturbance Mitigation Toolkit?



This toolkit has been developed to assist flood protection managers and ports developers in relation to waterfowl disturbance impacts arising from construction works within or adjacent to Natura 2000 sites (e.g. Special Protection Areas and Ramsar Sites). In addition, it is hoped that the toolkit can be used by planners when considering development plans in estuaries and coasts with a high conservation value for waterbirds. Importantly, this tool is not designed to replace traditional methods of environmental assessment and monitoring, but to provide an initial high level guidance in the identification of possible construction:waterfowl disturbance issues and assist in the development of appropriate mitigation methods where practicable. The toolkit can be used in conjunction with the Bird Disturbance Mitigation Android App which is available from Google Play.

Disturbance can occur from both visual and aural stimuli, and whilst there is a paucity of avifaunal response data for both sources of disturbance, it is our experience that in particular, data relating to noise stimuli responses are extremely poor. Probably as a result of this poor evidence base, consenting of construction activity adjacent to wetland sites of waterbird importance appears to be particularly precautionary, and this necessarily can constrain operations in some situations (e.g. works timings).

It is therefore the aim of this toolkit to better characterise construction sourced disturbance effects to waterbirds on estuaries, and in particular, the effects of generated noise, in order to provide both works management with a clear route to determine high level disturbance issues, and consenting bodies with sufficient information to reduce the level of 'precaution' applied to the planning process. It is also hoped that the toolkit will provide information on a suite of actions for universal management and mitigation methods to be employed regardless of such work's location.



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Considerations Within the Toolkit



From disturbance response monitoring at a number of flood defence improvement sites on estuaries, as well as other construction projects and potentially 'disturbing' operations, it is our observation that noise stimuli rarely cause waterbird disturbance before associated visual stimuli have an effect. Visual disturbance, although complex at a detailed level, has however been studied (and reported) more extensively, so that response thresholds for this form of stimuli are available for a number of species and disturbing activities. Noise in its own right can, of course, have a direct impact in some situations, although as a disturbance stimuli, *noise (or sound pressure level)* is a complex parameter to characterise.

Different species of bird have different tolerance thresholds to noise disturbance (and visual disturbance) and therefore construction works and other operations impact upon different species in differing ways. Furthermore, birds are liable to habituation (e.g. they usually become more tolerant with increased exposure time to regular activities) to both aural and visual disturbance stimuli. This is of importance, as different types of noise have different likely effects, and at its most simplistic, ongoing background or regular noise is likely to be more readily assimilated by waterfowl than sudden irregular noise events at a similar decibel level. As such, 'loud' works in a generally 'loud' environment may cause little actual ongoing disturbance (as birds are already tolerant or *habituated*), whilst quieter works in a quiet environment may potentially have a greater disturbance effect in some instances.

It is therefore important to emphasise that the development context is an important consideration in assessing disturbance potential, reflecting both the existing environmental considerations, as well as the sensitivity & importance of the waterbirds in the area and the likely construction activities.



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Context of the Toolkit



This toolkit has been developed using a combination of literature review information and field observation, tailored specifically for the purpose of defining disturbance impacts to avifauna from construction-type operations on or adjacent to intertidal areas.

However, paucity of published data on the subject means that large amounts of information used within the toolkit are from direct observation of flood protection works in the UK, and as such information may require updating as further research is carried out.

The toolkit is presented as a number of pages each providing information on aspects of bird disturbance, the basic ecology and tolerances common waterbirds found in estuarine and coastal habitats and mitigation measures.

Noise tolerances for each species are presented as thresholds which should not be exceeded when measured **at the bird (receptor)**. Also included for ease of use is a chart for key bird species, providing response levels at set distances and noise thresholds, allowing an assessment to be made by managers of the likely disturbance effect based on the known location of plant in relation to main bird areas.

This is a live document and thus open to revision when more evidence becomes available through further research or externally published papers.



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Background - Birds



The toolkit provides information on disturbance effects from a range of construction works to commonly encountered waterbirds on estuaries and other wetlands (for which we have observed behavioural responses). The term *waterbird* includes species of geese, ducks and waders, with detailed information provided within this tool for 1 species of goose, 2 species of duck, and 13 species of wader. These birds make up common elements of estuarine and coastal avifauna, although there are many other species that may be encountered. On this page we will deal with basic ecology and identification of these birds. Hover over the button to get basic text on the species. Later in the tool the individual Species Account sheets have a photograph of a typical individual as well as sensitivity information and mitigation measures. Colour-coding of the buttons reflects species sensitivity.



[Bar-tailed Godwit](#)



[Dunlin](#)



[Lapwing](#)



[Ringed Plover](#)



[Black-tailed Godwit](#)



[Golden Plover](#)



[Mallard](#)



[Sanderling](#)



[Brent Goose](#)



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Types of Waterbird Disturbance Stimuli



Different types of disturbance stimuli are characterised by different avifaunal reactions. Furthermore, the level of reaction is not uniform to certain types of activity and is not always intuitive. Generic guidelines at present are precautionary for consenting requirements and employ an approach distance to 300m and a low noise threshold figure of **55dB** (possibly based on research by Wintermans in 1991 which recorded no effect of shooting on roosting waders where noise levels did not exceed 55dB e.g. a level where no effect occurred rather than a threshold where effect commenced).

A 70dB noise threshold has however been developed over a period of years, based on published data as well as findings from primary observations (e.g. Cutts & Allen, 1999; Cutts, Phelps & Burdon, 2008 and Cutts & Hemingway 2010). It is considered that the threshold works as a general rule but is relatively simplistic as it does not take into account the type of stimuli or the species of bird involved. Whilst 'rules of thumb' can be applied, development specific details required to improve predictions.

Although in many instances, the larger the visual stimuli the greater the disturbance response, counter-intuitively this is not always the case and a large plant undertaking vigorous work may cause less disturbance than a single worker walking along the floodbank, particularly if walking onto the intertidal zone. A single sudden sound will generally cause more disturbance than a constant or regular noise regardless of noise level, e.g. a dropped piece of scaffold at 65dB will cause a greater disturbance reaction than ongoing vibration piling at 80dB. Habituation to a stimuli will also usually entail a reduction in the level of reaction - this applies to both visual and noise related disturbance. An exception to this is if multiple stimuli occur at the same time e.g. walkers, works and planes. In this case an effect called facilitation may occur, where a greater reaction than expected is observed.



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General Waterbird Disturbance Levels Stimuli



Generic waterbird responses to disturbance from a range of activities including construction work have been collated and summarised by IECS over time (e.g. Cutts, Phelps & Burdon, 2008), based on a range of research papers, but in particular, those included in Davidson & Rothwell 1993. The table below is based on the collation of these data together with author observations of construction studies on the Humber Estuary and produced in Cutts & Allen, 1999.

Personnel and plant on mudflat:	High (and should be restricted at all times)
Third party on mudflat:	High (but difficult to restrict)
Personnel and plant on seaward toe and face:	High to Moderate
Intermittent plant and personnel on crest:	High to Moderate
Third party on bank:	High to Moderate
Irregular piling noise (above 70db):	High to Moderate
Long-term plant and personnel on crest:	Moderate
Regular piling noise (above 70db):	Moderate
Irregular noise (50db - 70db):	Moderate
Regular noise (50db - 70db):	Moderate to Low
Occasional movement of crane:	Moderate to Low
Noise below 50db:	Low
Long-term plant only on crest:	Low
Activity behind flood bank (inland):	Low



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Noise Disturbance Effect on Waterbirds



Noise (sound pressure level; SPL) is a complex parameter usually measured in decibels (dB), but with a range of other metrics associated with this. Points to consider in monitoring and assessing noise are:

Noise levels are described on a logarithmic rather than linear scale, so that a doubling of the decibel figure does not entail a doubling of loudness; two or more noise sources are not directly additive in loudness effect; without a distance from source figure, a noise level is not of great value, except as an indicator of response threshold (e.g. a noise of 70dB at the receptor can either originate from a source of c. 90dB around 10m away, or a noise source of 120dB if 300m distant). Threshold response figures quoted in this report are for SPL at the **receptor** (bird) unless otherwise stated.

High Noise Level Effects

Noise disturbance is typified by regular responses to stimuli with birds moving away from the works to areas which are less disturbed (within noise tolerances). Most birds will show a degree of response to noise stimuli. Birds that remain in the affected area may not forage efficiently and if there are additional pressures on the birds (cold weather, extreme heat etc.) then this may impact upon the survival of individual birds or their ability to breed. For auditory disturbance to qualify as a high level, it must constitute a sudden noise event of over 60dB (at the bird, not at source) or a more prolonged noise of over 72dB. Included at the bottom of this worksheet is a graphic, showing how noise at source relates to noise at the receptor (using standard decay formulae) and categorising this as high, moderate or low impact.

Moderate and Low Noise Level Effects are described on the next page



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Noise Disturbance Effects on Waterbirds



Moderate Noise Level Effects

Moderate noise disturbance is typified as high level noise which has occurred over long periods so that birds become habituated to it or lower level noise which causes some disturbance to birds. This encompasses occasional noise events above 55dB, regular noise 60-72dB and long-term regular noise above 72dB, where birds have become habituated. There is cross-over in moderate and high level noise thresholds although the lower band can be assumed unless the species is particularly sensitive. Those species that are particularly sensitive are Brent Goose, Curlew & Redshank. Birds that may be more sensitive than average include Shelduck & Bar-tailed Godwit (Smit & Visser, 1993).

Low Noise Level Effects

Low level noise is classed as that which is unlikely to cause response in birds using a fronting intertidal area. As such noises of less than 55dB at the bird are included in this category. These effects are likely to be masked by background inputs in all but the least disturbed areas and thus would not disturb the birds close by. Noise between 55-72dB in some highly disturbed areas e.g. industrial or urban areas and adjacent to roads, may feature a low level of disturbance provided the noise level was regular as birds will to often habituate to a constant noise level.



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Noise Disturbance effects on Waterbirds



Based on the observed responses of waterbirds (primarily Mallard and Redshank) to various noise stimuli, it has been possible to derive an overview table utilising the standard distance decay rates for noise. As such, it is possible to calculate the likely disturbance effect for a noise level and distance of receptor from source. E.g. plant generating 100dB(A) at around source will provide a likely 'acceptable' receptor dose of 70dB(A) at c. 20m distance, and a source of 90dB(A) would be below the impact threshold at c. 10m.

Metres from Source	dB(A)										
0.67	120	110	100	95	90	85	80	75	70	65	60
1.33	114	104	94	89	84	79	74	69	64	59	54
2.67	108	98	88	83	78	73	68	63	58	53	48
5.33	102	92	82	77	72	67	62	57	52	47	42
10.67	96	86	76	71	66	61	56	51	46	41	36
20.67	90	80	70	65	60	55	50	45	40	35	30
42.67	84	74	64	59	54	49	44	39	34	29	24
85.33	78	68	58	53	48	43	38	33	28	23	
170.67	72	62	52	47	42	37	32	27	22		
341.33	66	56	46	41	36	31	26	21			
682.66	60	50	40	35	30	25	20				
1365.32	54	44	34	29	24						

Acceptable 'dose' levels (e.g. to 70dB(A) are shaded green with dark green unlikely to have any affect whilst the pale green might occasionally induce a low level behavioural response such as a heads-up; yellow to orange shading is where a response is likely but mitigation may be effective in reducing the disturbance risk; pale red where mitigation is necessary and might be of value, but with a remaining risk of effect; dark red where a flight response is almost certain to occur and would be increasingly difficult to mitigate through

Simple screening etc and may require the cessation of works during high sensitivity periods. However, the level of effect will change slightly on a site per site basis due to differing ambient noise levels at a location. A useful noise calculator resource can be found at: <http://www.masenv.co.uk/noisecalculator>



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Visual Disturbance Effects on Waterbirds



As noted earlier in this tool, whilst visual disturbance effects on waterbirds have been more frequently studied, empirical information on threshold variability remains poor. However, In most instances a visual stimuli will create a disturbance effect before any associated noise starts to have an effect e.g. a flight response might be expected by many species if approached to within c. 100-150m across a mudflat, whereas for such an affect to occur through noise alone, then this would require a SPL of c. 120-130dB to be generated at source (around the threshold of pain).

High Level Visual Disturbance

This is typified by regular reactions to visual stimuli with birds moving away from the works (source) to areas which are less disturbed. Most birds will show a degree of response to stimuli. Birds that remain in the affected area may not forage efficiently and if there are additional pressures on the birds (cold weather, extreme heat etc.) then this may impact upon the survival of individual birds or their ability to breed. Visual stimuli reaches high levels of disturbance extremely easily with workers operating outside of equipment, fast movement, large plant and close proximity to the birds (especially encroachment on mudflats) contributing to this level of disturbance.

Moderate Level Visual Disturbance

Typified as either high level disturbance which has occurred over long periods so that birds become habituated to it or less intrusive works which still cause a degree of disturbance. This describes visual stimuli such as works or third parties on the flood bank. Habituation occurs less with workers on the flood bank or foreshore working outside machinery. If a worker leaves plant it usually increases the disturbance level to high. There is a cross-over in the moderate and high level thresholds, although unless a species is particularly sensitive or it is a new activity then the lower band can be assumed.



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Low Level Visual effects are described on the next page

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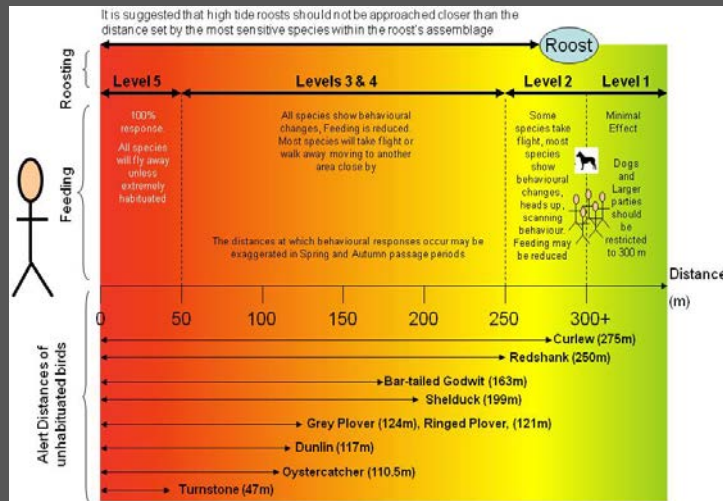
Visual Disturbance Effects on Waterbirds



Low level Visual Disturbance

This is stimuli that is unlikely to cause a response in birds using an adjacent wetland. Most works would not qualify as low-level impact unless they were out of sight of the birds and any disturbance then would be considered noise-related disturbance (there remain overflight issues for some species whereby flights to and from inland feeding and roost sites can mean that behind bank works have an effect). Long-term works inc. plant on a floodbank are also considered to be low impact. This type of work would initially qualify as moderate disturbance but with the absence of workers on the floodbank, birds would quickly become habituated. If workers were to appear alongside plant this would immediately increase the disturbance to moderate.

Click on the image below to enlarge
Taken from Cutts *et al*, 2009



To the left is a schematic summarising basic visual disturbance thresholds for general activities, key species and function. It indicates that for some species, behavioural responses during feeding may commence at around 300m distance (e.g. Curlew), whilst for others, a range of 150m to 100m is the response threshold (e.g. Dunlin). For roost sites, a generic response threshold radius of c. 300m has been derived, based around the approach distance for the most sensitive species. This because when disturbance occurs at a roost site, there is often a mass flight response or 'spook', where all species vacate an area at the first movement of an individual bird, regardless of respective species sensitivity thresholds).



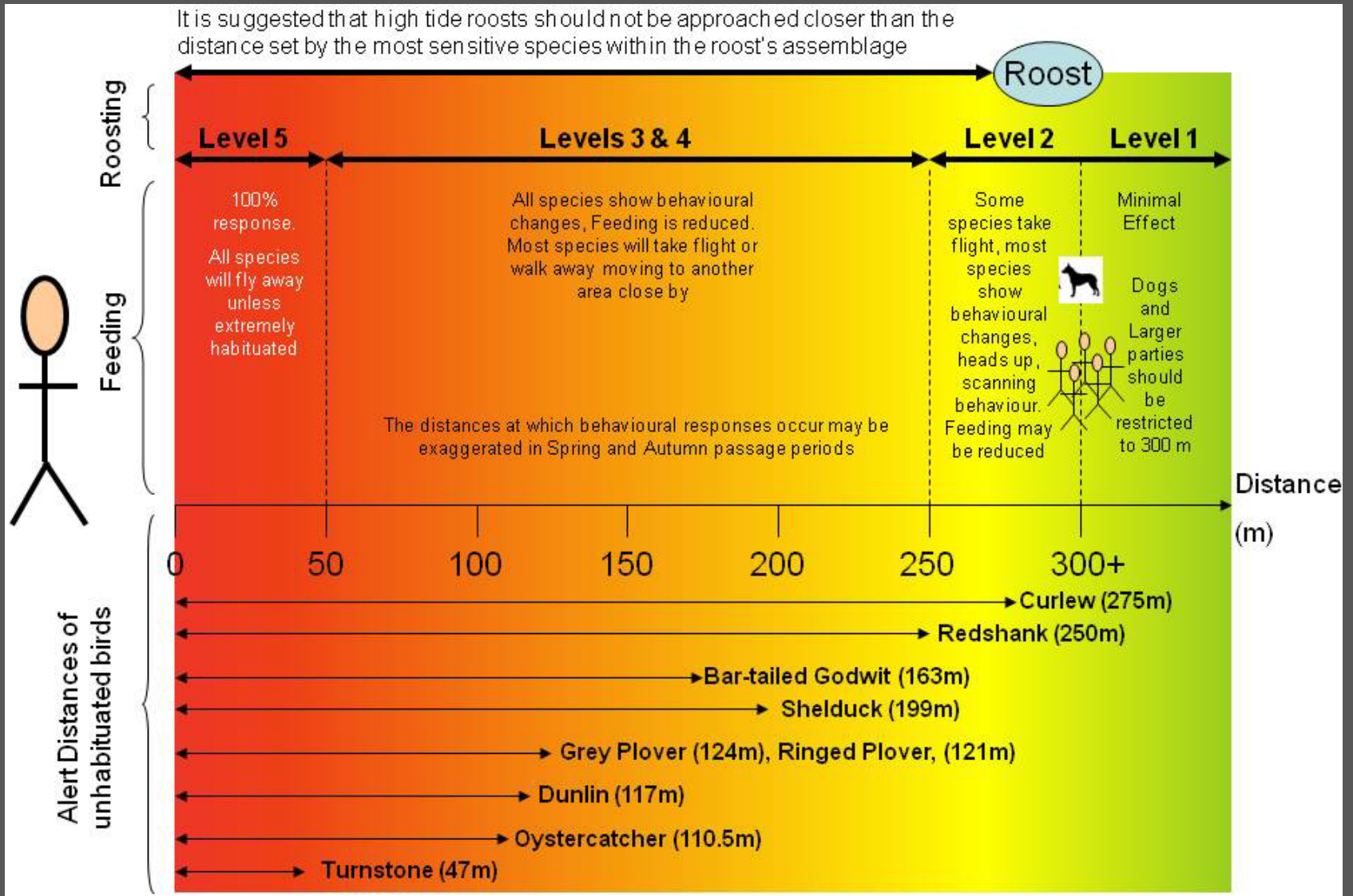
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Visual Disturbance on Waterbirds: Summary Effects



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High Level Disturbance Stimuli

- **Sudden single noise of over 60dB (at the bird)** e.g. single or initial pile impact, dropping of piles on hard surface in undisturbed environment.
- **Continuous/repetitive noise over 72dB (at the bird)** e.g. ongoing percussive or Movax vibro-piling (depending on receptor distance).
- **Close proximity of activities to birds** e.g. works or works access undertaken less than 100m from bird activity
- **Works on foreshore.** Potentially substantially greater level of impact compared to similar works on bank crest. Some habituation possible.
- **Workers operating outside of plant** e.g. single operative working on the bank may have a greater impact than an operational excavator or other plant.
- **Workers vacating plant** e.g. when an operator vacates an excavator or other plant, then disturbance levels can increase.
- **Works access** e.g. access by operators along bank crest to and from plant can have a greater disturbance effect than the plant operation.
- **Large/fast moving machinery** e.g. slow moving vehicles can have a lower impact than fast. However vehicles stopping can cause a flight response.
- **3rd parties accessing along the foreshore.** Often difficult to account for and manage, but restriction to public access can be effective mitigation.

Moderate Disturbance Stimuli

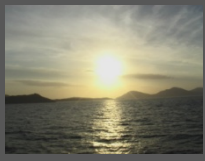
- **Sudden noises of 55-60dB (at the bird)** e.g. as above (55-60dB can be moderate or high depending on context).
- **Continuous/repetitive noises 60-72dB (at the bird)** e.g. as above.
- **High level disturbance activities that have reduced impact due to habituation.** As above, but if ongoing, habituation can occur reducing impact.
- **Slow moving/small plant.** Plant movement can cause disturbance at any speed. However vehicles coming to a halt can on occasion increase response.

Low Level Disturbance Stimuli

- **Noise of less than 55dB (at bird).** This is often below background levels in estuaries.
- **Noise of 55-72dB in a highly disturbed environment** e.g. with background ambient noise levels of >60dB.
- **Moderate level disturbances that have reduced impact due to habituation.** As above but with regular occurrence increasing habituation.
- **Works that are out of sight of birds and create a low level noise** e.g. behind bank - but overflying birds may respond and locate away from works.
- **High level works where the birds are always over 500m away (before start up).** This may be reduced to a 300m radius with habituation.
- **Moderate level works where the birds are over 300m away (before start up).** Potential for further slight range reduction with habituation (c. 250m)

It is emphasised that the above are only 'rules of thumb' and will often require additional detailed assessment on a site per site basis, reflecting a range of modifying parameters such as species assemblage detail, time of year, intertidal morphology, flood protection bank details, adjacent habitat, background activity etc. This information is designed for initial high level planning not detailed impact assessment.





Seasonality of Disturbance Sensitivity



Timing of works has the potential to reduce impact levels substantially, including the reduction in disturbance effects. However, the efficacy of timing in achieving this will depend on the species (and associated habitats) in proximity to the planned works. This toolkit primarily considers the effects of disturbance to waterbirds on estuaries, and these birds are most numerous during the autumn, winter and spring.

However, although most waterbirds will vacate estuaries during the summer, this absence is relatively short, as some species migrate through estuaries to northern breeding grounds during the late spring, with northern European estuaries generally cleared latest, whilst failed and non-breeders can move back through estuaries on return migration during late summer, with arrivals at northern sites being earliest. As such, the 'summer period' of 'no waterfowl' is effectively only very short, although in terms of numbers, September through to April inclusive features the greatest sensitivity.

Seasonal Waterbird Sensitivity Summary by Functional Group

Broad monthly sensitivity of waterbird groups in relation to construction works

Broad Functional Group	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Feeding Wildfowl	H	H	H	M	M	L	L	L	M	M	H	H
Roosting Wildfowl	H	M	M	M	L	L	L	M	H	M	H	H
Small Feeding Waders	H	M	H	H	M	0	0	M	M	H	H	H
Large Feeding Waders	H	M	H	M	L	0	0	M	H	H	H	H
Roosting Waders	H	M	L	L	L	0	0	M	H	H	H	H
General Sensitivity	H	H	H	H	M	L	L	M	H	H	H	H



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Seasonality of Disturbance Sensitivity



This disturbance toolkit concentrates on impacts to non-breeding birds. However, these too require some consideration. The breeding season can be considered to run from March to July for most species and during this time many of the species mentioned in the toolkit are absent from estuaries as they breed in the high Arctic (e.g. Turnstone & Sanderling), on upland moors (e.g. Dunlin & Golden Plover) or on wet meadows away from estuaries (e.g. Black-tailed Godwit, Curlew & Redshank). Only Oystercatcher, Shelduck and Ringed Plover breed on the foreshore and its surrounds although Curlew, Lapwing and Redshank may breed in relative proximity to estuaries.

In the UK, birds which are showing signs of breeding MUST be considered under the WCA, 1981.

In addition, differing habitats will vary in their main sensitivity periods, based around function e.g. mudflats are most important during the winter for wintering waterbirds, but reedbed and wet grassland are generally more important during the spring and summer for breeding birds (inc. passerine species). A broad characterisation of monthly sensitivities of key aquatic habitats based on all birds (including non SPA species) are given below. However, this is a high level approach and individual sites may have variations on these sensitivity weightings that should be taken into e.g. assemblage, habitat & location.

Wetland Habitat Seasonal Sensitivity Summary

Broad monthly sensitivity of wetland habitats (for birds) in relation to disturbance and damage/loss

Broad Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mudflat	H	H	H	H	M	L	L	M	H	H	H	H
Saltmarsh	H	H	L	M	M	M	M	L	M	H	H	H
Reedbed	M	L	M	H	H	H	H	M	M	L	M	M
Open Water	H	M	M	H	H	H	L	L	L	M	H	H
Wet Grassland	M	L	M	H	H	M	L	L	M	M	M	M
Scrub	L	L	M	H	H	M	L	L	L	L	M	M



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Selected References



A summary of findings from research papers is provided in Cutts & Hemingway 2012. A selection of the most useful texts of the subject are provided below:

Cayford, J., 1993. Wader disturbance: a theoretical overview. Wader Study Bulletin, 68, pp. 3-5.

Cutts, N.D., Phelps, A., & Burdon, D., 2009. Construction and waterfowl: Defining sensitivity, response, impacts and guidance. Report to Humber INCA. Institute of Estuarine & Coastal Studies, University of Hull.

Cutts, N.D., & Hemingway K.L.H., 2012. Bird disturbance from flood and coastal risk management construction activities. Report to Cascade Consulting. Institute of Estuarine & Coastal Studies, University of Hull.

Gill, J.A., Norris, K., & Sutherland, W.J., 2001. The effects of disturbance on habitat use by Black-tailed Godwits *Limosa limosa*. Journal of Applied Ecology, 38, pp. 846-856.

Goss-Custard, J.D., Triplet, P., Sueur, F., & West, A.D., 2006. Critical thresholds of disturbance by people and raptors in wading birds. Biological Conservation, 127, pp. 88-97.

Hirvonen, H., 2001. Impacts of highway construction and traffic on a wetland bird community. Proceedings of the 2001 international conference of ecology & transportation. pp.369-372.

IECS, 2007. Avifaunal disturbance assessment: flood defence works, Saltend. Report to the Environment Agency. Institute of Estuarine & Coastal Studies (IECS), University of Hull, UK.

Koolhaas, A., Dekinga, A., & Piersma, T., 1993. Disturbance of foraging Knots by aircraft in the Dutch Wadden Sea in August-October 1992. Wader Study Group Bulletin, 68, pp. 20-22.

Smit, C.J., & Visser, J.M., 1993. Effects of disturbance on shorebirds: a summary of the existing knowledge from the Dutch Wadden Sea and Delta area. Wader Study Group Bulletin, 68, pp. 6-19.

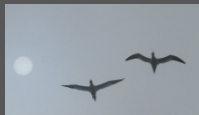
Wright, M.D., Goodman, P., & Cameron, T.C., 2010. Exploring behavioural responses of wading birds to impulsive noise. Wildfowl, 60, pp. 150-167.



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Species Accounts – Disturbance



The identification, ecology and sensitivity of the following species are addressed in detail on the following **Species Accounts** pages in taxonomic order. These species are considered to be some of those most commonly encountered on estuaries and for which disturbance sensitivity can be addressed. Navigation to each **Species Account** can be made by clicking on the links below (given in taxonomic order & coloured for individual disturbance sensitivity). International name is in brackets.

(Branta) Brent Goose

Branta bernicla

(Common) Shelduck

Tadorna tadorna

Mallard

Anas platyrhynchos

(Eurasian)
Oystercatcher

*Haematopus
ostralegus*

(Common) Ringed
Plover

Charadrius hiaticula

(Eurasian) Golden
Plover

Pluvialis apricaria

Grey Plover

Pluvialis squatarola

(Northern) Lapwing

Vanellus vanellus

(Red) Knot

Calidris canutus

Sanderling

Calidris alba

Dunlin

Calidris alpina

Black-tailed Godwit

Limosa limosa

Bar-tailed Godwit

Limosa lapponica

(Eurasian) Curlew

Numenius arquata

(Common) Redshank

Tringa totanus

(Ruddy) Turnstone

Arenaria interpres



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Brent (Brant) Goose (*Branta bernicla*)



Disturbance Potential: High Sensitivity



Brent Geese are a species highly sensitive to noise disturbance and they react in a variable manner to visual disturbance (Smit & Visser, 1993). From this study they were found to react to up to 92% of aircraft passes although this declined to 64% with habituation. Although there is an element of visual disturbance with aircraft, often the noise is the greater stimuli, especially when the aircraft fly high. The sensitivity of Brent Geese also varies depending on their activity, especially to visual disturbance. When foraging they tolerate disturbance relatively nearby with an average proximity to disturbance threshold of 105m for first reaction. When roosting or loafing the birds are far more sensitive, with the range for first reaction increasing to 205m, nearly doubling in distance the effective range. This is likely to be due to increased vigilance at roost. Further to this it has been shown that during wildfowling seasons, in areas where Brent Geese are a quarry species, the range at which they will react to potential disturbance stimuli increases further to 350m indicating a dynamic response to potential disturbance activities based around a number of parameters.

Advice & Mitigation:

Brent Geese are extremely sensitive to moderate and high level visual disturbance. If geese are within 400m of works then consideration should be given to mitigation including the commencement of works and efforts should be made to avoid high level disturbance at such time if possible.

Brent Geese are very sensitive to noise stimuli but due to their wary nature and liability to flush, the minimum approach distance can be expected to be no less than 100m. At this distance using the noise response works noise required to create high level disturbance would be 110-115dB at source and thus not particularly prohibitive. This increases to 120-125dB at 300m.

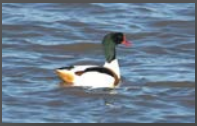
Due to their sensitivity to disturbance Brent Geese are unlikely to be found in areas with high levels of general disturbance (not works disturbance). If there are geese in a moderately or highly disturbed area expect them to be more sensitive than in an area of low level normal disturbance and try to adjust accordingly.



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Shelduck (*Tadorna tadorna*)



Disturbance Potential: **High Sensitivity**



Shelduck are generally a wary species and are highly sensitive to visual disturbance. Typically they approach construction works no closer than 300m and are affected by visual disturbance up to 500m away from source. Aural disturbance occurs from 72dB upward. However, the species is subject to a high degree of habituation and further exposure to sounds of the same or greater level can lead to no response to stimuli. No response has been recorded for noise levels as high as 88dB but this is likely to be an extreme 'no response' level and caution should be exercised at receptor levels over 70dB. Observation of disturbance responses from flood protection works has suggested that Shelduck react to noise in approximately 30% of exposure events to sudden noise above 60dB or any noise above 70dB.

Advice & Mitigation:

Shelduck are extremely sensitive to moderate and high level visual disturbance. Ducks that are closer than 500m to activity should be given consideration when commencing works and efforts should be made to avoid activities with a potential high level of disturbance at such time if possible.

Shelduck are quite sensitive to noise stimuli but due to their wary nature and liability to flush, the minimum approach distance can be expected to be no less than 150m. At this distance using the noise effects table, works noise required to create a high level of disturbance at this range would be 115-120dB at source and thus not particularly prohibitive unless undertaking pilling. This would increase to 125-130dB at 500m.

Due to their sensitivity to disturbance Shelduck are unlikely to be found in areas with high levels of general disturbance (not works disturbance). If there are ducks in a moderately or highly disturbed areas, then expect them to be more sensitive to disturbance events than in an area of low level normal disturbance and attempt to adjust works accordingly.



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Mallard (*Anas platyrhynchos*)



Disturbance Potential: **Moderate Sensitivity**



Mallard are a relatively tolerant species and will habituate rapidly to activity. In undisturbed areas Mallard will flush at moderate range (up to 500m) but in more disturbed habitats (and where they often come into human contact), such as a typical estuary, this figure is reduced to between 25-300m dependent upon the stimuli (with people causing the most extreme reaction). Stationary objects can be assumed to make lesser impacts than those that move as it has been shown that slow moving and stationary boats cause a lesser displacement of Mallard than fast moving boats. However tolerances may vary seasonally and be reduced during the wildfowling season. There is very little information on the effects of noise disturbance on Mallard but direct disturbance observation of piling recorded 2 incidents of Mallards reacting to noise (heads-up response) at levels of 69dB and 71dB although higher noise generation instances c. 80dB had no observed response to loafing and foraging birds in a moderately 'noisy' tidal freshwater site on a busy navigation. Some individual Mallard were also observed foraging around equipment pontoons whilst works were ongoing, indicating habituation.

Advice & Mitigation:

Mallard are relatively tolerant of moderate and high level visual disturbance. However, birds that are closer than 200m should be considered at the commencement of works and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

Mallard are not thought to be particularly sensitive to noise stimuli but there is little evidence for this other than through our direct observation and as such a standard approach should be employed with noise up to 72dB acceptable at the bird, but with caution above 55dB (60dB in a highly disturbed area). As Mallard will forage up to within 50m of plant, this means that a source noise threshold of 105-110dB would be applicable but with caution above 87-92dB. They are quite resilient to works but will be displaced by walkers/workers on the mudflat and possibly on the floodbank. Mallard are likely to be present in lower densities in highly disturbed areas, and those that are present are likely to be highly stressed, so if birds are closer than 200m to works, then high level disturbance should be avoided if possible, especially workers operating away from plant.



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Oystercatcher (*Haematopus ostralegus*)



Disturbance Potential: **Moderate Sensitivity**



Oystercatchers are relatively tolerant of disturbance stimuli and will habituate rapidly to ongoing activity. In undisturbed areas they will flush at great range (up to 500m) but in more disturbed locations such as a typical estuary, this figure reduces to between 25-200m dependent upon the stimuli (with people causing the most extreme reaction). Agricultural vehicles average a 60m threshold before they are seen to react (and a fair assumption would be that the figure for construction plant would be similar). Stationary people and plant can be assumed to create a lesser impact than those that are mobile, as it has been shown that bait diggers cause a lesser displacement of Oystercatchers than walkers (although again habituation may be a factor in this). There is very little information on the effects of noise disturbance on Oystercatchers, but direct observation at a highly disturbed site (ambient noise level of 60dB) saw a reaction to only 9% of events with a degree of habituation assumed. Prior to the commencement of the works, Oystercatcher were observed foraging close to the works, but once activity commenced, birds foraged at 200m+ range with occasional birds venturing to within a radius of 100m from the activity.

Advice & Mitigation:

Oystercatcher are relatively tolerant of moderate and high level visual disturbance. Birds that are closer than 200m to a potential disturbance source should be considered when commencing works and efforts should be made to avoid high level disturbance events at such a time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

Oystercatcher are not thought to be particularly sensitive to noise stimuli but there is little evidence for this, so as such a standard approach should be applied, with noise up to 72dB acceptable at the bird but with caution used at levels of above 55dB (60dB in a highly disturbed area). As Oystercatcher will forage up to within 50m of plant, this means that a source noise threshold of 105-110dB may be possible but applied with caution at levels above 87-92dB. They are quite resilient to works but will be displaced by walkers/workers on the mudflat and possibly on the floodbank. Oystercatchers are likely to be present in lower densities in highly disturbed areas and those that are present are likely to be highly stressed, so if birds are closer than 200m to works, then high level disturbance activities should be avoided if possible, especially by workers operating on the frontage, away from plant.



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Ringed Plover (*Charadrius hiaticula*)



Disturbance Potential: **Low Sensitivity; extremely tolerant with habituation**



Ringed Plover are thought to be an extremely tolerant species that habituates to anthropogenic activities rapidly. They are also tolerant of people, allowing approach as close as 30-50m before flushing when confronted with a lone walker on the mudflat. There is no published evidence with regard the Ringed Plover's reaction to noise or construction works but it is likely that again they have a high threshold to such activities given their general high tolerance. Observation of disturbance impacts suggest response to construction activity is consistent with wider disturbance tolerances reported from earlier research, with birds approaching works to within 20m on occasion. However, at distances within 50m from a disturbance source they would readily flush, only to land nearby and continue foraging almost immediately. At distances of over 100m from activity birds rarely showed any sign of disturbance and appeared often unperturbed when other species in their vicinity were reacting. Ringed Plovers were observed to not react to any noise stimuli, despite exposure to noise levels up to 88dB from aircraft flying overhead.

Advice & Mitigation:

Ringed Plover are very tolerant of moderate and high level visual disturbance. Birds that are closer than 50m to works should however, be given consideration when commencing works and efforts should be made to avoid high level disturbance at such time if possible especially, if it includes workers on the mudflat/fronting intertidal zone.

Ringed Plover would appear not to be very sensitive to noise stimuli and to habituate rapidly, especially in conjunction with visual stimuli. A noise level of up to 75dB is considered acceptable at the bird, but with caution given above 60dB levels (65dB in a highly disturbed area). They will forage extremely close to plant (<50m), and a source noise threshold of 107-112dB can be tolerated but with caution at levels above 93-98dB. If birds are primarily using an area closer than 50m to works, then it is likely that additional mitigation will be necessary. They are resilient to works activities and unlikely to be readily displaced by walkers/workers unless on close approach. Only potentially highly disturbing activities should be avoided when birds are using an area within 50m of works.



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Golden Plover (*Pluvialis apricaria*)



Disturbance Potential: **Moderate Sensitivity**; Annex 1 of the EU Birds Directive



Typically they are birds of upland in summer and agricultural land in winter. They can be present on intertidal mudflats in very large numbers during the autumn and winter, where they primarily roost (often in association with Lapwing (*Vanellus vanellus*), and can similarly use inland fields, often adjacent to estuaries as additional roost areas when mudflats are covered by the tide. As with the Lapwing, there has been very little research undertaken on the reaction and tolerance of Golden Plover to disturbance in their wintering areas, either from noise or visual stimuli, and unfortunately the species was not present during field studies at works sites during the IECS data collection process. A precautionary 'standard' approach is therefore required.

Advice & Mitigation:

Reasonably tolerant of moderate level visual disturbance, but birds that are closer than 200m to potential activities should be considered when commencing works and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on the mudflat/fronting intertidal zone. Of particular note is the potential for inland roosts, often in arable fields adjacent to estuarine/riverine locations. A similar disturbance distance threshold should be considered therefore in terms of inland usage works, although flocks will use fields adjacent to industrial plant where visual and aural stimuli can be readily habituated to.

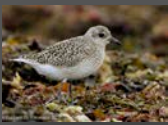
Golden Plover are moderately sensitive to noise stimuli but with little direct evidence, a precautionary approach assumes tolerance of noise up to 72dB being acceptable at the bird but with caution at levels above 55 dB (60dB in a highly disturbed area). As Golden Plover will roost to within 300m of plant this means that a source noise threshold of 120-125dB may be acceptable, but with caution above 107-112dB. If birds approach closer than 300m additional mitigation should be put in place. As the species often flies between the intertidal and adjacent terrestrial habitat to roost and feed, the presence of activity behind (landward) of flood defences can also have an influence on behaviour (even when out of sight to birds using the intertidal zone), with limited data suggesting that differential site take up occurs where works are present with flocks moving to adjacent (possibly sub-optimal) areas to roost.



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Grey Plover (*Pluvialis squatarola*)



Disturbance Potential: **Moderate Sensitivity**



Limited data suggest that Grey Plover are a relatively disturbance tolerant species, although the ability of Grey Plover to habituate to works is unknown. They are surprisingly tolerant of people, allowing approach as close as 50-100m before flushing when confronted with a lone walker on the mudflat, even when roosting. However, despite this 'tolerance', Grey Plover may abandon highly disturbed areas in favour of quieter areas to forage and roost and the threshold linkages for this or undetermined. It is also largely unclear how tolerant the Grey Plover is to noise disturbance, and unfortunately there were no Grey Plover observed near the various disturbance monitoring sites. As such, the limited evidence require a precautionary approach in setting likely response thresholds for the species to works.

Advice & Mitigation:

Grey Plover are tolerant of moderate and high level visual disturbance, however, birds that are closer than 200m to works should be considered prior to commencement of the activity, and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

Grey Plover are probably moderately sensitive to noise stimuli but due to their wary nature, the minimum approach distance can be expected to be no less than 150m. At this distance using the noise:distance table, the sound level required to create a high level disturbance impact would be 115-120dB at source and thus not particularly prohibitive and this would increase to 125-130dB at 500m from source.

Grey Plover are resilient to flushing by works but may be displaced by walkers/workers on the mudflat and possibly on the floodbank. Grey Plover are likely to be absent in highly disturbed areas and those that are present are likely to be highly stressed, so if birds are closer than 200m to works, then high level disturbance activity should be avoided if possible.



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Lapwing (*Vanellus vanellus*)



Disturbance Potential: **Moderate Sensitivity**



Typically the Lapwing is a bird of the uplands in summer and agricultural land in winter. However they do use the intertidal zone to roost (often with Golden Plover, *Pluvialis apricaria*) and can be encountered in large numbers at such sites, which are often habitually utilised. There is very little research on the reactions of Lapwing to disturbance in their wintering areas, either in response to noise or visual stimuli. Due to this paucity of information, a standard approach is considered appropriate, with additional information used, where possible, from the disturbance effects work being carried out by IECS. Unfortunately Lapwing were not encountered from the study, but a small number of records were collected from earlier work suggesting no response to visual disturbance at c. 300-400m. Previous *ad hoc* observations suggest that Lapwing do not react particularly strongly to disturbance when at roost, but information is limited and can only support a relatively conservative position on disturbance potential.

Advice & Mitigation:

Lapwing are reasonably tolerant of moderate level visual disturbance stimuli. However, birds that are closer than 300m to planned activities should be considered when commencing works and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on a mudflat. Of particular note however, is their potential for inland roosting, often in arable fields adjacent to estuarine/riverine locations. A similar disturbance distance threshold should be considered therefore in terms of inland usage and the location of works should be considered in the context of potential field usage by the species.

Lapwings are thought to be only moderately sensitive to noise stimuli but there is little evidence to support this, and so a standard 'precautionary' approach should be applied, with noise of up to 72dB acceptable at the bird but with caution given for noise levels in excess of 55dB (60dB in a highly disturbed area). As Lapwing will roost to within 200m of plant, this means that a source noise threshold of 115-120dB can be applied, but with caution above 87-92dB. If birds approach closer than 200m, then appropriate mitigation should be put in place.



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Knot (*Calidris canuta*)



Disturbance Potential: **High Sensitivity to Noise Disturbance**; **Tolerant of Visual Disturbance**



Despite a paucity of published disturbance response research data, Knot appear to be a relatively tolerant species that habituates to works rapidly. They are also surprisingly tolerant of people but despite this tolerance of visual disturbance, they are highly disturbed by overflying aircraft which combine visual stimuli with noise and a resemblance to raptors (predators). This sort of reaction may be a result of facilitation - a number of different stimuli occurring simultaneously causing a greater reaction than expected. Knot would also seem to be highly sensitive to noise disturbance, moving away from stimuli readily, and from a study on the Dee estuary it would appear that such displacement can have significant impacts on Knot at a population level. Direct observation of disturbance responses from flood works saw Knot responding in a similar way to that described from the limited existing research, with birds reacting to walkers at <75m when roosting. Birds were occasionally flushed or showed disturbed behaviour to truck movements which encompass a number of differing stimuli - noise, large size - although reactions were restricted to within 100m. Knot were seen to react to aircraft overhead at a noise level of 88dB (heads-up).

Advice & Mitigation:

Knot are tolerant of moderate and high level visual disturbance events. Birds that are closer than 100m should be considered when commencing works and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

Knot are conversely quite sensitive to noise stimuli, especially in conjunction with visual stimuli, and as such a noise of up to 70dB is acceptable at the bird but with caution required at levels above 55 dB (60dB in a highly disturbed area). As Knot will forage close to plant (<50m) and to workers (>75m), this means that a source noise threshold of 100-105dB can be applied with caution required above 87-92dB. Knot are resilient to works activity in general, but may be displaced by walkers/workers on the mudflat and possibly on the floodbank. Knot are likely to be present in lower densities in highly disturbed areas and those that are present are likely to be stressed, so if birds are closer than 75m to potential works, then disturbance should be avoided, especially by workers operating away from plant.



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Sanderling (*Calidris alba*)



Disturbance Potential: **Low Sensitivity; extremely tolerant with habituation**



Sanderling are thought to be an extremely tolerant species that rapidly habituates to anthropogenic activity. They are also tolerant of people, allowing approach as close as 6-50m before flushing when confronted with a lone walker on the mudflat. There is no published information regarding their reaction to noise or construction works, but it is likely that as with other 'tolerant' species, they have a relatively high threshold to construction work activity and associated noise. Observation of disturbance responses identified Sanderling response behaviour to be consistent with that described from existing research, with birds tolerating an approach distance of less than 20m before reacting. This was observed in a highly disturbed area, with much public use of the foreshore and thus some degree of existing habituation would be expected. Of the 88 potential disturbance events observed from the study, only 6 caused reaction, of which none were seen to be caused by the works and with walkers (and dog walkers in particular) causing the greatest reactions. There was no evidence of reactions to noise measured to 90dB from piling operations.

Advice & Mitigation:

Sanderling are tolerant of moderate and high level visual disturbance. However, birds that are closer than 50m to the works should be considered when commencing works and efforts should be made to avoid high level disturbance at such time if possible especially if it includes workers on the mudflat/fronting intertidal zone.

Sanderling are not very sensitive to noise stimuli and habituate rapidly, especially in conjunction with visual stimuli. A noise of up to 75dB is considered acceptable at the bird but with caution at levels above 60dB (65dB in a highly disturbed area). As Sanderling will forage close to plant (<100m) this means that a source noise threshold of 112-117dB could be applied for close feeding individuals, but with caution above 97-102dB. If birds are closer than 100m then mitigation should be applied, but for birds present at some distance from the works, then a tolerance to c. 120db works might be expected. Sanderling are resilient to works and are unlikely to be displaced by walkers/workers. As such, highly disturbing activities should be avoided only where birds are within 75m if possible.



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Dunlin (*Calidris alpina*)



Disturbance Potential: **Low Sensitivity**; subspecies *schinzii* Annex 1 of the EU Birds Directive



Dunlin are a relatively tolerant species that habituates to various works. They are also surprisingly tolerant of people, allowing approach as close as 50-90m before flushing when confronted with a lone walker on the mudflat. When foraging, they are often initially disturbed by activity start-up, with a flight response, but will then forage back towards the works, approaching to within 25m on occasion, before sometimes 'spooking' and moving away again, to repeat the process. Despite this general tolerance of visual disturbance they can be disturbed by overflying aircraft which combine visual stimuli with noise and have a resemblance to raptor predators. This sort of reaction may be a result of facilitation - a number of different stimuli occurring simultaneously causing a greater reaction than expected. Dunlin are moderately sensitive to noise disturbance, moving away from highly disturbing stimuli. Direct observation of disturbance events found that Dunlin exhibited a similar pattern to that identified from previous research, with birds occasionally reacting to works. Birds were occasionally flushed or showed disturbed behaviour to truck movements however, in some instances birds would forage within 20m of the works with habituation. Despite this Dunlin can be displaced from up to a 300m range by regular high level stimuli and were seen to react to aircraft overhead at a noise level at receptor of 88dB (heads-up).

Advice & Mitigation:

Dunlin are very tolerant of moderate and high level visual disturbance. Birds that are closer than 75m should be considered when commencing works and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

Dunlin are not particularly sensitive to noise stimuli and as such a noise level of 72dB measured at the bird is acceptable but with caution above 60dB. Dunlin will forage extremely closely to plant (<50m) and >75m from worker. This means that a source noise threshold of 102-107dB can be applied but with caution above 92dB. Dunlin are resilient to works but may be displaced by walkers/workers on the mudflat and possibly on the floodbank. Dunlin are likely to be present in lower densities in highly disturbed areas and those that are present are likely to be highly stressed, so if birds are regularly present closer than 75m to the potential works, then high level disturbance events should be avoided if possible, especially for workers away from plant.



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Black-tailed Godwit (*Limosa limosa*)



Disturbance Potential: **Moderate Sensitivity**



Black-tailed Godwit are an under-studied species with regard disturbance impacts, both from noise and visual sources. Gill *et al.* (2001) suggest that the species is tolerant of disturbance but little detail on how this affects birds below the population level is described. Given that it is suggested that the Black-tailed Godwit is a robust species with regard disturbance, it is suggested that a standard approach should be used until further evidence is available. No Black-tailed Godwit were observed during the recent disturbance data collection work by IECS, but from previous work on the Humber, they were observed to be tolerant of general works including Movax pilling at a range of c. 150m, and on one occasion were observed moving towards a noise source whilst tideline foraging, with a noise level at receptor (pilling) of 70dB. A flight response by a small flock was also noted at a range of c. 250m relating to crane jib operation moving a load above the skyline over the flood defences.

Advice & Mitigation:

Given the paucity of information, Black-tailed Godwit are considered tolerant of moderate visual disturbance. However, birds that are closer than 250m to activity should be considered when commencing works and efforts should be made to avoid high level disturbance at such a time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

They are considered moderately sensitive to noise stimuli and can be expected to approach works to within 100m. At this distance using noise response data, the source level required to create high level disturbance would be 110-115dB and possibly greater (based on limited observed response information) thus not particularly prohibitive. Moderate disturbance at this distance would be caused by source noise of 92dB plus, but this is considered precautionary given data deficiencies. Due to these issues, information on how close Black-tailed Godwit will forage in relation to works is uncertain, and as such, if they approach closer than 100m then caution should be exercised. They are resilient to flushing by works but may be displaced by walkers/workers on the mudflat and possibly on the floodbank. They may be absent in highly disturbed areas and those that are present are more likely to be stressed, so if birds are closer than 100m to works, then high level disturbance should be avoided if possible.



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Bar-tailed Godwit (*Limosa lapponica*)



Disturbance Potential: **Moderate Sensitivity**; Annex 1 of the EU Birds Directive



Bar-tailed Godwit are a relatively disturbance tolerant species that habituates to works rapidly. They are also surprisingly tolerant of people, allowing an approach range of as close as 40-100m before flushing when confronted with a lone walker on the mudflat. However, despite this tolerance, Bar-tailed Godwits rapidly abandon highly disturbed areas in favour of quieter areas to forage and roost. research has indicated that Bar-tailed Godwit are moderately affected by auditory stimuli, reacting to 38% of overflying planes in one study. Direct observation of disturbance responses by the species to flood defence works supported the evidence with regard reactions to visual stimuli. Only a single negative reaction, caused by a third party, was noted at a moderately disturbed site, whilst during the same study, 140 potential disturbance events were tolerated by the birds, including several aircraft passes recorded at between 69-72dB. However, despite seemingly being unaffected by the works, the species did not forage within 200m of the activity, despite foraging activity being actively pursued beyond this range, suggesting that they had actively vacated the area close to the works, this being consistent with previous research findings.

Advice & Mitigation:

Bar-tailed Godwit are tolerant of moderate and high level visual disturbance stimuli. However, birds that are closer than 200m should be considered when commencing works and efforts should be made to avoid high level disturbance events at such time if possible especially if it includes workers on the mudflat/fronting intertidal zone.

Bar-tailed Godwit are moderately sensitive to noise stimuli, but due to their wary nature the minimum approach distance can be expected to be no less than 150m. At this distance, using works noise response levels, sound levels required to create a high level disturbance would be 115-120dB at source and thus not particularly prohibitive. This increases to a 125-130dB source tolerance at a range of 500m.

Bar-tailed Godwit are resilient to flushing by works but may be displaced by walkers/workers on the mudflat and possibly on the floodbank. Bar-tailed Godwits are likely to be absent in highly disturbed areas and those that are present are likely to be highly stressed, so if birds are closer than 200m, high level disturbance stimuli should be avoided if possible.



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Curlew (*Numenius arquata*)



Disturbance Potential: **Moderate Sensitivity**



Research evidence indicates that Curlew are an extremely wary species that does not habituate to works rapidly and are also particularly intolerant of people, allowing approach to a range of 120-300m before flushing when confronted with a lone walker on the mudflat. This figure may rise to 550m in a disturbed environment when facilitation effects occur and Curlew are also highly reactive to aircraft, research showing disturbed behaviour for 42-86% of aircraft over-flights. However, from the recent programme assessing disturbance responses from flood defence works, this intolerance was not evidenced to the same degree. Observation of two moderately disturbed sites, one with highly disturbing works and one with moderately disturbing works both had Curlew foraging regularly within 100m. No reactions were observed to machinery operation or aircraft passing overhead. Earlier monitoring of impacts identified a general intolerance of the species to the presence of people on flood banks (in vehicle was OK).

Advice & Mitigation:

Curlew are considered to be wary of moderate and high level visual disturbance. Birds that are closer than 300m should be considered when commencing works and efforts should be made to avoid high level disturbance at such a time if possible, especially if it includes workers on the mudflat/fronting intertidal zone. Similarly, whilst they may tolerate vehicle movements, once a person gets out of a vehicle then flight can occur.

Curlew are moderately sensitive to noise stimuli but due to their wary nature the minimum approach distance can be expected to be no less than 100m. At this distance using the noise response table, noise required to create high level disturbance would be 107-112dB at source and thus not particularly prohibitive, and increasing to 117-122dB at 300m. If birds should approach closer than 100m, then highly disturbing activities should be avoided if possible.

If the works are in a highly disturbed area with aircraft and disturbance from the public then expect Curlew to be particularly wary and adjust accordingly. Curlew may well be displaced by the works in these areas so extra care should be shown.



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Redshank (*Tringa totanus*)



Disturbance Potential: **High Sensitivity to Noise Disturbance;** **Tolerant of Visual Disturbance**



Redshank are a relatively tolerant species that habituates to works rapidly. They are also surprisingly tolerant of people, allowing approach as close as 70-115m before flushing when confronted with a lone walker on the mudflat. Despite this tolerance of visual disturbance, they are highly disturbed by overflying aircraft which have a resemblance to raptors. They are also highly sensitive to noise disturbance, moving away from stimuli readily. Observation of works impacts on Redshank identified a broadly similar tolerance range to that of existing research, with birds reacting to workman at <75m. Redshank were seen to react to aircraft overhead at noise levels of 72dB (heads-up) and 88dB (flushed) but it is unlikely that there was a visual component to this response, as the flight altitude was high.

Advice & Mitigation:

Redshank are very tolerant of moderate and even high level visual disturbance stimuli. However, birds that are closer than 100m of works should be considered when commencing works and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

Redshank are conversely particularly sensitive to noise stimuli, especially in conjunction with visual stimuli. As such a noise of up to 70dB is acceptable at the bird but with caution above 55dB (60dB in a highly disturbed area). As Redshank will forage extremely close to plant (<50m) and >75m to workers, this means that a source noise threshold of 100-105dB should be applied, with caution above 87-92dB.

Redshank are resilient to works but may be displaced by walkers/workers on the mudflat and possibly on the floodbank. They are likely to be present in lower densities in highly disturbed areas and those that are present are likely to be highly stressed, so if birds are closer than 75m from a works source, high level disturbance should be avoided if possible, especially by workers operating away from plant.



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Turnstone (*Arenaria interpres*)



Disturbance Potential: **Low Sensitivity; extremely tolerant with habituation**



Turnstone are thought to be an extremely tolerant species that habituates rapidly. They are tolerant of people, allowing approach as close as 30-50m before flushing when confronted with a lone walker on the mudflat (and will feed closely around people on harbours etc). There is no published evidence with regard their reaction to noise or works, but it is likely that again they have a high threshold to noise and works. Direct observation of disturbance effects from works found Turnstone responses to be consistent with the expected high tolerance, with birds allowing approach to works to within 10m before reacting. This was in a highly disturbed area with much public use of the foreshore and of 127 potential disturbance events observed, only 19 caused reaction of which only 3 were caused by the works with trucks flushing Turnstones at between 15-100m. Walkers (and dog walkers in particular) caused the greatest reactions. There was no evidence of reactions to noise, which reached levels above 90dB due to piling.

Advice & Mitigation:

Turnstone are very tolerant of moderate and high level visual disturbance, although birds that are closer than 50m proximity should be considered when commencing works and efforts should be made to avoid high level disturbance at such time if possible, especially if it includes workers on the mudflat/fronting intertidal zone.

They are not very sensitive to noise stimuli and habituate rapidly, especially in conjunction with visual stimuli. A noise of up to 75dB appears acceptable at the bird, but with caution suggested for levels above 60dB (65dB in a highly disturbed area). They will forage extremely close to plant (<50m and often within 10m), which means that a source noise threshold of 107-112dB can be applied with caution possible above 93-98dB. However, high noise levels at source (c. 120db) are probably acceptable for birds foraging at distance, but if birds are regularly foraging closer than 50m, then this should be mitigated for. They are resilient to works and are unlikely to be displaced by walkers/workers. As such highly disturbing activities should be avoided if birds are within 50m if possible.



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