How can UK wildlife rehabilitation centres prepare wild caught British passerines for rerelease?

Presented by

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Abstract

The capture, sale and possession of wild caught British birds is prohibited in the UK under the Wildlife and Countryside act (1981). Offences often result in wildlife rehabilitation facilities boarding the birds for the duration of the court case. If approval is given, they are also responsible for the rehabilitation and release of these birds, often using methods similar to those for injured or orphaned wild birds. Though many studies have investigated the success of raptor rehabilitation, the implications of releasing a wild-caught passerine that may have spent the best part of it's lifetime in captivity is as yet unknown. A questionnaire was sent to six wildlife facilities in the UK to determine the similarities and differences between care methods and opinions on suggested improvements. It was found that centres often had similar care methods but significantly varied when deciding on important behavioural factors for release. Additionally, electronic datasets of admissions over 10 years and case bird recoveries were analysed to determine frequencies, outcomes and post release survival. Passerine case bird admissions were found to have increased over 10 years. 81.42% of case outcomes were releases and 75% of recovered birds were found alive and well. There was also a significant difference between life stage on admission on case outcome. It was concluded that despite the good release rates and overall contentment with the current protocol, the current lack of post-release information gives no indication of true success. Post release success is essential to ensure the welfare of these birds and to maintain populations within the wild if they reproduce. It is suggested that some additions to the current protocol may be beneficial like encouraging competitive behaviours and predator avoidance training. Such research can aid wildlife centres in providing the best survival chances for these birds.

[296 words]

1. Introduction

Great Britain's adoration for their native bird species has spanned centuries and have resulted in organisations such as the Royal Society of the Protection of Birds (RSPB) and the British Trust for Ornithology (BTO) having been formed. Under the Wildlife and Countryside act (1981), birds have their own section of offences and protections. National birdwatching schemes are still popular to this day, namely the Big Garden Birdwatch run by the RSPB which boasts nearly half a million participants a year (RSPB, 2020). For some, the admiration for birds goes beyond the wild and can fuel the illegal trade in wild caught native birds as pets or additions to collections. Attempts to rerelease birds confiscated from such collections are greatly encouraged (Thompson, 2019) however effects of long-term captivity has not yet been studied to assess post-release survival of wild-born captive birds.

1.1 An overview of native bird trade in Britain

The Wildlife and Countryside Act (1981) makes it illegal to take, trap, sell, advertise to sell, show intention to purchase or make intentional actions towards sale such as possession or transport of wild British birds dead or alive. The exception are those listed in part 1 of schedule 3 whom may be sold if it possesses a closed ring with an identification number to prove the animal was captive bred. These closed rings are issued by the British Bird Council (BBC), an organisation approved by the Department of Environmental, Farming and Rural Association (DEFRA) to monitor the keeping, breeding, exhibiting and sale of British birds (British Bird Council, 2020). A violation of these rules result in a fine not exceeding £5,000, no more than six months imprisonment or both (Wildlife and Countryside act, 1981). The UK public and magistrates opinion is that the most punishable attribute of a wildlife crime is not ecological damage made but the size of the defendants economic gain from the crime (St. John, Edwards-Jones, Jones, 2012).

In 2017, there was 36 recorded cases of taking, possession and selling of non-raptor wild birds. Finches were most common as their bright plumages makes them desirable. A 'Mule' is a hybrid of two species, most commonly a Goldfinch cross Canary which results in often infertile but colourful offspring (Carr, 2014). A quick search of "Goldfinch" on a popular buy/sell site (Preloved,

2020) displayed a single Siberian goldfinch cross Bullfinch male hybrid reaching £350. Though many captive bred morphs and mules were seen with varying prices, those displaying wild colouration were often sold at a higher price (£80-£280) than most mules (£50-£65).

1.2 Current protocol for seizing and rehabilitating case birds

The current Royal Society for the Prevention of Cruelty to Animals (RSPCA) protocol for wild caught finches details the care requirements, information recorded, and post-release actions taken to ensure best practice possible (Thompson, 2009). Birds are confiscated by RSPCA Animal Control Officers and transferred to the nearest wildlife centre that has the space for them. On admission all non-ringed birds must be ringed and their identification number recorded on their card along with any prior knowledge or observations. Those in poor health are immediately quarantined. During boarding plenty of vegetation, perches, mixed feed, hanging millet and broccoli heads are recommended as a suitable enriched environment for boarded birds. For 14 days all birds must be kept in flight cages so the defendant/s may bring their own expert witness to assess the birds. The RSPCA may also examine and video the birds behaviour for their own use. After 14 days they can be transferred to a large outdoor aviary if approved by the case officer. Different species of bird have their own care requirements. Those who look unwell or thin are not moved and seek veterinary attention. Any mortalities whilst boarding are recorded and kept in a freezer for evidence.

Sometimes, purely the nature of the case may discriminate a wild bird from captive bred (Thompson, 2019). However, methods such as stable hydrogen isotope analysis in feathers (Kelly, Thompson, Newton, 2008), comparing ecological differences in species (Cramp, 1992), identifying behavioural indicators (Thompson, 2019) and feather condition (Cristol et al. 2005) can all aid in identifying a wild from captive bred individual. DNA analysis may be a future option for identification but has only yet been used in raptors (Millins, Howle, 2014).

During preparations for release time spent in outdoor aviary, age, weight, feather condition, season, weather and number of birds being released at a time affects the decision of the centre over a release (Thompson, 2009). Feeding posts can be set up at release sites to help

transgression. There is little mention of behaviour in these assessments. Including behavioural factors such as pre-release observations into the protocol that may ensure the birds have the necessary skills in which to survive after prolonged time in captivity.

1.3 Implications of rehabilitation on seized bird welfare

Wildlife welfare is a controversial topic especially in the field of rehabilitation. There are three outcomes when encountering a wild animal in need (Kirkwood, Sainsbury, 1996) [see: table 1]. From a welfare perspective all three outcomes can be justifiable in different situations, however ethical considerations cause conflict over which outcomes should be implemented. In context of bird rehabilitation 'welfare' is being defined here as providing species-specific husbandry measures that accounts for both physiological and psychological needs to increase fitness and survival chances post-release. The utilization of welfare aspects within husbandry protocol in rehabilitation is essential not only for physical recovery (Gordon, Gentile, 1985) but may also increase post-release survival (Grogan, Mathews, 2008).

Table 1: Case bird key outcomes (Kirkwood, Sainsbury, 1996)

Rehabilitation	Animal is either unlikely to recover without treatment or in a circumstance where the recovery period will significantly impact an individual's survival.
Euthanasia	Individual is in distress and unlikely to recover. In most cases, the inability to return to the wild for example disabled animals are euthanised on the grounds of their inability to survive and ethical considerations of keeping wild animals in captivity (Thompson, 2019).
No Intervention	Individual is likely to recover and the distress of rehabilitation may be detrimental to its condition.

The effects of capture and rehabilitation depends on if a bird is truly wild or captive bred. Wild birds typically display erratic behaviour when approached (Thompson, 2019). Wildlife assistants

speak of a steady bird if it's captive bred due to habituation to handling and captive environments. Both stereotypic behaviour (Garner, Mason, Smith, 2003) and displacement behaviour, often through aggression between individuals (Duncan, Woodgush, 1971), are indicators of a high stress levels. Captive birds have weaker responses to acute stress in a captive environment (Cabezas, Tella, Carrete, 2012) and therefore often adjust easier. In the same study, wild birds show longer corticosterone responses which stimulates learning and memory to habituate to a new environment. However, it is hypothesised that the high mortality rates in the transportation of wild birds results in accidental selection of the stress coping abilities in individuals. Furthermore, the erratic behaviour typical of a wild bird often causes damage to the feathers and cere after a certain period in captivity (Thompson, 2019).

Furthermore, wild behaviour may be affected through gradual habituation to a novel environment. Butler et al, (2006) observed foraging behaviour in wild caught chaffinches decreased >75% in trials conducted within two days of capture. This same probability decreases by 50% 12 days after capture. The trials were conducted at a specific time frame within a foraging enclosure with specialised feeders resembling grass. Results conclude a lower perceived risk of starvation due to the ad libitum feeding style within captivity. These studies beg the question of how captivity, especially long-term, affects the post-release survival of wildlife after becoming accustomed to a captive setting.

1.4 Purpose and aims.

The data was analysed along with a literature review and current protocol analysis. Aims were to build the foundations of a proposed protocol which accounts for wild caught passerine case bird welfare both pre and post release whilst addressing the practicality of the implications on wildlife workers. Protocols are necessary to maintain standards of care both cross-centres and between staff within centres. Often written by wildlife managers who utilize scientific data and personal experiences in the text, they aim to set a standardised care routine for wildlife staff to reference when needed.

It is expected that there will be similar care methods in all wildlife centres due to the ease of access to recommended and peer-reviewed protocols, however there may be differences in decision making between centres regarding factors of most and least importance and decision making for case outcomes. It is predicted that release rates of wild caught passerine case birds will be high.

For the sake of ease of reading, wild caught passerine case birds will be from hereafter referred to as simply ‘case birds’.

2. Materials and methods

2.1 Ethics statement

This project was approved by the Research Ethics Committee at Plumpton College and the RSPCA ethics committee.

2.2 Questionnaire

An expert-interview questionnaire was produced on Microsoft Word (2018) to determine how centres care for and decide the outcomes of case birds once they are seized and taken for holding or rehabilitation. Campbell (2000) used a similar expert interview method on marine biologists and conservationists to measure acceptance of contemporary methods of wildlife conservation, demonstrating how vital the opinion of experts are to the application of new methods within conservation. Their opinion ultimately predicts which methods are implicated, changed or rejected. This study aims to reflect this idea to create a plan that will be accepted and practical for wildlife rehabilitation staff. The questionnaire was distributed via email to six wildlife centres in the UK and contained a mix of multiple choice, scale and text box questions. Additionally, a form of consent was attached along with an overview of the study and a statement of confidentiality under the Data Protection act of 2018.

2.2.1 Participants

Six registered wildlife centres from a variety of locations in England were asked to fill out a questionnaire on case birds. Four of the six centres work for the RSPCA. For the sake of confidentiality, the centres in this study were renamed in letters alphabetically from A to F. The individuals asked to complete the questionnaires on behalf of their facility were senior members of staff, most often the manager.

One centre was unable to answer 3 of 22 questions due to the small number of cases encountered, however it was decided that there was still enough data to include.

Fig 1: Distribution of UK wildlife facilities used in a questionnaire on passerine case birds

2.3 Bird data collection

A ten-year electronic dataset between 2010-2019 on 580 rehabilitated passerines (see: Table 1) was provided via USB by RSPCA Mallydams Wood Wildlife Centre in East Sussex, UK. Data consisted of species, admission reason, area found, life stage, date admitted, outcome result and outcome date. Individuals of passerine species that had been admitted under “legal case bird” were used for statistical analysis.

Table 1: passerine case bird species admitted between 2010-2019

Species	**No. Individuals**
Brambling Fringilla Montifringilla	2

Bullfinch Pyrrhula Pyrrhula	6
Chaffinch Fringilla Coelebs	13
Goldfinch Carduelis Carduelis	508
Goldfinch mule	12
Greenfinch Chloris Chloris	18
Hawfinch Coccothraustes Coccothraustes	2
House sparrow Passer Domesticus	1
Lesser redpoll Acanthis Cabaret	5
Redpoll Acanthis	9
Robin Erithacus Rubecula	4
Total	**580**

Data on a total of 20 recovered passerine case birds released from RSPCA Mallydams wood between 2004 and 2019 were also sent electronically via email, originally recorded by the British Trust for Ornithology operating in the South East of England. Data consisted of 18 Goldfinch, 1 Bullfinch and 1 Greenfinch.

All data was in the form of Microsoft Excel documents (2018 edition).

2.4 Statistical analysis

Statistical tests were conducted on Genstat (2018 edition) software from data on Microsoft Excel (2018) spreadsheets.

A Goodness of Fit Chi Square was used to test if the frequency of admitted birds changed annually, if there was variation of numbers of birds in each outcome category and to test the

circumstances in which recovered birds are found. All tests were under the assumption that frequencies would be of equal distribution.

A one-way ANOVA and a Tukey post hoc analysis was used to investigate if life stage on admission affects outcome. Four life stages were used: “adult”, “fledgling”, “juvenile” and “nestling”. The life stage “eggs” was ignored as they are generally not allowed to hatch for imprinting reasons. Any data left blank or labelled ”unknown” was excluded.

3. Results

3.1 Case Bird Questionnaire

Six centres participated in a questionnaire on their care, considerations and opinions on case birds in their facilities.

3.1.1 Estimated numbers

When asked the estimated frequency of an illegal wild bird trapping case in each centre, three of the six centres reported encountering cases less than once a year, one bi-annually and two less than monthly. Of these, two centres reported 1-5 individual birds per case, another two reported 11-20 birds and one reported over 30 individuals per case. One respondent was unsure so did not partake in this question.

On the question about the average length of time held in the facility, four centres stated they kept case birds for 1-3 months and one reported a longer holding time of 3-6 months. Again, one centre did not partake in this question.

Regarding possible case outcomes for the case birds all six centres agreed they release their wild caught birds however they differed on other factors (see: Table 2).

Table 2: Results of question on wild-caught non-raptor case bird possible outcomes.

Returned to owner	Private collection	Release	Euthanasia: unfit for wild	Other	Centre
X		X	X		A

X	X	X	X	Birds may die whilst in the centre.	B
		X	X		C
		X	X		D
X	X	X			E
		X	X		F

When asked for an estimate on the frequency of rerelease of the case birds in their care, three centres reported a release rate of >75%. One reported a lower rate of 51-75% and another lower still at 26-50%. One centre did not answer this question therefore cannot be included in this result.

3.1.2 Rehabilitation and husbandry

When asked about the enrichment provided amongst the centres, all six participants declared that they provided both vegetation and hanging enrichment such as millet to their case birds but often differed on other enrichment types (see: Table 3). All respondents agreed they offered case birds multiple food types.

Table 3: Enrichment provided in wildlife centres for wild-caught passerine case birds.

Vegetation	Millet	Scatter	Mirrors	Outdoors	Other bird contact	Toys	Predator training	other	Centre
X	X	X							A
X	X			X	X				B
X	X	X							C
X	X	X							D
X	X	X		X					E
X	X	X		X	X				F

Table 4: response to a multi-answer question on social grouping of wild caught non-raptor case birds

All species together	By case	On behaviour	On health	Pairs	Individually	Other	Centre
	X						A
X	X	X	X				B

			X		X		C
	X	X	X				D
	X						E
	X	X	X				F

On a multiple-choice question of all the methods of social grouping of case birds used in a centre, there was much variation between the facilities on both the method and the number of methods used (see: Table 4).

All centres agreed they house birds according to their species and natural social grouping. When asked if case birds are provided with different husbandry techniques than wild birds in their care, three respondents said yes, two said no and one was unable to provide a definitive answer.

3.1.3 Behaviour in rehabilitation

Five respondents reported that they do not conduct behavioural observations on case birds, but all agree they do take notes on behaviour during daily routines. The remaining respondent reported weekly observations of >10 minutes. Four of six centres stated that they provide individualised care routines dependant on behaviour, yet the other two respondents claimed they do not.

When asked to rate the factors and their influence on the decision to release a bird, all centres differed in their answers (see: Table 5). However, some similarity of opinions were identified in some behaviours. Centre F was excluded from this result due to inconsistencies in the grading scale.

Table 5: Results on the most (1) to least (10) important factors affecting case bird release decision

	A	**B**	**C**	**D**	**E**	Mean	Range
Tameness to humans	5	4	7	1	10	5.4	9
Sociability to same species	6	9	9	4	8	7.2	5
Aggressiveness	10	10	10	9	7	9.2	3
Avoidance	8	8	8	6	2	6.4	6
Activity	7	5	5	7	6	6.0	2
Foraging ability	9	6	3	5	5	5.6	6
Disease	1	1	1	2	1	1.2	1
Feather condition	2	2	2	3	3	2.4	1
Weight	3	3	6	10	4	5.2	7
Stereotypies	4	7	4	8	9	6.4	5

Disease appeared to have the overall biggest impact (mean=1.2, range=1), followed closely by feather condition (mean=2.4, range=1). The overall lowest ranking factor was aggressiveness

(mean=9.2, range=3). Tameness appeared to show most variation in answers (mean=5.4), which ranged the full 1-10 scale (range=9).

Once asked to note all behavioural indicators are used to assess release, all participants noted both avoidance behaviours and activity levels as an important behaviour to assess. The testing of other behavioural indicators varied amongst the centres (see: Table 6).

Table 6: behavioural indicators used to assess for the release of wild caught passerine case birds

Tameness	Avoidance	Social	Aggressive	Activity	Foraging	None	
X	X			X			A
X	X	X		X	X		B
X	X	X		X	X		C
X	X	X	X	X	X		D
	X			X	X		E
X	X	X	X	X	X		F

Furthermore, each respondent was asked to use a scale of 1=unlikely to 10=very likely and reply in their own words to how likely individual personality affects a birds rerelease chances. Only one centre thought this was likely, the others did not support this theory (see: Table 7).

Table 7: responses to ‘how likely personality affects passerine case bird release chances’.

C	1 = very unlikely	“*I don’t feel that a shy bird would have any less chance of survival in the wild than a bolder bird.*
E	1 = very unlikely	“*Case birds are assessed by an independent expert who looks for wild behaviour, not personality”*
A	3 = unlikely	“*Their individual character may influence how bold they are in the aviary in going to feeders etc but a birds release would be judged on the individual health, fitness and condition and whether it displayed behaviour that would be deemed as ‘Tame’”*
B	5 = unsure	“*Some behavior traits like if the bird is habituated to people/imprinted. will obviously have a big impact on that individual's chances of release. But some behaviour like boldness vs shyness is harder to judge. Your example of bold vs shy individuals might be correct however It may be that bolder individuals are more at risk when released as they might put themselves in riskier situations then shy birds. for example they may readily use garden feeders and get caught by a cat whereas a more cautious bird may watch the garden for a longer period of time to see if it is safe to use the feeder.”*
D	5 = unsure	*“A birds behaviour in captivity isn’t always a true indication (a shy bird can become aggressive if it feels threatened and a bold aggressive bird can be an imprint.)”*
F	7 = likely	*“For suitability for rehabilitation”*

3.1.4 Release

Five of six centres reported releasing birds in various areas dependant on the nature of the case however one centre stated they always soft release on site. Four centres provide post-release feeding stations wherever they release. One centre provides feeding stations only on their grounds, and the remaining one provides feeding stations only at external sites.

3.1.5 Opinions on current protocol

Lastly, the six respondents were asked if they would like to participate in potential future trial husbandry regimes (See: Table 8). Only half of the participants responded with 'Yes' to the proposal.

Table 8: Responses to a proposal of new passerine case bird husbandry regime by wildlife centres

A	Yes	*"Happy to try anything that might improve post release survival but we see very few case passerine birds*."
B	Yes	*"I am happy with the way we deal with case birds, but am open to new ideas if they improve post release survival rates"*
C	No	*"We do not feel that we have 'case birds' in our centre enough for this to be applicable*."
D	Not sure	*"Possibly, but would like more details first"*
E	No	*"We follow an extensive protocol which works"*
F	Yes	*"Furthering knowledge in the interest of animal welfare"*

3.2 Rehabilitated Case Bird Dataset

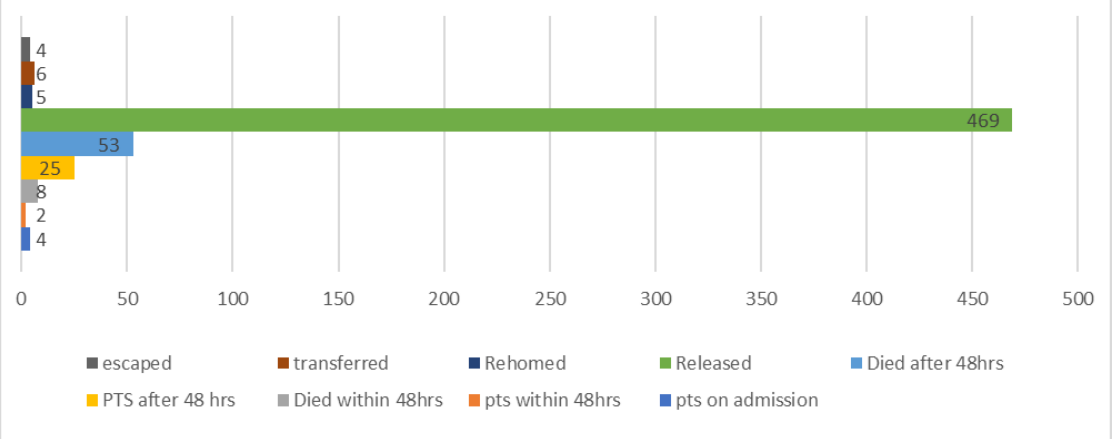
Analysis of admission and recovery data from RSPCA Mallydams Wood.

3.2.1 Have frequencies of admissions changed over 10 years?

The frequency of birds admitted over 10 years was significantly different to what was expected assuming that the frequency of birds admitted per years should be consistent ($\chi 2$ (9)=357.89, p=0.001). Frequencies of birds admitted increased over the ten years recorded.

3.2.2 Do frequencies of case birds in each outcome category vary?

Fig 1: frequency of passerine case birds recorded in each outcome category.



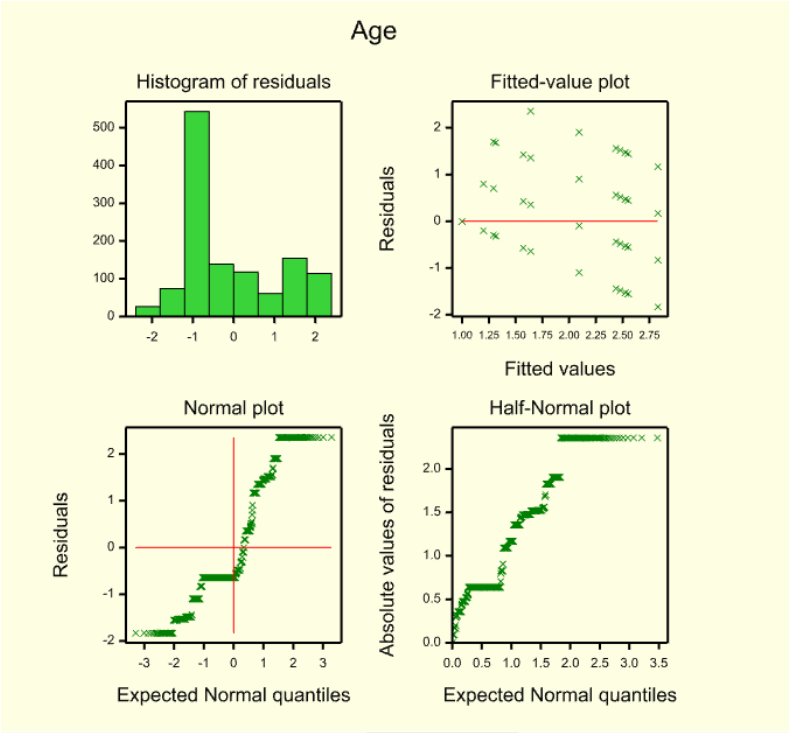
Under the assumption that frequency of each outcome would be evenly distributed, the frequency of all outcomes was statistically significant to what was expected ($\chi 2$ (8)= 2963.51, p=0.001). 81.42% of outcomes were releases and the least recorded outcome was euthanasia within 48 hours (0.35%).

3.2.3 Do circumstances in which birds are recovered vary?

The frequency of birds found in different categories ('trapped by ringer', 'alive taken into care' or 'found dead') was significantly different to what was expected assuming that the outcome was evenly distributed ($\chi 2$ (2)=16.32, p=0.001). Three quarters of birds recovered were found alive and trapped by a ringer. Only one individual was found dead.

3.2.4 Does life stage on admission affect the outcome of a case bird?

Fig 2: residual plots for life stage on admission affects outcome.



There was a significant difference between life stage on admission between each outcome ($F_{(11, 1217)}$ = 18.88, P = <.001). Residual plots show normal distribution of residuals and homogeneity of variance. Some comparisons between outcome and life stage were significant (see: Table 9).

Table 9: multiple comparisons on how case outcome affects life stage in passerine case birds

	Claimed	Escaped	Rehomed	Transferred	Dead on Arrival	Released	Died after 48hrs	Died on admission	Died in 48hrs	PTS after 48hrs	PTS in 48	PTS admission
Claimed												
Escaped	-											
Rehomed	-	-										
Transferred	-	-	-									
Dead on arrival	-	-	-	-								
Released	-	-	-	-	-							
Died after 48hrs	-	-	-	-	-	<0.05						
Died on admission	-	-	-	-	-	-	-					
Died in 48hrs	-	-	<0.05	<0.05	-	<0.05	-	-				
PTS after 48hrs	-	-	<0.05	<0.05	-	<0.05	-	-	-			
PTS in 48hrs	-	-	<0.05	<0.05	-	<0.05	-	-	-	-		
PTS on admission	-	-	<0.05	<0.05	-	<0.05	<0.05	-	-	-	-	

4. Discussion

4.1 Case Bird Questionnaire Conclusion

4.1.1 Estimated numbers

Frequencies of case birds were reportedly low with half of the respondents encountering cases less than once a year. Estimated numbers of individual birds admitted per case were most likely to range between 11-30 individuals. Low frequencies of cases and individuals suggest case bird rehabilitation may be a small issue compared to others in wildlife care, which in turn may reduce willingness of centres to adopt new strategies.

The most popular case bird the goldfinch (*Carduelis Carduelis*) has a typical lifespan of 2 years (Robinson, 2015). The legal system allows two weeks where the case defendant may collect evidence for court (Thompson, 2009), which coincides with most participants stating they keep birds on average between 1-3 months. However, some court cases take a while to close, which may explain one centre keeping birds for 4-6 months on average: up to a quarter of an average lifespan.

Most centres euthanise on the grounds of being unfit for the wild. The centre that did not euthanise was one of two respondents that has sent case birds to private collections which explains the result of individuals who are unfit for the wild. However, it was not specified what “unfit for the wild” meant and it is assumed birds would be euthanized if their health was in decline. All centres release case birds as expected but only half agreed they would return the bird to the owner. This may be due to a majority of offenders pleading guilty once the birds are seized or that birds are transferred to the centre once the case is closed.

Half of the respondents reported a release rate of >75% with the lowest at 26-50%. Rates were based off estimates most likely reflecting their own previous releases. The release rates indicate a good level of success amongst case bird releases but the centre who responded medium/low (26-50%) provided only two possible outcomes on the previous question: release or euthanise. Interestingly, this particular centre checked for more behavioural factors before release than others, therefore their criteria may be stricter than others on which birds are fit for release, but the low frequency of cases may not provide an accurate representation of overall success.

4.1.2 Rehabilitation and husbandry

All centres provided adequate enrichment and offered multiple food types for case birds. This was expected as environmental enrichment is vital to reduce stress (Smith, Taylor, Nicol, 1995) and varied diet choices allow birds to select required nutrients just as they do in the wild (Robbins, 2012).

All centres claimed to house birds according to a species’ social nature, but that may just be interpreted as keeping in groups. The most common group method were by case, health and behaviour. The only method rejected by all centres were pairings. The rejection of pairs is possibly a result of stress related aggression (Duncan, Wood-Gush, 1971) causing stressed birds to fight, which is why large groups of birds kept in a large aviary may be the most preferred method to provide space to escape from others and resources for all individuals. The varying housing methods may be dependant on the individual bird’s needs, number of individuals per case or the facilities available but the current grouping methods appear sufficient to benefit both individuals and the group.

Centres that keep multiple species of passerine together may do so by case and which species were admitted at one time. There were also differences over case birds having different husbandry to wild birds, which may have been controversial as many centres are prepared for wild birds and believe the best way to rewild animals is to treat them as such. Nonetheless, special efforts to avoid taming, increase foraging (Guyon, 2009), train for predators (Griffin, Blumstein, Evans, 2000) and encourage fear of humans may have positive effects on their success (Blumstein, 2014).

4.1.3 Behaviour in rehabilitation

It is often encouraged to minimise disturbance of wild birds in rehabilitation (Thompson, 2019 [2]) which may explain the majority of facilities only noting behaviour during routines, assumed to be twice daily. Nonetheless, one centre did conduct weekly observations of under 10 minutes. Behavioural observations provide information on rewilding progress but observer effects may produce distorted results (Bughardt et al., 2012). It may be beneficial to record the birds for an hour a week to observe their progress without observer presence.

It may be beneficial to use behavioural assessments to modify care routines as this can provide opportunity for each individual. For example a shy bird may benefit from being left alone but a group that displays little neophobia may benefit from predator training. This has yet to be scientifically verified. Four centres provided individual care dependant on behaviour but it was not specified what behaviours were accounted for and what additional care was used. This implies that some centres do consider behaviour when forming a care routine for their birds.

On factors regarded most to least important for release, physical factors were seen of highest importance as a behaviourally competent animal cannot survive without physical health. Factors such as aggression scored low as this may not have much to do with success in the wild; a aggressive bird can defend territory but a shy bird may be less likely to fall victim to predators (Groothuis, Carere, 2004). Nonetheless some factors such as tameness ranged the full 1-10 scale showing that facilities do differ when assessing certain traits pre-release.

Additionally, doubts are apparent over the influence of personality on post release success. Though none doubted the birds had personalities, some did not see the possibility of it's impact

on survival. One evaluation of captive reared animals concluded that a ‘one size fits all’ approach is inappropriate and providing conditions to promote behavioural flexibility may be essential to survival (Watters, Meehan, 2006) such as enhancing competition over food to promote natural guarding or ‘sneaking’ behaviours the ‘winners’ or ‘losers’ may need to perform in the wild.

4.1.4 Release

Release sites of case birds varied dependant on the case nature in all but one participant, which may benefit the animals if they are released within the same area they were thought to be captured. However, this is only truly applicable if working bird traps were found during investigations. The remaining facility that only soft released on site may have done so due to ease of monitoring and to habituate the birds to a wild environment. There may be a need to vary release sites to avoid overpopulation of an area, however birds often disperse quickly (Tweed et al. 2003) and the low numbers of admitted likely does not affect populations.

All centres provided post-release feeding stations in some way. Feeding stations may provide opportunities to monitor released animals and provide an extra resource as they habituate to the wild again, especially in the case of soft releases (Bright, Morris, 1994).

4.1.5 Opinions on current protocol

Responses to a proposal of trailing a new husbandry regime was varied among the respondents. Two centres felt the low numbers of case birds would make such a trial difficult to achieve, or that it would take many years to produce a sufficient dataset. Another opinion was that the current protocol already works well and there is little need for a new one. Release rates do reflect this opinion, yet there is little data on their post-release success. Nonetheless, half of the respondents stated they were willing to try other methods for the sake of improving welfare standards and post-release survival, despite the current protocol working well which indicates there is some interest in continually improving standards.

4.2 Case Bird Data Conclusion

Despite cases being reported as low in the questionnaire, the frequency of case birds admitted displayed a steady increase over the 10 years studied. This could imply that the frequency of this wildlife crime in the UK is increasing, or simply that authorities are improving at identifying

offenders. According to the RSPCA prosecutions and annual report in 2018, crimes against wild birds have increased between 2016 to 2018 (RSPCA, 2018) but the RSPB (2014) shows reports of the taking, sell or possession of non-bird of prey species have decreased over 50% between 2009-2014. This suggests that such offences frequently fluctuate. However, it is important to note that numbers were based off individual birds not number of cases, as there may be many birds per case.

81.42% of case bird outcomes were 'released' which matches the over 75% score that half the questionnaire respondents estimated they released. Often release rates are seen as a success however the RSPCA states that true success in rehabilitation is when post-release survival rates match that of their wild counterparts (Grogan, Kelly, 2013), though there is no mention of reproduction to further contribute to populations. So far there is no UK passerine case bird post-release survival figures as of yet.

It was expected that rates of recovery would show bias due to the unlikely possibility that case birds were to be captured alive and well. Of over 500 birds released a total of 20 were recovered with only one mortality. Furthermore, the single mortality was found killed by window strike 173 days after release, suggesting its survival up until the incident was successful. Molina-Lopez, Casal and Darwich (2011) also found that trauma accounted for 49.5% of mortalities in rehabilitated raptors. Despite the unsuccessful 15% there may still be a disproportionate frequency of unsuccessful cases due to their ease of capture so actual figures may be much lower. The high rates of successful recaptures indicate that current care procedures are working but this does not mean measures cannot be taken to improve these numbers.

Though all birds studied are most likely wild-caught, their life stage at capture may have a profound affect on their post-release survival as birds must be able to fly strongly before release. Prolonged captivity may reduce performance of behaviours such as foraging (Butler et al, 2006) and overall long-term survival (Richardson et al, 2015). The most notable differences in life stage on admission were between those who ended up being rehomed, transferred and released. These groups were most often frequented by adults. Fledgling and nestlings were most likely to have died in care or euthanized possibly because they are less robust to environmental stressors,

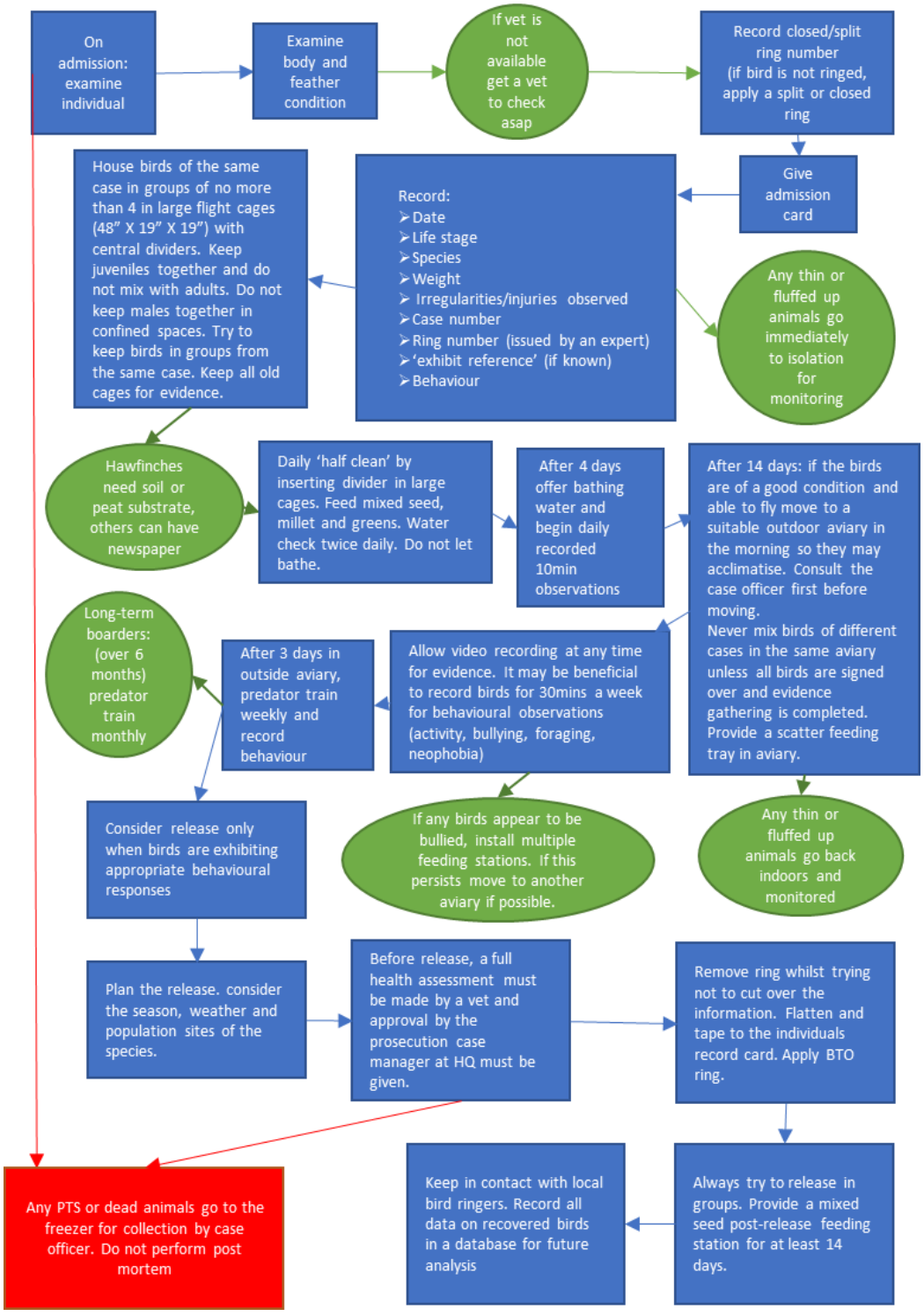
especially if kept in small broods (Lenvai et al, 2008). However, there is no indication of whether the juveniles raised in care have equal survival chances to the adults once released.

4.3 Implications

As with all intervention regarding animals, there is ethical considerations surrounding case bird rehabilitation. Kirkwood and Sainsbury (1996) highlights such issues for treating wildlife disease and suggest conservation reasons should be more influential over decisions to intervene. When applied to case birds these ideologies highlight the question of why do we rehabilitate and why do we not release immediately? Avoiding rehabilitation could avoid prolonged captivity, dramatically reduce stress and may even aid the health of wild populations by "thinning out" individuals who perish from their period of captivity or thereafter. Nonetheless, ongoing court cases mean birds have to board somewhere for a period of time and rehabilitation centres are best equipped to deal with wild birds. Furthermore, the theory that captured birds may reduce low-neophobic individuals from the wild may not apply as some traps are left out for weeks and are most often inconspicuous and unmanned. Most British garden birds live between 2-5 years in the wild (James, 2008). As it is generally unknown for how long an offender has kept a bird and rehabilitation may last beyond six months, a significant proportion of their lifetimes may be in captivity. For this reason the decision to monitor, care for and habituate case birds to a wild-like environment proves the most beneficial method and is widely accepted by most.

The flow chart below is based off Thompson's original 2009 case bird protocol as many centres agreed it is effective. Some additions including behavioural factors have been made (see fig: 3). In the flow charts PTS stands for "put to sleep' and BTO stands for "British Ornithological Society".

Fig 3: Protocol flow chart with additional proposed steps.



Daily video recorded observations after 4 days was implemented to provide information on behaviour without observer presence affecting behaviours (Wade, Zalucki, Franzmann, 2005). It is suggested two or more staff review the footage in order to decrease observer effects (Balph, Balph 1983) .

Predator avoidance training may benefit by sensitising birds to risks in the wild and may increase post release success (Ellis et al. 1997) though some have found no effect (Miller et al, 1990). In a controlled setting McLean, Hölzer and Studholme (1999) concluded birds trained in predator avoidance by their mothers showed similar responses to those trained in captivity. Crane and Ferarri (2017) observed multiple wild-caught species had lower baseline neophobia than captive bred individuals, presumably due to habituation to the wild or bias over highly neophobic animals rarely getting captured. Young animals displayed weaker neophobic responses than adults. Predator training comes in multiple forms such as visual, chemical or auditory. It may be beneficial to combine methods. A suggestion is to provide a moving model, preferably one attached to a form of remotely controlled device to 'chase' the birds as seen in McLean, Hölzer and Studholme's (1999) study. It may also be beneficial to imitate more than one predator for example a fox on the floor and a kite overhead. Combined with the scent of a predator (which may be faeces from other admissions) and recordings of species-specific alarm calls. This provides a more complete predatory experience. Long-term predator training may cause the emergence of inappropriate responses (Griffin et al. 2000). It would be recommended that antipredator training becomes infrequent for long-term boarded case birds. Training only enhances natural responses, not form them. Additionally, modern standards of animal welfare limits some effective methods as it would be unethical to risk harm. Predator training must be cheap, efficient and quick for ease of implementation.

Additionally, a behavioural check flow chart was created to specify the appropriate behaviours and responses seen during observations on admission (see: fig 4), during rehabilitation (see: fig 5) and when assessing release (see: fig 6). Among trained staff such behaviours are easily identified and may be up to individual opinion as to what requires intervention. Nonetheless a behavioural chart is beneficial as a guideline if needed. Note that unless loss of resources or aggression begins to have physical effect on individuals (weight loss, injuries etc.) it may be better to keep just two or three feeding station to promote some competitive behaviour (Watters, Meehan, 2006).

Fig 4: Proposed behavioural check flow chart for wildlife centres stage 1: on admission.

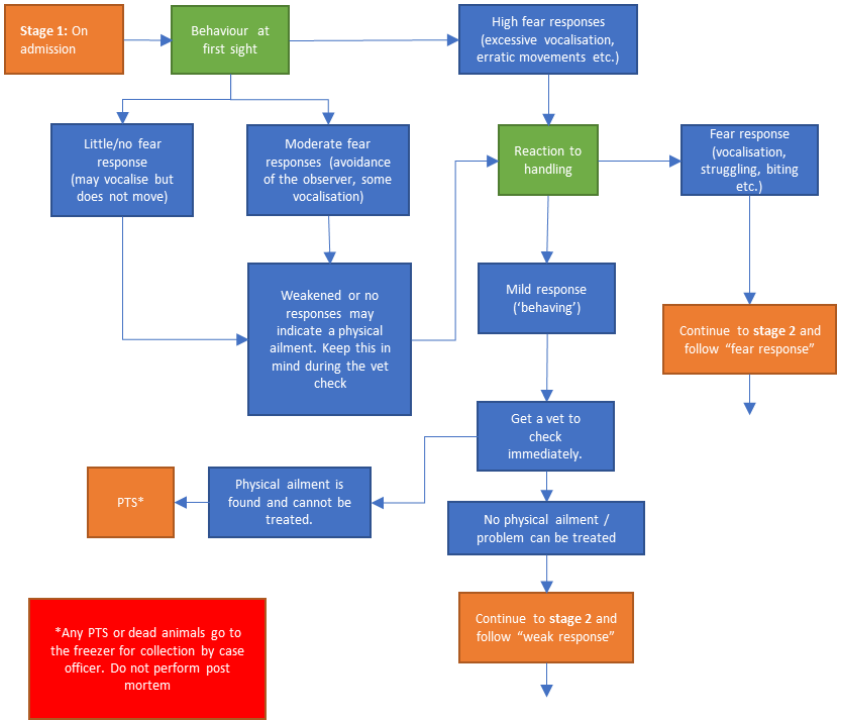


Fig 5: Proposed behavioural check flow chart for wildlife centres stage 2: During rehabilitation.

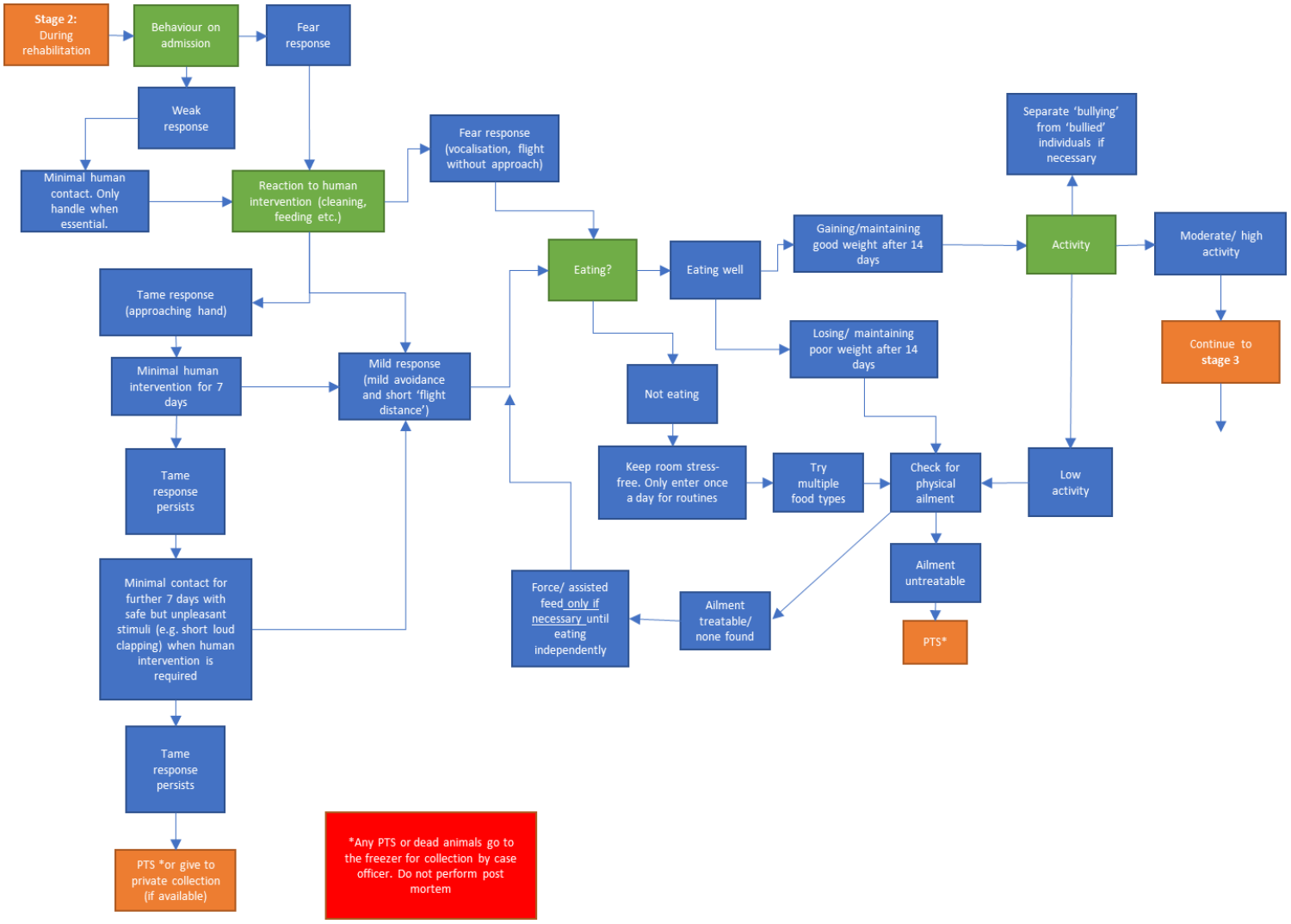
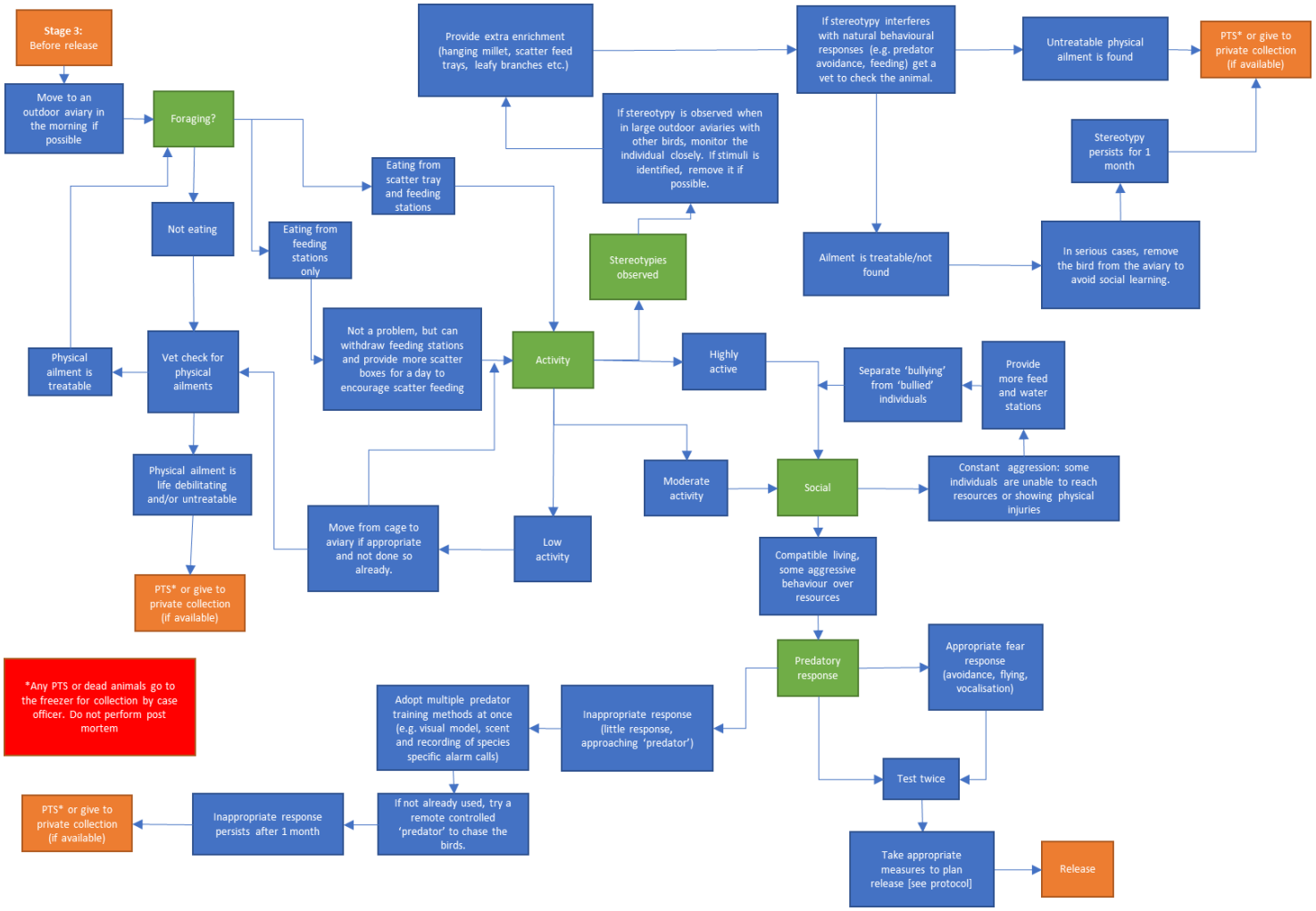


Fig 6: Proposed behavioural check flow chart for wildlife centres stage 3: Release.



4.4 Limitations

Here a guide has been proposed to aid centres in boarding and releasing case birds. However, it is evident in the questionnaire results that wildlife facilities are happy with current procedure. This begs the question; does anything need to change? The results here do show a good release rate. However, there has not yet to knowledge been studies on wild-caught passerine case bird success in rehabilitation. Far more information is needed on the care, release rates and post release success across the country to provide a complete assessment. There is very little knowledge on success post release or even breeding success, as birds will have to reproduce in order to contribute to overall populations. Therefore, a suggestion is to air on the side of caution. Creating small changes that are cheap and easy to implement for the benefit of the birds whilst working around busy wildlife staff appears to be the best approach to begin improving the system.

4.4.1 Questionnaire

Questionnaires can provide good estimates to measure perception of the case bird problem. It also may increase likelihood of participation, as working people prefer to estimate numbers than take time to find exact figures. However, the numbers of wildlife centres in the UK are limited and frequencies of passerine case birds are lower still. For this reason, some facilities appear to view it as an insignificant issue compared to other difficulties wildlife centres face on an annual basis. Keeping the questionnaire short enough to encourage participation did mean some more elaborative questions being sacrificed, but it was decided that a sufficient amount of data was provided whilst being mindful of busy workers.

4.4.2 Dataset

Admission data provided a good number of case birds over ten years, but sample size may have been greatly improved by combining the data from multiple centres. The recovered bird dataset was small as likelihood of recapture is low. Additionally, recovered cases may be biased as more than often of dead or sick birds are recaptured. The probability of a released bird to be caught alive and healthy is low. Though recording is thorough, there are always risks of errors whether that be human error or electronic glitches.

All admission and recovery data was only collected from one wildlife centre therefore cannot be assumed that results apply to all UK case birds. However, this small dataset may still be a contribution to an effective overview of the welfare and success of wild caught birds alongside other methods such as the questionnaire used.

5. Conclusion

The subject of wild-caught passerine case birds in the UK seems vastly understudied. A larger-scale project spanning across the entire UK is required for a better analysis of care in wildlife centres. Similarly, a long-term study on recovered case birds and perhaps an investigation further into past recoveries will provide a far better account for post-release success. Furthermore, a review of more prolific wildlife trafficking such as exotic wild birds and how they are rehabilitated may be hugely beneficial and can be reflected into case bird rehabilitation globally. Thorough

reports detailing all aspects of their daily care in rehabilitation would further investigate the differences in care of case birds across different facilities. Ideally a large number passerines can be radio tracked and their success recorded. However, case birds are still infrequent residents at British wildlife centres and require thorough, long-term studies to truly understand the mechanisms in successful post-release survival.

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References:

Balph D. F., Balph M. H. (1983) On the psychology of watching birds: the problem of observer-expectancy bias. *The Auk*; Vol 100, pp. 755-757.

Blumstein D. T. (2014) Attention, habituation and antipredator behaviour: implications for urban birds. Avian Urban Ecology. *Oxford University Press*; London, UK.

Bright P. W., Morris P. A. (1994) Animal translocation for conservation: performance of dormice in relation to release methods, origin or season. *Journal of Applied Ecology*; (31) pp. 699-708.

British Birds Council (2020) *Homepage* [online] available at: http://www.britishbirdcouncil.com/home [accessed 16/1/20]

Burghardt G. M. et al. (2012) Perspectives – minimizing observer bias in behavioural studies: A review and recommendations. *Ethology*; 118(6) pp. 511-517.

Butler S. J., Wittingham M. J., Quinn J. L., Cresswell W. (2006) Time in captivity, individual differences and foraging ability in wild-caught chaffinches. *Applied Animal Welfare and Behaviour;* 143 (4) pp. 535-548.

Campbell L. M. (2000) Human need in rural developing areas: perceptions of wildlife conservation experts. *The Canadian Geographer*; 44(2) pp. 167-181.

Carr V. A. V. (2014) Mules and hybrid birds. *Read Books ltd*; Redditch, UK.

Cramp S. (1992) The birds of the Western Palearctic, vol. 6. *Oxford University Press*; UK.

Crane A. L., Ferrari M. C. O. (2017) Patterns of predator neophobia: a meta-analytic review. *RSPB Royal Society Publishing*; 284. Canada.

Cristol D. A., Armstrong J. L., Whitaker J. M., Forsyth M. H. (2005) Feather-degrading bacteria do not affect feathers on captive birds. *The Auk*; 122(1) pp. 222-230

Duncan I. J. H., Woodgush D. G. M. (1971) Frustration and aggression in the domestic fowl. *Animal Behaviour*; (19) pp. 500-504.

Ellis D. H., Dobrott S. J., Goodwin J. G. (1997) Reintroduction techniques for Masked Bobwhites. Endangered Birds: management techniques for preserving threatened species; *University of Wisconsin press;* Madison, USA

Garner J. P., Mason G. J., Smith R. (2003) Stereotypic route tracing in experimentally caged songbirds correlates with general behavioural disinhibition. *Animal Behaviour*; (66) pp. 771-727.

Gordon J. M., Gentile A. M. (1985) Environmental influences on locomotor recovery following cortical lesions in rats. *Behavioural Neuroscience*; 99(4) pp. 678-669

Griffin A. S., Blumstein D. T., Evans C. S. (2000) Training captive-bred or translocated animals to avoid predators. *Conservation biology;* 14(5) pp. 1317-1326.

Grogan A., Kelly A. (2013) A review of RSPCA research into wildlife rehabilitation. *Veterinary Record 2013*; UK.

Grogan A., Mathews F. (2008) Post-release survival of hand-reared pipistrelle bats. *Animal Welfare;* 17(4) pp. 29-33

Groothuis T. G. G., Carere C. (2004) Avian personalities: characterization and epigenesis. *Neuroscience and Biobehavioural Reviews;* (29) pp. 137-150.

Guyon J. (2009) The impact of captivity on the behaviour of mute swans (Cygnus Olor). The *Plymouth Student Scientist*; 2(2) pp. 22-37.

James R (2008) RSPB ask an expert: *how long do the common garden birds live?* [online] available at: https://ww2.rspb.org.uk/birds-and-wildlife/bird-and-wildlife-guides/ask-an-expert/previous/gardenbirdage.aspx [accessed 12/04/2020]

Kelly A., Thompson R., Newton J. (2008) Stable hydrogen isotope analysis as a method to identify illegally trapped songbirds. *Science and Justice*; (48) pp. 67-70.

Kirkwood J. K., Sainsbury A. W (1996) Ethics of Intervention on the welfare of free-living wild animals. *Animal Welfare*; 5 pp. 235-243.

Lendvai A. Z., Loiseau C., Sorci G., Chastel O. (2008) Early developmental conditions affect stress response in juvenile but not in adult house sparrows (*Passer Domesticus*). *General and Comparative Endocrinology*; 160 (1) pp. 30-35.

Miller B., Biggins D., Wemmer C., Powell R., Calvo L., Hanebury L., Wharton T. (1990) Development of survival skills in captive raised Siberian polecats (Mustela Eversmanni) II predator avoidance. *Journal of Ethology*; 8(1) 95-104.

Millins C., Howle F. (2014) Analysis of suspected wildlife crimes submitted for forensic examinations in Scotland. *Forensic science medicine and pathology*; June 2014. Available at: https://www.researchgate.net/profile/Caroline_Millins/publication/263165838_Analysis_of_suspected_wildlife_crimes_submitted_for_forensic_examinations_in_Scotland/links/54e1c5750cf24d184b11514c.pdf [accessed 31/01/20]

Molina-Lopez R. A., Casal J., Darwich L. (2011) Causes of morbidity in wild raptor populations admitted at a wildlife rehabilitation centre in Spain from 1995-2007: A long term retrospective study. *PLoS One*; 6 (9) pp. 246-253.

Preloved (2020) *Buy and sell in the UK and Ireland/ Search: Goldfinch*. [online] available at: https://www.preloved.co.uk/search?keyword=Goldfinch [accessed 16/1/20]

Richardson K., Castro I. C., Brunton D. H., Armstrong D. P. (2015) Not so soft? Delayed release reduces long-term survival in passerine reintroduction. *Flora and Fauna International, Oryx.* (1) pp. 1-7.

Robbins C. (2012) Wildlife feeding and nutrition. *Academic press ltd*; London, UK.

Robinson R. A. (2015) Birdfacts: profiles for birds in Britain and Ireland. *BTO, Thetford*. available at: https://app.bto.org/birdfacts/results/bob16530.htm [accessed 16/03/20]

RSPB (2020) The world's largest wildlife survey [online] available at: https://www.rspb.org.uk/get-involved/activities/birdwatch/celebrating-the-worlds-largest-wildlife-survey/#worlds-largest-survey [accessed 29/01/20]

RSPB (2014) Birdcrime report 2014. [online] available at: https://www.rspb.org.uk/globalassets/downloads/documents/positions/wild-birds-and-the-law/birdcrime-2014.pdf [accessed 27/03/20]

RSPCA (2018) Prosecutions and annual report 2018 [online] available at: file:///C:/Users/Lharv/Downloads/RSPCA%20Prosecutions%20annual%20report%202018.pdf [accessed 27/03/20]

Smith C. P., Taylor V., Nicol C. (1995) Environmental enrichment information resources for labatory animals, 1965-1995: birds, cats, dogs, farm animals, ferrets, rabbits and rodents. *DIANE*; USA.

St. John F. A. V., Edwards-Jones G., Jones J. P. G. (2012) Opinions of the public, conservationists and magistrates on sentencing wildlife trade crimes in the UK. *Environmental Conservation*; 39 (2) pp. 154-161.

Thompson R. (2009) Wild Caught Finch Protocol for Wildlife Centres. *Internal publication*.

Thompson R. (2019) *Personal communications*

[2] Thompson P. (2019) Wildlife Rehabilitation Manual. *Washington Department of Fish and Wildlife;* USA.

Tweed E. J., Foster J. T., Woodworth B. L., Oesterle P., Kuehler C. (2003) Survival, dispersal and home-range establishments of reintroduced captive-bred Puaiohi, Myadestes Palmeri. *Biological Conservation;* (111) pp. 1-9.

Wade M. R., Zalucki M. P., Franzmann B. A. (2005) Influence of observer presence on pacific damsel bug behaviour: who's watching whom? *Journal of Insect Behaviour*; vol 18, pp. 651-667.

Watters J. V., Meehan C. L. (2006) Different strokes: Can managing behavioural types increase post release success? *Applied Animal Behaviour Science*; vol 102, pp. 364-379.

Wildlife and Countryside Act (1981) *Section 21: Penalties*. Available online at: https://www.legislation.gov.uk/ukpga/1981/69/section/21 [accessed 17/1/20]

Wildlife and Countryside Act (1981) *Section 6: sale etc. of live or dead wild birds, eggs etc*. Available online at: https://www.legislation.gov.uk/ukpga/1981/69/section/6 [accessed 16/1/20]

Appendix.

Table 10: Frequency of birds admitted to RSPCA Mallydams wood between 2010-2019

Year	Cases
2010	14
2011	89
2012	17
2013	74
2014	32
2015	37
2016	59
2017	100
2018	33
2019	179

Fig 7: Goodness of fit chi square output on the number of birds admitted over 10 years

Goodness-of-fit test for observed versus expected values

Pearson chi-square value is 357.89 with 9 d.f.

Probability level (under null hypothesis) p < 0.001

Fig 8: Goodness of fit chi square output on the number of birds in each outcome category

Goodness-of-fit test for observed versus expected values

Pearson chi-square value is 2963.51 with 8 d.f.

Probability level (under null hypothesis) p < 0.001

Fig 9: Goodness of fit chi square output on the circumstances in which wild birds are found.

Goodness-of-fit test for observed versus expected values

Pearson chi-square value is 16.32 with 2 d.f.

Probability level (under null hypothesis) p < 0.001

Fig 10: one-way ANOVA chart on how life stage affects outcome

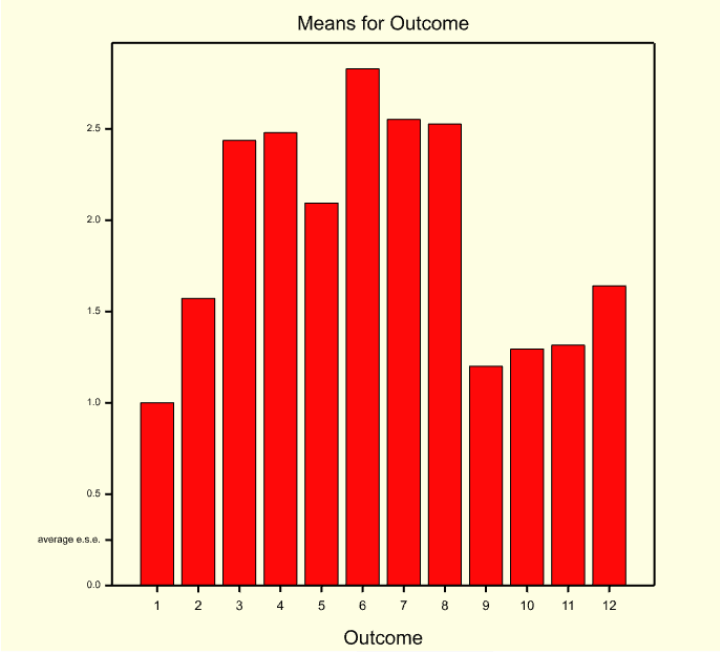

Fig 11: one-way ANOVA output on how life stage affects outcome

Analysis of variance

Variate: Age

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Outcome	11	263.193	23.927	18.88	<.001
Residual	1217	1541.974	1.267		
Total	1228	1805.167			

Fig 12: Post hoc confidence intervals on how life stage affects outcome

Studentized Maximum Modulus 95.0% confidence intervals

Unequal number of observations per mean. (Input as table.)

MEAN, LOWER, UPPER are tables.

Outcome	Mean	Lower	Upper
Claimed	1.000	-1.390	3.390
Dead arrival	1.571	-0.235	3.378
Died admission	2.438	1.242	3.633
Died after 48	2.093	1.653	2.533
Died in 48	2.479	2.081	2.878
Escaped	1.200	-0.938	3.338
PTS admission	2.829	2.398	3.260
PTS after 48	2.526	1.978	3.075
PTS in 48	2.552	1.664	3.439
Rehomed	1.294	0.135	2.454
Released	1.641	1.456	1.825
Transferred	1.316	0.219	2.413

Fig 13: Tukey's post-hoc output on how life stage affects outcome

ukey's 95% confidence intervals

utcome

Comparison	Difference	Lower 95%	Upper 95%	Significant
Claimed vs Escaped	-0.2000	-2.672	2.2725	no
Claimed vs Rehomed	-0.2941	-2.342	1.7541	no
Claimed vs Transferred	-0.3158	-2.343	1.7118	no
Claimed vs Dead arrival	-0.5714	-2.882	1.7388	no
Claimed vs Released	-0.6408	-2.489	1.2075	no
Claimed vs Died after 48	-1.0932	-2.967	0.7806	no
Claimed vs Died admission	-1.4375	-3.498	0.6229	no
Claimed vs Died in 48	-1.4792	-3.347	0.3891	no
Claimed vs PTS after 48	-1.5263	-3.417	0.3644	no
Claimed vs PTS in 48	-1.5517	-3.518	0.4142	no
Claimed vs PTS admission	-1.8293	-3.702	0.0433	no
Escaped vs Rehomed	-0.0941	-1.969	1.7810	no
Escaped vs Transferred	-0.1158	-1.968	1.7368	no
Escaped vs Dead arrival	-0.3714	-2.530	1.7867	no
Escaped vs Released	-0.4408	-2.095	1.2136	no
Escaped vs Died after 48	-0.8932	-2.576	0.7897	no
Escaped vs Died admission	-1.2375	-3.126	0.6509	no
Escaped vs Died in 48	-1.2792	-2.956	0.3975	no
Escaped vs PTS after 48	-1.3263	-3.028	0.3754	no
Escaped vs PTS in 48	-1.3517	-3.137	0.4331	no
Escaped vs PTS admission	-1.6293	-3.311	0.0522	no
Rehomed vs Transferred	-0.0217	-1.252	1.2088	no
Rehomed vs Dead arrival	-0.2773	-1.933	1.3779	no
Rehomed vs Released	-0.3467	-1.252	0.5585	no
Rehomed vs Died after 48	-0.7991	-1.755	0.1571	no
Rehomed vs Died admission	-1.1434	-2.427	0.1404	no
Rehomed vs Died in 48	-1.1850	-2.130	-0.2398	yes
Rehomed vs PTS after 48	-1.2322	-2.221	-0.2433	yes
Rehomed vs PTS in 48	-1.2576	-2.383	-0.1317	yes
Rehomed vs PTS admission	-1.5352	-2.489	-0.5814	yes
Transferred vs Dead arrival	-0.2556	-1.885	1.3740	no
Transferred vs Released	-0.3250	-1.183	0.5324	no
Transferred vs Died after 48	-0.7774	-1.689	0.1337	no
Transferred vs Died admission	-1.1217	-2.372	0.1289	no
Transferred vs Died in 48	-1.1634	-2.063	-0.2637	yes
Transferred vs PTS after 48	-1.2105	-2.156	-0.2651	yes
Transferred vs PTS in 48	-1.2359	-2.324	-0.1481	yes
Transferred vs PTS admission	-1.5135	-2.422	-0.6049	yes
Dead arrival vs Released	-0.0694	-1.470	1.3309	no
Dead arrival vs Died after 48	-0.5218	-1.956	0.9120	no
Dead arrival vs Died admission	-0.8661	-2.536	0.8042	no
Dead arrival vs Died in 48	-0.9077	-2.334	0.5188	no
Dead arrival vs PTS after 48	-0.9549	-2.411	0.5009	no
Dead arrival vs PTS in 48	-0.9803	-2.532	0.5718	no
Dead arrival vs PTS admission	-1.2578	-2.690	0.1743	no
Released vs Died after 48	-0.4524	-0.820	-0.0845	yes
Released vs Died admission	-0.7967	-1.729	0.1357	no
Released vs Died in 48	-0.8383	-1.177	-0.4998	yes
Released vs PTS after 48	-0.8855	-1.332	-0.4394	yes
Released vs PTS in 48	-0.9109	-1.610	-0.2118	yes

Released vs PTS admission	-1.1884	-1.550	-0.8269	yes
Died after 48 vs Died admission	-0.3443	-1.326	0.6377	no
Died after 48 vs Died in 48	-0.3859	-0.844	0.0717	no
Died after 48 vs PTS after 48	-0.4331	-0.975	0.1090	no
Died after 48 vs PTS in 48	-0.4585	-1.222	0.3054	no
Died after 48 vs PTS admission	-0.7360	-1.211	-0.2611	yes
Died admission vs Died in 48	-0.0417	-1.013	0.9296	no
Died admission vs PTS after 48	-0.0888	-1.103	0.9250	no
Died admission vs PTS in 48	-0.1142	-1.262	1.0336	no
Died admission vs PTS admission	-0.3918	-1.371	0.5878	no
Died in 48 vs PTS after 48	-0.0471	-0.570	0.4754	no
Died in 48 vs PTS in 48	-0.0726	-0.823	0.6776	no
Died in 48 vs PTS admission	-0.3501	-0.803	0.1024	no
PTS after 48 vs PTS in 48	-0.0254	-0.830	0.7791	no
PTS after 48 vs PTS admission	-0.3030	-0.841	0.2348	no
PTS in 48 vs PTS admission	-0.2775	-1.038	0.4833	no

Warning 1, code UF 2, statement 470 in procedure AMCOMPARISON

Variances vary and decisions regarding group membership are inconsistent, so there may be gaps in the lines or letters linking means in identical groups.

	Mean	
Claimed	1.000	a
Escaped	1.200	a
Rehomed	1.294	ab
Transferred	1.316	ab
Dead arrival	1.571	abc
Released	1.641	abcd
Died after 48	2.093	abce
Died admission	2.438	abcdef
Died in 48	2.479	acef
PTS after 48	2.526	acef
PTS in 48	2.552	acef
PTS admission	2.829	acf