Clearing the way for Norfolk's water voles: an analysis of the Norfolk Mink Control Project (up to end 2016).

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Introduction

The American Mink (*Neovison vison*) is a medium sized mustelid native to North America, frequently farmed for its pelt which is used to make luxury clothing. It has been introduced to many areas around the world, particularly Europe and South America, through accidental and deliberate releases from fur farms (Zschille 2012, Fraser 2013, Fasola 2016). Outside of its native range, the American mink is a highly invasive and destructive predator, preying on native mammals, birds, and fish. It is linked to declines in European mink (found in Eastern Europe, Russia, and a few areas around the France-Spain border), Pyrenean desman, and water voles, as well as predating popular native birds such as kingfishers (as seen on Springwatch back in 2012), gamebirds, and waterfowl (Ferraras 1999, Garcia-Diaz 2013). In the UK fur farming is now illegal (as of the Fur Far ming (Prohibition) Act 2000) but the American mink population, the product of multiple escapes and releases, is firmly established. In fact the species has now spread to almost all of the country bar the very north of Scotland (Fraser 2013). Several control efforts are in place to prevent the spread and reduce the established population of American mink in the UK, and it is illegal to release the animals into the wild.

Figure 1 – Clockwise from top left: Water vole (*Arvicola amphibius*), Mink raft with otter guards (dowling), American Mink (*Neovison vison*). © Stephen Mace, NMP.

The Norfolk Mink Project (NMP) was established in 2003 with the aim of reducing the mink population in Norfolk, UK. This is carried out with the use of live traps set either on the bank or on specially constructed "mink rafts" (see Figure 1, above). Traps are set in response to mink sightings or field signs, or in response to tracks recorded on clay pads installed on the rafts. Traps are checked, by law, at least once a day and clay tracking pads are checked every 1-3 weeks. Captured mink are dispatched using an appropriately powerful firearm. Trapping by individuals such as gamekeepers

had been going on for some time prior to the establishment of the NMP but the project represented the first attempt to create a county-wide strategy. The network of rafts and traps are managed on a day to day basis by a large number of volunteers, most of whom operate on their own land where adjacent water bodies exist, classified by the river catchment in which they operate (see Figure 2). These volunteers are managed by a team of catchment coordinators who seek and train new volunteers, distribute equipment, and collect capture records that are fed back to the steering group.

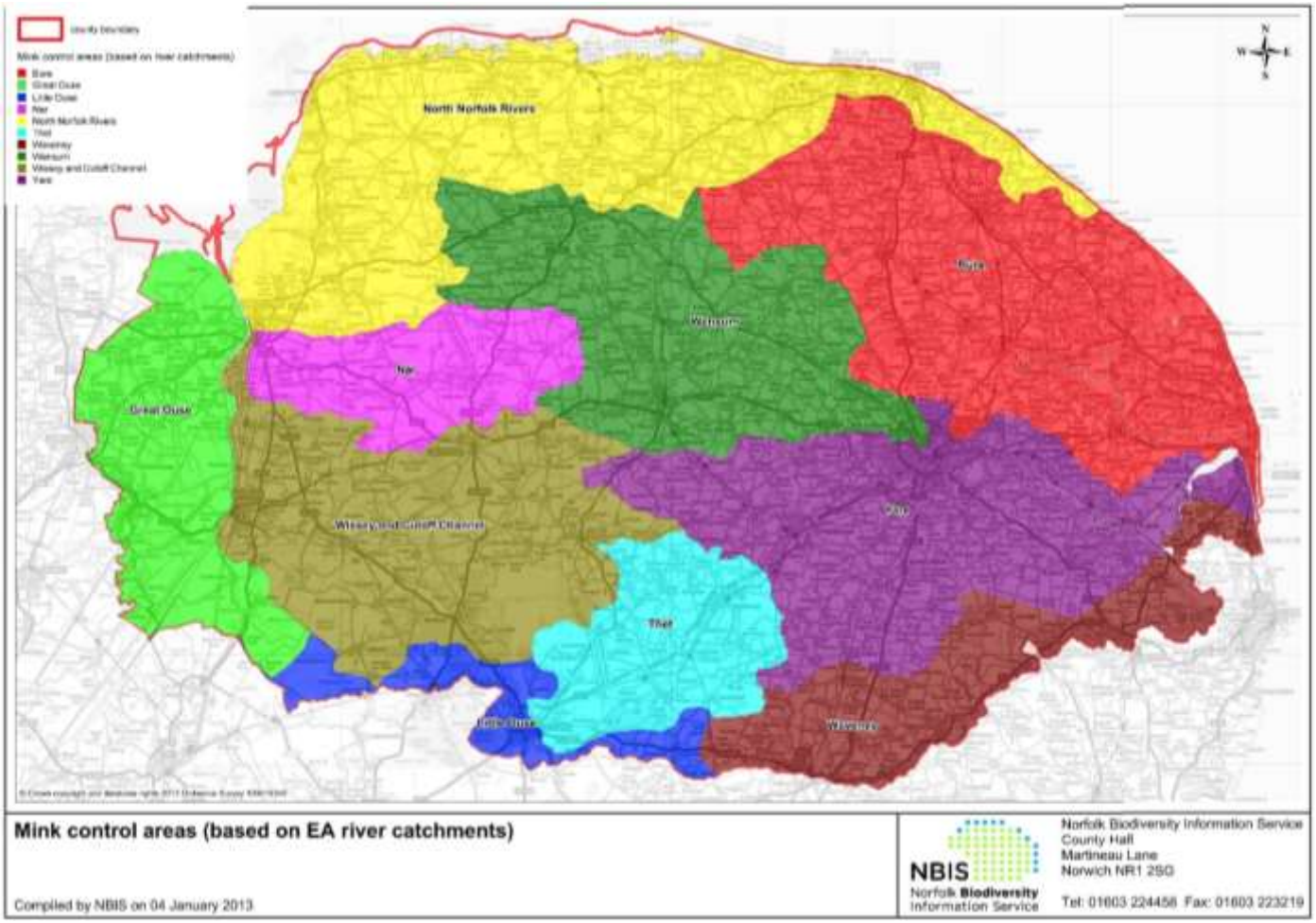


Figure 2 – Control areas within Norfolk, coloured by river catchment boundaries. The Little Ouse and Waveney catchments are largely coordinated by the Suffolk Wildlife Trust, rather than the NMP.

This report details efforts to analyse the data recorded by the NMP over the last fourteen years, aiming to improve practices and target the project's approach in an objective way. The primary objectives are:

1. To establish the monetary value of volunteer effort within the project, with a view to securing future funding.
2. To determine the extent to which the project is impacting the Norfolk mink population via analysis of trends in the number of mink captured per unit of effort expended.
3. To support the targeting of the project through the assessment of potential mink habitat and trapping coverage.

Methods

Volunteer survey

In order to improve the assumptions underpinning the below calculations, a short questionnaire was designed (using SurveyMonkey) and sent out to all volunteers for whom the project holds email address details. The survey was distributed via a weblink inserted into an email requesting participation, sent on the 14th February 2017, and again via a reminder email sent on the 27th of the same month. The survey was closed to new responses at 9am on the 1st March 2017 in order that the results could be collected and passed into later analyses. Of the 186 email addresses on the database, 30 could not be delivered to (presumably they have been deactivated since being entered into the system). We also received a very small number of responses from people who were not active in the project (either had stopped or were never active), contrary to the information held in the database. Errors were noted and passed on to the database manager. In total the survey yielded 41 responses, however 5 of these had to be removed from the analysis due to the respondent answering '0' to all or multiple questions. This was assumed to be someone being deliberately unhelpful.

Volunteer effort

The monetary value of the effort expended by volunteers on behalf of the project was calculated based on the Heritage Lottery Fund (HLF) rates for unskilled/skilled/highly-skilled labour. This is the amount of money that would be made available by the funding body to support the employment of a dedicated trapper who would carry out the work currently carried out by the volunteer network. For the purposes of the calculations in this report, the 'skilled' labour rate (£150 per day or £18.75 per hour) has been chosen because detecting and trapping mink requires working unsupervised and with knowledge of animal sign identification and correct dispatch procedures (including relevant firearms skills). Separate estimates of raft check effort and trapping effort were calculated (due to the differing check frequencies required).

Due to uncertainties in the data, chiefly concerning the amount of trapping effort occurring (not recorded by project), two methods were used to estimate volunteer effort. The first calculates trapping effort by extrapolating from the number of mink caught each month while the second uses the number of traps (either bank or raft) active in each month multiplied by a number of checks inferred from the volunteer survey.

Method 1

Raft check effort for each month was calculated to be the number of rafts active in that month (loaned out according to the database) multiplied by 1.57 (average number of checks per month according to volunteer survey) and then 0.84, the average (median was chosen to combat outlying values) proportion of the time survey respondents reported their raft was out and monitoring.

Trapping effort was calculated from the number of mink captured in a given time period. This is because we have a much murkier view of how much time traps are deployed, compared with rafts. Based on the volunteer survey and published literature (Porteus 2012), it takes around 7 days for a mink to be caught once a trap is set. The final check involves dispatching a mink and so takes twice

as long (equivalent to an extra check). We estimate that for each mink successfully captured there has been at least two unsuccessful trapping attempts, equal to 30 checks. Therefore for each mink captured we count 38 (7+1+30) trap checks.

The total effort value was then converted to a monetary value by multiplying by 5.47 (17.5 minutes of skilled labour, as inferred from the volunteer survey).

Therefore the total value of volunteer effort for each month is represented by the equation:

$$E_1 = 5.47 \times ((R \times 1.57 \times 0.84) + (M \times 38))$$

Where E_1 represents effort value, R represents no. active rafts, and M represents no. mink captured.

Method 2

Effort was calculated by counting the number of rafts, traps, and 'raft+trap' combinations active in any given month and multiplying these numbers by an estimate of the number of checks occurring. The three categories were necessary as volunteers with both raft and trap had the option of deploying both at the same time, and therefore effort will be slightly different. As an example to illustrate how the numbers were reached, if a volunteer possesses two rafts and a trap then this was counted as one raft and one 'raft+trap'.

Raft check effort (E_R) for each month is calculated as the number of active rafts (R) multiplied by the number of checks taking place each month according to the volunteer survey (1.57) and then by the proportion of the time rafts are out on the water (0.84 according to survey).

$$E_R = R \times 1.57 \times 0.84$$

Trapping effort (E_T) for each month was calculated as the number of active traps (T) multiplied by the number of checks (daily by law, so 30) and then by the proportion of time traps are set (0.41 according to survey).

$$E_T = T \times 30 \times 0.41$$

'Raft+trap' effort (E_{RT}) is calculated separately as when a volunteer has both available, they have the option to either set the trap only on the raft, once a mink is detected, or set it on the bank while the raft is in monitoring mode. As such there are three components; raft check effort (time when trap is not set on raft), trapping effort on raft, and trapping effort on bank. Raft check effort is calculated as the number of 'raft+trap' pairs (RT) multiplied by the number of raft checks per month (1.57), the proportion of time rafts are on the water (0.84), and then the proportion of the time rafts do not have a trap set on them (0.83). Trapping effort on the raft is the number of 'raft+trap' pairs (RT) multiplied by the number of trap checks per month (30), the proportion of time the raft is on the water (0.84), and then the proportion of the time the trap is set on the raft (0.17). Trapping effort on the bank is the number of 'raft+trap' pairs (RT) multiplied by the number of trap checks per month (30), the proportion of time rafts are on the water (here we assume that volunteers would not deploy traps in the period of the year when they do not deploy rafts), the proportion of time the trap is not on the raft, the proportion of time traps are set on the bank (0.41), and finally by the proportion of volunteers who actually deploy their trap when not in use on the raft (0.4).

$$E_{RT} = (RT \times 1.57 \times 0.84 \times 0.83) + (RT \times 30 \times 0.84 \times 0.17) + (RT \times 30 \times 0.84 \times 0.83 \times 0.41 \times 0.4)$$

$$\therefore\ E_{RT} = (RT \times 1.095) + (RT \times 4.284) + (RT \times 3.430)$$

Therefore the total value of volunteer effort for each month is represented by the equation:

$$E_2 = 5.47 \times (E_R + E_T + E_{RT})$$

Where E_2 represents effort value, E_R represents raft check effort, E_T represents trapping effort, and E_{RT} represents 'raft+trap' effort.

Mink captured per unit effort

Trends in the mink population were estimated using 'mink kills per unit effort' as a proxy for actual population surveys. It is assumed that as the population is reduced, the effort required to capture each animal increases (i.e. kill per unit effort goes down). For this section, trapping effort could not be estimated from the number of mink kills as it would need to be independent (no. mink kills would be divided by the effort estimate so cannot be a component of it). Therefore *Method 2* (above) was used to calculate volunteer effort, but without the monetary component (i.e. effort was not multiplied by 5.47).

Therefore the number of mink caught per unit of effort (the unit being, arbitrarily, 1000 checks), per month, is given by the equation:

$$ME = \frac{M}{E_2/1000}$$

Where *ME* represents mink captures per unit effort, E_2 represents volunteer effort, and *M* represents no. mink captured.

Mapping

In order to visualise the control effort achieved by the project across the county, a series of maps were produced using the GIS capabilities of the Broads Authority. The potential mink habitat of Norfolk was designated by overlaying the Environment Agency's flood map (Zone 3 – the most frequently flooded) and layers from the Natural England Priority Habitat Inventory dataset onto OS maps of the county (Ordnance Survey open data). Locations of rafts and traps were plotted onto this map along with a radial buffer of 1.5km (based on an approximate territory size of 2-5km (Zschille 2012)) around each point to represent the area covered by the NMP's efforts.

Control coverage for each catchment (boundaries according to EA datasets are slightly different to those of the NMP but serve as an approximation) was calculated as the percentage of mink habitat (wetland habitats such as wet woodland, grazing marsh, fen, etc.) covered by the buffer described above.

Maps were also produced for each year (since the project's inception in 2003) showing all mink events (sightings, captures, roadkills, etc.) to give an indication of which locations are consistently producing mink and therefore represent possible entry points to the county or shelters for breeding populations.

Results & Discussion

Volunteer survey

The results of the volunteer survey are summarised in the following table. There were 36 useful responses to the survey (~24% of volunteers polled, ~9% of total volunteer network) but not all questions were applicable to all respondents. The number of responses to each question is shown as well as the mean and median response (N.B. Q7 & Q9 were multiple choice so there is no average. Proportion of respondents choosing each option is reported instead). The format of the responses (i.e. percentage, number of days, etc.) is noted underneath each question.

Table 1 – Results from the volunteer survey, distributed via email to volunteer database. Format of answers is noted below each question and both mean and median responses are reported, if appropriate.

Question	Mean	Median	No. responses
Q1 If you have no raft, and only set your trap on the bank: For what proportion of the time is your trap actually set? E.g. if your trap is set every day for 3 months each year, that would be 25% of the time. If it's set for a week every other month, that's about 12%, etc. Proportion (%) of time	47	41	15
Q2 If you have a raft: For what proportion of the year, on average, is it on the water and being checked? E.g. if your raft is on the water all year except for a couple of months over winter (for maintenance, etc.), that would be about 75-80%. If it is on the water all year but only checked for 6 months of the year, that would be 50%. Proportion (%) of time	72	84	30
Q3 If you have a raft: How often do you check the clay tracking pad on the raft when in monitoring mode (clay pad installed, no trap)? E.g. if you check the pad every two weeks, put 14 days. Three weeks would be 21 days, etc. If this is variable, try to average it out, i.e. if you check more frequently when you think there might be mink about but generally you check every 3 weeks or so, just put slightly less than 3 weeks, maybe 18-19 days. No. days	22	19	28
Q4 If you set your trap only in response to mink sign/sightings (as opposed to having it out all the time): When you catch a mink, how long, on average, does this take after first setting the trap? No. days	7	7	13
Q5 If you set your trap only in response to mink sign/sightings (as opposed to having it out all the time): On average, how long do you leave the trap out before removing it, in the event that you don't catch anything? Please write how often this happens (1 in 10 occasions, 1 in 5, etc.) in the comment box in Q10. No. days	15	15	17
Q6 If you have both a raft and a trap: For what proportion of the time, on average, is the trap set on the raft? E.g. if you estimate the trap is out for roughly one week per month that would be about 25%, 10 days every two	32	17	18

months is about 17%, etc. Here we're only interested in the actual amount of time your trap has been out on the raft, no matter whether you've set it in response to a mink or speculatively. Proportion (%) of time			
Q7 If you have both a raft and a trap: When your raft is in monitoring mode (clay pad installed, no trap), do you set your trap elsewhere on land or do you store it and wait for a mink to be detected? Set trap on land when not on raft / Only set trap on raft	40/60	NA	23
Q8 How long does it take you to check your raft or trap? Please include any travel time specifically associated with checking the raft/trap (i.e. away from what you would be doing otherwise). If dispatching captured mink adds a significant amount of time please estimate the amount of time in the comment box in Q10. No. minutes	26	17.5	36
Q9 In an average week, how long do you spend looking for mink sign, not including raft/trap checks? No time at all / <1h / 1-2h / >2h	39/50/8/3	NA	36
Q10 If you have any other comments regarding the questions above (or any other aspect of the Project) please enter them in the text box below. If you want to give any estimates of time spent doing something or how often something occurs, please give this in terms of "hours per day", "% of time", "times per week", etc. rather than using words like "sometimes" or "often" as this will be more useful. Free-form text answer.	NA	NA	16

Comments left in response to Q5 suggest that mink are captured in anywhere from 1 in 5 to 3 in 4 occasions where a trap is set. It was therefore decided to include one unsuccessful trapping attempt (15 checks) to each mink count in the volunteer effort calculation, as an intermediate value based on these responses.

Comments from Q8 suggested that dispatching a mink roughly doubles the time required to deal with a trap. Therefore successful trapping attempts each had an extra check added to their effort calculation (to represent the final check being twice as long).

The majority of respondents indicated in Q9 that they spend either no time at all or less than one hour per week looking for mink sign other than on their raft or trap. Given that it is likely only the more enthusiastic volunteers responded to the survey, it was decided not to include this effort in calculations as it would not have added a significant amount and is subject to considerable uncertainty.

A significant number of respondents reported that they had not encountered mink for some time, despite the animals having been a common sight in the past. This is anecdotal but compounds the overall impression (detailed in the population trends section below) that the mink population has been considerably reduced.

Volunteer effort

Volunteer effort was quantified in terms of the monetary value of work conducted by volunteers of behalf of the project. This has two components, raft checking and trap checking, which were combined to reach a yearly total. This calculation was made by two methods.

Using *Method 1*, it was estimated that effort contributed to the project is worth around £30,000-£40,000 per year (see figure 3). This is likely to be an underestimate given that the amount of trapping effort is based on the number of mink captured and that this does not necessarily reflect the actual number of trap deployments. Detected but uncaptured mink may occur more frequently than is accounted for in the model. Unfortunately volunteers do not record this at present and survey responses concerning the issue were not sufficient to infer a useful estimate. Additionally, there are a significant number of volunteers who only operate traps and therefore may spend extended periods of the year checking those traps, rather than just a short period around the time a mink is detected and caught. Particularly in later years, when mink have become rarer, many of these trappers are presumably expending a considerable amount of effort checking their traps, for whatever period of the year they are deployed, while reporting relatively few mink captures. This would make the effort estimate calculated by this method seem artificially low, especially in recent years where the difference between the two methods is most apparent (figure 3).

A second method (*Method 2*) was also used, based on survey responses and the number of rafts & checks active in each month, to estimate the number of checks occurring and therefore the amount of effort being expended. This resulted in a much higher estimate, suggesting that *Method 1* does underestimate the amount of trapping effort and that unsuccessful trapping attempts are more frequent than is evident from the limited survey responses (constant trapping is also a component, as discussed above). With this method the annual value figure rises to around £300,000 per year (in later years). It is probable that this second estimate is an overestimate. If we assume that only the most enthusiastic volunteers responded to the survey, then the proportion of time rafts and traps are deployed can be assumed to be some way lower. Anecdotal evidence suggests that fewer people than is inferred from the survey deploy their traps on the bank while rafts are in monitoring mode, which would reduce a component of the estimated effort. In addition, raft check frequency recorded by the Scottish Mink Initiative was around 10 per year per raft, slightly lower than that suggested by our survey (~15). However we regard this as a more robust method (albeit limited by lack of effort recording), especially in later years, as it takes into account the fact that effort largely continues despite a marked decline in mink captures.

In any case, the true value is probably somewhere in between the results from the two methods and represents a sizable contribution to the success of the project. We believe that the true value is currently around £115,000 per year (roughly one quarter of the difference between the two methods' estimates above the minimum value), based on what we know about the deployment of rafts and traps despite much lower mink levels (see following section). The project is leveraging double its operating budget (around £20,000) at the very least, and probably considerably more, from the volunteer network each year, providing strong evidence to funding bodies of the project's efficacy.

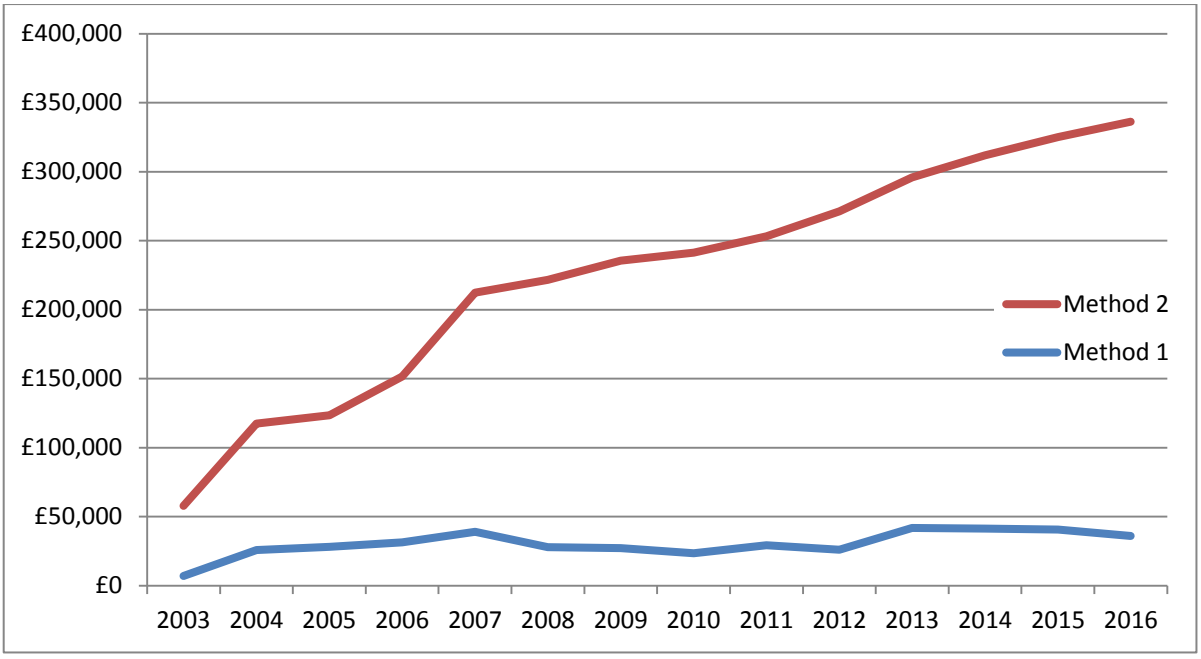


Figure 3 – Monetary value of volunteer effort, calculated by the two methods detailed previously and based on the results of the volunteer survey. Effort value is based on HLF rates combined with monthly raft/trap check estimates, combined to give year on year trends.

Mink captured per unit effort

Trends in the Norfolk mink population were estimated using mink captures per unit effort (in this case 1000 raft/trap checks) as a proxy, since a true census is impossible. In all catchments where control has been established for some years, there is a clear spike in captures per unit effort at the start of control followed by a sharp decline over a couple of years and then maintenance of a low level until present (see figure 4). This is mirrored in the trend in actual captures (not shown), suggesting that we are seeing a real population drop (as opposed to simply an increase in effort). This is supported by a decrease in the number of mink events (see following section) throughout the county (but particularly in central areas where control is most established) and a general sense among the volunteers that mink are now considerably less frequently encountered, as reported in the discussion of survey results, above. This also fits with statistical analysis performed by the Scottish Mink Initiative which suggested that a comprehensive control effort should result in the mink population dropping to around 6% of previous levels after 9 years of control (ASFB & RAFTS Newsletter, 2016). The NMP has managed to reduce most catchments to around 10% after 10-14 years, depending on catchment, which is a decent result, particularly given the lower investment and higher catchment connectivity (due to wetlands and drainage dykes) as compared with the SMI.

In the Bure the trend in mink captures is not so clear, possibly due to a period of lower effort and recording (anecdotal evidence) around 2011-2013 caused by staff illness. It is possible that the population rebounded to an extent or that kills were inaccurately reported during this time causing the trend in captures to spike again. Happily, the trend seems to be downward for now. The other catchment where the trends in mink captures and captures per unit effort do not correlate is the Wissey & Cut-off channel. This is a relatively new catchment, with control beginning in 2007, and also does not have the coverage enjoyed by other catchments. It is also near the western boundary of the control area and so may experience incursions from untrapped areas. The North Norfolk Rivers, Great Ouse, and Thet catchments have been part of the project for too little time to be able to draw conclusions.

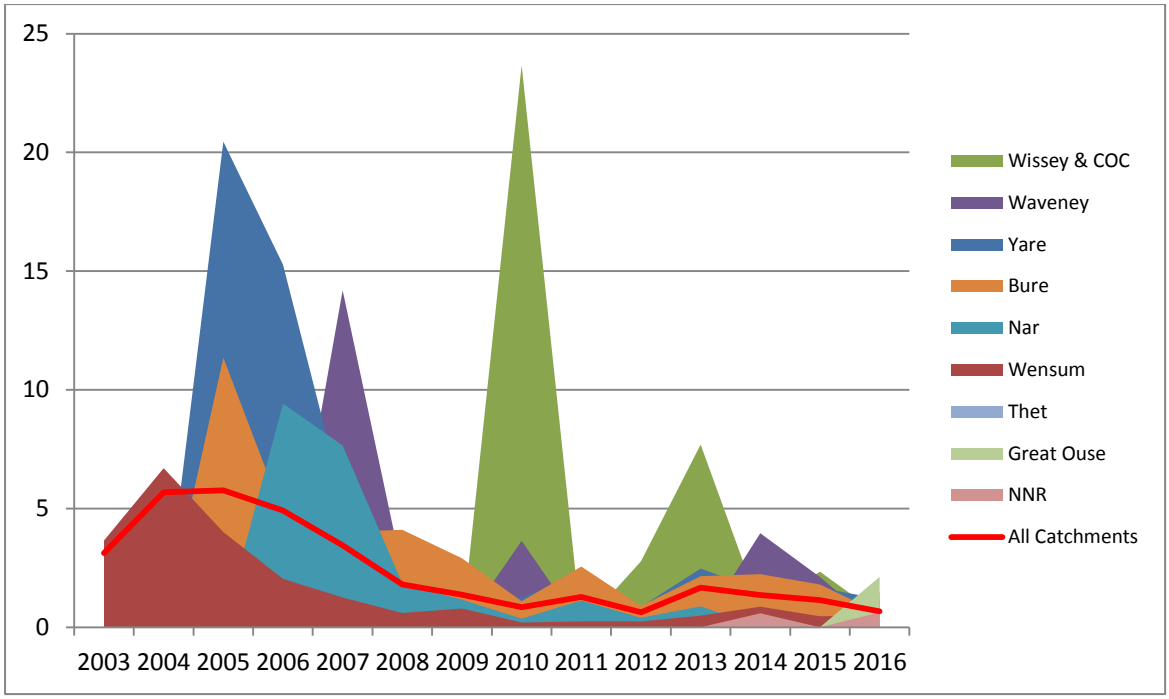


Figure 4 – Trap captures per unit effort (1000 raft/trap checks) in all catchments. Effort was calculated according to *Method 2* both because it had to be independent of the number of mink captured and because of the limitations of *Method 1* discussed previously.

Mapping

Using the GIS capabilities of the Broads Authority, the amount of mink habitat (wetland habitats according to the Natural England Priority Habitat Inventory dataset) was calculated for each catchment. Control coverage was measured as the percentage of habitat covered by a 1.5km radial buffer around all current rafts and traps (see figure 5). Table 2, below, details the results of this.

Some catchment boundaries used in this calculation are different to those used by the NMP. Coverage of the Great Ouse, Little Ouse & Thet, Wissey + South Level & COC, and Waveney catchments appears artificially low due to their spanning county boundaries (see figure 5). The area under the NMP's control is much smaller and therefore has less habitat area to cover than it appears from the GIS data. Similarly the NMP's Nar catchment is contained within the EA's "North West Norfolk Rivers" catchment and is not shown separately here. The combined NNR catchment probably has coverage of around 18-20% while the Nar is much higher (see Figure 5).

Table 2 – Raft and trap coverage of potential mink habitat (wetland habitats) in the EA operational catchments covered by the NMP.

EA Catchment	Total Mink Habitat (Ha)	Covered area (Ha)	% coverage
Bure	14704.2	9408.5	64
Great Ouse (several combined EA catchments)	1948.3	17.3	0.9
Little Ouse & Thet	7273.1	534.8	7.4
North Norfolk + North	12580.4	2836.3	22.5

West Norfolk Rivers (including the Nar)			
Waveney	9779.7	3054.6	31.2
Wensum	6297.6	4183.5	66.4
Wissey + South Level & COC	6780.3	2246	33.1
Yare	6020.2	3335.5	55.4

The 'Traffic light' system currently in place to categorise the catchments in terms of control success is based on subjective assessments by the steering group. For this reason it is suggested that from now on these discussions take into account the Mink per Unit Effort and Control Coverage. As an objective measure, the project should use Mink per Unit Effort (capture/(effort/1000)) to decide traffic light status, with Control Coverage providing a confidence level to associate with that designation. Level 1 (lowest confidence) is applied where coverage is below 30%, Level 2 (intermediate) between 30% and 60%, and Level 3 (highest confidence) at coverage over 60%. Here we have determined thresholds to be: 0.5 mink per 1000 checks for Green/Amber, and 1.5 for Amber/Red. This results in the catchments being designated as shown in the table below. It should be noted that the Waveney is missing a lot of data and that this figure should be taken with a pinch of salt. Equally, the Nar is unlisted due to the catchment boundary issues but has not seen a mink kill in several years so should remain Green.

Table 3 – Traffic light status of the EA catchments best corresponding to NMP catchments. Status is a simple division of the mink per unit effort results while confidence level is based on percentage coverage. 1 indicates low confidence while 3 indicates high confidence.

Catchment	Status	Confidence level
Bure	Amber	3
Great Ouse	Red	1
Little Ouse & Thet	Amber	1
NN + NWNR	Amber	1
Waveney	Green	2
Wensum	Amber	3
Wissey + SL & COC	Amber	2
Yare	Amber	2

The following map shows the coverage achieved over the whole county. The light blue represents the Environment Agency's flood map (i.e. the approximate wetland area) while the darker blue overlay represents the area covered by rafts and traps (within 1.5km of a raft/trap as explained in the methods section). Also shown are the EA catchment boundaries (red) and the approximate NMP catchment boundaries where different (black dotted line). This is primarily evident along the county border with Suffolk (south) and where the NMP has separated the Thet and Little Ouse, and the Nar and NNR, and where part of the COC catchment has been added to the Wissey (see figure 2 for clarification on the NMP catchments). The Great Ouse catchment is only partially shown on this map.

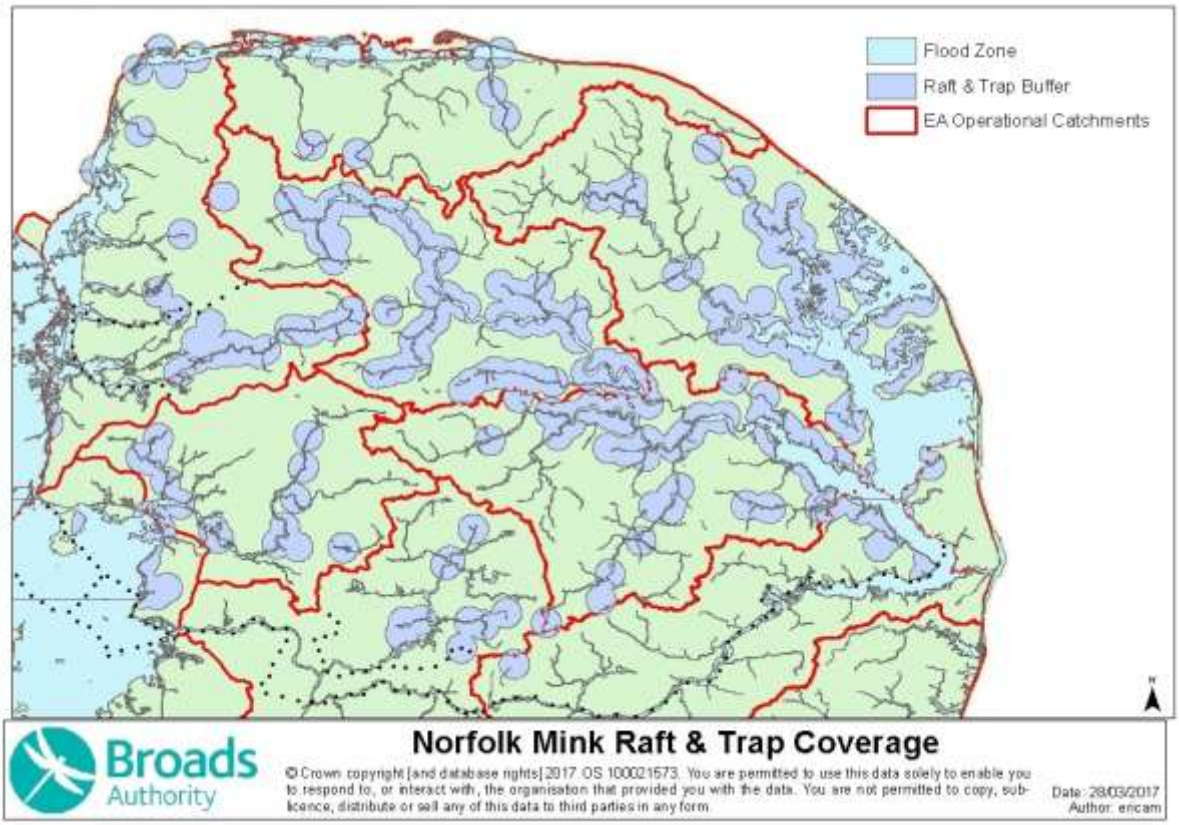
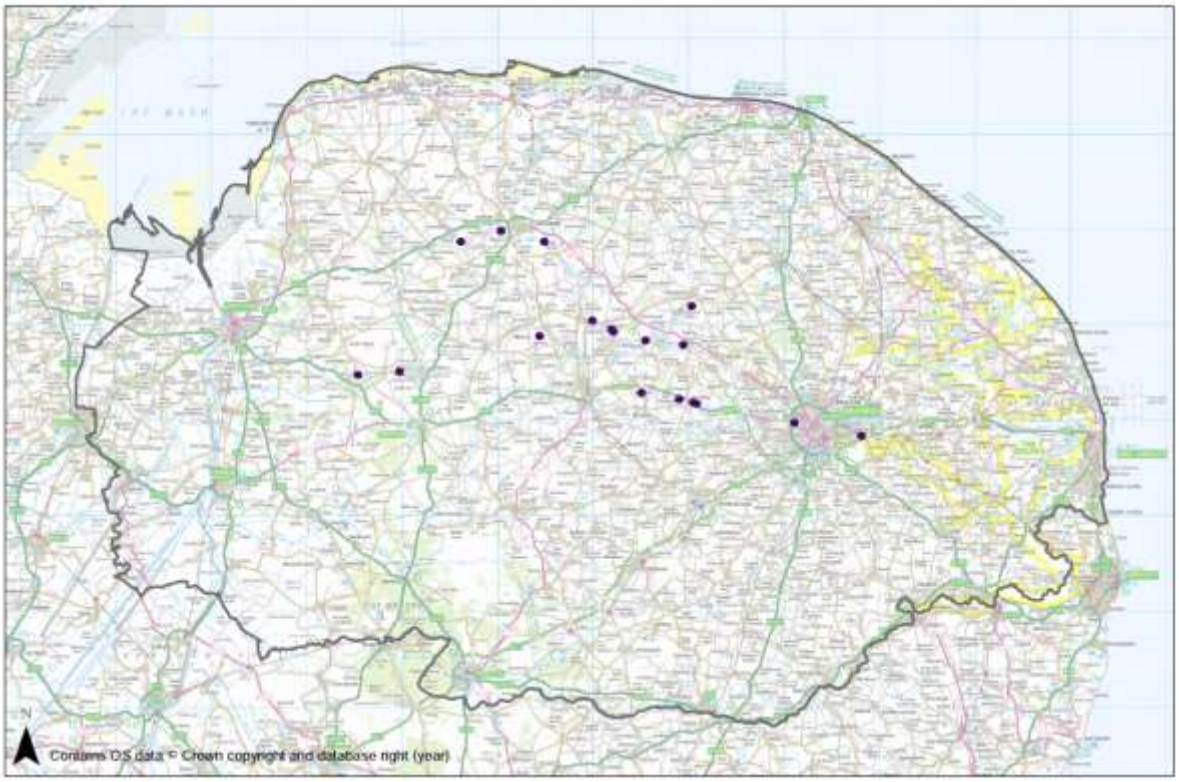


Figure 5 – Map of Norfolk with approximate mink habitat as represented by the EA flood zone (light blue), with the area covered by rafts and traps overlaid (darker blue). This is defined as the area within 1.5km of a raft or trap. EA catchment boundaries are shown in red. The map was kindly produced by Erica Murray and Vicky Short (Ecologist and GIS Officer, respectively, Broads Authority).

The following fourteen maps (all produced by Broads Authority GIS Officer – Vicky Short) show the locations of recorded mink events (Live Sightings, Tracking Plate Signs, Field Signs, Captures, Roadkills, etc.) for each year the project has been running. For the first few years, control was limited to the Wensum and so the first few maps show events only in this area. As control becomes established in a larger area from 2005 onwards, we can see that the majority of events seem to be occurring in the Broads area to the east of the county. Later years see an increase in activity in the Wissey catchment (added to the project later). There is very little activity in the north, west, and south edges of the county but this is likely due to these areas being added to the project fairly recently. We expect activity in these areas to become more apparent in the coming year or two. A notable change over the years is that the centre of the county, the upper reaches of the Wensum, has become much quieter since the project began, indicating a substantial success in this area.

Mink Events 2003



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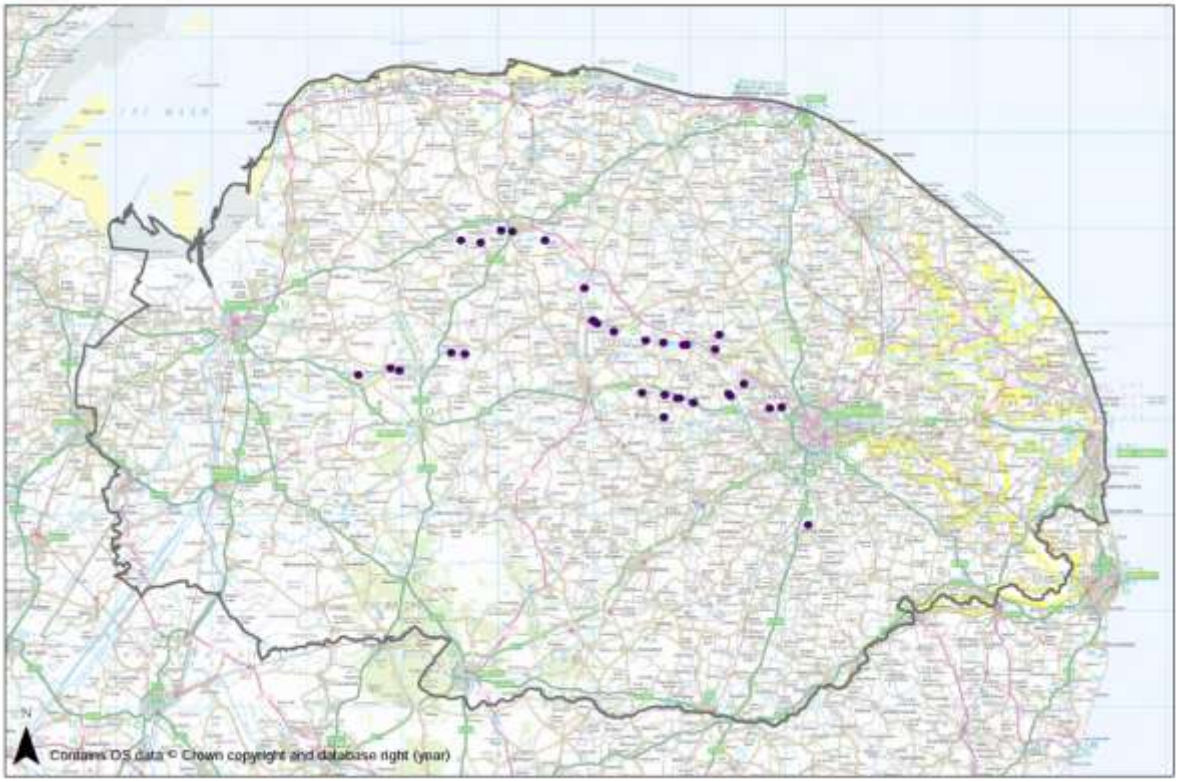

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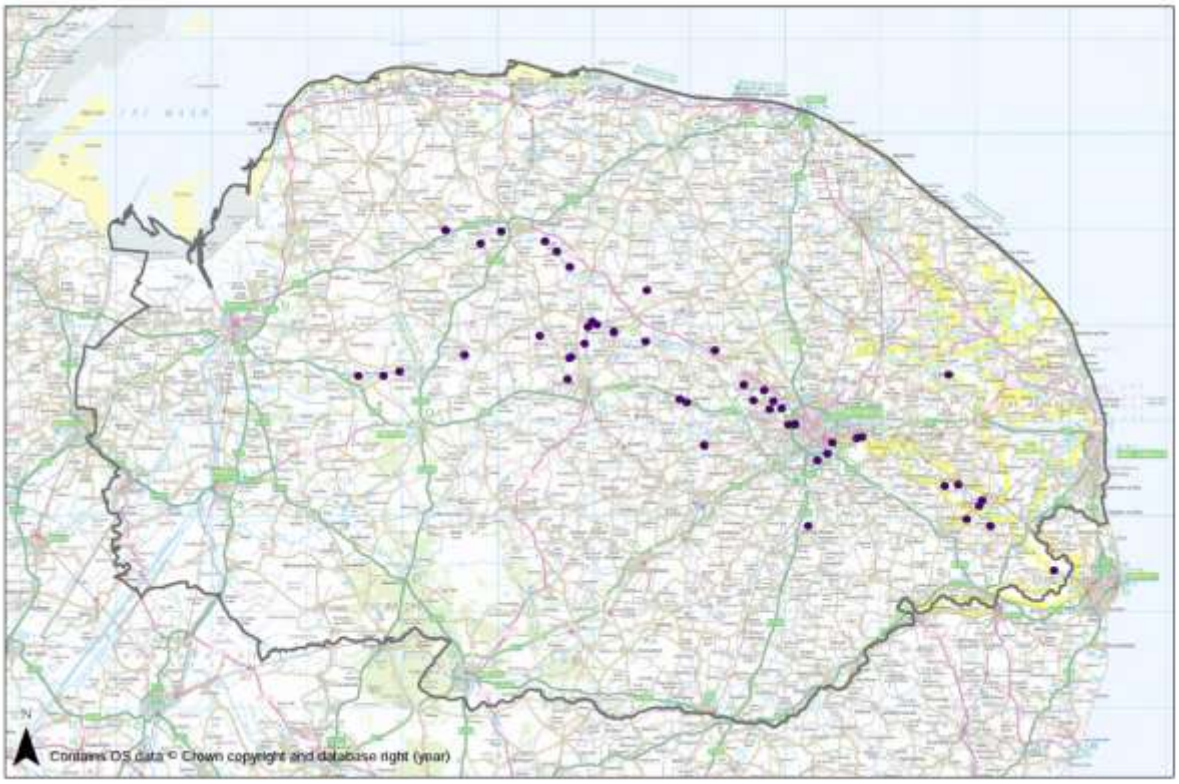

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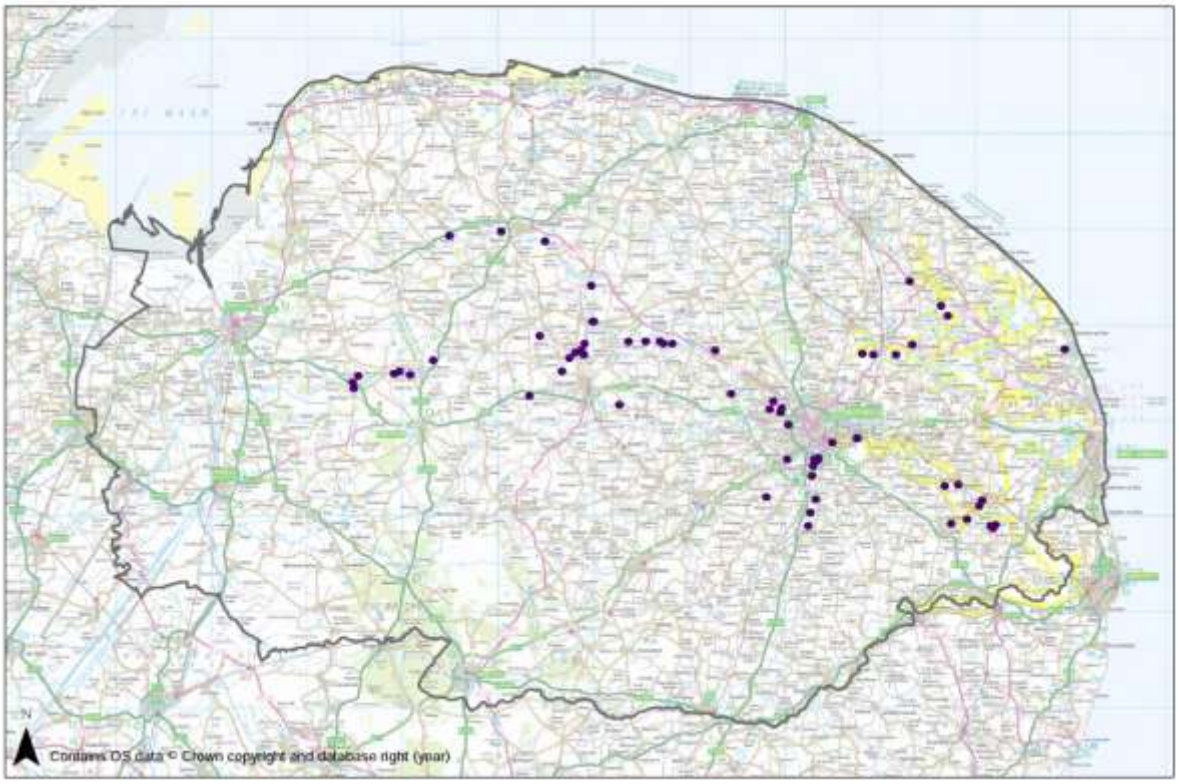
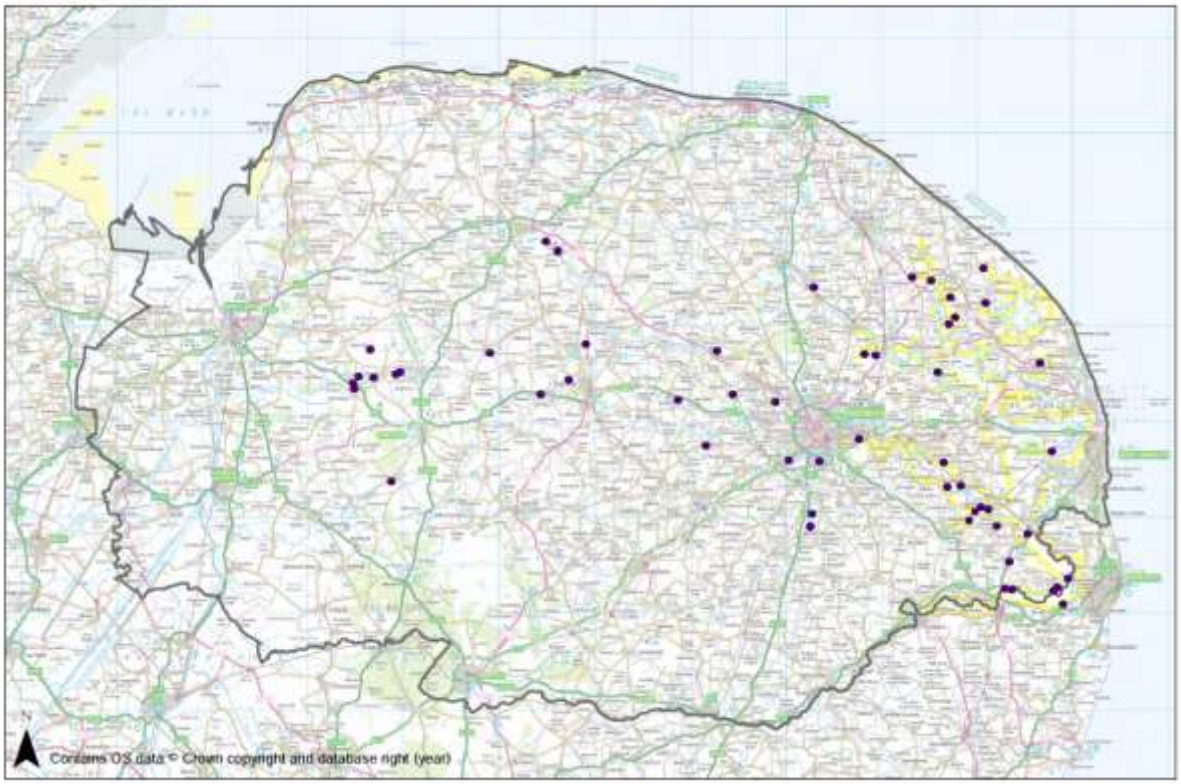
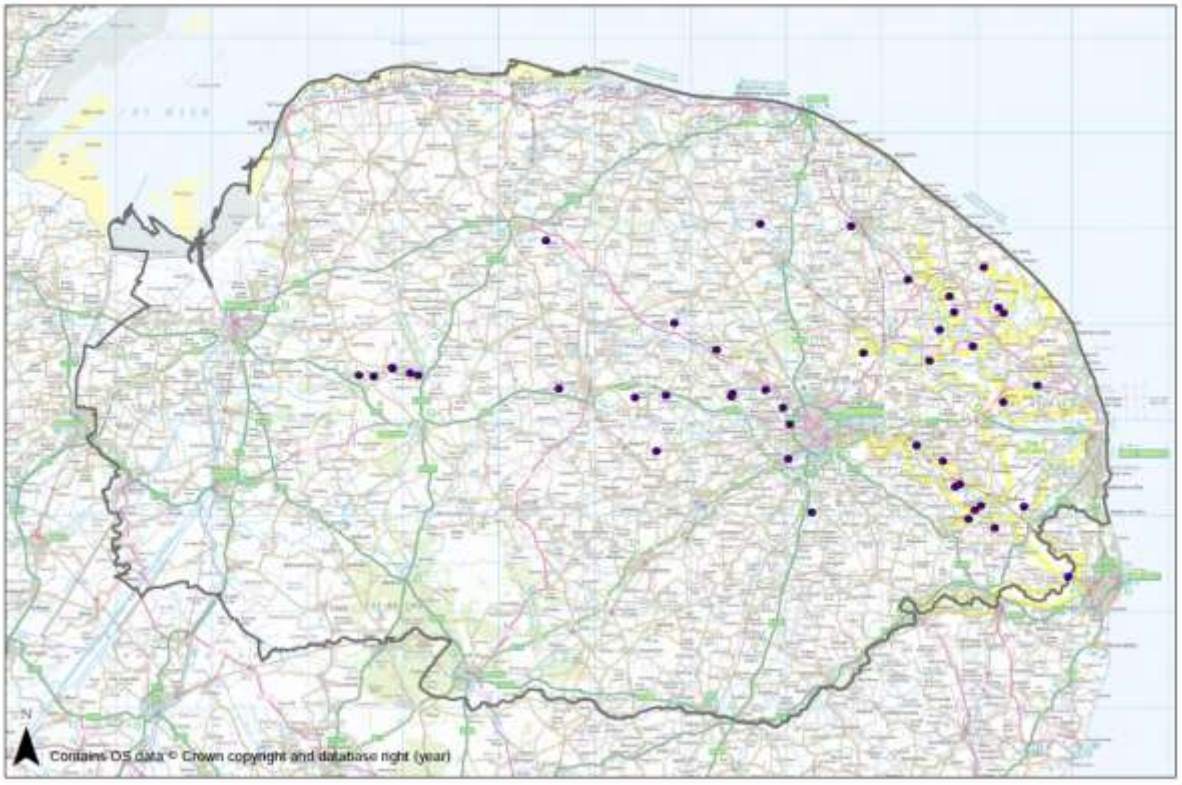


Mink Events 2007



Mink Events 2008



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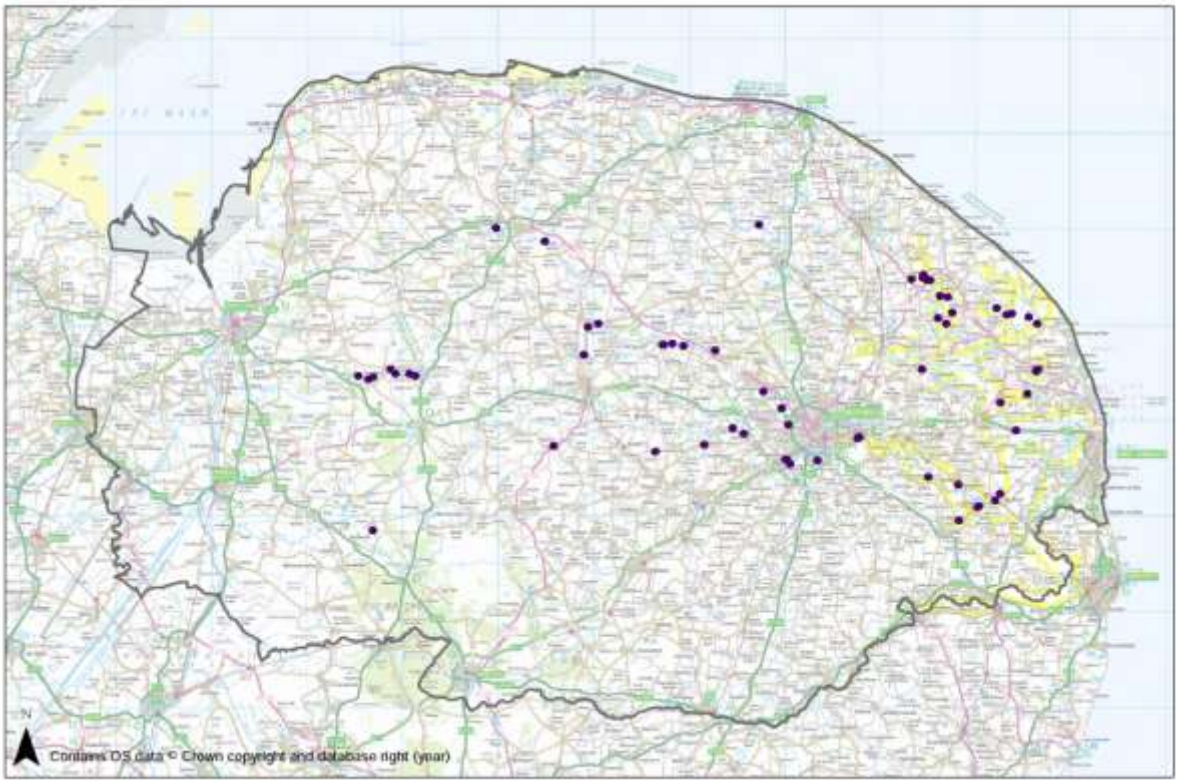

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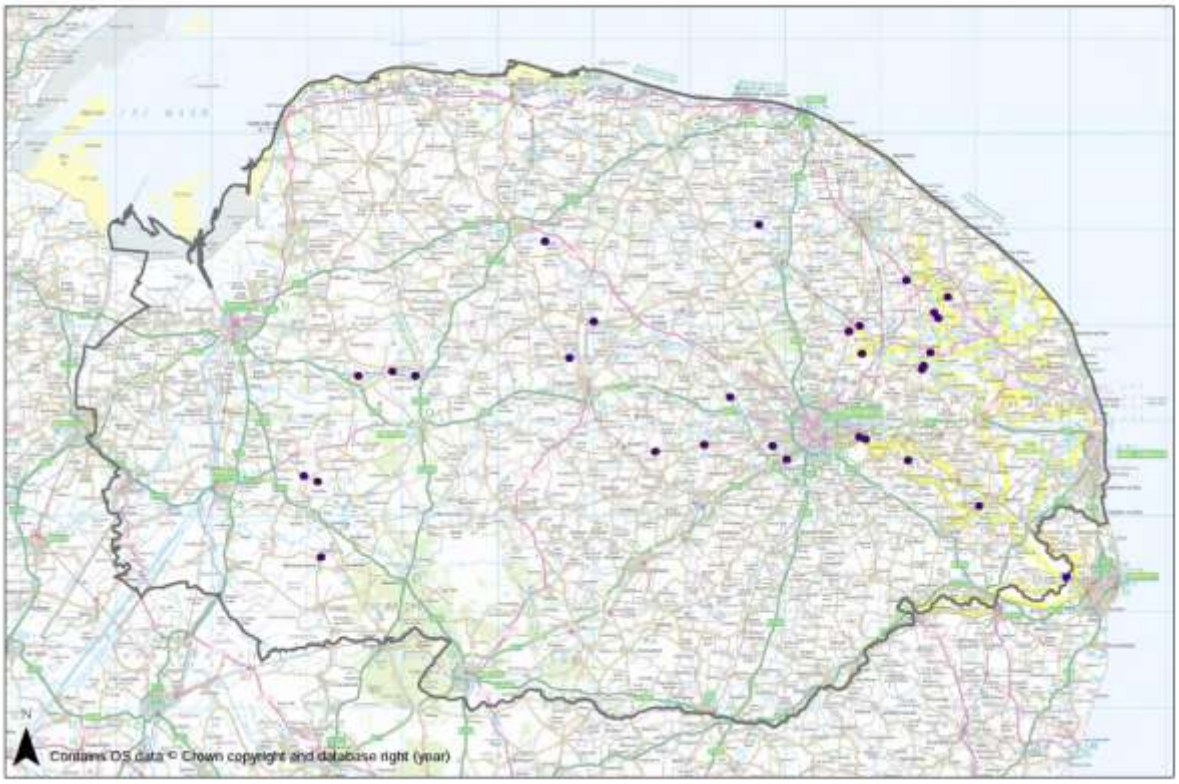

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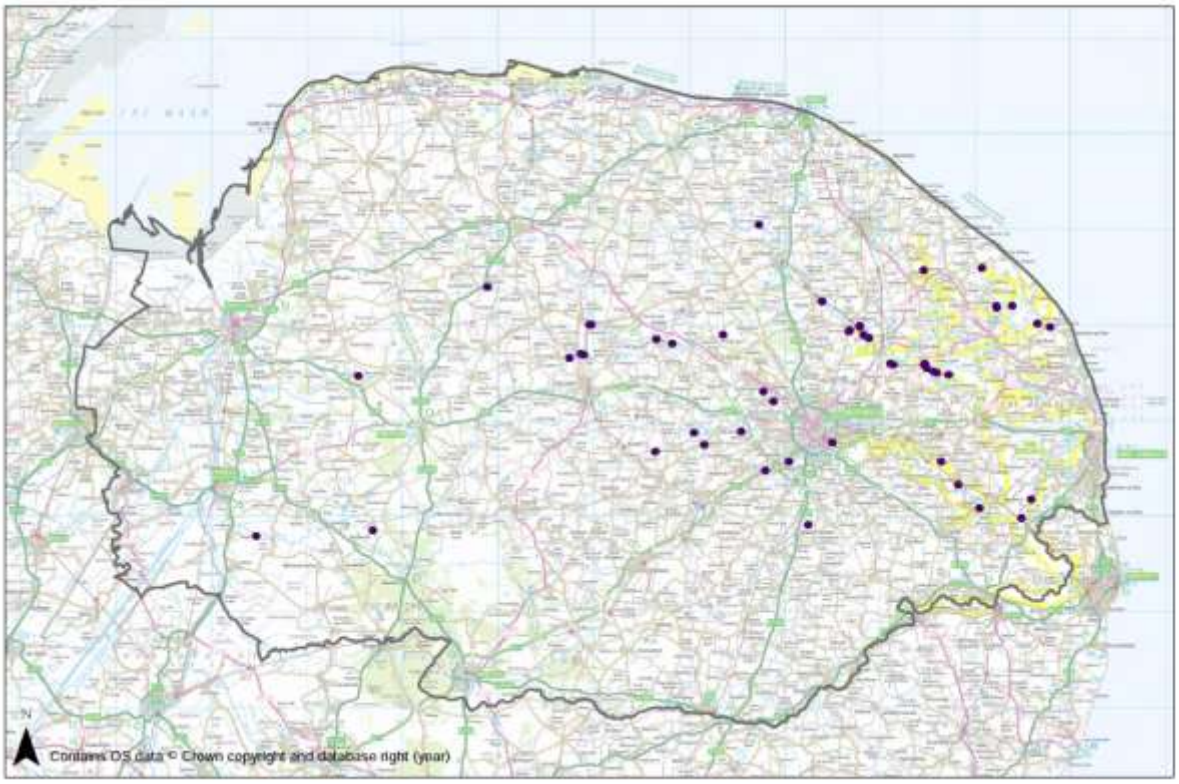

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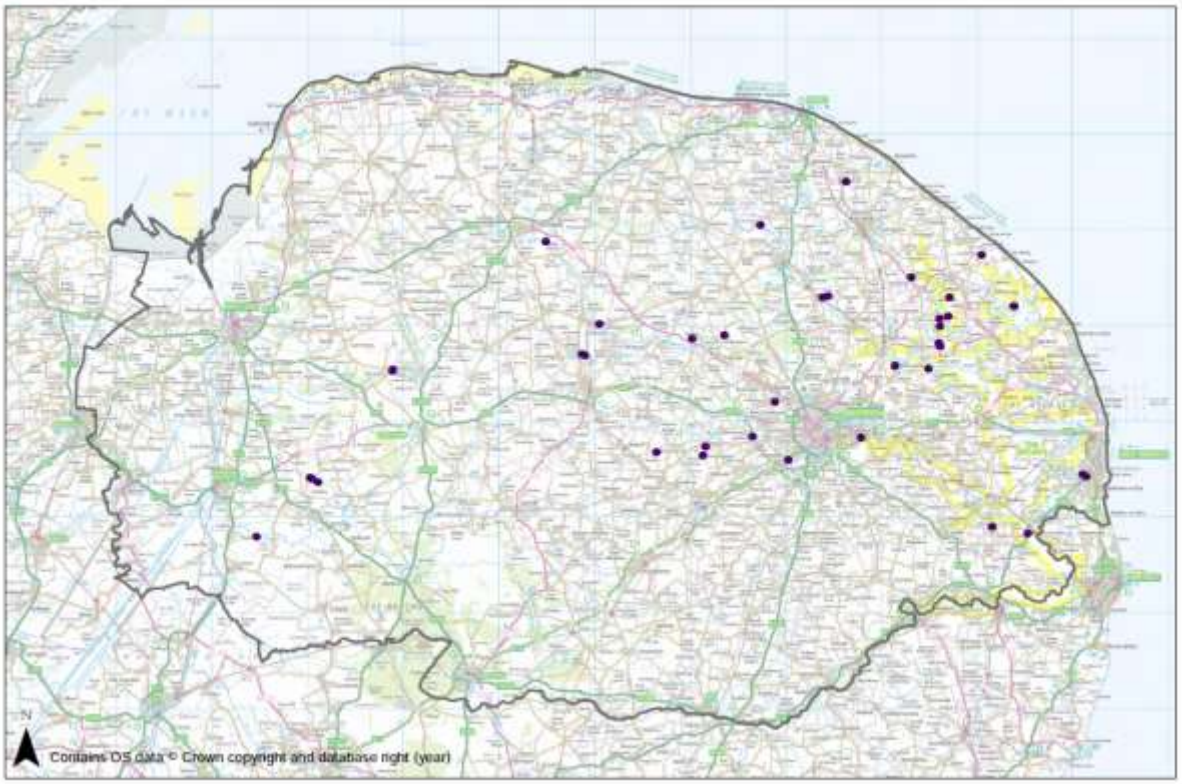

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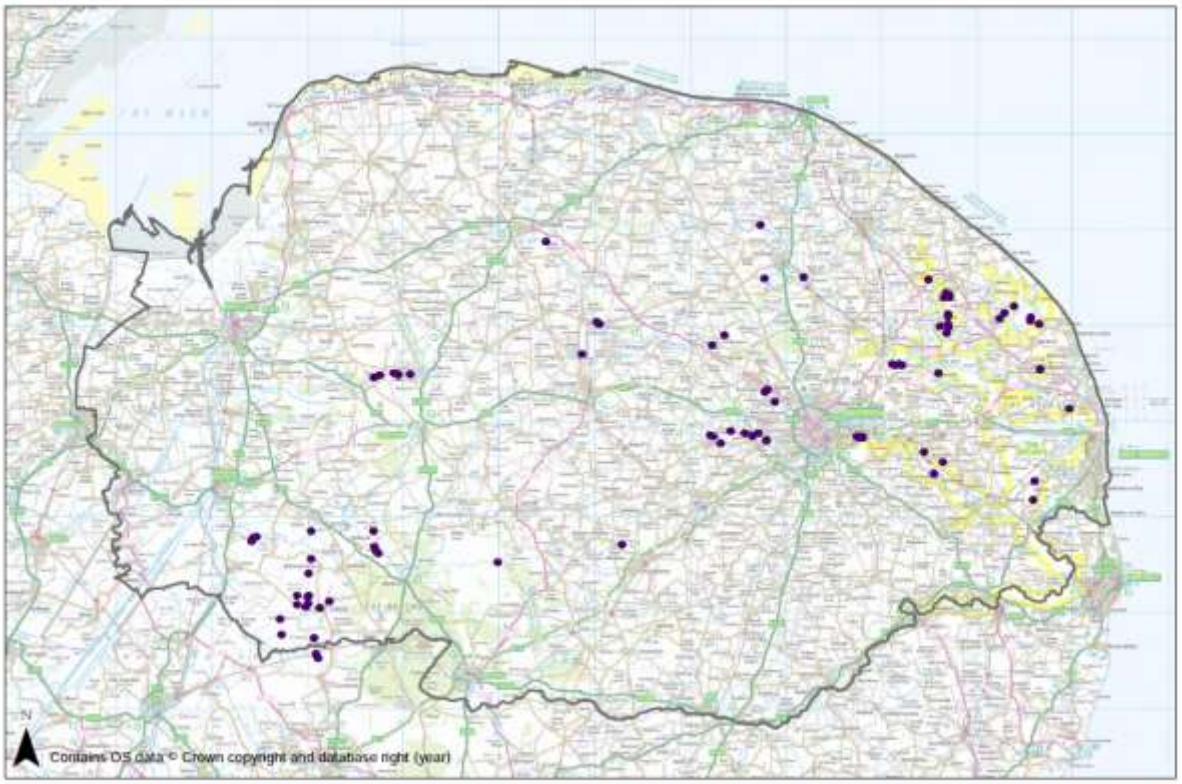

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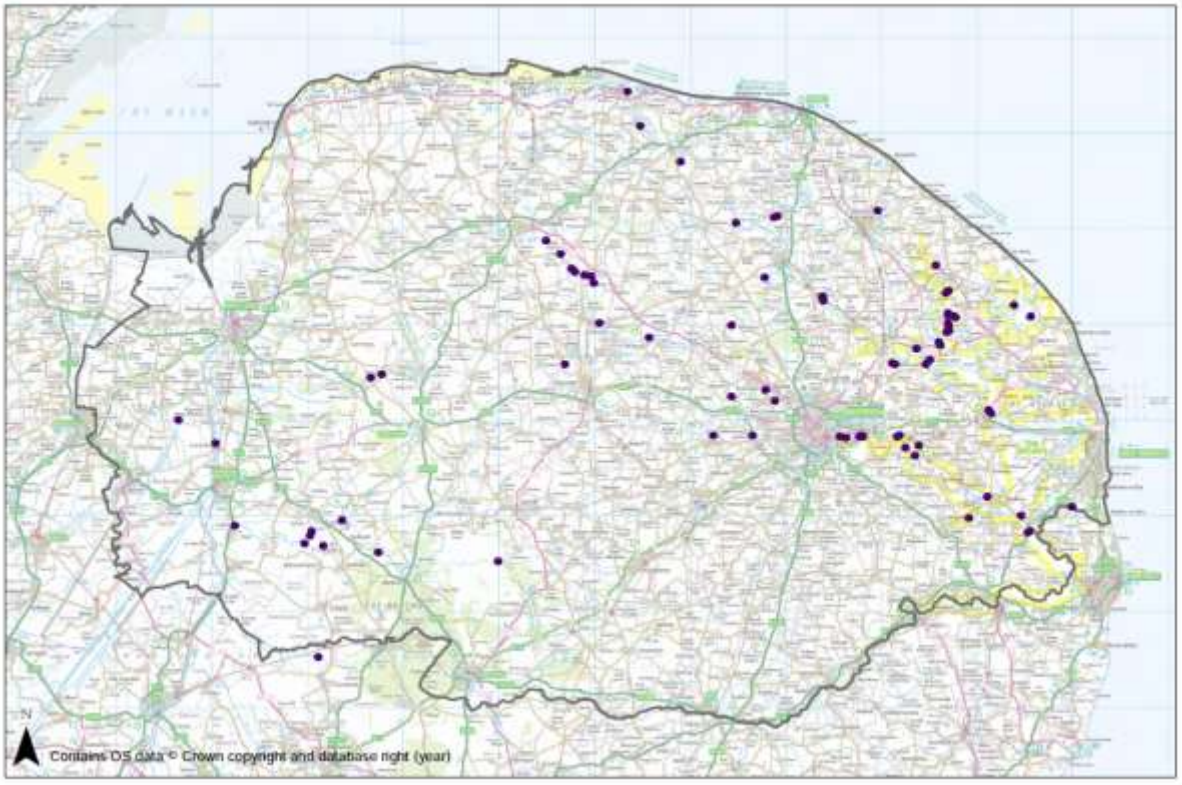

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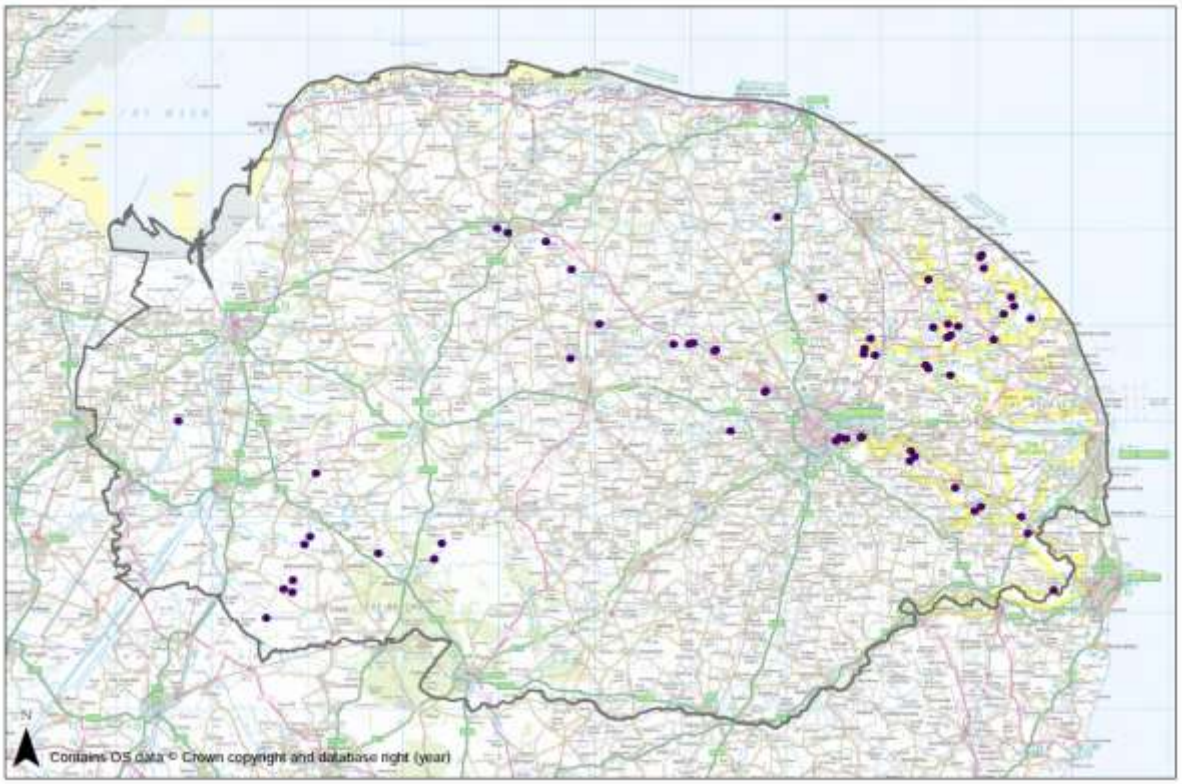

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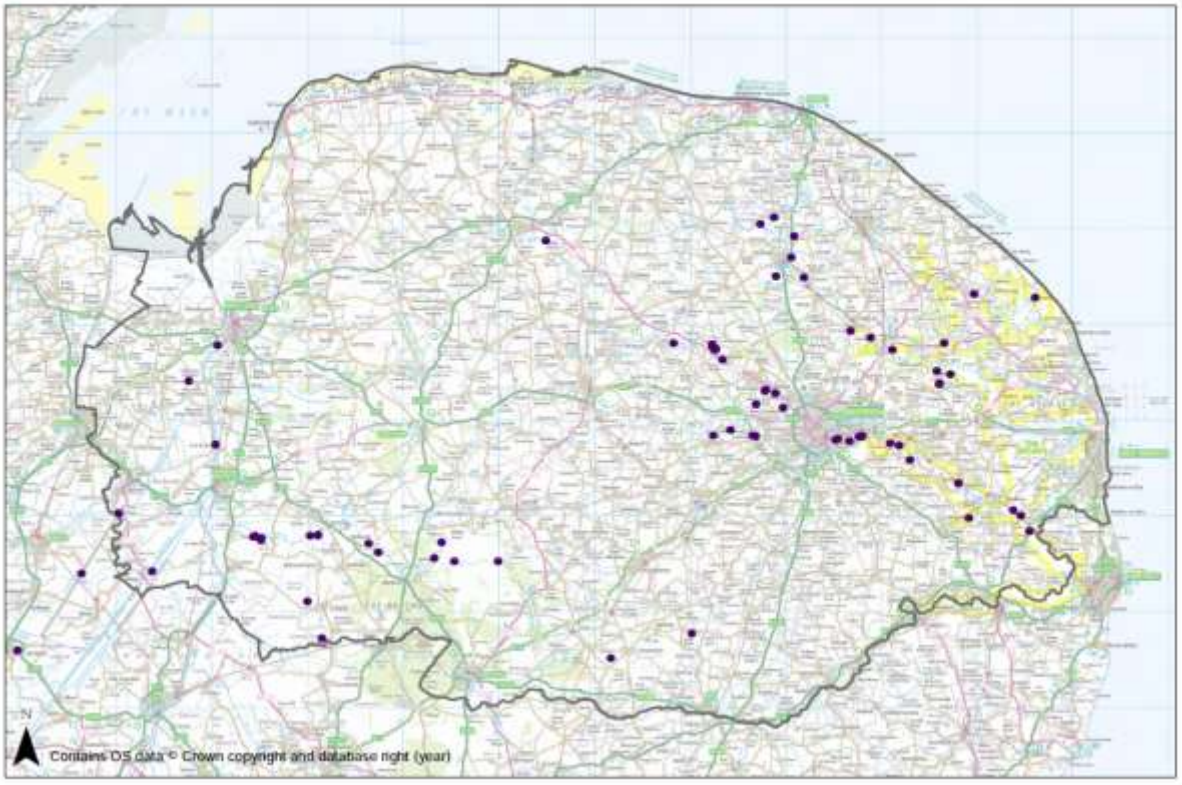

Summary

Volunteer effort was calculated to be worth between £40,000 and £300,000 per year to the project, with a best current estimate of around £115,000 per year. This is a quite remarkable return on a funding budget of around £20,000 per annum. Two methods for calculating this value have been developed and will be available for future analysis.

All catchments where control is well established exhibit markedly lower population statistics than in previous years. Most are below 10% of previous levels according to the 'capture per unit effort' analysis. Newer catchments such as the Thet, Great Ouse, and NNR, cannot yet be analysed properly due to lack of data.

Catchment control coverage was mapped out (see figure 5) and calculated precisely using the GIS capabilities of the Broads Authority and data from the Environment Agency, Ordnance Survey, and Natural England. Coverage was highest in the Wensum (66%), Bure (64%), and Yare (55%), the most well established catchments. The newer catchments have lower coverages (1-33%) and perhaps require more investment, although in certain cases this result may be an underestimate due to the catchment boundaries crossing county lines, and therefore including habitat that falls outside the NMP's jurisdiction.

A method to underpin an objective 'Traffic Light' system was developed and can be used to justify the classification of catchments from now on. The thresholds may need fine tuning at a later stage.

Recommendations

One of the primary limitations of this body of work is that the volunteer effort calculations are grounded in a series of assumptions concerning the amount of time spent checking rafts and traps. While the NMP maintains a comprehensive database containing details of mink kills & sightings, and records of where equipment is loaned out, when, and to whom, there is a notable lack of record keeping with respect to the time spent checking that equipment. Without this, the calculations rely on general assumptions of check frequency and check duration, multiplied by the number of items in operation. Therefore the principle recommendation of this report is to implement a record keeping system detailing time spent by each volunteer on each check, as well as mink detections (which are currently not recorded unless they result in a kill).

Gemma Webster at Napier University, Edinburgh (formerly of the University of Aberdeen) was involved in a system called MINKAPP that provided this functionality to the Scottish Mink Initiative, in a limited capacity. Given the difficulty in reaching our volunteer base electronically, a better way to go may be to implement a paper recording system, where volunteers are issued with pre-printed notebooks in which they can record their checks (and the result of those checks). Not only would this improve check record keeping, but it has the potential to improve communication between the volunteers and the coordinators, who are sometimes left unaware that a volunteer has lost their equipment or moved away, by virtue of requiring relatively frequent contact to retrieve notebooks and issue new ones. One possible format is suggested below, based on the raft check records of Gavin Devaney (Broads Authority). If notebooks prove to be prohibitively expensive then a less exact method would be to devise a questionnaire, similar to the one employed here, that coordinators can take out to a sample of volunteers (asking the questions on the spot to ensure and clarify

responses). This would only have to be done occasionally, when the coordinator is in the right area, and would have the advantage of reaching volunteers who do not use email, as well as, again, giving the opportunity to touch base with volunteers who we do not hear from often.

Table 4 – Example of format for pre-printed notebooks handed out to volunteers.

Date	Raft (R) or Trap (T)?	Grid Ref	Mink sign/ capture? (Y/N)	Comments (condition of raft/trap, water vole sign, time spent, etc.)
23/03/2015	R	###	Y	Mink scat present
23/03/2015	T	###	N	-
07/04/2015	R	###	N	-
07/04/2015	T	###	Y	1male

It is also recommended that a table be added to the cloud database that shows the kill per unit effort so that the population trends can be easily monitored. This can be easily calculated by the methods used in this report. The database system should keep a running total of rafts and traps active in each month, as well as mink caught, and output the kill per unit effort figure. This can also be tallied up on a yearly basis.

The third recommendation of this report is to establish better link-up with neighbouring wildlife trusts. The Essex WT is already using the cloud database as of this year and we can expect to include their data in a wider ranging report in the future. The Suffolk trust does not currently use the same system but since certain catchments (notably the Little Ouse and Waveney) cross the county boundary and are in fact largely controlled by the SWT, it would make sense to include their records in the database so that combined control coverage can be better calculated. If this is not possible then future work should include a more precise look at how much habitat the NMP is responsible for in the catchments crossing county lines, so that a more accurate coverage figure can be calculated. One quick method may be to calculate what proportion of each catchment falls within the NMP area and scale the habitat estimate based on that, however this would be confounded if mink habitat is unevenly distributed spatially across the catchment.

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