

Data Quality and Verification

Scoping report and Terms of Reference

Version	Author	Date	Notes
1.0 – first draft	John Sawyer/Rachel Stroud	7 Sep 2015	Outline document
1.1 – second draft	Martin Harvey	17 Oct 2015	Builds on outline to flesh out ideas and provide background info
1.2 – third draft	Martin Harvey	3 Nov 2015	Incorporating comments on previous draft

The NBN partnership collates biological records from many different sources, using many different techniques. Inevitably the quality of this data can vary. Some is contributed by novices just starting out with an interest in watching wildlife, some is contributed by internationally recognised experts.

Biological records are used in many ways, which can lead to significant outcomes, for example in research, conservation, policy work and development control.

In order to ensure that data are used appropriately we need to know about the quality of the data: has it been checked, and if so how and by whom? Currently a variety of approaches are taken to checking biological records, using a mix of human review and machine analysis, and carried out by a mix of volunteers and professionals.

What are the issues

Lots of verification is taking place, and the results in terms of the availability of high quality data and published atlases etc. are impressive. But there are pressures on the system, and the perception is that there is a growing mismatch between the numbers of records for which verification is sought, the speed of verification that is desirable, and the numbers of people able to carry out the role.

Such issues can be divided into five categories (the numbering does not imply any prioritisation):

1. The increasing rate at which data is collected

- Biological recording is becoming more popular, at least at the 'entry-level' end of the continuum
- New technology for capturing records is producing more data more quickly
- Technology is also leading to new areas of biological recording, e.g. through environmental DNA and the use of camera traps and audio recording, that are likely to produce a step-change in the amount of data being collected

2. Increasing expectations

- There are pressures to make data more quickly and more openly available – these pressures may sometimes be misguided or unrealistic but they do exist, and there is a genuine need for recent data to be swiftly available for planning and policy work, and for

research and conservation

3. Technological change

- The current proliferation of recording apps and websites is proving disruptive to 'traditional' recording, with verifiers finding it difficult to keep up with the number of routes by which records may be collated, and leading to verifiers feeling overwhelmed in some cases, and/or choosing not to engage with new developments
- Some aspects of online recording bring with them new issues, such as increasing the likelihood that verifiers will be asked to interact with recorders that they don't have any 'real-life' knowledge of.

4. Gaps in skills and capability

- There are concerns that there aren't enough people with sufficient taxonomic skills to carry out verification, especially looking at recruitment for the 'next generation' of verifiers
- Dealing with large amounts of data may require technological skills: not all verifiers are equally skilled in taxonomy and technology
- There are some taxonomic groups for which no recording scheme exists, and for which a route for verification is lacking; and for some groups there is still a lack of basic taxonomic knowledge upon which a verification process could be constructed
- There are concerns that in recent years a lot of resource and funding has gone in to encouraging the growth of new cohorts of novice recorders, and public participation in recording activities, but there has not been a matching increase in resources to recruit and support the more experienced people required to verify the resulting data, and support novice recorders to continue their engagement

5. Challenges in liaison and recognition

- With more people and organisations involved with biological records at both national and local level, it becomes increasingly challenging to ensure that information (such as verification decisions) is shared, efforts are not duplicated (e.g. a record being verified multiple times), and that appropriate recognition and resourcing is available to all the collators and verifiers who may have played a role
- The techniques used and issues considered by verifiers can vary widely between different taxonomic groups – a 'one-size-fits-all' approach is unlikely to be viable.

Purpose and role of the Data Quality and Verification working group

This working group is being established by the NBN Trust in November 2015 as a contribution to implementation of the new five-year NBN Strategy 2015-2020. In particular, this working group will contribute to part fulfillment of the NBN's Strategic Aim 1: "Record, collect, diversify, enhance and mobilise biological data". An NBN strategic priority is to grow our capacity and capability to record and collect high quality biological data.

This group will focus on the following actions taken from the NBN Action Plan:

- 1A.1 Increase verification capacity through establishment of a UK Verification Network to share best practice, celebrate success and recruit
- 1A.6 Maintain and improve NBN Record Cleaner rule sets and identify

- quality of records across all NBN systems
- 1E.4 Establish taxonomic group mentoring schemes
- 3A.3 Attract new generations of biological recorders and motivate to increase recording and share data (with a particular emphasis on succession for verification in the future)

The Data Quality and Verification working group will be responsible for guiding the NBN in carrying out these actions over the five year timespan of the NBN's current Strategy.

Objectives

The group will need to establish a series of objectives to steer its work. These will be developed at an initial meeting; suggested objectives for consideration are:

- To increase verification capacity in the UK to ensure quality control and standards
- To develop mechanisms for distinguishing between data of varying quality.
- To support the current network of verifiers so that they have the resources and equipment they need
- To assist with succession planning and training for quality assurance and verification into the future.

Actions towards these objectives will need to be agreed by the working group, along with realistic plans to implement the actions; such actions could include:

- Compile up-to-date information on verification capacity and capability
- Work towards better links between local and national verifiers
- Identify and develop tools and mechanisms that could support the verification process
- Develop procedures for recruiting and training additional verifiers
- Develop procedures for enabling the verification status of records to be easily documented and shared
- Facilitate the establishment of a wider Verification Network that will allow for issues relating to verification to be discussed and coordinated.

The group will develop and agree performance criteria that will enable it to assess progress towards its Objectives and ultimately towards the NBN's Strategic Aims – what do we want to have achieved in five years time, and how will we show that it has been achieved? Work will be needed to establish baseline figures for such criteria.

Scope

Verification is an issue for virtually all biological data, and the working group will need to focus its efforts on the areas that are of the greatest priority and that offer the best chance of making progress towards the NBN aims. Some overall boundaries are indicated in the table below, but the group may need to focus some of these more tightly for parts of its work.

Scoping question	Recommendation
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Taxonomic scope	All species groups in principle, recognising that different groups may have very different requirements in relation to verification
Geographic scope	The UK, in line with the NBN's remit, but links with partners in other areas will be considered where appropriate
Type of recording	Primarily species recording, although verification issues also arise in relation to recording habitats and other environmental data, which the group may wish to address as a lower priority

Terms of reference

Membership

The working group will need to work with a wide range of partners across the NBN, to ensure that any proposed actions have a broad consensus and will therefore stand a better chance of succeeding. In particular, the group needs to be able to engage with organisations and individuals at local and national level, and drawing on knowledge from both the voluntary and professional sectors.

The working group should represent a wide range of sectors while not becoming too large for effective decision-making. It is recommended that the group consist of up to 12 people from organisations that expressed an interest during the strategy consultation (see Appendix 2), aiming for representation from national recording schemes, LERCs, museums, NGOs and the education sector. The working group will be under the joint leadership of the national Biological Records Centre (BRC, who work with most of the national recording schemes) and the Association of Local Environmental Records Centres (ALERC, who represent LERCs across the UK).

The group will also need to reach out to consult with others involved with verification. In particular, the voluntary recording schemes are of critical importance to verification, but are unlikely to be able to devote large amounts of time to the working group. The working group will need to find ways in which to engage with voluntary schemes, e.g. using a mix of meetings, emails, questionnaires and other contacts, and will need to provide expenses for volunteers where relevant.

The working group can establish sub-groups to work on particular issues, and this provides an opportunity for additional sectors and organisations to be engaged as appropriate.

Verification will always be an important issue in the collating of biological records, and it is likely that this working group will be needed throughout the five-year period of the NBN Strategy. The initial membership of the working group will be for a year, although we expect that some members will continue with the group for the life of the Strategy. Membership will be reviewed at the end of each year to ensure that continuity is maintained while allowing for

changes in membership where needed.

Working methods

Members of the working group should come prepared to play an active role in delivering the group's objectives/actions. The lead organisations (with help from the NBN Secretariat) will be responsible for arranging meetings and planning agendas, appointing a chair, documenting actions and outcomes, and reporting back to the NBN Board.

We expect working groups to generate annual reports that will go to the NBN Board and to the leadership teams of the participating organisations.

It is anticipated that there will be two single-day meetings per year, which will be held at a location convenient for the group. Tele-conference facilities will enable members who are unable to travel to participate. Members will not be asked to attend meetings if the topics are not relevant to them. Guests will sometimes be invited, for show-and-tell sessions or to share expert knowledge. The working group will use a range of communication tools as appropriate (e.g. teleconferencing, screen shares, Google docs, email groups) to facilitate good communications within and beyond the group, while minimising meeting and travel time.

Meeting agendas will be made available to NBN Members in advance of meetings so that views of members can be represented at the meetings. Likewise, meeting minutes will be made openly available, so NBN Members are kept abreast of progress.

Liaison with other working groups

The working group should liaise with other NBN working groups where there are overlapping issues would benefit from a joint approach. The NBN Secretariat will liaise across all working groups to facilitate this. It is likely that data quality and verification issues will be particularly relevant to these other working groups:

- Group 2: Mobilising historic data
- Group 3: Biological recording online
- Group 4: Improving biological data flow
- Group 5: Increasing use of our data

Outline agenda for first meeting:

- Introductions
- Overview of the purpose of the working group and its relation to the NBN Strategy
- Review of issues and objectives
- Prioritisation and timetabling of actions
- Group structure and working practices
- Allocation of initial tasks

Sharing of information

It is likely that the group will use systems such as Google docs and/or

Dropbox to share documents within the group. It will be good to make information available more widely available as well where appropriate, and this should be done via the NBN website.

Resources

Resources will be required to take forward certain actions, or to ensure that actions can be completed in a timely manner. The working group will need to consider whether funding or other external resourcing is required, and if so look at the options for raising funds, or in-kind support, from within the working group membership; or look at options for obtaining funds from elsewhere.

Appendix 1: Overview of data quality and verification issues

What is verification?

The Oxford English Dictionary provides several definitions for the word “Verify”, of which the most relevant to biological recording is:
“To ascertain or test the accuracy or correctness of (something), esp. by examination or by comparison with known data, an original, or some standard; to check or correct in this way.”

Ambiguity sometimes results from the term “verification” being used in the context of a record being verified or not verified (rejected) – we tend to say that verification is being carried out even when we are rejecting records.

The OED definition supports the idea that some sort of evidence is required in order to verify a record, and it also takes in the possibility of verifying a record based on “comparison with known data” (which could include automated screening) or “by comparison with some standard” (such as the verification procedure of a recording scheme).

James (2011) provides definitions for “verification” and “validation” within biological recording as two separate but related tasks:

- Data verification: ensuring the accuracy of the identification of the things being recorded.
- Data validation: carrying out standardised, often automated checks on the “completeness”, accuracy of transmission and validity of the content of a record.

In practice, verifiers for recording schemes and centres often carry out some elements of verification and validation at the same time, looking at the identification element of a record, and at the record’s general level of precision and accuracy (including the record’s location data and other details), and the extent of supporting evidence that has been provided for it.

Verifiers are frequently required to express an opinion on the quality of records that have been submitted with no supporting evidence (e.g. no associated photo or specimen), a judgment that has to be made based on whether the record seems ‘likely’ (i.e. is not an outlier in any way), and on whether the recorder has, or seems likely to have, the relevant skills and to have taken sufficient care over identification to make the suggested identification trustworthy. The outcome of stating that a record has been “verified” is generally seen as a statement that the record can be trusted to provide robust evidence of an occurrence of the species in question; and/or that meets the standards required to be accepted by the recording scheme represented by the verifier.

A more generalised definition of “verification” could be:

- Documenting the level of confidence that can be placed in a biological record, so that it is possible to judge whether the record is fit to be used for particular purposes.

Who does verification?

The majority of verification is carried out by people associated with National Recording Schemes and Societies (NSS) and/or with Local Environmental Records Centres (LERCs). Verification may also be carried out by people working on particular recording projects (either funded or voluntary), or for local natural history groups.

There is a lot of variation in how different NSS and LERCs organize verification, related of course to differences between taxonomic groups, and to the great variation in the organisations themselves: NSS may be hosted by large organisations that employ support staff, or they may be entirely run by a single volunteer; LERCs also vary in their size, remit and resources.

The great majority of verification is carried out by volunteers, although they may be supported to a greater or lesser extent by staff within their NSS or LERC. The larger NSS often have a network of regional verifiers (referred to as “county recorders” in many instances), who may also act as a verifier for their LERC.

Verification may also be carried out by in the context of museum curation, academic research and professional consultancy. In some cases this is done in collaboration with NSS or LERCs, but the links between sectors are not always well-developed for data sharing and verification.

It is important to remember that most if not all verifiers do more than just verify records! Many verifiers put a lot of effort into supporting and training recorders (often acting as mentors), and they may also be involved with: producing identification resources; running other recording scheme activities (e.g. field meetings and other events); writing distribution atlases or contributing to reviews of rare species; advising on the conservation of species; curating collections; researching or contributing to research; and so on. Their time is valuable and should not be taken for granted.

How is verification done?

Approaches to record verification vary, with the most significant factor being the nature of the taxonomic group in question and the type of recording that being carried out. There is a great difference between verifying data for ‘popular’ species groups for which identification skills are relatively widely spread, as opposed to a ‘specialist’ species group for which dissection of specimens may be required before an identification can be confirmed. For surveys that include assessments of habitats or measure of environmental variables such as weather there may be requirements to verify these data types as well as the species records.

For those groups where records are not entirely dependent on the examination of specimens, the verification process will usually include:

- Looking for outliers, e.g. records from new locations or atypical habitats or dates, records of species that are rare or difficult to identify

- Assessing what level of experience the recorder has – records from a novice recorder will require a different level of scrutiny than records from an experienced recorder
- Assessing whether the record is sufficiently well evidenced to meet the criteria being used for assessment

Verification has sometimes appeared to take place ‘behind closed doors’, and not all recording schemes have documented their procedures. Some examples of documentation are Cofnod (2014a, 2014b) for an LERC perspective, Moran and Musgrove (2011) for a large NSS, and Harvey (undated) for a county recorder.

FAQs

This list includes some of the questions raised during the NBN Strategy consultations.

- How many people are currently engaged in verification in the UK? Is this number increasing or decreasing?

There has never been a full review of how many people are involved in the verification of biological records. The total number must be well in to the hundreds, taking into account the number of NSS and LERCs, and allowing for the larger NSS networks of county verifiers. Over 200 people are registered as verifiers for the iRecord online system.

Some data on the scale of work that verifiers undertake are available in Harvey and Roy (2015), based on responses from 104 people (74 associated with NSS, 25 with LERCs, 5 with other projects).

- How does this number break down by demographics and taxonomic interest?

This does not appear to be well-documented.

- Are there verification gaps where we have no verifying capacity whatsoever?

Yes, there are many examples of taxon groups with no national recording scheme (e.g. aphids, bibionid flies, many of the soil invertebrates). Unsurprisingly many of these groups are hard to identify, or may be very small or hard to find. For some groups there is a shortage of fundamental taxonomic knowledge, which is a prerequisite for providing identification tools and thus prohibit progress with recording. However, no gap analysis is currently available of all these ‘missing’ taxon groups.

- Approximately how many records does each verifier receive per year?

Numbers of records received by NSS and LERCs varies between less than a hundred for specialist schemes through to hundreds of thousands for the larger NSS and LERCs, and millions for the BTO (unpublished data gathered to inform Harvey and Roy 2015). The larger schemes share verification among county or regional verifiers. Even so, county moth recorders, for

example, can receive many tens of thousands of records per year.

- What proportion of these records are they able to verify?

This question was answered by 40 respondents during work for Harvey and Roy 2015. Of these 40, 19 (all representing NSS) indicated that they were able to verify all the records they received. The other 21 were split between NSS and LRCs, and suggested there was a lot of variation with some verifying 70% of incoming records and some less than 1%. However, there was some ambiguity here, with some responses apparently referring only to records that were accepted rather than rejected, and some only to verification online as opposed to verification offline.

- How many use verification support tools with inbuilt 'rules' e.g. Record Cleaner, iRecord, BirdTrack?

When asked if they used Record Cleaner, about a quarter of 101 responders said yes (Harvey and Roy 2015). There are over 200 registered verifiers on iRecord, some more active than others.

- How are verifiers 'appointed' and their ability assessed?

This is not comprehensively documented. Anecdotally the situation varies a lot, with some NSS or county groups having formal appointment procedures, while others are completely independent or else acquire the role in an informal way. There is no formal assessment of abilities, but many verifiers are requested or persuaded to take on the job by their peers, so an informal peer-review system operates.

There are examples of successful recruitment and training of new and sometimes relatively inexperienced verifiers, e.g. Butterfly Conservation's work to develop the National Moth Recording Scheme, and the appointment of new county recorders during the FSC's "Invertebrate Challenge" project in Shropshire.

- How did they develop their skills and what support was essential in enabling them to do this?

Anecdotally this has varied enormously. There are examples of verifiers having a background in museum taxonomy, or as ecological consultants, or as 'interested amateurs' (bearing in mind that amateur status does not necessarily imply any deficiency in skills). Many recorders develop their skills through participation in recording scheme activities, which may include training workshops, informal field meetings and individual mentoring.

- To what extent is verification constrained by lack of volunteer time as opposed to other factors (e.g. recorder not responding to queries raised by the verifier, the fundamental un-verifiability of some records etc)?

A similar question was addressed in Harvey and Roy 2015, but no clear answer emerged. Five potential constraints to supplying verified data to the NBN were listed: lack of field recording; lack of verifiers' time; lack of recorder experience/training; taxonomic uncertainty; records not digitised.

Of these, the constraint that scored highest on average was "lack of recorder

experience/training". Most of the five categories were ranked as "most constraining" by some responders, and "least constraining" by an equivalent number of responders. Responses from LERCs showed some differences to responses from NSS, with LERCs more likely to regard lack of time as a constraint, and taxonomic uncertainty as least constraining.

- What proportion of national schemes and societies currently insist on all records being verified by a single national recorder and what proportion are prepared to accept verification by a wider pool of experts?

Of 91 responders in Harvey and Roy (2015) just over half were part of a team of verifiers, with this proportion being higher for LERC verifiers than for NSS. Just under half of NSS responded that they were part of a team, but some of these responses indicated that they were sole verifiers for their county, while being part of the bigger national team of verifiers across all counties.

- What tools and systems do verifiers use? And is there anything that can be done to improve them to help verifiers?

A wide range of tools are used, depending on what software the verifier has access to, what they are comfortable using, what fits in with their colleagues and with the people who send them data. There are many opinions on which software works best and what features are most important. There is a trade-off between having software that is tailored to meet the requirements of a particular scheme very well, but is difficult to integrate with others, as opposed to systems that attempt to provide a solution for all but are not tailored perfectly to any one thing.

- Deciding who is right. What happens when new taxonomic experts join the verification Network and verify a record differently from the current national verifier – who has the final say?

This debate is only beginning to be had, as many recording schemes have relied on only having one person who has the final say, at least within a given county.

So far there is no evidence of frequent disagreement among verifiers within systems such as iRecord that do allow for shared verification, but this issue may arise more often if more verifiers join the system.

The answer to most such disputes lies in open dialogue and respect for people and evidence. If a dispute really cannot be resolved then the only solution may be to flag the record's verification status as "disputed".

- What are the drivers for increasing the speed at which data becomes available?

There are different opinions about how important it is to make data widely available quickly, with legitimate concerns that an over-emphasis on speed of dataflow could lead to a reduction in data quality. However, there are a number of factors driving a desire for increased speed of access to data of known quality, including: recorder motivation (recorders like to see their data being used, and dots appearing on maps); invasive species monitoring (rapid reporting of the discovery and spread of invasive species can help target

action to mitigate any negative effects); protected species (which can have significant impacts on planning decisions); information for government agencies and policy makers (who may need to make decisions based on centralised data collation via NBN and do not have the resources to contact individual data providers).

References and further information

Reference	Keywords
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Silvertown, J., Harvey, M., Greenwood, R., Dodd M., Rosewell, J., Rebelo, T., Ansine, J., McConway, K. 2015. Crowdsourcing the identification of organisms: A case-study of iSpot. <i>ZooKeys</i> 480: 125-146. doi: 10.3897/zookeys.480.8803 http://zookeys.pensoft.net/articles.php?id=4633	Crowd-sourcing

Appendix 2: interested parties

In response to the draft Action Plan 32 people and organisations indicated a desire to be involved in this area of work. Seven expressed an interest in leading the working group, a further 18 to be involved with the working group, and a further seven wishing to be kept informed. They are listed here.

Organisation	Already doing this	Would like a role	Keen to lead	Want to be partner	Category
ALERC	No	Yes, if we had more resources	Yes		LERC
Amphibian and Reptile Conservation	Yes, but do more with more resources	Yes, if we had more resources	Yes		NGO (conservation)
Centre for Environmental Data and Recording	Yes	Yes definitely	Yes	Yes	LERC
Centre of Ecology and Hydrology	Yes, but do more with more resources	Yes definitely	Yes		Academic, links to NSS
Devon Wildlife Trust	Yes	Yes, if we had more resources	Yes	Yes	NGO (conservation)
Norfolk Biodiversity Information Service	Yes, but do more with more resources	Yes definitely	Yes	Yes	LERC
Northampton Biological Records Centre	Yes, but do more with more resources	Yes, if we had more resources	Yes		LERC
British Trust of Ornithology	Yes, but do more with more resources	Yes definitely		Yes	NSS
Bees, Wasp and Ant Recording Scheme	Yes, but do more with more resources	Yes, if we had more resources		Yes	NSS
Caddisfly Recording Scheme	Yes, but do more with more resources	Yes, if we had more resources		Yes	NSS
Cumbria Biodiversity Data Centre	Yes, but do more with more resources	Yes, if we had more resources		Yes	LERC
Field Studies Council	Yes	Yes, if we had more resources		Yes	NGO (education)
Greenspace Information for Greater London	No	Yes, if we had more resources		Yes	LERC
Greater Lincolnshire Nature Partnership	Yes, but do more with more resources	No, but we would like to be kept informed		Yes	Other
iSpot/Open University	Yes	Yes, if we had more resources		Yes	Academic
Lincoln Naturalist Union	Yes, but do more with more resources	Yes, if we had more resources		Yes	Local society
Leicester and Rutland Environmental Record Centre	Yes	Yes definitely		Yes	LERC
NatSCA		Yes definitely		Yes	Museum
ReCORD	Yes, but do more with more resources	Yes, if we had more resources		Yes	LERC
Scottish Biodiversity Information Forum	No	Yes, if we had more resources		Yes	Other

Organisation	Already doing this	Would like a role	Keen to lead	Want to be partner	Category
Sussex Biological Record Centre	Yes	Yes definitely		Yes	LERC
Seasearch	Yes, but do more with more resources	Yes, if we had more resources		Yes	NSS
Sussex Wildlife Trust	Yes, but do more with more resources	Yes definitely		Yes	NGO (conservation)
The Wildlife Information Centre	No	Yes, if we had more resources		Yes	LERC
West Wales Biodiversity Information Centre	Yes	No, but we would like to be kept informed		Yes	LERC
Botanical Society for Britain and Ireland	Yes	Yes definitely			NSS
Hampshire Biodiversity Information Centre	Yes, but do more with more resources				LERC
JNCC, NRW, NE	Yes				Govt
National Forum for Biological Recording	No	No, but we would like to be kept informed			Other
Powys Biodiversity Information Services	Yes, but do more with more resources	No, but we would like to be kept informed			LERC
People's Trust for Endangered Species	No	No, but we would like to be kept informed			NGO (conservation)
Yorkshire Naturalists Union	No	No, but we would like to be kept informed			Local society