FOOTPRINT ECOLOGY

Back from the Brink Monitoring review

Summary

A review of species monitoring undertaken by each BftB project found that almost all primary species were monitored and that 17 projects achieved fully fit-for-purpose monitoring for the majority of their species.

A wide variety of monitoring approaches were used to quantify changes in one, or more commonly both, of abundance and distribution. In many cases, any population-level changes will be seen beyond the project lifespan (although the objectives of ongoing monitoring may differ from those set out in BftB).

Species recovery was assessed by each BftB project using species recovery curves (SRC). This review (prior to validation by the national taxon groups) found that 78% of final SRC scores were appropriate; that 82% of species progressed by at least one species recovery step and that Step 6 (Recovery Solutions Trialled) was the most frequently achieved step. A non-linear format indicating the extent of progress made at each step for each species over the lifetime of the relevant project is proposed.

Lessons learned for species recovery monitoring are discussed and include:

- Using the development phase of projects to investigate how best to measure species recovery (including obtaining baseline data and defining monitoring objectives);
- Using a designed experimental approach for recovery trials wherever possible;
- Ensuring sufficient funding is available for advice from partners when working across taxa;
- Promoting a geospatial approach to data collation and analysis.

A number of recommendations concerning the use of the species recovery curve are made for future projects and include:

- Using a non-linear representation of species recovery progress;
- Providing guidance and further clarity on each step;
- Adding actions required to complete steps and levels of confidence;
- Using species recovery targets.

1. Introduction

1.1. Monitoring progress in species recovery has been a key element across the Back from the Brink programme (BftB). Here we summarise a review of the species monitoring carried out by all BftB projects and then review use of the Species Recovery Curve (SRC), the measure of success that BftB set out to use across all projects.

2. BftB species monitoring

Summary

- Monitoring was carried out by all 19 projects
- Fit-for-purpose monitoring was fully achieved for 10 single species projects and within 7 integrated projects (although these included primary species for which monitoring was less robust e.g. due to cryptic habits or complex behaviour/ecology or due to time constraints).
- Monitoring objectives varied and included overall population monitoring within a defined area and monitoring change due to management interventions.
- A wide variety of monitoring techniques were carried out, including some novel techniques
- A rigorous experimental approach to monitoring interventions would have allowed greater confidence in the outcomes of solution testing

Compliance with planned monitoring

2.1 Monitoring was carried out for all but a handful of projects. Table 1 provides a summary of a RAG[1] assessment of the monitoring planned and implemented by each project based on the updated interim audit carried out by Just Ecology in 2019. The update was based on information provided in the final reports, monitoring plans, Species Recovery Curve submissions and Species Summary Sheets, where available. It was not possible to refer back to project staff/lead partners staff - in some case the RAG rating might have been assigned differently with access to additional information. In particular, whether the data have been analysed with change assessment in mind was deduced from the species summary sheets/species recovery assessments rather than the data produced. As far as possible, the RAG assessment has been carried out with the species-specific monitoring objectives in mind. “Fit for purpose” monitoring was achieved for the majority of species within 17 projects.

[1] Red Amber Green

Objectives

2.2 Monitoring objectives varied and included (i) surveys to establsh presence/ distribution/abundance of a species (for example Matted Bryum on the Sefton Coast), (ii) monitoring to assess species responses to interventions including management and translocations etc. (e.g. Chequered Skipper). Many projects incorporated more than one element (e.g. Pale Dog Violet). In some cases, monitoring was confined to a subset of locations within project sites (e.g. ground beetles in Breckland).

2.3 Strikingly, there was little evidence of the use of designed experimental approaches to monitoring, which would have improved the testing of recovery solutions, a key step for many BftB species. The extent to which this might have been unsuccessfully attempted by projects is not known[2] (a specific question to projects would have been needed to clarify this). In some cases it was also difficult to determine the extent to which negative records were made (i.e. whether a species was truly absent or was under-recorded due to limited survey effort).

Techniques and approaches

2.4 Table 2 provides an overview of the diversity of monitoring techniques used in BftB projects. In general, projects aimed to use techniques that would identify change in the distribution and abundance of species, although for some species obtaining meaninful abundance data was not realistic (e.g. Narrow Headed Ant, Pine Marten, Shrill Carder Bee) and for these species distribution data were the key measure of population change. This was also the case for many annual species, for which abundance may fluctuate widely, meaning that a long-term data set is needed to interpret change. Conversely, for some species for which only limited monitoring was carried out, only abundance data were collected (e.g. ground beetles within a small subset of the project area in Colour in the Margins - although historic distribution data were also compiled as part of the project). For a small number of species, survey work was carried out to provide information on behaviour (e.g. habitat use) rather than population-level change.

1.1. [2] e.g. landowners' preferences for particular size/shape of bare ground scrapes on landscape grounds invalidated a planned experimental approach in Dorset's Heathland Heart.

Table 1: RAG assessment update[3] (showing monitoring objectives achieved, nearly achieved, not achieved, evidence not available, not achievable due to project constraints/not relevant.

Project	1. Reliable baseline information available from a known point in time	2. Fit for purpose methodology in place for ongoing monitoring	3. Clear targets set for species recovery	4. Monitoring methodology being implemented to plan	5. Monitoring data are safely stored and have been shared or made accessible	6. Data have been analysed with change assessment in mind	7. Methods/ coverage considered reliable to detect changes in abundance and distribution over the longer term
IP01 - Adding Diversity to Dorset's Heaths							
IP02 - Ancients of the Future							
IP03 - Colour in the Margins							
IP04 - Cotswolds Limestone Grassland							
IP05 - Gems in the Dunes							
IP06 - Rockingham Forest							
IP07 - Shifting Sands – Securing a Future for the Brecks							
SP01 - Barberry carpet moth							
SP02 - Black-tailed godwit							
SP03 - Grey long-eared bat							
SP04 - Lesser Butterfly-orchid							
SP05 - Cornish path moss							
SP06 - Field cricket							
SP07 - Ladybird spider							
SP08 - Little whirlpool ramshorn snail							
SP09 - Narrow headed ant							
SP10 - Pine marten							
SP11 - Shrill carder bee							
SP12 - Willow tit							

[3] See Update of late 2019 Audit compiled by Just Ecology and updated by Footprint Ecology. Species summaries and monitoring plan were not available for Ancients of the Future and Lesser Butterfly-orchid respectively.

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SUMMARY	For single species, this was available, or the first year of BftB surveys could be used. For integrated projects, robust datasets suitable for assessing interventions were generally not available (with exceptions). Existing data could some-times be used for status assessments.	In place for most species. Further work is needed to refine methods in some cases[4]	Set for all single species projects (although these were not generally referred back to the Species Recovery Assessments). Not set for integrated projects.	In general, monitoring was implemented according to plan. In some cases, coverage was reduced or less than anticipated or the ideal monitoring plan could not be implemented.	Data were generally securely stored and shared. In some cases, duplication will be an issue as data were shared via several routes (e.g. partners, local records centre, national schemes and NBN) to overcome issues surrounding biological data flow.	Some change analysis has been achieved within almost all projects but not for all species and often with limited applicability due to short project timepan e.g. for long-lived species or annuals that fluctuate.	Methods considered reliable to detect changes in abundance/ distribution for majority of species, but with limitations for a sizable minority (8 projects). For some species methods need adapting[5] or coverage increasing[6], or only one of distribution and abundance could be assessed due to complex ecology, natural fluctuations or monitoring techniques used.[7]

[4] E.g. Ladybird Spider (an approach was proposed but not fully adopted by partners), Willow Tit (the approach declined in effectiveness due to "playback fatigue") and Cosnard's Net-winged beetle (monitoring technique did not produce hoped for results. Invert monitoring methods in IP02 were not considered suitable for National Monitoring Plans.

[5] E.g. Necklace Ground Beetle, for which surveys may have been too early

[6] E.g. Sand Lizard

[7] E.g. Pine Marten, Barberry Carpet Moth These were categorised as amber for consistency with the previous audit, although distribution data are adequate to detect change in occupancy/range. Abundance is not necessarily an appropriate measure for annual species over short time spans, as it may fluctuate widely

Table 2: Overview of different monitoring approaches/techniques used by BftB projects with some illustrative examples.

Techniques	Examples
Productivity	Counts of chicks reared per pair, Black-tailed Godwit
Evidence of breeding	Purbeck Mason Wasp burrows; Woodlark territories; Ladybird Spider webs; rabbit warren census
Counts of individuals within pre-defined areas	Counts of Grey Long-eared Bat, Lesser Butterfly Orchid,
Estimates of population size (e.g. coverage within an area)	Area occupied by Cornish Path Moss, Pillwort, Purple Milk-vetch
Sampling	Evidence of Pine Marten in 7 sites within project area; Shrill Carder Bee transects; suction sampling for Downy Set-aside Beetle, Little Whirlpool Ramshorn Snail ditch lengths, timed rabbit point counts
Use of proxies	Sand Lizard test-egg burrows; monitoring of habitat feature distribution as a proxy for Red-horned Cardinal Click Beetle, Narrow-headed Ant nests
Presence/absence	Barberry Carpet larvae on Barberry bushes
Radio-tracking	Tracking to establish habitat use (not population change) e.g. Bechstein's Bat, Barbastelle Bat, Willow TIt
Camera trapping	Pine Marten
Use of artificial refugia/boxes etc.	Refugia for Adder; den boxes for Pine Marten; dead wood boxes for saproxlic invertebrates
Pheromone lures/playback	Violet click beetle, Willow Tit
Passive acoustic monitoring	Use of Audio Moth for Barbastelle, Noctule to obtain baseline distribution data
DNA techniques	Explored for saproxylic beetles and fungi (Ancients of the Future
Surveys of suitable habitat	Tree roost site surveys for Barbastelle

Monitoring legacy

2.5 For relatively long-lived species and those such as saproxylic invertebrates dependent on veteran tree features that take a long time to become suitable, longer-term monitoring is required. Such monitoring seems most secure for species for which ongoing project work is likely (e.g. Shrill Carder Bee; Chequered Skipper), where pre-existing monitoring was built on (e.g plant monitoring in Shifting Sands) and where project partners have gone on to build and support volunteer monitoring capacity (e.g. Dorset's Heathland Heart). However, not all methods will continue to be suitable going forwards e.g. where monitoring techniques were focussing on response to recovery solution trials rather than wider population changes. As requirements change (e.g. a greater number of sites or more self-lead volunteer surveys) and over time (e.g. intervention-specific monitoring becomes less relevant) methods may need to change.

3. Species Recovery Curve review

Introducing the Species Recovery Curve

3.1 A Species Recovery Curve (SRC) provides a description of a species recovery journey from when the species was identified as a priority for action. The conceptualised illustration shows the species' trajectory though a slowing of the population decline, recovery and eventual population stability at the desired level. This is linked to the various stages of action required (information gathering, designing and trialling interventions, rolling out action more widely and the cessation of interventions/ instigation of sustainable management). Initially designed for use at the national level, it has been adapted for application at the local or landscape level by BftB to enable its use as a measure of success of locally based species recovery projects. Recognising that species recovery is not necessarily linear, and that progress may be made in later steps before earlier steps are fully complete, an additional dimension was also added to show the extent to which each steps was achieved (none, limited, partially, mostly, fully) - we refer to this version, which can be represented by a radial diagram rather than a curve, as a Species Recovery Assessment. Note that other versions of the Species Recovery Curve are currently in use (see Pheasey & Foster 2021; Lake et al., 2021).

Methods

3.2 An SRC position was assigned to each of the BftB primary species by the national taxon groups during the development phase of each project. Final positions were assigned by project staff/Rethink Nature members at the end of each project, together with a forecast of the expected position in five years time as a result of work carried out by the project. A narrative explaining the justification for the level of acheivement for each step was also provided. These justification and evidence for these scores (including the level of acheivement of step) and the narratives were evaluated using the process shown in Figure 1. A species was considered to be at a given step of the species recovery process when that step had been at least partially achieved (therefore the species could be considered to be at this step, but not to have fully completed it, and previous steps may not have been completed in full). The levels of achievement were also scored in the review process (none = 0, limited = 1, partially = 2, mostly = 3, completely = 4).

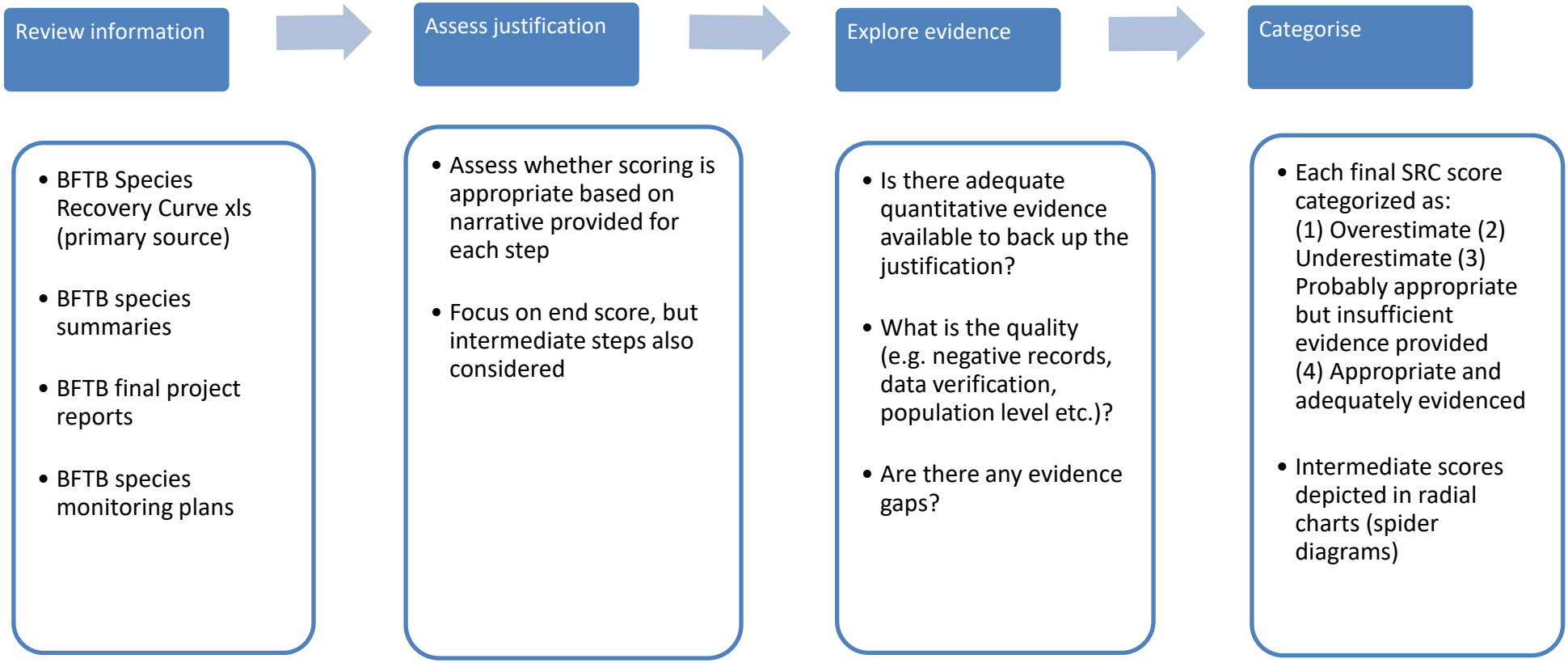

Figure 1. process used to evaluation BftB Species Recovery Curves.

Results of Species Recovery Curve evaluation

3.3 The full evaluation (including a summary graphic, radial charts (spider diagrams) for each species, the scoring for the achievement of steps plus accompanying narrative and the justification for any differences between the project score and reviewed score) is found in the accompanying set of Species Recovery Curve spreadsheets[8]. A summary table of scores is presented in Appendix 2 and includes the sum of step scores which gives an indication of how fully each step has been achieved and is unique to the BftB approach. For example, within the Limestone's Living Legacy project, Marsh Fritillary was considered to be at Step 7 with a step achievement score of 26 (36 would be the maximum possible score), whereas Heath Beefly (Dorset's Heathland Heart) was considered to be at Step 7 but with a step achievement score of only 20, indicating that considerable work is still needed at preceding steps. Headline results of the evaluation are shown in Figure 2.

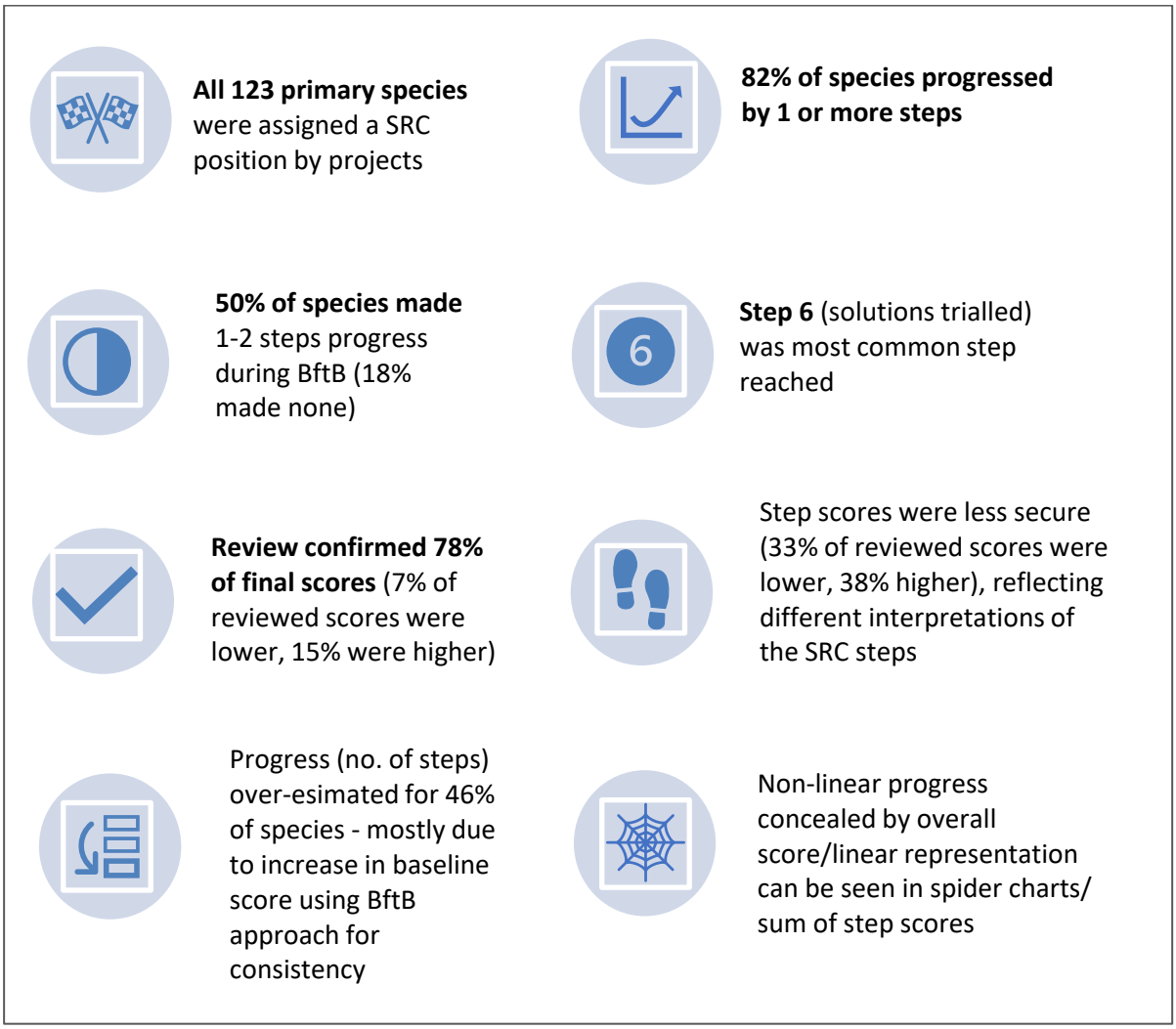

Figure 2: headline results of the SRC evaluations.

[8] The evaluation summary provided here is based on this review with a focus on achievements within projects, and not any changes to final scores made by the national taxon groups, which are not available at the time of writing.

3.4 In general, the final species recovery step assigned by projects was confirmed in the review process. It was overestimated for amphibians (represented by only one species) and underestimated for fungi and slightly underestimated for invertebrates (both influenced by a large number in the Ancients of the Future project that were hard to assign due to very non-linear progress and complex conservation requirements). Intermediate scores (the degree of completion of each step) were less securely score, probably a reflection of the novelty of the approach and different interpretations of the subjective categories. In most cases where final scores were changed in the review, this was due to changes in the intermediate scores within a step (e.g. a change to or away from "partial" completion, the point at which a species was considered to be on a given step during the review process) or because the same rule of thumb was not used by projects (again this was notably the case for the Ancients of the Future project, where some progress was often made at steps 5-6 but lack of progress at earlier steps meant that this progress was based on assumptions).

3.5 Lessons learned about using the species recovery curve (and examples) are listed in Table 3 and recommendations made in Figure 4. Figure 3 shows charts for the single species projects, with the score for each step as proposed by the relevant project staff/partner depicted in red and the reviewed score depicted by orange dashes. Each step is indicated by a consecutive position around the circumerence of the chart, and the extent of competion at each step is shown by the score for that step, with zero (i.e no progress) at the centre of the chart and four (i.e. step fully complete) on the outer ring. If a simple numeric approach is preferred, the Species Recovery Assessment can also be considered by looking at the ratio of the sum of these step scores to the total that could be achieved if the final step reached and all preceding steps were fully achieved.

Figure 3: Species Recovery Curve assessments for BftB Single Species project. RED the baseline position allocated at the start of the project subsequent scores as allocated by project staff, ORANGE the reviewed start point using the BftB approach and the reviewed endpoint

Lessons learned

Table 3: Lessons learned during BftB concerning the application of the Species Recovery Curve as a measure of success for project-based species recovery work.

Lessons learned	*Example*
(1) The narrative accompanying each step in the SRC is very important, as it provides the justification for why the species recovery process is considered to be at a particular step when robust data are not available. This is particularly useful for application at the local level and for species for which there are significant knowledge gaps.	*Five-banded Tailed Digger Wasp was considered to be at step 6, the narrative explained that more individuals were found after bare ground creation than in the baseline survey. Although this indicates use of habitat, not breeding, expert opinion is that the bare ground will provide nesting habitat and habitat for weevil prey.*
(2) The Species Recovery Assessment approach (i.e. including a measure of completeness of steps) is useful to pick up progress within steps in many cases, including species considered to be at a relatively high level.	*Field Cricket was already at position 8 with translocations having been carried out and some recovery. BftB contributed further to recovery through habitat management linking population and translocations, but the success of this will not be evident for about 5 years so the next step could not be achieved within the project timespan.*
(3) A measure of completeness is also useful to provide a fuller picture progress for species with some progress at higher steps but significant gaps at preceding steps	*The Necklace Ground Beetle (Colour in the Margins) was at step 6 but all progress made during the project was in Step 2*
(4) The use of the 3-tailed RSPB model would be useful for species for which ongoing interventions will be required	*Interrupted Brome (Colour in the Margins) is an arable weed that relies on being sown with a crop and is unlikely to be able to persist without ongoing annual highly targeted interventions. A definition of what recovery for this species could look like is needed before progress with steps 7-9 can be made.*
(5) Where steps are not complete, the actions needed to complete the step should be identified wherever possible to inform future work	*For Pheasant's Eye (Colour in the Margins), the narrative helpfully specified that more information is needed about seed longevity within the soil seed bank, optimal soil nutrient and pH conditions and vegetation communities that support the pollinators that the species requires.*
(6) Steps 4 conflates understanding of autecology understood and implementation of monitoring plan, making it hard to differentiate progress between the two elements – these should be separated out. Similarly, Step 7 conflates the identification and the adoption of the best approach	*There are gaps in understanding of the autecology of Tower Mustard (Shifting Sands) but a robust monitoring plan is in place that will continue to be implemented after the project finished.*
(7) Guidance is needed on local application so that transferable knowledge developed elsewhere can be included and so that the requirement for a National Monitoring Plan can be interpreted more consistently at the local level.	*There is a body of literature and research on Juniper, but this was not reflected in the Step 4 score for the species in Limestone's Living Legacy.*

Lessons learned	*Example*
(8) Targets for species are important for evaluating the extent of recovery (such targets were rarely referred to in the SRC spreadsheets even though targets were defined for several species in the monitoring plans).	*For Black-tailed Godwit, targets for productivity were set and allowed the success of short term "heading starting" interventions achieved through the project to be seen in the context of likely long-term trends once the interventions stop.*
(9) For several species, actions included the provision of advice to landowners or policy makers. Using the Species Recovery Assessment approach, this could be reflected as limited or partial progress at step 7 (full progress would require evidence that the recommended solutions were being implemented)	*The Grey Long-eared Bat project shared knowledge with the team developing the new agri-environment scheme where bespoke measures for the species are being considered.*
(10) If used in very limited circumstances (e.g. just one project site) the Species Recovery Curve/Approach become clumsy and loses meaning. Similarly, the wider context should be considered in projects where just a small number of sites are included.	*A solution for Pennyroyal was trialled at the only location within the Dorset's Heathland Heart area with historic records. This was very successful (at least in the short term), the score of 8 is lacking real meaning in the wider context of the species in the area (which is however doing well at other sites) Interventions for Lesser Butterfly Orchid were successful at increasing the population at one of two sites within the project area, but true recovery would require restoration across the previous range for the species in the project area*
(11) Several species were included in more than one project; there was little evidence of integration between the projects (e.g. sharing knowledge, experience and best practice at different steps including monitoring)	*E.g. Adder in Roots of Rockingham and Dorset's Heathland Heart, Sand Lizard in Gems in the Dunes and Dorset's Heathland Heart*
(12) In integrated (cross-taxa) projects, the most robust assessments were provided where partner organizations had contributed expertise e.g. through expert monitoring or advice.	*The Limestone's Living Legacy (hosted by Butterfly Conservation) assessments for plants were generally as strong as for butterflies, a reflection of the contribution by a partner organisation.*
(13) To evaluate project progress, it is important to differentiate achievements of the project from those contributed by other concurrent projects.	*E.g. Calicium adspersum (Ancients of the Future) . "Species now considered likely to be extinct in England. Intensive survey efforts have been taking place at its last known English site (High Park, Blemheim) outside of BftB and not relocated the species. Note, the species is now also likely extinct in Wales".*
(14) Care is needed in interpreting the BftB SRC approach as it can demonstrate progress when other factors are causing the ongoing decline of the species.	*Although arguably 2 steps progress has been made to step 7 (partial) for Willow Tit within the project area, the species has continued to decline over the project period. If "full" completion of each step were required to achieve a given step, higher scores could not be attributed to species that are still declining as was the case here.*

Recommendations for use of the species recovery curve as a project assessment tool

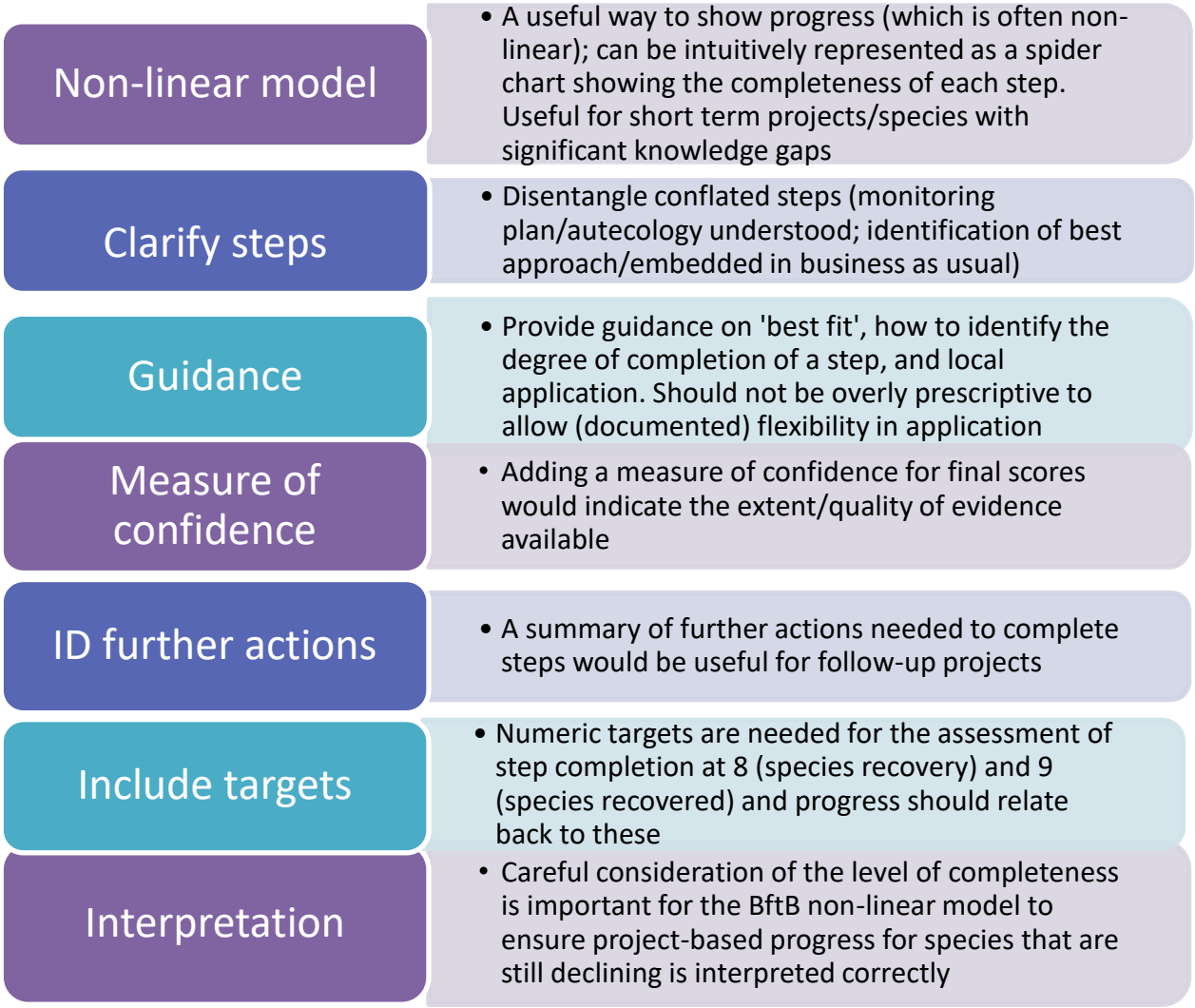

Figure 4: A summary of recommendations for future use of the Species Recovery Curve drawing on lessons learned during BftB.

Conclusions

3.6 Overall, the adapted **Species Recovery Curve** (referred to here as the Species Recovery Assessment) has proved to be a **useful tool for showing progress in species recovery at the project level**, and in general project staff were able to apply the BftB SRC approach. The approach can be used to show both linear and non-linear progress both within and between steps, and provides an indicaton of where progress has been made to help secure the likely recovery of the species, even if monitoring data are not yet available or do not yet indicate recovery (a constraint of the relatively short project periods, as most species, with the exception of some plants and invertebrates with short life cycles) cannot be expected to show signs of recovery within 3 years).

3.7 **How recovery can be measured** should be **identified in the development phase** of species recovery projects (including units, abundance, distribution, occupancy, sampling and baseline data). Similarly the mechanisms needed to ensure that project-derived data can be accessed and are meaningful in the future should be established to ensure **clean data-flow.**

3.8 **Monitoring objectives** should be carefully defined (e.g. to assess the results of specific interventions, or as an overall assessment of population change) to help focus effort and identify techniques. Wherever possible, an **experimental approach** should be taken to testing species recovery measures to ensure robust results.

3.9 Unsurprisingly**,** monitoring was in general **more robust for single species projects**. Most integrated projects were over-ambitious in terms of the number of primary species included; this is seen in the variability in quality of assessments and recovery progress made.

3.10 **Cross-taxa working requires cross-taxa advice and support** with regard to monitoring (this may work best when specific funding is allocated, rather than relying on in-kind contributions).

3.11 **Communication** between projects is vital to allow **integration** e.g. for projects with the same species or same types of interventions or habitats (and should be explicitly built into projects) and to ensure **consistent use of monitoring techniques and recovery measures**.

3.12 **Geospatial skills** should not be overlooked in bringing together project teams, as they greatly facilitate the collection, complilation, storage and interpretation of monitoring data (including negative records).

3.13 Ideally, **summary data would be compiled** (e.g linked to monitoring plans as was partially achieved for Shifting Sands). This would allow more robust evaluation of outputs, including a **meta-analysis of species responses** according to themes (e.g. bare ground creation, livestock grazing, tree management, translocations etc. which could provide useful **conservation evidence**) in addition to the **evaluation of project success**.