1 Review of Member State approaches for setting FRVs

1.1 Introduction

Primary input to the project was provided by questionnaires filled by Member State representatives involved in Article 12 (Birds Directive) and Article 17 (Habitats Directive) reporting. The inquiry focused on methods for setting FRVs.

The response rate was high: 23 out of 27 Member States! Croatia was not addressed because of its recent EU membership and BG, PL, PT and RO didn't respond. Apart from insight in approaches used by Member States the filled questionnaires gave many valuable suggestions and references.

This document presents a review of the responses in the context of Article 17 reports on current values and reference values for HD features for the period 2007-2012. Specific methods used by MS in setting FRVs are included as well.

1.2 Reporting context

The Article 17 reporting format and guidelines for the period 2007-2012 allowed reporting of FRVs as unknown ('x') or by using operators (using the symbols ≈, >, >>) apart from providing real values in km^2 for FRR and FRA and number of individuals/agreed exceptions/other units for FRP. The questionnaires sent to the MS asked among others for criteria used to report FRVs as 'x' or with operators.

This paragraph shows how MS actually reported these categories, based on a documented database compiled by EEA from the Article 17 reports for the period 2007-2012[1]. This database was used to find out for how many habitats and species FRVs have been reported as 'x', by operators or real values (fig. 1.1). Table 1.1 explains the different categories used in this figure.

[1] http://www.eea.europa.eu/data-and-maps/data/article-17-database-habitats-directive-92-43-eec-1

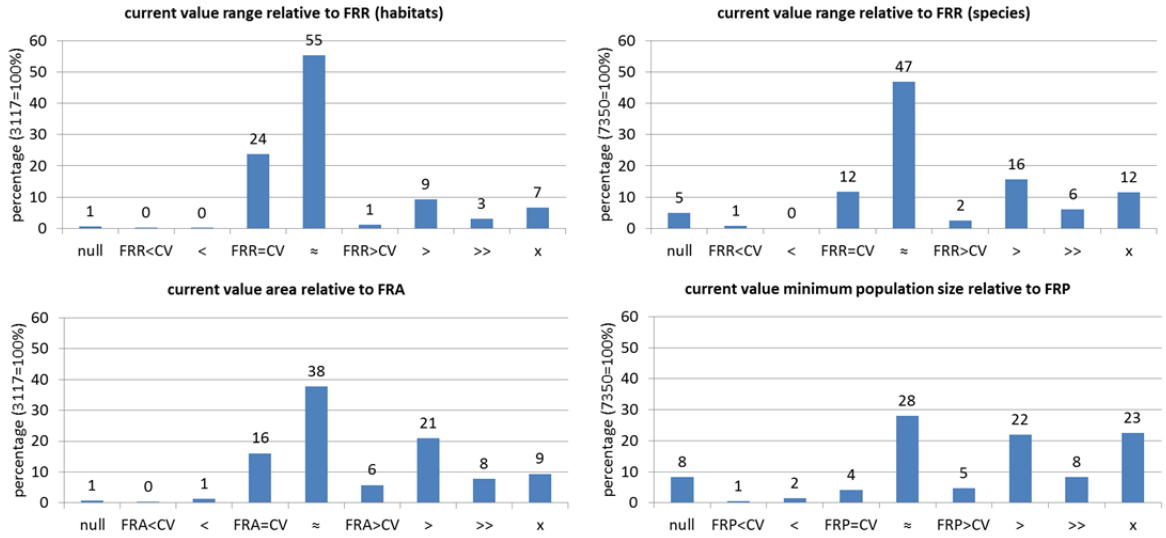

Figure 1.1. Categories of FRVs reported for habitats (3117 records in EU27) and species (7350 records). See table 1 for explanation.

Table 1.2. Explanation of FRV-categories used in figure 1.1 as extracted from the database of Article 17 reports for the period 2007-2012. CV (current value) is the reported value for the range, area or minimum population size.

category	explanation
null	current value not reported and no operator reported
FRV<CV	real value for FRV < current value (only in exceptional cases) and no operator reported
<	< operator reported (idem)
FRV=CV	real value for FRV = current value and no operator reported
≈	≈ operator reported
FRV>CV	real value for FRV > current value and no operator reported
>	> operator reported
>>	>> operator reported
x	FRV reported as unknown

The figure shows that the current range is considered sufficient (FRR=CV or FRR ~) for 80% and 60% of the reported habitats and species respectively. For area and population the corresponding figures are about 55% and 30%. On the other hand, real values different from current values (mostly FRV>CV), are only reported for 1% (FRR habitats), 2% (FRR species), 6% (FRA) and 5% (FRP) of the habitats or species.

For the project, reported real values different from current values are most interesting from a methodological point of view because these values are the result of explicit considerations about reference values relative to current numbers and areas. Table 1.2 presents the number of habitats and species reported this way.

Table 1.2. Number of habitats (nhab) and species (nspec) reported with real-valued FRA>CV and/or real-valued FRP>CV and as percentage of total numbers. MS not in this table didn't report this kind of real values.

country	tothab	nhab with FRA>CV	%hab	totspec	nspec with FRP>CV	%spec
BE	59	25	42	85		
BG	90	1	1	204	33	16
CY	43			56	3	5
DE	92	19	21	199	10	5
DK	60			83	5	6
EE	60			99	1	1
ES	117	5	4	425	17	4
FR	132			312	6	2
IE	58	10	17	69	8	12
IT	132			336	1	0
LT	54			99	1	1
LV	57	6	11	114	7	6
PL	81	5	6	187	5	3
SE	89	44	49	166	102	61
SK	66	1	2	195	8	4
UK	83	22	27	133	13	10

The table makes clear that only a few other Member States than SE assessed real-valued FRVs systematically. Apparently, species are more often assessed this way than habitats; BE is a notable exception.

1.3 Summary of Member State approaches

1.3.1 General aspects

Documented methodology for setting FRVs

The Article 17-reporting format includes entries to describe the methods used to set reference values and this information is available from the database compiled by EEA. However, general considerations and methodology used to set FRVs have been documented by a few Member States only: BE, FR, NL and UK. Their approaches are summarized in chapter 3. Some MS didn't determine FRVs explicitly (DK, FI). Expert opinion is mentioned as the main basis for setting FRVs e.g. by ES, GR, HU, LT and SI, but in fact most if not all MS somehow (and wisely) included expert opinion in considering and weighting factors in setting FRVs.

Using 'unkown' and operators

The Guidelines (Evans & Arvela 2011: 21) state: *'The use of operators should help to reduce the use of 'unknown' to a minimum. Expert judgement will be required to determine if the operator should be '>' or '>>'. If the operator is '>>', the current value is very likely to be 'more than 10% below FRV and the parameter 'Unfavourable-Bad'.*

Most MS use 'unknown' as expected: in the case of lack of data, mostly actual distribution data but sometimes historical data. Particular situations or species groups include marine caves several marine species (IE) and *Cladonia* spp./*Lycopodium* spp. of HD Annex V (NL, SE). Some MS use 'unknown' in case of occasional findings (EE) or new arrivals (BE-VLG, CZ, MT). Another reason is discussion about the occurrence or definition of a feature (AT).

The use of operators is far less harmonised and occurs in several unrelated cases:

1. As a result of expert opinion and sufficient confidence despite the lack of proper data. This is the situation envisaged in the Guidelines.
2. Several MS reported only operators (see table 1.2). Reasons are uncertainty about methods for the assessment of real values and/or uncertainty about the interpretation and (political) consequences of real values. For species, BE-VLG uses general population ecological (genetic) rules which '*gives a good indication whether or not the actual population has a FCS (= meets the FRP), but does not allow a quantitative approach to set a real value for FRP (or such values are subject to important scientific discussions)*'. NL doesn't want to report figures for common, widespread species corresponding to 'the whole of the Netherlands'. Some MS consider the use of operators 'balanced', 'sufficient' or 'adequate' for the final assessment of CS (e.g. DK, GR).
3. Specific interpretations: '>' has been used for habitats with restoration potential (EE); '≈' for species and habitats confined in range due to physical constraints (MT).

Values when HD came into force

A FRV must be at least the value (range, surface area, population size) when the HD came into force (Evans & Arvela 2011). For FRR the spatial configuration must be included as well.

As stated implicitly or explicitly by several MS, this requirement is not very relevant for the process of setting FRVs. In many cases a feature was clearly not viable when the HD came into force. Some MS note that increased knowledge and better data resulted in adjusted (including smaller) FRV estimates in 2013 (GR, NL, UK). Some MS remark that exact values when the HD came into force are and will remain poorly known (AT, BE-VLG).

Feasibility

About half of the MS indicate that feasibility considerations have not been used in setting FRVs (AT, BE-VLG, CZ, DK, ES, FI, FR, GR, HU, IT, LV, SI, SK), whereas the other MS somehow included technical, social and/or financial aspects. It is noted that potential habitat can be irreversibly destroyed, e.g. by cities, land reclamations or closing of sea arms, resulting in technical constraints on restoration and that this kind of feasibility inevitably must be included in setting FRVs (NL, UK). Some MS emphasise that more guidance on feasibility is needed (BE-WAL, IT, LT).

Concerns about including or not feasibility aspects might be the result of uncertainty about the interpretation and consequences of FRVs. IE states: '*it is more important to demonstrate that efforts are being made to move towards an ecological/conservation target rather than setting a lower target for financial and social reasons*'.

1.3.2 Factors and methods

FRR and factors to be considered

The Guidelines mention the following factors which should be considered in setting a FRR (Evans & Arvela 2011, III.a.i): 1 Current range; 2 Potential extent of range; 3 Historic range and causes of change; 4 Area required for viability of habitat type/species including consideration of connectivity and migration issues; 5 Variability including genetics.

Most MS (AT, BE-WAL, CZ, DE, EE, ES, FR, GR, HU, IE, IT, LT, LU, LV, MT, NL, SE, SI, SK, UK) consider both current and historical range. Potential extent (BE-VLG, BE-WAL, CZ, EE, ES, FR, GR, HU, IE, IT, LT, LU, LV, MT, NL, SE, UK) and area required for viability (BE-VLG, BE-WAL, CZ, EE, ES, FR, GR, IE, LT, MT, SE) are used less and variability only by DE, EE, ES, GR, IE, MT, SE. The latter factor was explicitly rephrased by DE as plant-sociological, altitudinal and regional variation based on natural landscape units. NL includes the requirement that FRP/FRA must be covered by the FRR.

Connectivity and viability issues emerge in the assessment of FRP as well and require more guidance in setting FRVs (see also the paragraph Connectivity aspects).

FRP and factors to be considered

The Guidelines mention the following factors which should be considered in setting a FRP (Evans & Arvela 2011, III.a.ii): 1 Population should be sufficiently large to accommodate natural fluctuations and allow a healthy population structure ; 2 Potential range; 3 Historic distribution and abundances; 4 Biological and ecological conditions; 5 Migration routes and dispersal ways; 6 Gene flow or genetic variation including clines (slightly re-ordered to show correspondence with factors mentioned under FRR).

Historical distribution is used by most MS. Only BE-VLG, CY, DK and FI didn't use this factor. Next comes the requirement that populations must be sufficiently large (BE-F, BE-W, CZ, DE, EE, FR, HU, IE, IT, LU, MT, NL, SE, SI, SK, UK). Potential range (BE-WAL, CZ, EE, FR, GR, HU, IE, IT, LT, LU, LV, MT, NL, SE), Biological and ecological conditions (BE-VLG, BE-WAL, CZ, DE, EE, ES, FR, GR, HU, IE, IT, LT, LV, MT, NL, SE) and Migration routes and dispersal ways (BE-VLG, BE-WAL, CZ, DE, EE, FR, GR, IE, LT, LU, LV, MT, NL, SE) are used by 60-70% of the MS. Gene flow or genetic variation only by BE-VLG, EE, GR, IE implicitly, SE.

BE-WAL considers connectivity as well (number of linked populations, colonies, grid cells). Likewise NL includes considerations on current population size, the number of metapopulations needed and/or the population density for more common species (see also the paragraph Connectivity aspects).

FRA and factors to be considered

The Guidelines mention the following factors which should be considered in setting a FRA (Evans & Arvela 2011, III.a.iii): 1 Actual distribution and actual variation (including quality of habitat); 2 Potential natural vegetation; 3 Historic distribution and causes of change; 4 Requirements of typical species (including gene flow); 5 Dynamics of the habitat type; 6 Natural variation (slightly re-ordered to show correspondence with factors mentioned under FRR).

The first three factors correspond to those already considered for setting the FRR. MS used these factors likewise in setting the FRA. 'Natural variation' for FRA resembles 'variability' for FRR and was used by about 40% of the MS (BE-VLG, BE-WAL, DE, EE, ES, FR, GR, IE, MT, NL, SE, UK) as was 'Dynamics of the habitat type' (BE-WAL, CZ, EE, ES, FR, GR, IE, LT habitat 7120 only, LV, MT, NL, SE, UK). 'Requirements of typical species' was far less used (DE, HU, IE implicitly, MT, NL, SE, UK) despite the primary importance of this factor apparent from the Guidelines. BE-VLG and NL considered the Red List status of typical species.

Connectivity aspects

The questionnaire asked *What method(s) did you use in the assessment of connectivity aspects of FRP and/or FRR?* More than 40% of the MS didn't use specific methods. Seven MS (BE-VLG, EE, ES, FR, LT, LU, MT) used GIS-analyses of habitat coverage in the landscape, and just a few (BE-VLG, EE, LU, SE) used direct or indirect genetic methods or dispersal studies. Expert opinion is mentioned as well. SE notes that connectivity is related to both the area and quality of the habitat (barriers to dispersal). In fact, this dual role of connectivity, 1) as factor to be considered in setting FRVs and 2) to be assessed as a component of the CS parameter Structure & functions or Habitat for the species, is implied in the Guidelines as well (see above, FRA and factors to be considered).

Whether, at which level (FRR or FRA/FRP) and how connectivity aspects are relevant in setting FRVs need more guidance, including the marine environment where connectivity is even less understood than on land.

Use of historical references

Although historical range and distribution have been used as important factors in setting FRVs by a majority of MS (see above), specific historical references have much less been considered. Some MS use more or less fixed reference years or periods: BE-VLG, BE-WAL, EE, ES, FR, LT, LU, NL (habitat types), SE, SI (mostly) and SK. DE uses fixed reference values with Red Lists as orientation. Specific references, such as a period when a feature was supposed to have FCS, are used (as well) by BE-VLG (only for birds), CZ, EE, ES, GR, IE, IT, LU, MT, NL (some habitat types and species) and SE. Five MS indicate that they didn't use historical references: DK (species), FI, HU, LV, UK.

Some countries (BE-WAL, IE, NL) elaborate on the decision rules used. Several MS included questions or suggestions on the use of references in general and more particular on reference periods. Clearly these aspects need more guidance.

Use of trend data
The use of trend data for setting FRVs is highly diverse across Member States. AT, CZ, DE, DK (HD-species), ES, FI, LT, LV, MT, SI and SK didn't use trend data. BE-WAL only for bats, BE-VLG only for species with large dispersal rates and DK only for habitats; EE, FR, GR, HU, IT, LU, NL, SE and UK for habitats and HD-species while EE, GR and LU mention birds as well.

Use of estimates of MVP
The questionnaire asked *Did you use or include estimates of minimum viable population size?* The following MS don't use MVPs: AT, CZ, DE, DK, EE, FI, HU, IT, LT and SE (not for the reporting), SI and SK. For DK this is remarkable considering Box 3.4 in McConville & Tucker (2015) devoted to the use of MVPs by Denmark. BE-VLG, GR, LU, LV and NL use MVP-values from the literature. Some MS applied specific analyses: CY (PVA: birds), ES (handful of species), GR, LU, MT (special cases e.g. *Aphanius fasciatus*), LV and UK (special cases, e.g. Fisher's estuarine moth).

Differentiation in methods
BE-VLG, CZ (for groups of species/habitats), DE, EE, FR, LU, LV, SK and UK perform standardized approaches in setting FRVs for species and habitats; NL only for terrestrial habitats. GR and IT use different approaches depending on the taxonomic group.

Other species-related contrasts resulting in different methods are: marine vs. terrestrial (IE, LT, MT, NL), annex V vs. other annexes (BE-VLG), migratory vs. non-migratory species (BE-VLG, LT, NL), colonial vs. non-colonial birds (CY), common widespread vs. other species (NL) and population units, e.g. individuals vs. tree trunks (SE).

Data-driven differentiation results from differences in monitoring programmes e.g. dune habitats, saltmarsh, upland etc. (IE, SE), data quality (SE, SI) and availability of historical data (MT).

1.3.3 Spatial scale

FRVs for mobile species
The questionnaire asked *How did you assess references values for mobile species with dynamic ranges crossing national boundaries or going beyond EU territories?*

This species group was not considered explicitly by AT (but lynx in discussion), CY (island situation), CZ (despite cross border exchange), DK, ES, FI, FR, HU, LT (mostly reported as unknown), MT (island situation; most marine species reported as unknown) and SK. Although there may be movement of several terrestrial fauna across the border with Northern Ireland, IE considers it unlikely that the conservation status of most of these species are impacted by activities outside Ireland.

BE-WAL, EE, LU and SI (taking into account adjacent countries) did assess mobile species explicitly using expert opinion. GR considers only bird species with dynamic ranges crossing national boundaries as mobile; in setting FRVs the conservation status at the national and European level are taken into account. SE sets FRVs for large carnivores based on data in neighbouring countries. For mobile species DE assumes that an appropriate minimum share of the population must be present/maintained and that migration routes must be kept viable (e.g. fish migration) irrespective of the location of the reproduction/spawning sites. For some marine species, UK utilised data from large-scale international population surveys, cut to UK boundaries.

BE-VLG applies generalised genetic rules for mobile species: '*For mobile species with more widespread migration patterns, the real meta population could occur within a region much larger than FLanders. In these cases it is not always possible to reach the FRP in Flanders alone; if there are less than 5,000 individuals within Flanders, and the population is not decreasing, then it can still be considered in FCS. This system was used for several of the bat species*' (from McConville & Tucker 2014). The whole of Flanders is considered as FRR for mobile widespread species. For migratory fish, NL calculated a FRP

based on estimates of how many fish should reach the spawning sites (outside the country) taking mortality rates into account; for bats, only wintering in the Netherlands, FRVs are based on the wintering populations only; for cross border populations of *Euplagia quadripunctata* NL calculated its national FRV assuming that the neglected part of the population also would contribute to the survival of the species (compare assumptions used by DE above); for common widespread species NL assesses the FRR as the whole country and FRP as ≈ (operator).

Features requiring reference values above MS-level

The tender specifications for the Service contract acknowledge that '*for some habitats and species FRVs might best be set on national (-biogeographic) level, for others the level of the EU-biogeographic region might be more appropriate and again for others (e.g. large carnivores) the population level might be considered the most relevant one to set FRVs*'.

The filled questionnaires suggest reference values above MS level for large carnivores, seals, marine migratory species (sea turtles, some cetaceans), migratory fish, migratory bats and large birds (of prey) with large home ranges. Apart from considerations about individual behaviour, methods above the MS level are motivated to avoid double counting and to recognise all parts of a species life cycle (IE).

Small countries (BE, LU, NL) note that many species and habitats inherently show relevant trans-boundary dynamics but don't suggest FRVs above MS level in this case (see also FRVs for mobile species, above).

Population-based FRVs are suggested for small, isolated populations by FR (for species occurring in one biogeographic region), GR (e.g. *Vipera ursinii*), HU, and IT and in principle for all HD-species with small dispersal capacity (e.g. amphibians) by BE-VGL.

SE proposes to reconsider the calculation of FRVs for biogeographic regions within Member States (a point raised by BE-WAL as well):

- A FRV should be calculated for a biogeographic region part of the MS for 1) species with regionally important populations, 2) species or habitats with regionally differentiated management or 3) when threats and pressures are different between different biogeographic regions.
- One FRV for the entire MS (covering several biogeographic regions) is appropriate for species which are migrating throughout the MS and between the regions, and where a separation of sub-populations is not meaningful. This can also apply to habitats where conditions in the previous point are not met.

For habitats, the questionnaires present no arguments for considering trans-boundary FRVs, except (BE-WAL) when a habitat is supposed to host very mobile species or if a habitat has a small, trans-boundary distribution. Examples for these cases are not given. BE-WAL further notes that '*a huge issue is the lack of homogeneity for habitats definitions, between MS or between regions. Even for forest habitats or heaths, the definition may be very different from one MS to another*'.

1.4 Documented approaches by Member States

McConvile & Tucker (2013) already reviewed practices and underpinning assumptions used by Member States in interpreting FCS and setting FRVs, in particular with regards to widespread species with extensive populations outside Natura 2000-sites.

This paragraph summarizes explicitly documented approaches for setting FRVs by Member States. Table 1.3 provides references to this documentation (extracted from the MS questionnaires).

Table 1.3. References to documentation on defining and setting FRVs by Member States.

MS	reference	link
BE-VLG	Louette et al. (2011)	https://www.inbo.be/nl/publicatie/bridging-gap-between-natura-2000-regional-conservation-status-and-local
	Louette et al. (2013)	https://www.inbo.be/nl/publicatie/staat-van-instandhouding-status-en-trends-habitattypen-en-soorten-van-de-habit
FR	Bensettiti et al. (2012)	http://spn.mnhn.fr/spn_rapports/archivage_rapports/2012/SPN%202012%20-%2027%20-%20Guide_methodologique_EVAL_V1_fev-2012.pdf
NL	species: Ottburg & Van Swaay (2014)	http://library.wur.nl/WebQuery/wurpubs/fulltext/359115
	habitats: Bijlsma et al. (2014)	http://library.wur.nl/WebQuery/wurpubs/fulltext/342755
UK	JNCC (2007)	http://jncc.defra.gov.uk/PDF/FCS2007_ukapproach.pdf

1.4.1 Belgium - Flanders

Louette et al. (2011) describe the stepwise approach used by Flanders to derive its conservation objectives. The first step is the assessment of the current conservation status at the regional level (i.e. both within and outside the SCIs) based on the HD-parameters range, area/population, specific structures & functions of habitats/quantity and quality of the habitat of species, and future prospects. Secondly, reference conditions that mirror a favourable conservation are drawn from knowledge of the current conservation status, as well as indicative, but not yet allocated nature development potentials in the landscape. Setting up reference conditions is furthermore supported by historical and actual distribution and abundance data of habitats and species, ecological signatures of habitats and species, complemented with expert judgment. These reference conditions were further fine-tuned with socio-economical considerations, via a participation process with stakeholders. Louette et al. (2013) describe the setting of FRVs in more detail.

FRR for habitats were set by adding critically evaluated historical locations to the current distribution; for some habitats locations of site-specific, future conservation targets were added as well. Likewise, FRA includes current area and the area corresponding to decided future targets at the site level.

FRR for species was often taken as the area when the HD came into force (1994) or to correspond to federal conservation objectives. FRPs were mainly based on generalised genetic rules provided by Mergeay (2012) who recommends a minimum effective population size N_e = 500 corresponding to a census population of at least 5000 adult individuals, possibly distributed outside Flanders and across several metapopulations. For the conservation of one metapopulation, the objective is to conserve 95% of the genetic diversity in 100 year, with required population numbers given by Mergeay (2012). Apart from these recommendations, FRPs resulted from site-specific objectives for isolated populations near range limits as well.

1.4.2 France

Bensettiti et al. (2012) discuss the approaches for setting FRVs, explored and applied by France. As a general strategy, information from species or habitat specific survival and viability studies is preferred over historical data.

In setting FRR (ARF) for species and habitats a minimum value of 100 km^2 is assumed, corresponding to the threshold of IUCN Criterion D Vulnerable (Rodriquez et al. 2011). Historical data are used to estimate a sufficiently large potential range.

In the absence of complete demographic and abundance data, several alternatives for setting FRP (PRF) are considered, based on Sanderson (2006), often including a historical approach.Reported FRPs can be the sum of FRPs for individual, more or less isolated populations. The use of a single, universal minimum population size, e.g. derived from Traill et al. (2007), is considered not satisfactory.

FRA (SRF) is considered the most difficult FRV to estimate. Different approaches are used depending on the extent of the habitat. For localised habitats mainly determined by physical conditions, such as caves, spring areas, bogs and lakes, the area of occurrence of the particular conditions is used as FRA,

generally corresponding to the actual area, and sometimes adjusted using historical data from the period 1950-60, e.g. for bogs. For widespread habitats, the FRA depends on the natural variation judged from the number of defining phytosociological associations. In this case they suggest a FRA of 2000 x the numer of associations, based on the threshold of 2000 km^2 for the area of occupancy corresponding to IUCN Criterion C Vulnerable, as given by Rodriquez et al. (2011). In any case, values can be adjusted by expert judgement. For (unspecified) special cases they suggest to derive the FRA from the FRPs of key species of the habitat.

1.4.3 Netherlands

The process of setting FRVs for species in the Netherlands has been reported by Ottburg & Van Swaay (2014). First, the FRP was determined, based on the minimum number of adult individuals necessary to ensure the long-term survival of the species. This was achieved by applying the MVP-concept, based on Traill et al. (2007), and by taking risk spreading into account. The latter consideration generally required several viable population core areas, i.e. with their own reference values, distributed over the (historical) range. Secondly, the FRR was determined, derived from the actual distribution and the requirement to encompass the FRP.

Bijlsma et al. (2014) derived FRVs for habitats in the Netherlands. Again, first the FRA was set '*using a stepwise approach based on (1) area trends relative to the historical surface area (i.e. stable or increasing, <1% decrease, >1% decrease), (2) current structure and function (in three classes) and (3) current Red-List status of typical species and the threat to qualifying vegetation types (in two classes). The reference year for the historical surface area is usually 1950, the year that is also used for Red Lists. For habitat types with a negative trend, this approach results in an expansion category, expressed as a percentage of the 'area lost', i.e. the historical area minus the current area*'. Appendices of the report present estimates of the historical surface areas of heaths, drift sands, raised bogs and a few grassland types in the Netherlands around 1950. Secondly, setting the FRR involved assessing whether there was a negative trend and whether the historical geographic diversity and rquired spatial connectivity in distribution were accounted for.

1.4.4 United Kingdom

The methodology used by the UK in setting FRVs is documented by the Joint Nature Conservation Committee (JNCC 2007). The documentation clearly describes how the general instructions for setting FRVs in the Guidelines were interpreted and structured into practical approaches with inherent shortcomings and uncertainties. This description probably applies to the approach of many Member States and therefore is reproduced here for the case of setting FRRs for habitats: '*The EC Guidance did not provide a definitive method by which viability of habitat range could be assessed, e.g. by specifying metrics and the thresholds for judgements. Nor was there a widely accepted 'off the shelf' method that could be applied. To overcome this problem, some key factors and questions were identified to take into account in determining viability. These factors were not necessarily exclusive, nor did they absolutely prove or disprove viability. They were used to give a reasonable indication of viability, based on expert judgement as to the significance of particular factors and the general weight of evidence. The approach relied on expert opinion, trends and general knowledge*'.

In setting FRRs for species, '*1994 was used as a preliminary baseline. Where 1994 data were not available the nearest, most recent alternative was considered. No presumptions have been made as to whether range was favourable or not at that time, but consideration was given to whether the range was sufficiently large to support a long-term viable population of the species. In the absence of detailed modelling, defining favourable reference values at a UK level has been problematic. To help overcome this, current trend data were used as an indicator and have been transposed into a decision tree to assist in setting favourable reference range values*'.

In setting FRPs *'due to time and resource constraints, population viability analyses were not carried out. Instead, current trend data were used as an indicator for determining viability and,* as for FRR, *transposed into a decision tree. Long-term has been interpreted by the UK as 12 -15 years or three generations (whichever is longer)'.*

Applying the concept of viability to habitats was considered problematic. In setting FRRs for habitats '*the approach relied on expert opinion, trends and general knowledge. In most cases this approach did not precisely define the FRR, but it did help to clarify if the current range was more or less than 10% below the FRR, i.e. if the range should be judged as inadequate or bad*'. '*Two main factors were considered: (i) the total range area; and (ii) how fragmented the range appeared to be (by way of the number and size of each range block, and how well each block was filled). The view taken was that habitats which covered a large part of the UK, or which had a relatively compact range were generally more likely to be viable. Habitats that had only a limited range or which had a fragmented range were less likely to be viable. A number of other factors were also considered. A recent decline in range triggered some concern, especially if the decline had been rapid (>1% per annum) and extensive. Allowance was made for habitats that are naturally scarce or have been scarce for many centuries, i.e. their current scarcity was not necessarily taken as a cause for concern*'.

In setting FRAs two main factors were considered. '*Firstly, total habitat area. As a crude guide, habitats covering less than about 3,000 ha were taken as 'scarce' and therefore at possible 'risk'. The second main factor was the area of individual habitat patches. The view taken was that larger patches of habitats are generally more likely to be viable than smaller ones and provide some interior conditions'.* Regarding habitat loss and fragmentation '*it was judged that fragmentation and isolation were unlikely to lead to a conclusion that the current habitat area need to be increased by more than 10% to ensure viability, i.e. the current area was not more than 10% below the favourable reference area*'. This conclusion results from the consideration that '*fragmentation and isolation are most likely to result in impoverishment (rather than actual habitat loss). They can be remedied (at least in part) without increasing the actual habitat area (but by way of buffer zones, which could be of another habitat, or improving agricultural practices)'*.