Otter distribution and habitat preference in Natura 2000 site Ria de Alvor

Introduction

The otter population in Portugal is considered to be one of the most stable and important ones in Europe (Trindade 1994), therefore it is intrinsic that measures are put in place to protect them. The Eurasian otter *(Lutra lutra)* is present throughout the whole of Portugal, including the rocky southwest coast (Trindade 1994). It is at the top of the food chain, therefore can be a good indicator of the health of the wetland ecosystem (Foster-Turley et al 1990). However, water pollution and habitat destruction are critical threats to otter populations (Stone & Sheean-Stone 1991). Furthermore, alteration of land use and land development for human use (Mara 2007) threatens their viability (Mason & Macdonald 1990), with intensive agriculture in particular threatening otter populations in the Algarve. As otters are particularly fastidious in their habitat selection (Stone & Sheean-Stone 1991), conservation priorities should focus on field surveys of current populations and identification of key habitats (Mason & Macdonald 1990). Following a preliminary study on the otters' distribution in the area (de Wilde 2015), this project will therefore examine habitat types and water quality in the Nature 2000 site Ria de Alvor; an area originally designated to protect, among other species, the Eurasian otter *Lutra lutra* (Figure 1).

Figure 1- Eurasian otter caught on camera trap in Abicada (Lieske de Wilde)

Aims and objectives

The main aim of this project is to establish the variety of different habitats present in Ria de Alvor which are in use by the otters, as well as looking at how different variables may be affecting their distribution. This will be met by three main objectives:-

1) Surveying current otter transects and identifying the habitats along each one
2) Testing the water quality in the main river channels throughout the site
3) Comparing results to preliminary surveys on the otters' presence in the area.

Methodology

The project took place in the Natura 2000 site Ria de Alvor which is situated in Southern Portugal in the Algarve (Figure 2), surrounding the location of A Rocha Portugal on the peninsula Quinta da Rocha (Figure 3). Using a simplified version of predefined river habitat survey methodology (Environment Agency 2003), the current otter transects as shown in Figure 4, were surveyed.

Figure 2- Location in Portugal

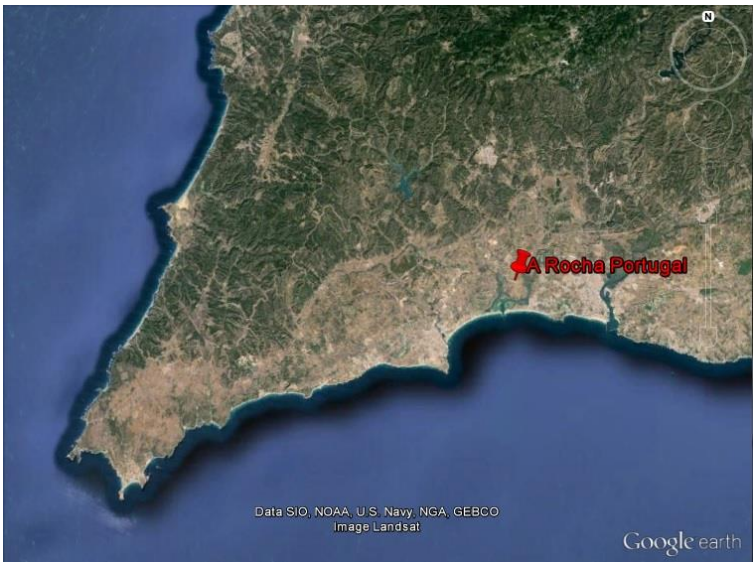

Figure 3- Location in the Western Algarve

The transects were incomplete because of problems with accessibility. This including private properties being present on Quinta da Rocha as well as areas which simply could not be reached by car or by foot. Therefore the river banks were surveyed as much as accessibility and terrain allowed, excluding Alvor dunes because of particularly high rates of disturbance from tourists. The surveys were carried out at appropriate times to avoid the heat of the day and excessively high water levels from rainfall or high tides. They were also conducted during May/June as these are the most suitable times of the year for this type of survey (Environment Agency 2003).

Furthermore, the transects were also broken up into sections to make the surveys easier to conduct. Alvor was split into two, one being north of the dam and the second, south. Abicada was also split into two with the first being the east side and the second, the west. Quinta da Rocha was split into three, one being on the northern east side, the second being east of the car park and the third being west of the car park. Meia Praia was also split into three, one in the south, the second opposite Quinta da Rocha and the third further north (Figure 4).

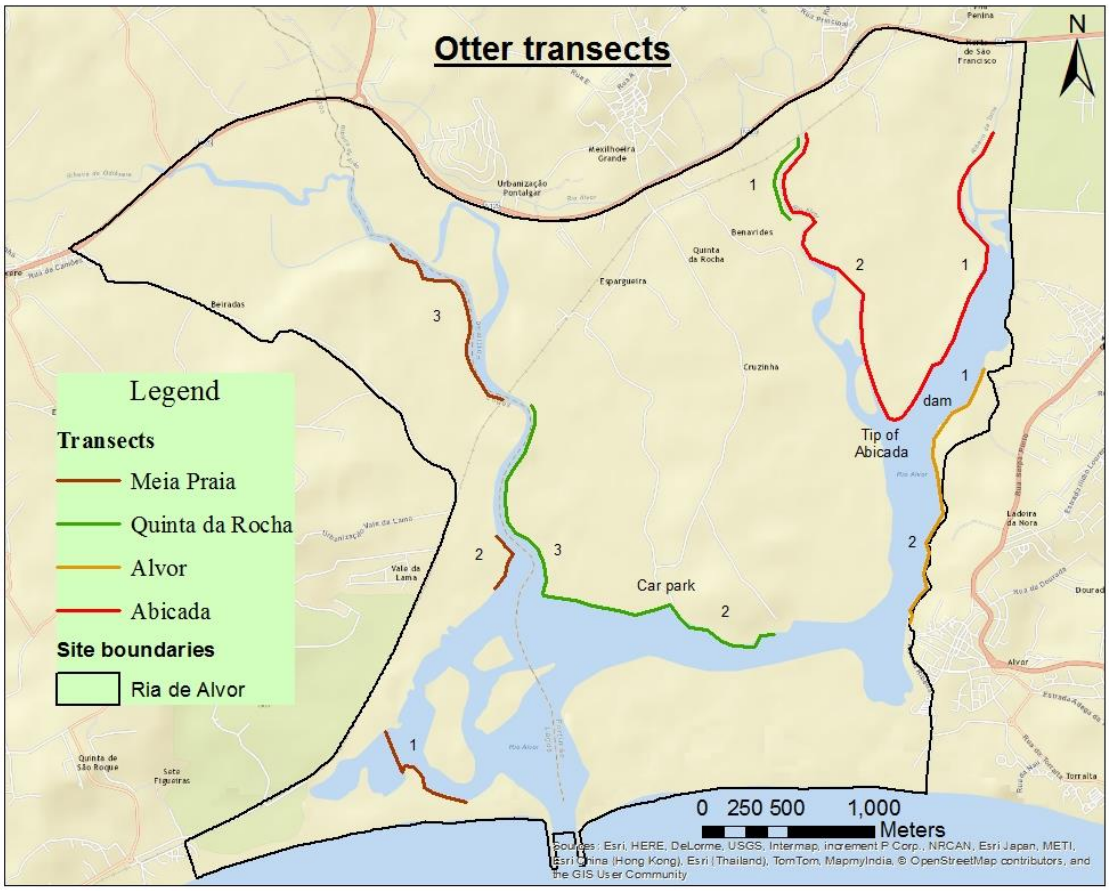

Figure 4- Otter transect sections within Ria de Alvor

For each section of the transects, a sweep up was conducted looking at dominant land use, bank profiles and associated features. Disturbance levels were also monitored by counting numbers of people, dogs, cars and boats seen. Furthermore, any otter spraints or tracks found were recorded and their location noted using a GPS.

Check points along each transect were also conducted in accordance with Environment Agency 2003 methodology. Certain adjustments were necessary because of Ria de Alvor being an estuarine site under the influence of tides, as well as the transects being longer than those in the standard methodology. They were therefore spaced approximately 250m apart to allow monitoring of any changes in habitat and aiming for at least ten check points in total for each transect as in the Environment Agency methodology. The distance was measured in paces, using the same person each time to ensure consistency, however because each transect is different in length, some had more check points than others.

At each check point, the location was recorded using a GPS. Various variables associated with the river bank, river channel, vegetation and land use were then recorded (See Appendix 1). These variables were chosen in accordance with the Environment Agency 2003 River Habitat Survey Manual. Furthermore, variables which were thought to be of importance to

the otters which weren't listed in the manual e.g. bank top vegetation percentage cover were also included in the surveys.

As well as check points along each transect, water quality will also be monitored at two different sites per transect as shown in Figure 5, ensuring the whole area is covered. The last figures of water quality are from 2013, therefore repeating the testing will ensure figures and measurements are up to date. The same general methodology will be followed to create consistency, including conducting the check points at low tide to reduce the influence of the sea.

The following variables will be measured at each water quality check point:-

- Turbidity
- pH
- Nitrate
- Nitrite
- Salinity
- Air and water temperature (Appendix 2).

All the information collected will then be used to determine the influence of water quality on the distribution of the otters.

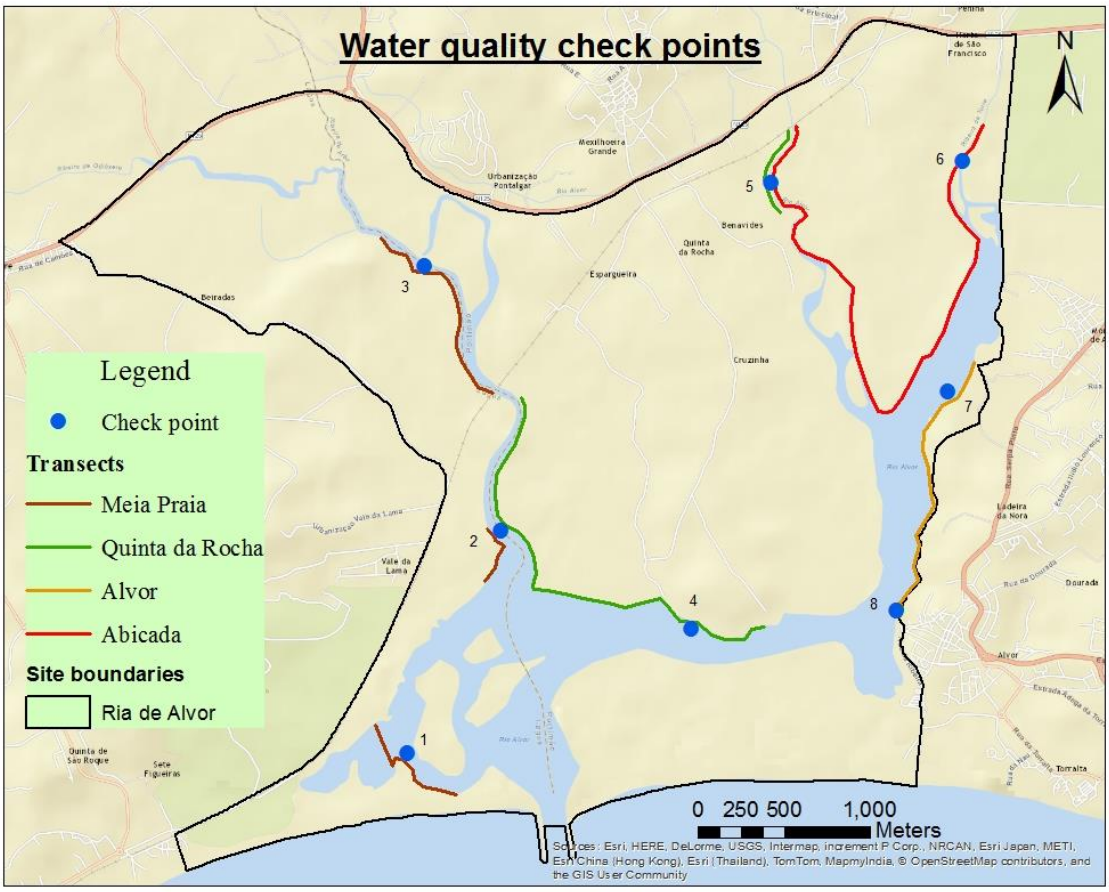

Figure 5- Water quality check points in Ria de Alvor

Once collected, all of the data collected was compared to previous preliminary surveys on the otters' distribution. Figure 6 shows all the signs of the otters' presence e.g. spraints and tracks, as documented in the preliminary study on their distribution in Ria de Alvor (de Wilde 2015) as well as other random observations made outside the surveys by members of the A Rocha team. This includes sightings from camera traps which were set predominantly in the Abicada region. Furthermore, sightings from this study of spraints and tracks were also included in Figure 6.

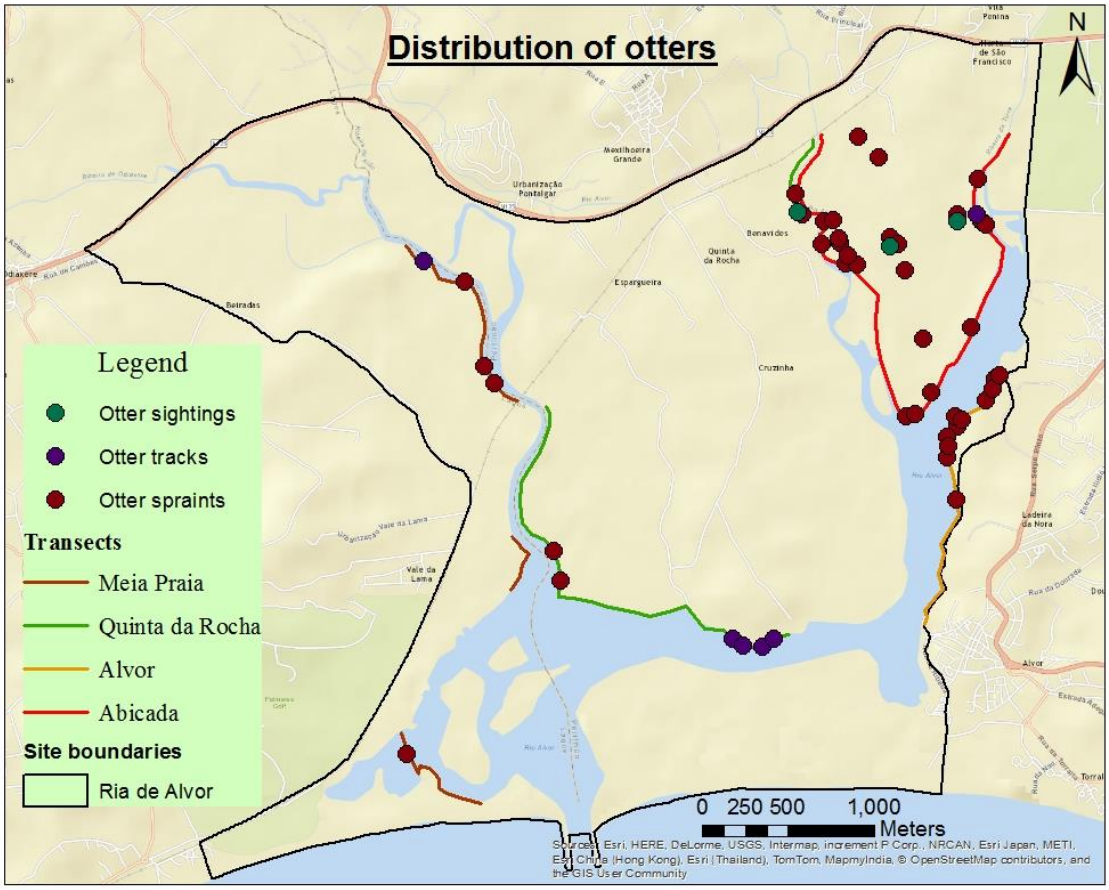

Figure 6- Distribution of otters in Ria de Alvor

Comparison of this data to the habitat data collected in this study was then conducted to assess the otters' use of the area, demonstrating how they use different habitats in the Natura 2000 site Ria de Alvor. Combined, the information can also be used to assess the influence of habitat on the otters' distribution in the area and potentially determine their preferred conditions.

Results

Sweep up

The predominant land use across all the surveys was wetland, with the exception of south part of Meia Praia which was open water and the most eastern part of the Quinta da Rocha transect which was rocky cliffs. There were trees scattered along most transects yet never being continuous, with exposed woody debris being present throughout Abidcada. Cliffs were also present both beside the lower part of the Alvor transect and the eastern section of the Quinta da Rocha transect. There were a variety of different bank profiles across the site, however the majority was noted as embankment, where the banks were comprised of manmade, artificial structures such as dykes.

The main finding from the sweep up was the correlation between levels of disturbance and the amount of evidence for the otters found (Figure 7, Table 1).

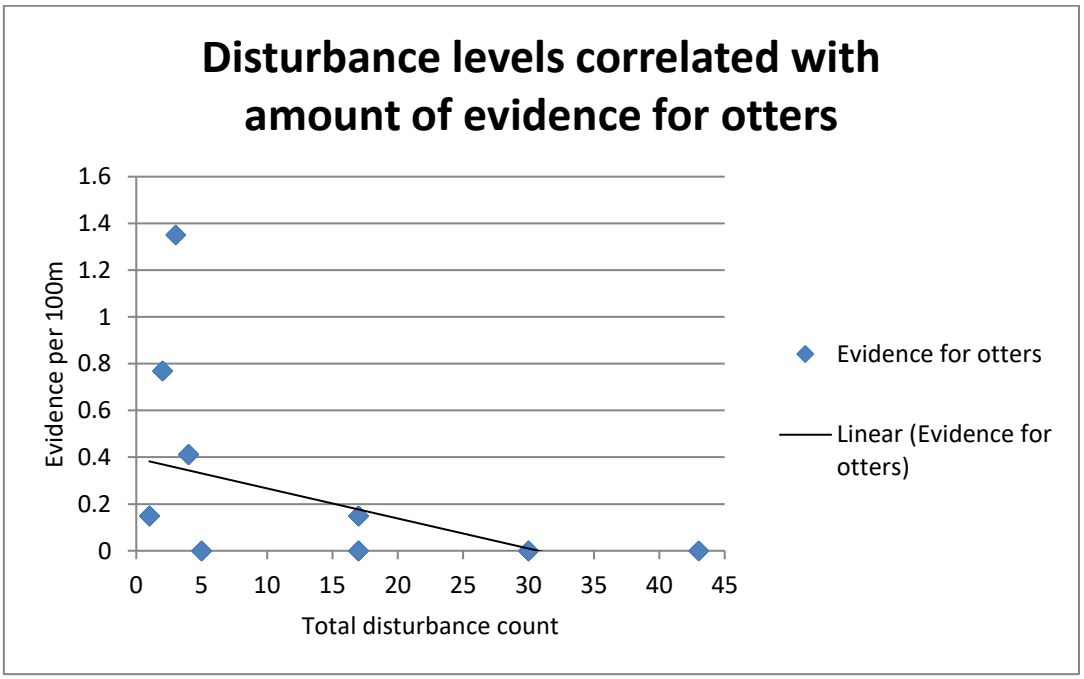

Figure 7 – Graph showing the correlation between the total disturbance count and evidence for otters (e.g. spraints, tracks) per 100 metres of each transect.

The graph shows a trend of increasing amount of evidence found with lower levels of disturbance. Disturbance was calculated as the sum of all people and other things related to human activity e.g. dogs, cars etc (Appendix 1) whilst evidence per 100 metres was the total spraints and tracks along a transect divided by its length and times by 100. It is clear when compared to Figure 6 that otter activity is lower where there is higher levels of disturbance by humans e.g. areas such the southern sections of Meia Praia and Quinta da Rocha. However in areas of low disturbance e.g. Abicada there is a much higher presence of otter activity.

Table 1- Variables measured per transect section

Transect section	Abbreviation	Total disturbance	Disturbance level	Evidence per 100m	Average vegetation cover %
Quinta da Rocha 1	QR1	2	Low	0.77	91.25
Quinta da Rocha 2	QR2	43	High	0	71.67
Quinta da Rocha 3	QR3	30	High	0	47.5
Meia Praia 1	MP1	17	Medium	0	33.75
Meia Praia 2	MP2	17	Medium	0	65
Meia Praia 3	MP3	5	Low	0	80
Alvor 1	AL1	3	Low	1.35	90
Alvor 2	AL2	17	Medium	0.15	49
Abicada 1	AB1	4	Low	0.41	67.5
Abicada 2	AB2	1	Low	0.14	74.38

Habitat assessment

Although many variables were measured along the transects, this report will focus on those particularly important to otters and their distribution, which includes bank material, land use and vegetation cover along the transects.

Figure 8 shows the land use in the surrounding area along each section of the transects.

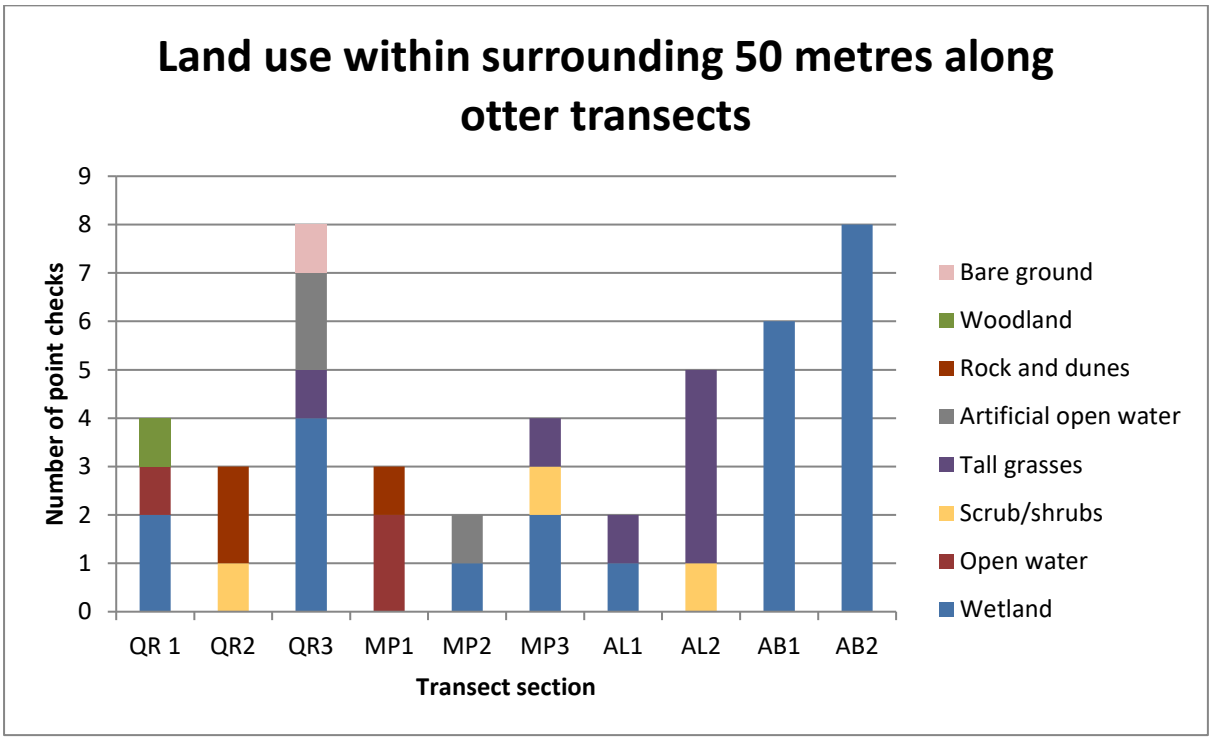

Figure 8- Differences in land use along otter transects sections in the surrounding 50 metres

The area's most common land use throughout the surveys was wetland, followed by tall grasses (Figure 8). The area where wetland is the most dominant type of land use is Abicada

where the highest levels of otter activity were also recorded (Figure 6, Table 1). Throughout Abicada, there was no other land use observed, with wetlands also comprising a substantial proportion of other transects (Figure 8).

The bank material varied across the Natura 2000 site, from earth and sand substrates to manmade substances such as concrete and modified banks, including those lined with boulders as a protective measure (Figure 9).

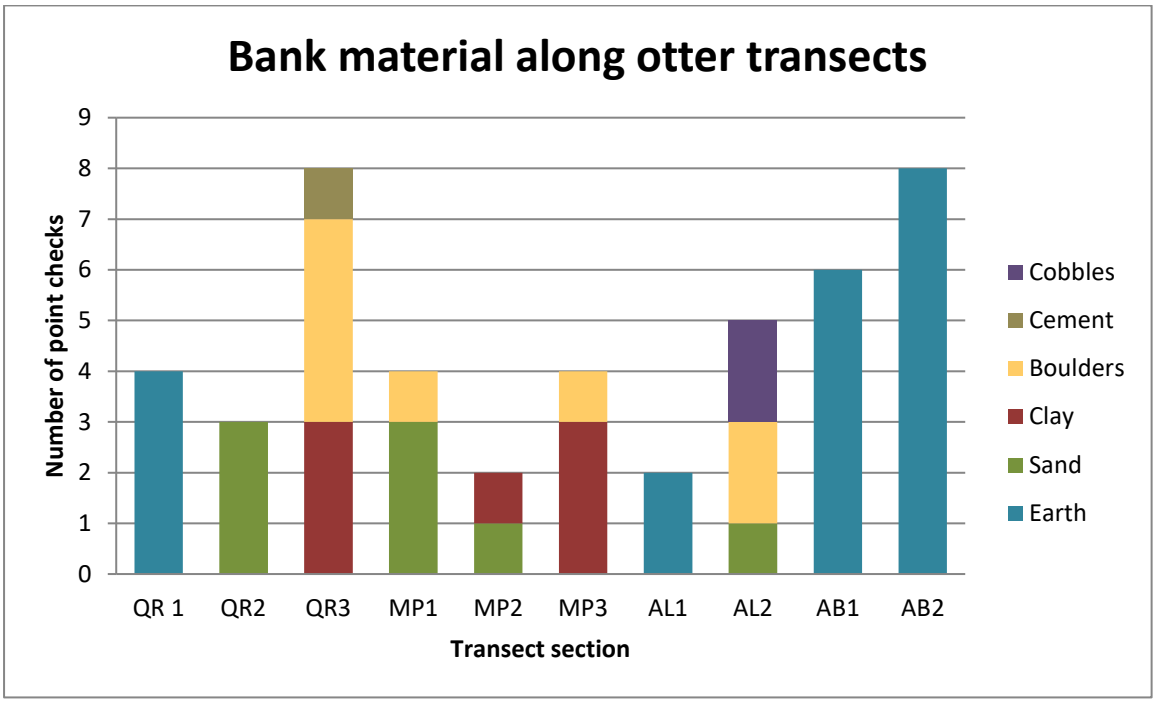

Figure 9- Differences in bank material along otter transect sections

An important observation however is that the areas where it is predicted there is the highest concentration of otter activity e.g. Abicada, the first part of the Alvor transect (AL1) and the eastern section of the Quinta da Rocha transect (QR1) are dominated by the bank material earth (Figure 9).

Earth was also the dominant bank material along the transect sections which had with dense vegetation. The two sections with the highest average vegetation cover as shown in Table 1 (90% for AL1 and 91.25% for QR1) had earth as the sole bank material recorded (Figure 9). These sections also had the highest count of otter evidence (Table 1), with the correlation between otter activity and vegetation cover shown in Figure 10. Furthermore, there is also a correlation between vegetation cover and disturbance levels from the sweep up (Figure 11) with dense vegetation occurring where there is low human disturbance (Table 1).

Vegetation type however, showed few significant findings as the whole site was dominated by scrub and shrubs. Similarly with vegetation structure, the site was dominated by uniform vegetation structure with little variations.

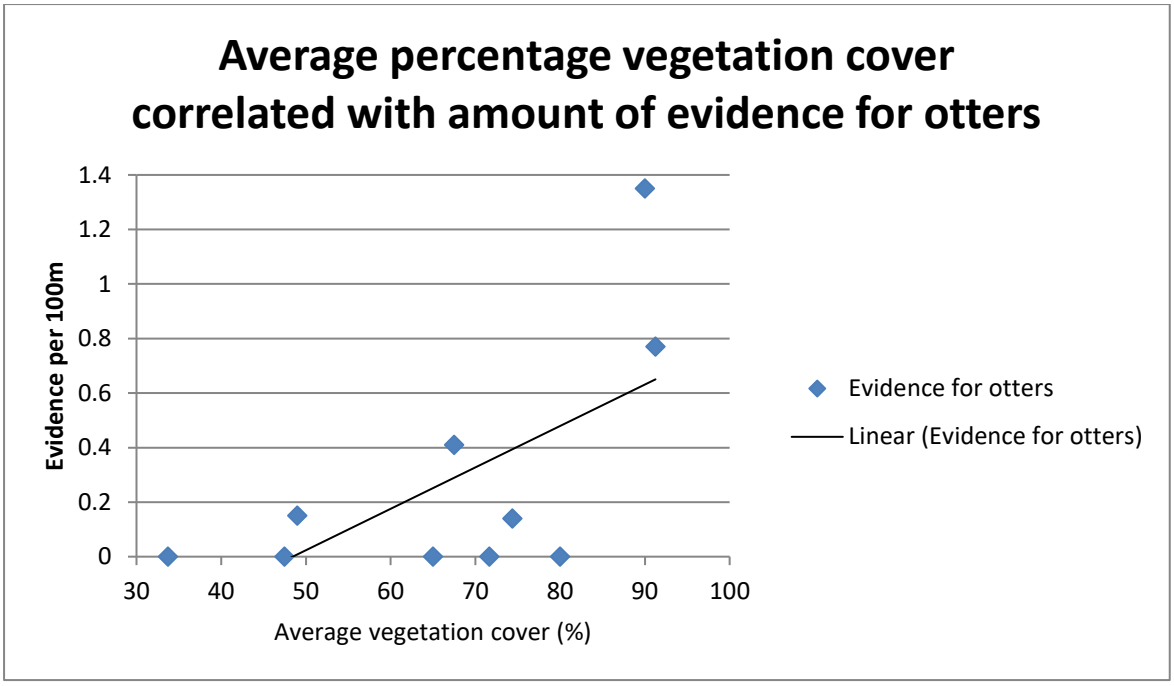

Figure 10- Graph showing the correlation between the average percentage of vegetation cover and evidence for otters (e.g. spraints, tracks) per 100 metres of each transect.

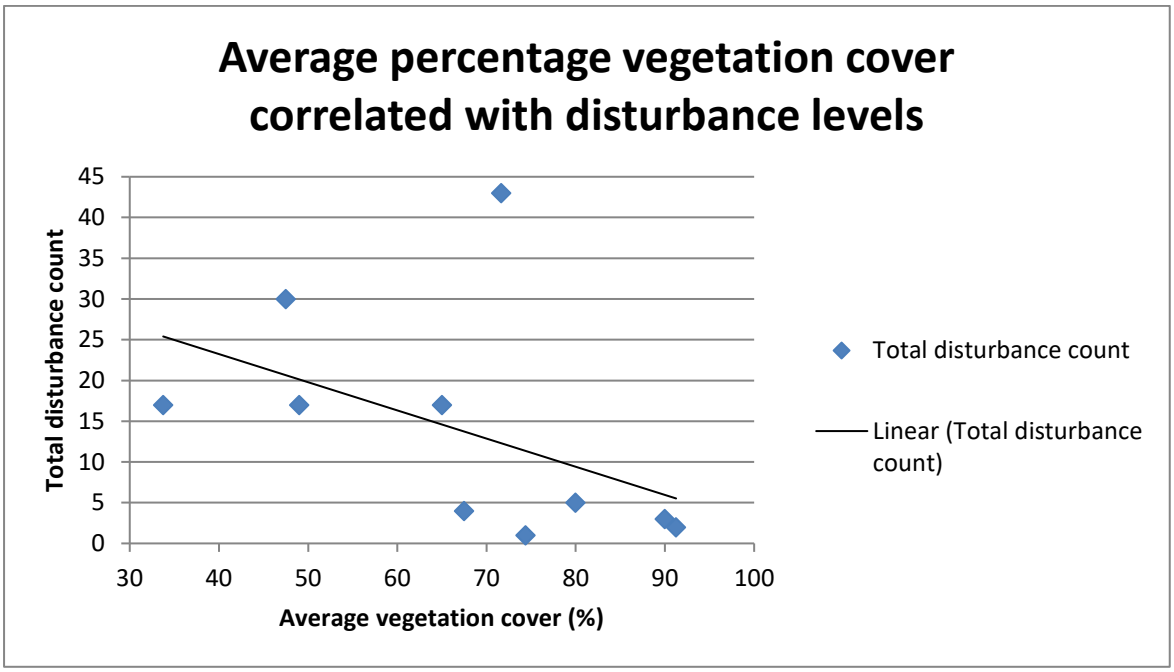

Figure 11- Graph showing correlation between the average percentage of vegetation cover and total disturbance count per transect section

Water quality

Water quality was also measured in eight different check points around the Natura 2000 site by taking readings of pH, Nitrite, Nitrate, turbidity and salinity (Figure 5, Table 2).

Table 2 – Different water quality variables measured in 8 check points

Check point	pH	Nitrate	Nitrite	Turbidity	Salinity
1	7	0.5	0	0	>36
2	7	0.5	0	0	>36
3	7	0.5	0	0	>36
4	7	0.5	0	0	35
5	7	2	0	20	<26
6	7.5	1.5	0	20	<26
7	7.5	0.5	0	20	35
8	7	0.5	0	0	>36

There is little variation in pH, however upstream on the eastern side at locations 6 and 7 it is slightly higher with nitrate levels also being slightly higher upstream at locations 5 and 6. There is no variation in nitrite levels, however like nitrate and pH, turbidity varies further upstream, being more turbid in locations 5, 6 and 7. Salinity shows expected results with higher salinity concentrations closer to the sea and lower measurements being recorded further upstream.

Discussion

Sweep up

The sweep up showed a correlation between the distribution of otters and human activity (Figure 7). The areas high in disturbance were the lowest in amounts of evidence for the otters found (e.g. tracks, spraints). Often otters exhibit very shy, elusive behaviour avoiding areas with high densities of human activity (Mason & Macdonald 2009) so although there is a possibility of errors associated with human searching effort, the correlation is a likely finding. In a Europe wide study, it was found that otters tolerated human presence to a certain degree beyond which, the habitat was considered sub-optimal or unsuitable habitat (Robitaille & Laurence 2002).

Furthermore, there are many negative direct and indirect effects of human activity on otters, including competition, disturbance, persecution, trapping, road kills, pollution and habitat destruction (Robitaille & Laurence 2002). In fact, otters often become locally extinct in areas of high human and road density (Robitaille & Laurence 2002) therefore explaining the correlation between human activity and otter presence found in this study (Figure 7). This could also contribute to an explanation for the distribution of otters found in the Natura 2000 site as areas with low disturbance e.g. Abicada (Table 1) show a much higher amount of evidence for the presence of otters (Figure 6).

Habitat assessment

For habitat preference, we should focus on areas which have the highest amounts of otter activity as it is these areas which will be used the most and are deemed as preferable or most suitable habitats. These areas as shown in Table 1 are Alvor, Abicada and the far eastern side of the peninsula Quinta da Rocha (QR1).

These three areas consist of a dominant land use which is wetland (Figure 8). Being semi-aquatic with various amphibious adaptations (Mason & MacDonald 1994), the presence of weltands is intrinsically important to otters' survival in an area. Furthermore, the wetlands in this study provide a source of freshwater (Beja 1992) which is necessary for drinking, hunting and grooming (Mason & MacDonald 1994).

The three areas under consideration are also dominated by the bank material earth (Figure 9). This is considered an important characteristic of otter habitats as it is essential for the excavation of dens and tunnels where there are no natural cavities (Camilo-Alves & Desbiez 2005). This bank material may also be an important substrate for vegetation, as transects with dense vegetation are dominated by earth (Figure 9, Table 1).

Vegetation cover is incredibly important as dense vegetation has been shown to be preferred by otters (Stone & Sheean-Stone 1991) because of being critical for foraging and resting behaviours (Durbin 1996). The transect sections with the highest vegetation cover (AL1 and QR1) also had the highest concentration of otter activity (Table 1, Figure 10) which further emphasizes their preference for areas with dense vegetation. Furthermore, areas with low vegetation cover correlated with high disturbance levels (Table 1, Figure 11), showing that human disturbance can have an indirect impact on otter distributions through habitat destruction and loss of vegetation (MacDonald & Mason 1983). The correlations in Figure 10 and 11 also show that many of the factors measured in this study are interlinked; therefore it is important to consider how different variables relate to one another when studying the distribution and habitat preference of otters.

Vegetation type and structure are also thought to be an important influence on otter distributions as the presence of adequate cover is a major factor determining their distribution (Kruuk 1995). This study however focused on broad, predefined categories because of a lack of detailed knowledge of local flora and the site was found to be dominated by uniform vegetation structure, consisting of scrub and shrubs. Previous studies often show scrub as a preference for otters as it provides dense vegetation and ideal cover for otters to use as resting sites (Mason & MacDonald 2009). Furthermore, it is speculated that complex vegetation structure with a variety of flora including trees, as otters often use their roots for shelter (Mason & MacDonald 2009), is preferred over uniform structure, however more in depth study on vegetation type and structure is required to examine the effects on otter distribution.

Water quality

The results from the water quality testing show little variation in pH and none in nitrite. Salinity is higher in locations closer to the sea because of the greater influence of salt water,

whilst locations further upstream gradually become less saline the further they are from the sea. The variation in nitrate and turbidity can also be explained by distance from the sea. Further inland there is an increase in the amount of agriculture, therefore there area higher amounts of runoff from fertilizer,s which can increase nitrate levels in the water (Letcher & Vallero 2011). Other agricultural activities including tilling and ploughing can also increase turbidity as they contribute to the increase in amounts of sediment particles in the water (Letcher & Vallero 2011).

Otters are shown in Figure 6 to be more densely distributed around areas further inland, however it is unlikely this is because of factors associated with agriculture, as an increase in disturbance and pollution often threatens their viability, resulting in a decrease in otter activity (Mason & MacDonald 1990). Seeing as otters are dependent on freshwater sources (Beja 1992), a more likely explanation is the salinity. Otters feeding near the sea need to wash themselves frequently in freshwater to prevent the deterioration in the thermal capacity of their fur (Kruuk & Balharry 1990) therefore this dependence on freshwater would affect their distribution.

Recommendations

This preliminary study was time restricted, therefore the main recommendation is to repeat the methodology for habitat preference in more detail e.g. conducting check points at more regular intervals (every 20-50 metres), measuring water quality variables to a higher precision and identifying specific vegetation types along transects. .

Another recommendation is to incorporate prey availability as a factor effecting otter distribution. This could include recording macro invertebrate density using kick and sweep sampling at each check point and identifying organisms caught. Furthermore, spraint analysis could be employed as a method of determining dietary preferences and sediment cores could also be used to calculate water quality indexes and determine aquatic biodiversity in the area.

Conclusion

This study indicates that otters prefer to reside further upstream, in wetland areas which have abundant, dense vegetation such as scrub and an earthy substrate. Abicada is therefore suggested as a key habitat for otters in the local area. Furthermore, it is likely the otters prefer areas with less human disturbance and lower levels of water pollution. However, it is recommended that future studies are conducted to confirm this and further specify habitat conditions which are preferable for otters.

Acknowledgements

I would first and foremost like to thank Lieske de Wilde for the considerable amount of help she provided not only in the planning stages, but also in conducting the project. I would also like to acknowledge Paula Banza for all her support and guidance as well as numerous volunteers, including Henrianne Brink, Jo Conway, Jack Devlin and Charlie Booty for their assistance with the fieldwork.

References

Beja, R, P. (1992), Effects of freshwater availability on the summer distribution of otters Lutra lutra in the southwest coast of Portugal. Ecography, 15: 273–278.

Camilo-Alves.C & Arnoud Desbiez (2005) *The use of a natural cave for breeding by giant otters in the brazilian pantanal: observations and new insights on giant otter behavior*. Fazenda Bela Vista, Pantanal, Caixa postal 18, Centro 79300-000 Corumbá / IUCN Otter Spec. Group Bull. 22(1)

De Wilde (2015) Report preliminary otter survey in Ria de Alvor. A Rocha Portugal. Unpublished.

Durbin, L. S. (1996) *Individual differences in the spatial utilization of a river-system by otters (Lutra lutra).* Acta theriol. 41:137-147

Environment Agency (2003) *River Habitat Survey in Britain and Ireland- Field Survey Guidance Manuel 2003 Version.* Environment Agency, Bristol (Available in published or electronic form)

Foster-Turley.P, Macdonald.S.M & Mason.C (1990) *Otters: an action plan for their conservation* IUCN/SSC Otter Specialist Group, University of California

Kruuk, H. (1995). *Wildotters - Predation and populations.* Oxford University Press.

Kruuk, H., & Balharry, D. (1990). Effects of sea water on thermal insulation of the otter, Lutra lutra. *Journal of Zoology*, *220*(3), 405-415.

Letcher,M,T & Vallero,D (2011) Waste: A Handbook for Management. Academic Press. Science.

Mara.W (2007) *Otters* Marshall Cavendish ISBN 0761425276, 9780761425274

Mason & MacDonald (1994) Status and conservation needs of the otter (lutra lutra) in the Western Palaearctic. Council of Europe. Issues 18-67, Otters

Mason, C. & Macdonald, S. (1990) *Conclusions and priorities for otter conservation*. In: P. Foster-Turley, S. Macdonald and C. Mason (eds), Otters: an action plan for their conservation, pp. 80-88. Gland, Switzerland.

Mason, C.F & Macdonald, S.M., (1983) *Some factors influencing the distribution of otters (Lutra lutra)*. Mamm. Rev. 13, 1-11.

Mason.C.F & Macdonald.S.M (2009) *Otters: Ecology and Conservation* Cambridge University Press ISBN 0521101344, 9780521101349

Robitaille, J. F., & Laurence, S. (2002). Otter, Lutra lutra, occurrence in Europe and in France in relation to landscape characteristics. *Animal Conservation*,*5*(4), 337-344.

Stone.D & Sheean-Stone.O (1991*) Otters: An Action Plan for their conservation* IUCN ISBN 2831700965, 9782831700960

Trindade, A. (1994) Monitoring *Lutra lutra* Habitats in Portugal: a Conceptual Plan . *IUCN Otter Spec. Group Bull*. 10: 41 – 46

Appendices

Appendix 1 - Preliminary river habitat survey form

Transect name-

Surveyed from (facing downstream) - left bank right bank

Sweep up

Dominant land use-

Bank profile-

Trees-

Associated features-

GPS	Spraints	Tracks	Other notes
1			
2			
3			
4			
5			

Other significant characteristics-

Disturbance levels

People-

Dogs-

Cars-

Boats-

Other

Point checks

	Point check number				
GPS	**1**	**2**	**3**	**4**	**5**
Bank					
Material					
Modification					
Features					
Bank top vegetation					
Structure					
Type					
Percentage cover					
Channel					
Substrate					
Flow type					
Modification					
Features					
Vegetation					
Land use					
5m					
50m					
Other notes					

Appendix 2- Water quality form

Check point number	pH	Nitrate	Nitrite	Turbidity	Salinity
1					
2					
3					
4					
5					
6					
7					
8					