Key terms and concepts in the IUCN Red List Criteria

Photo © Brad Wilson

An amphibian species

Critically Endangered A2ace;B1ab(iii)

- At least 80% **reduction** in **population size** over the past 10 years or three **generations**.

- Restricted **extent of occurrence**.

- The population is either **severely fragmented** or occurs in just one **location**.

- **Continuing decline** in extent and/or quality of habitat.

Key Terms

- Important to understand what these terms mean and how to calculate them appropriately.

- Not all of the criteria use all of the terms.

- Not essential to have data for ALL of these terms.

Population Size
(mature individuals only)

Subpopulations

Population
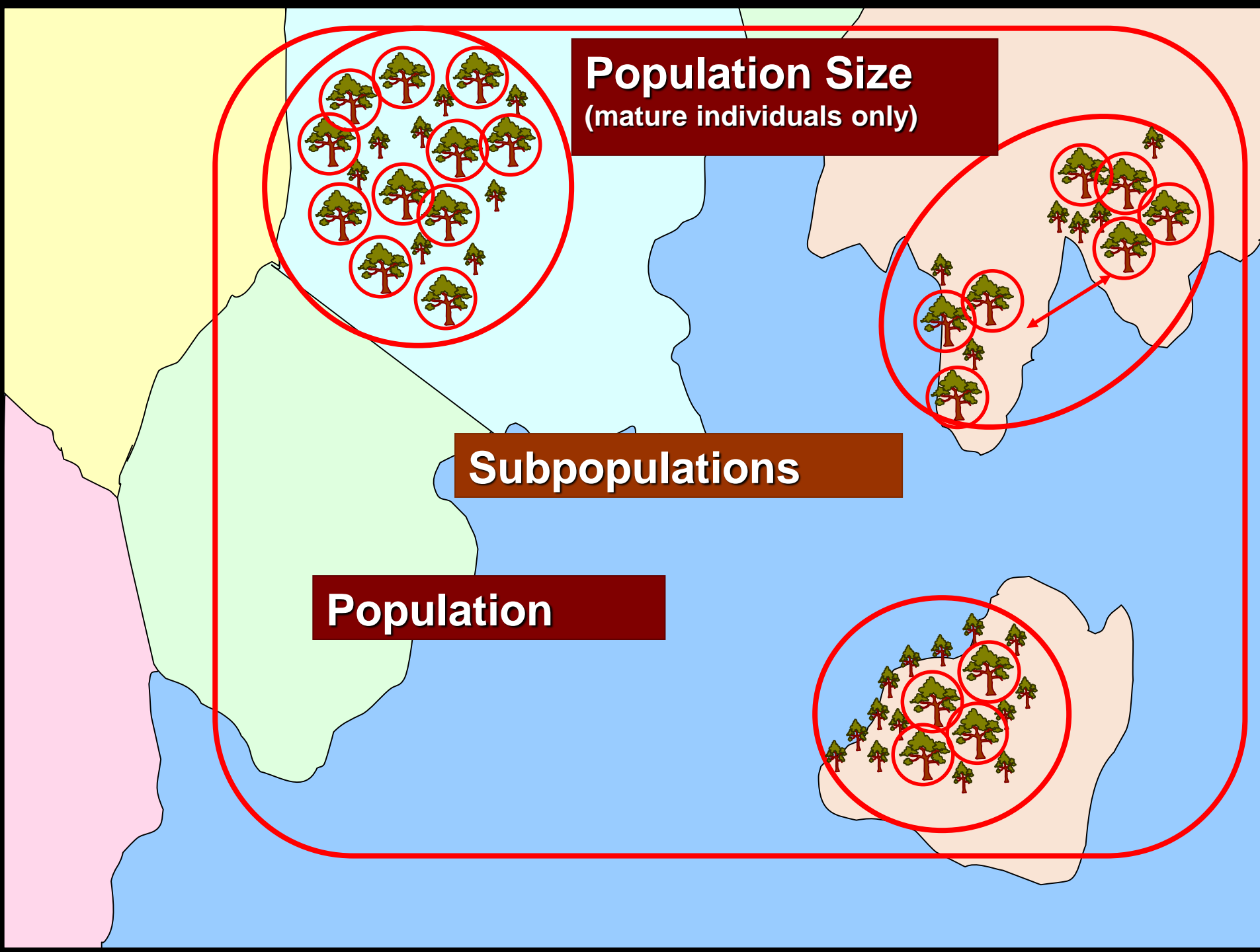
Used to scale time-based measurements to account for different survival and reproduction rates

e.g. ≥ 50% population decline measured over 3 generations

Several definitions (all acceptable):

- Average age of parents of the current cohort ("cohort" = newborn individuals in the population)

Number of parents

Age at first breeding
(youngest parent of current cohort)

Generation Length
(average age of parents of current cohort)

Age at last breeding
(oldest parent of current cohort)
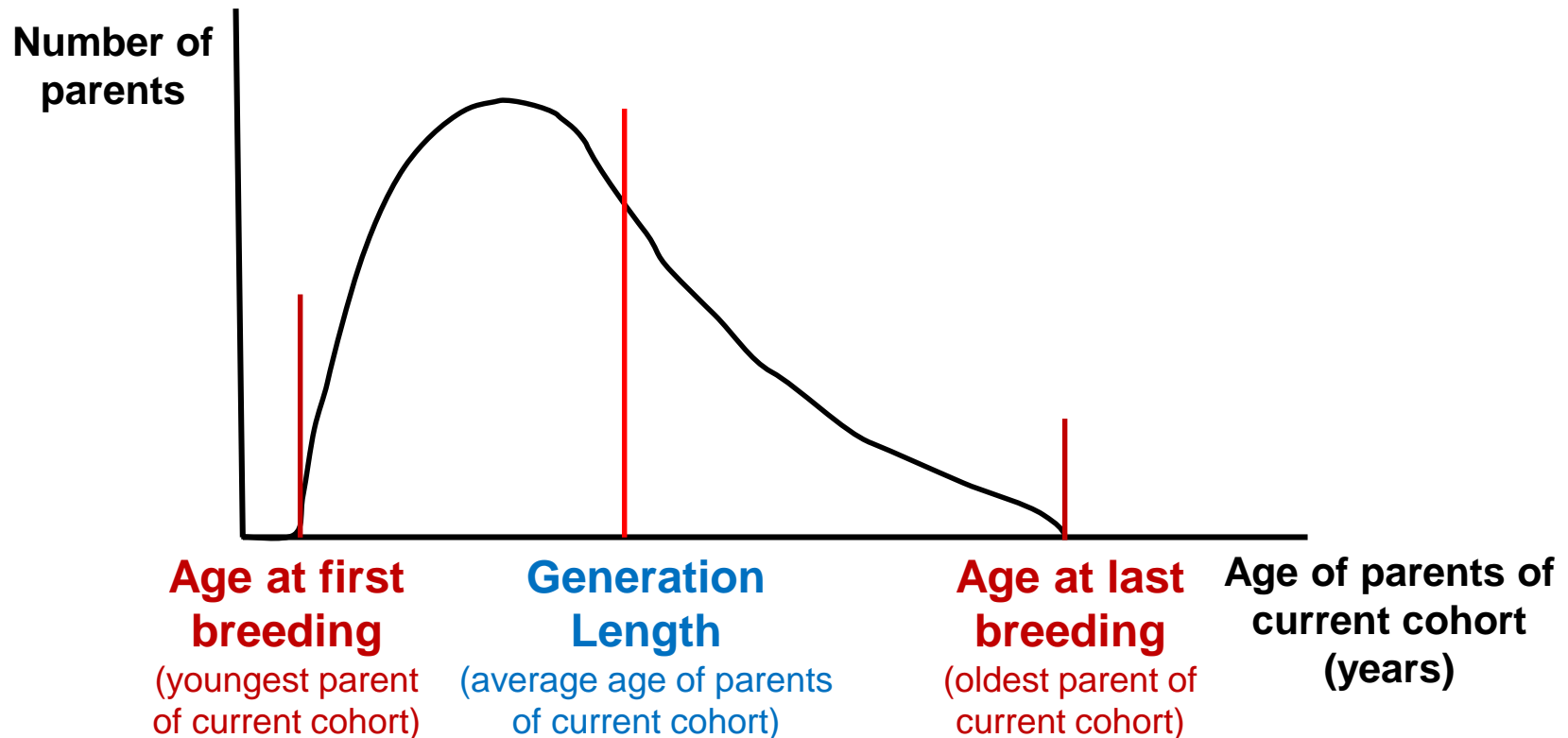
Age of parents of current cohort (years)

Several definitions (all acceptable):

• Average age of parents of the current cohort ("cohort" = newborn individuals in the population)

• Mean age at which a cohort of newborns produce offspring

• Age at which 50% total reproductive output is achieved

• Mean age of parents in a population at the stable age distribution

• Time required for the population to increase by the replacement rate

- **Scales time-based measurements to account for different survival/reproduction rates.**

- **Reflects turnover rate of breeders.**

- **Always use *natural* generation length.**

Generation Length

Life table data (e.g., survival rate and fecundity for all age classes)

Generation Length Workbook.xls

(https://www.iucnredlist.org/resources/generation-length-calculator)

Reduction

Reduction is a % decline in population size over the time period specified in criterion A (10 years or 3 generations).

Population Size

Time

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Calculating 3 generation decline with exponential assumption and only 2 years of data													
2	Instructions: Enter data only in blue-highlighted cells. The result is in the yellow-highlighted cells.													
3	Notes: constant exponential rate is assumed													
4	Generation time (years)=	15		Assessment period=		45	years	...						
5	Assessment year=	2005		3 generations ago=		1960		...						
6														
7	Year 1	Population in year 1	Year 2	Population in year 2	# years between 3-gen ago and Year1	# years btw Year2 and present	# years btw estimates	Annual change	Change btw 3-gen ago & Yr1	Change btw Yr2 & present	Population 3 gen ago:1960	Population current:2005	3-gen change	
8	1970	10,000	1990	7,000	10	15	20	98.23%	84%	77%	11,952	5,357	-55.2%	(reduction)
9														
10												Criterion A2:	EN	
11												Criterion A1:	VU	

First Subpopulation

For graph only:

	Year	Predicted	Year	Observed
16	1960	11952	1970	10,000
17	2005	5357	1990	7,000
18	1970	10000		
19	1990	7000		

Intro | **Exponential Decline** | Linear Decline | Multiple populations | A1-A4

CriterionA_Workbook.xls

(https://www.iucnredlist.org/resources/criterion-a)

Guidelines for Using the IUCN Red List Categories and Criteria

Reduction

Reduction is a % decline in population size over the time period specified in criterion A (10 years or 3 generations).
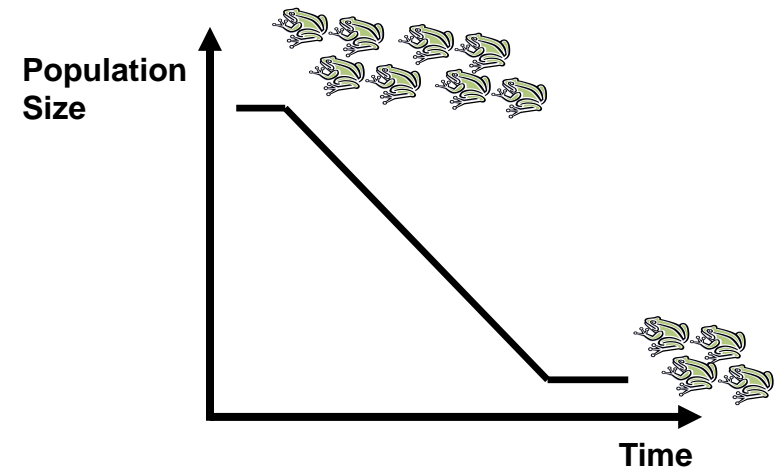
Continuing Decline
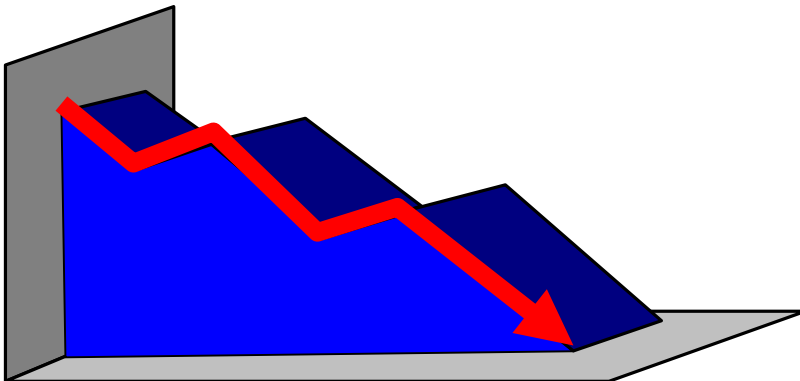
Continuing Decline is a recent, current or projected future decline which is liable to continue unless remedial measures are taken.

	Reduction	Continuing Decline
Timing:	• One-off event • Ongoing	• Decline is expected to continue unless something is done to stop it.
Applies to:	• Population size	• Population size • Extent of occurrence • Area of occupancy • Area, extent and/or quality of habitat • Number of locations • Number of subpopulations

Extreme Fluctuations

Wide, rapid and frequent variation in population size, or subpopulations, or locations, or distribution (typically tenfold increase or decrease)
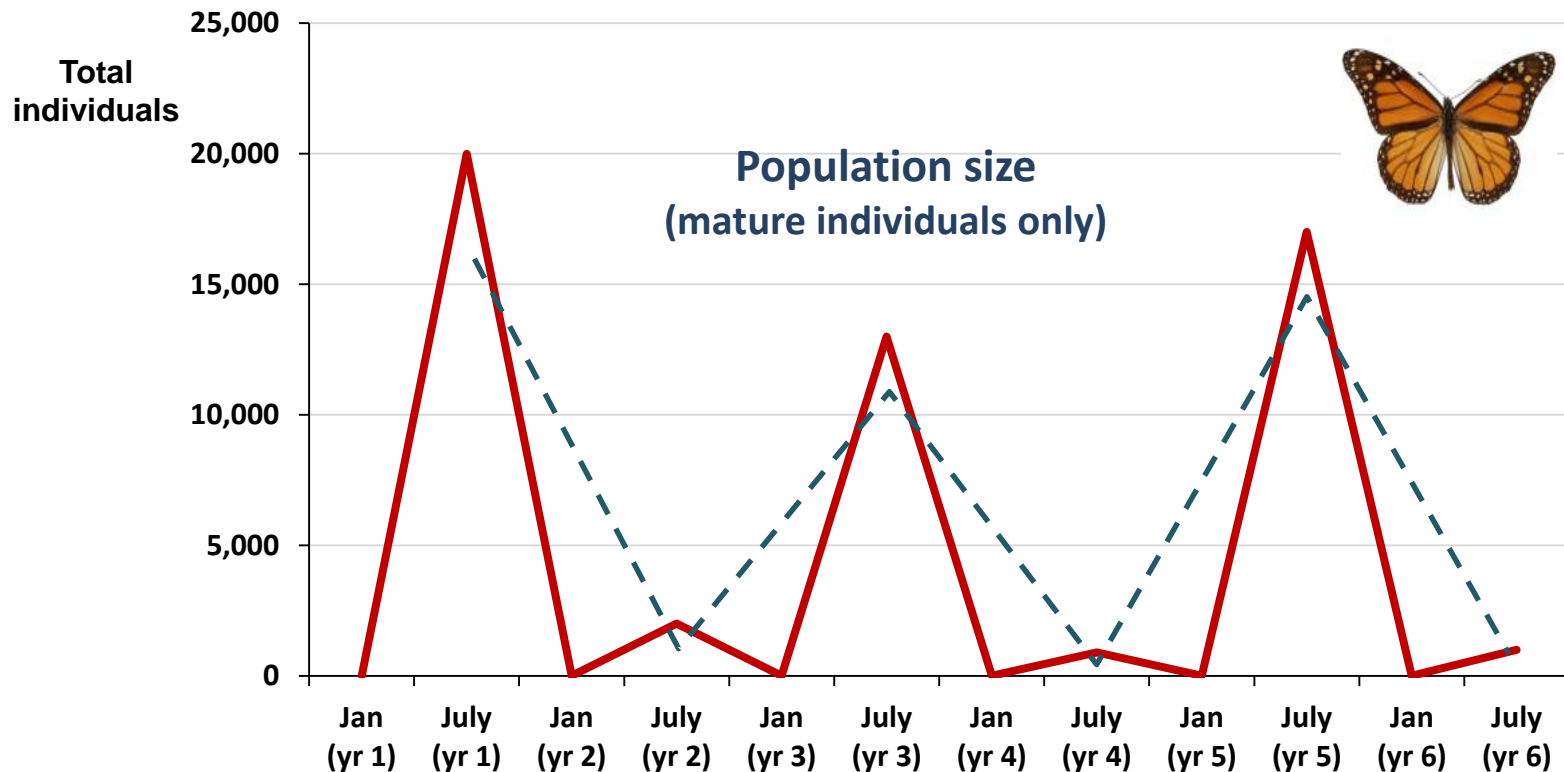
Real changes in total population size; **extreme fluctuation**

Extreme Fluctuations

Wide, rapid and frequent variation in population size, or subpopulations, or locations, or distribution (typically tenfold increase or decrease)
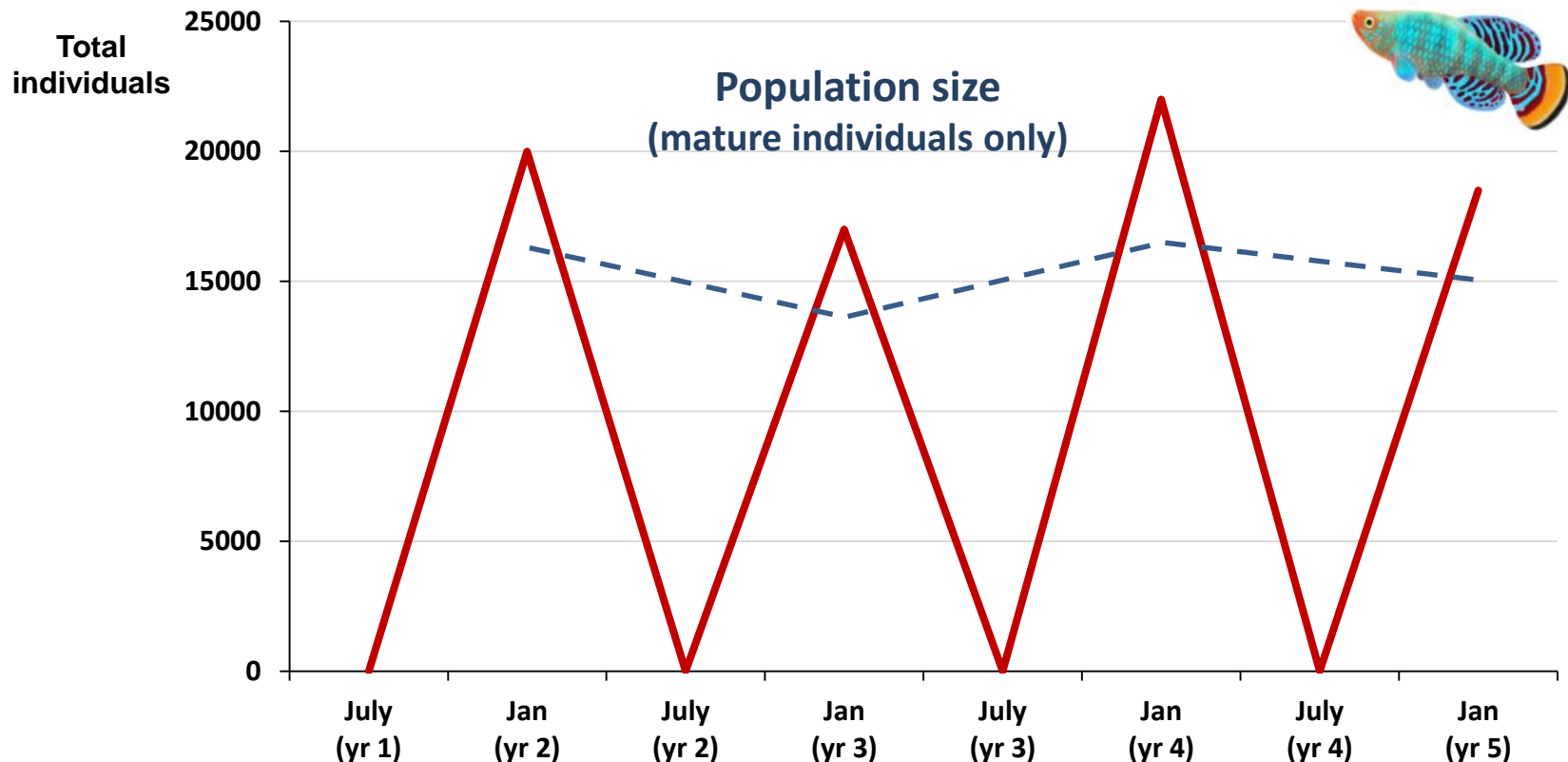
Natural seasonal fluctuations; **<u>not</u> extreme fluctuation**

Most individuals (>50%) found in small, isolated subpopulations between which there is very little dispersal. These subpopulations may be too small to be viable.

Taxa with highly mobile adult stages or producing large numbers of small, mobile diaspores can disperse more easily and are not so vulnerable to isolation through fragmented habitats.

Taxa producing small numbers of diaspores (or none at all), or only large ones are less able to disperse over wide areas and are more easily isolated.
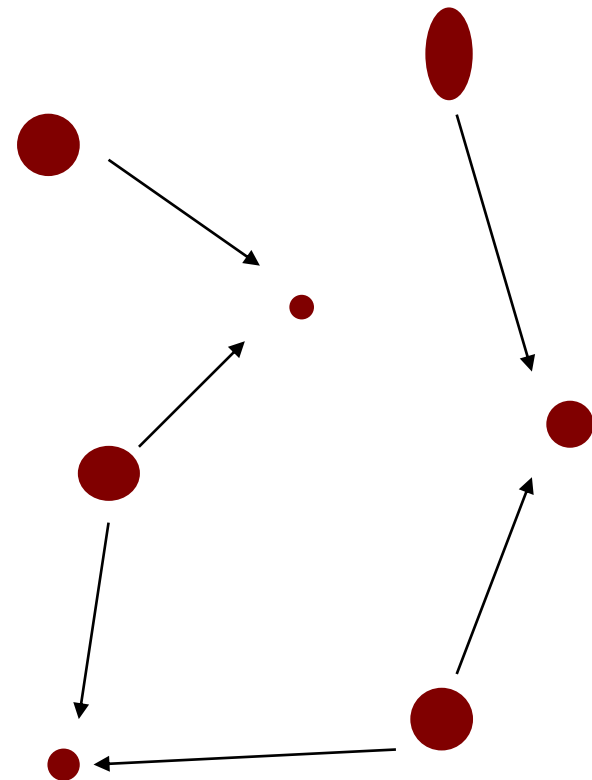
Extent of Occurrence

Area of Occupancy

Extent of Occurrence: area within the shortest continuous imaginary boundary drawn around all known, inferred, or projected sites presently occupied by the taxon.

…EOO ≠ the species' range.
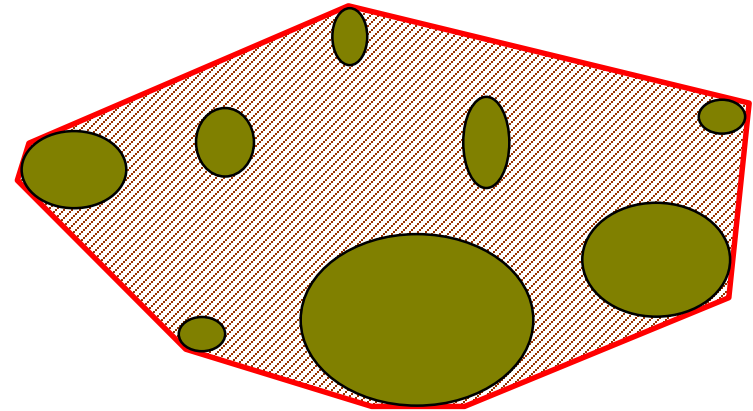
Area of Occupancy: area within the extent of occurrence which is actually occupied by the taxon (measured by overlaying a 2x2 km grid and counting number of occupied cells).
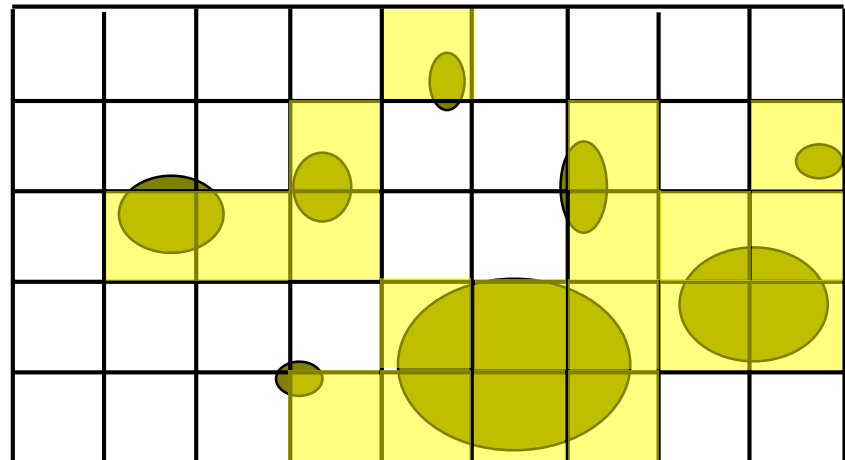
- **Distribution map**
  – Data points (red dots)
  – Limits to distribution (blue polygons)

- **Extent of occurrence (EOO)**
  – Entire area within the minimum convex polygon (e.g., 121,536 km²)

- **Area of occupancy (AOO)**
  – Total occupied 2x2 km grid cells (e.g., 40 km²)
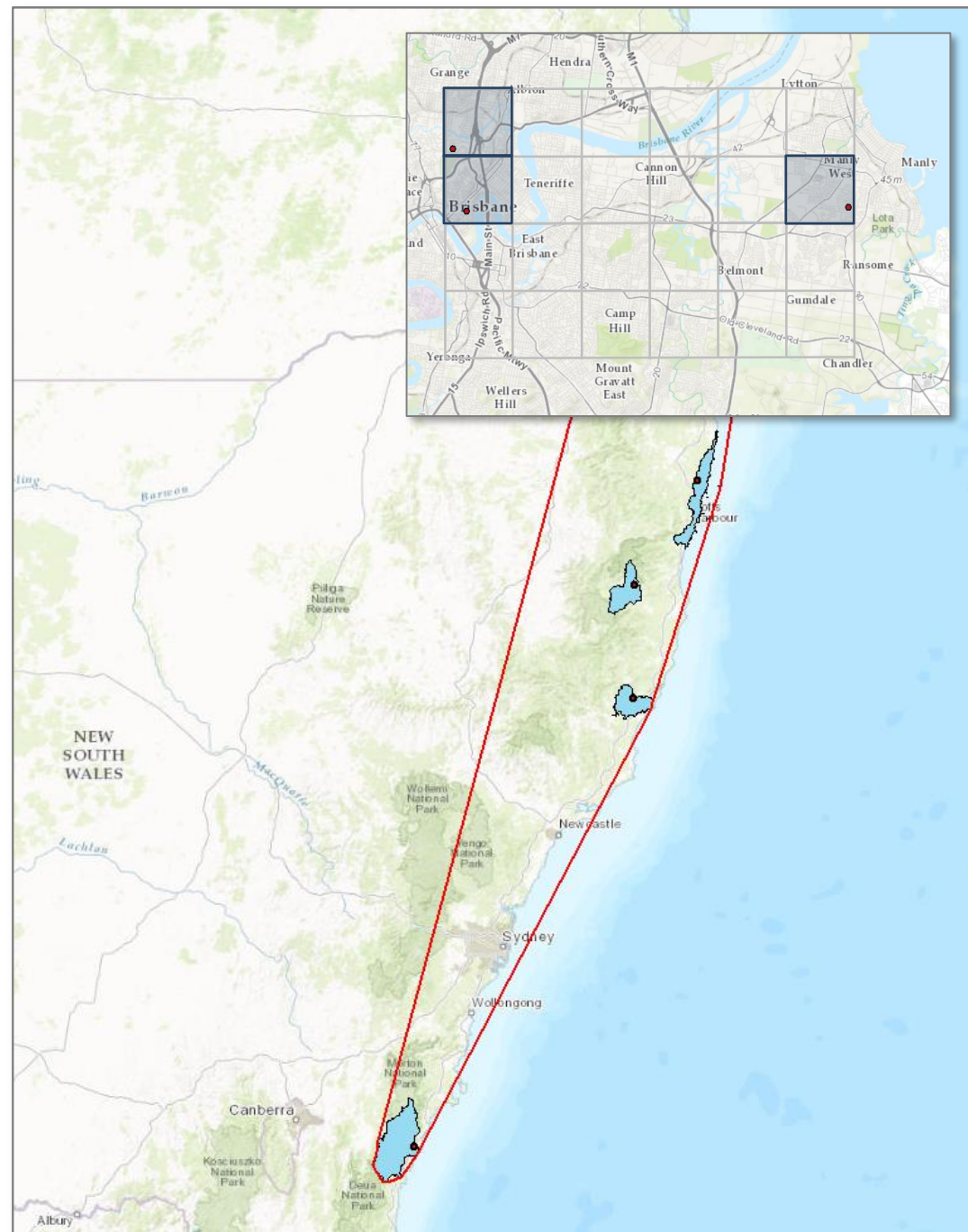
Extent of Occurrence

Comparison of taxa with same AOO but different EOO – a single threatening event is more likely to impact the taxon with the smaller EOO:

Threatening event
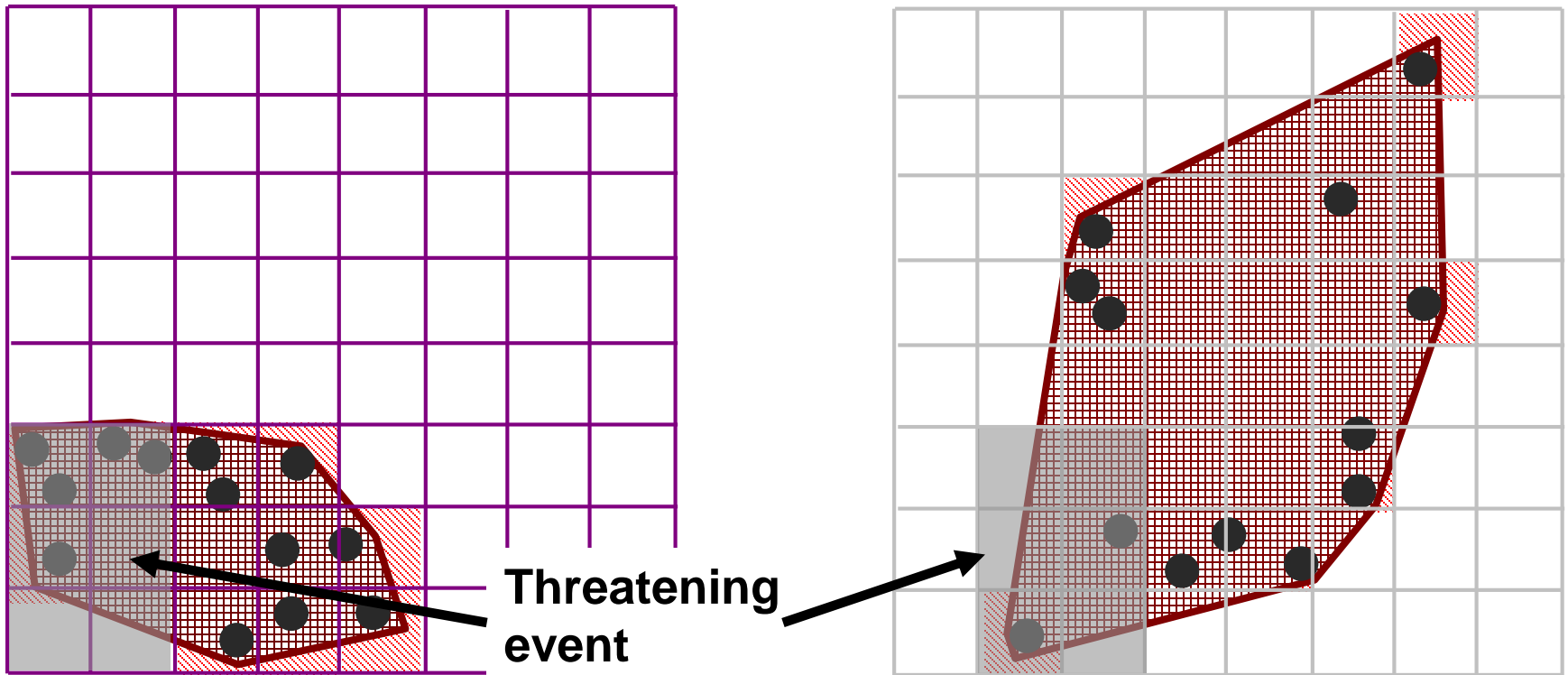
AOO = 10x4 = 40 km²
EOO = 44 km²

AOO = 10x4 = 40 km²
EOO = 105 km²

Extent of Occurrence

Comparison of taxa with same AOO but different EOO – a single threatening event is more likely to impact the taxon with the smaller EOO:
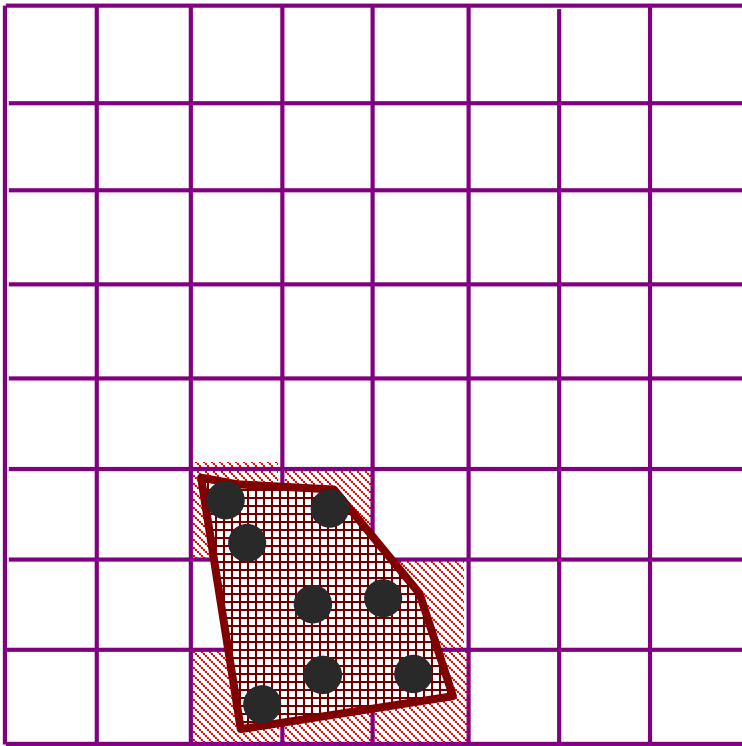
AOO = 7x4 = 28 km^2
EOO = 28 km^2
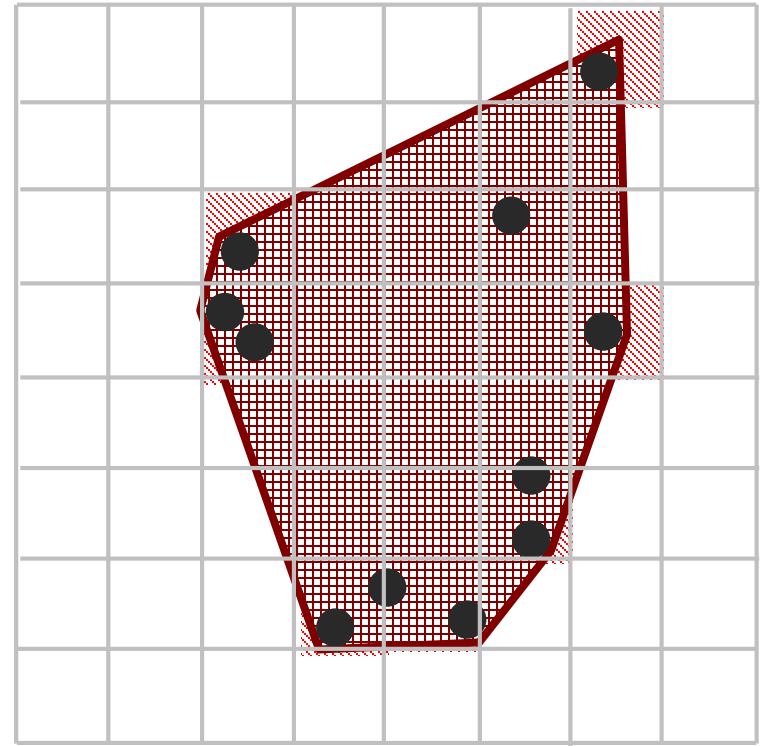
AOO = 8x4 = 32 km^2
EOO = 82 km^2

Area of Occupancy

Mongolia

Bulgan River

China

AOO

Grid = 34 selected
4km2 each
= 140 km2

Actual = 60km
avg 50 metres wide
= 3 km2

Leuciscus dzungaricus distribution
2km x 2km grid

0 5 10 15 20 25 30 35 40 Kilometers
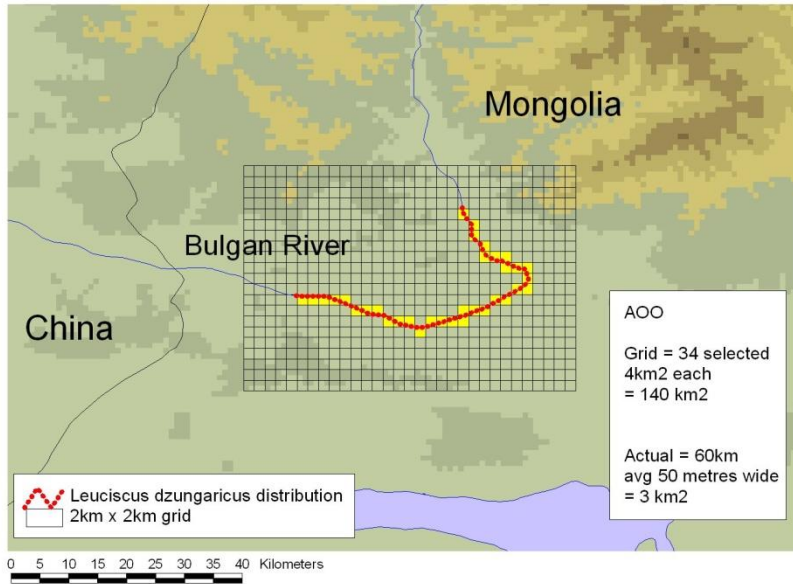
- Linear habitats: AOO measurement must be **consistent with threshold values** – use a 2x2 km grid for AOO estimates.

Breeding

Nonbreeding (Marine)
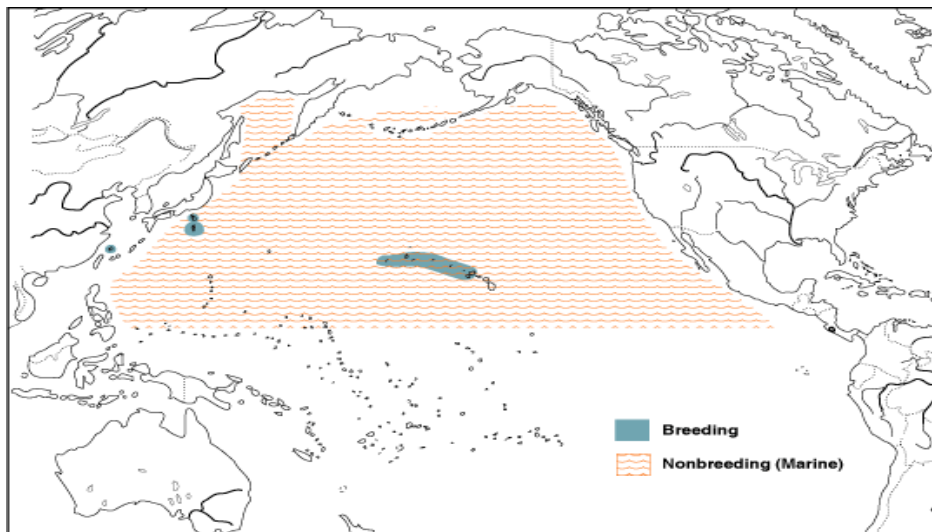
- AOO can also be measured as the **smallest area essential at any stage to the survival**

Location is a geographically or ecologically distinct area in which **a single threatening event can rapidly affect all individuals of the taxon.**

Location

Invasive species

2 locations

Location

Pollution
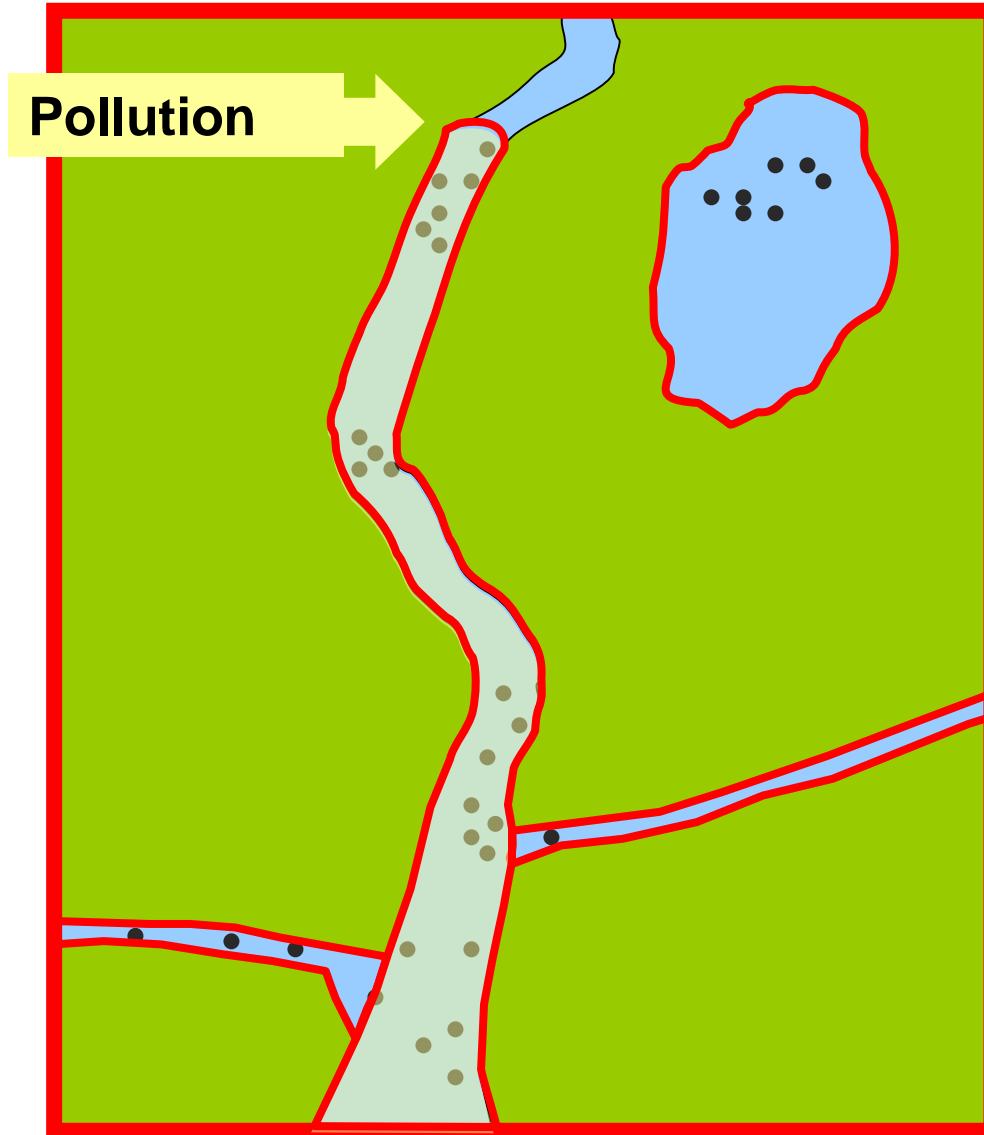
4 locations

Location
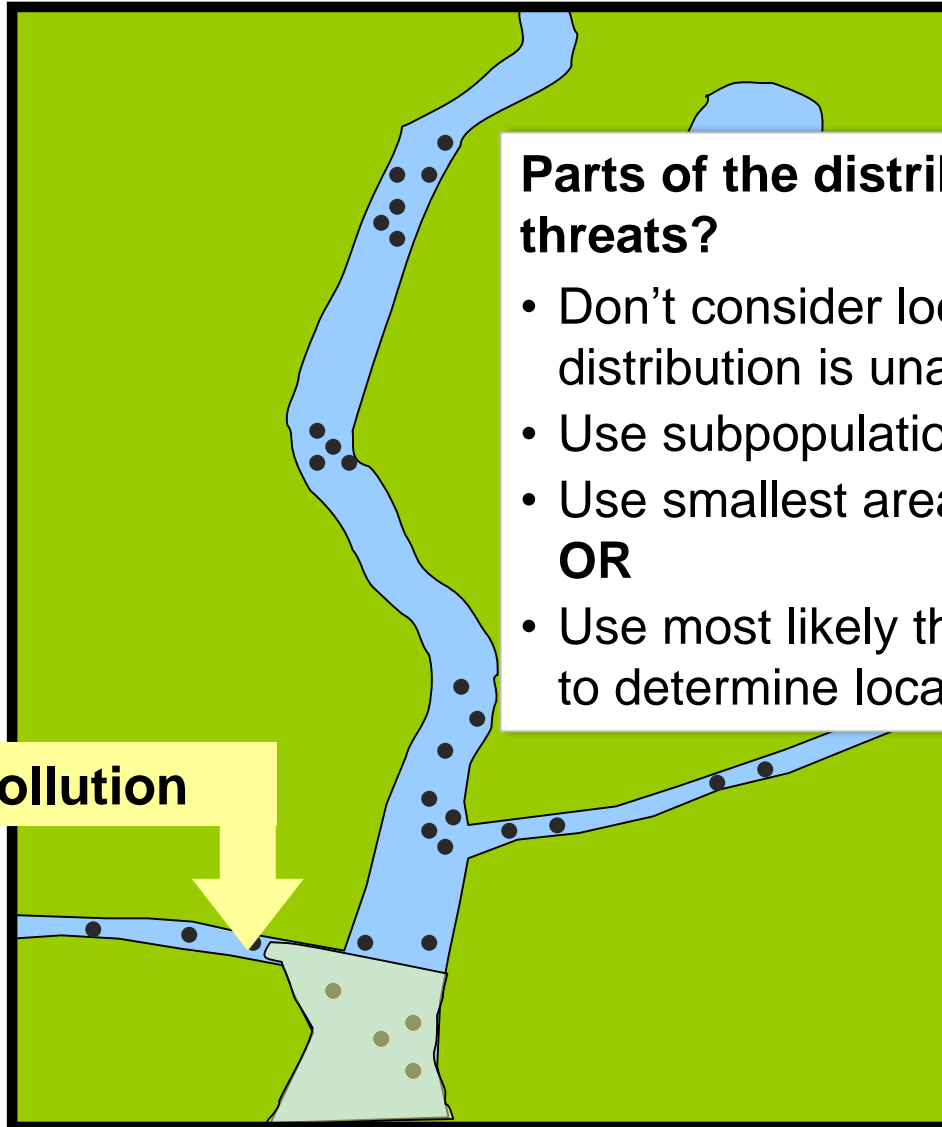
Parts of the distribution not affected by any threats?

- Don't consider locations at all (if >50% of distribution is unaffected); **OR**
- Use subpopulations as surrogate for locations; **OR**
- Use smallest area affected to determine locations; **OR**
- Use most likely threat to occur in unaffected areas to determine locations there.

Pollution

4-5 or >5 locations...?

Location

If most serious threat does not affect entire distribution: can use other threats to count locations in areas not affected by most serious threat.

Pollution

Fishing

Pollution

Dam
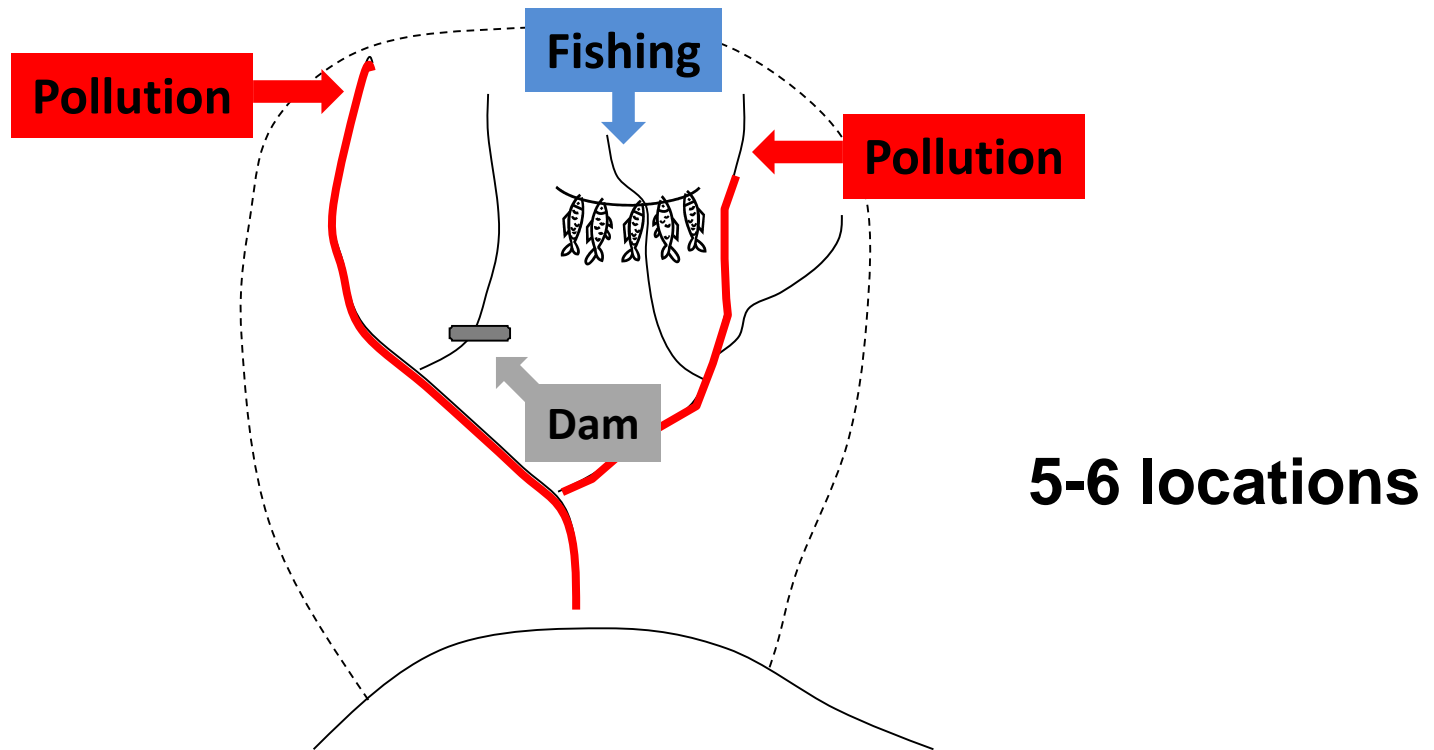
5-6 locations

If there are no plausible threats, do not consider locations at all.

Quantitative Analysis

Quantitative Analysis is any form of analysis which estimates the extinction probability of a taxon based on known life history, habitat requirements, threats and any specified management options (e.g., Population Viability Analysis (PVA)).

Quantitative Analysis

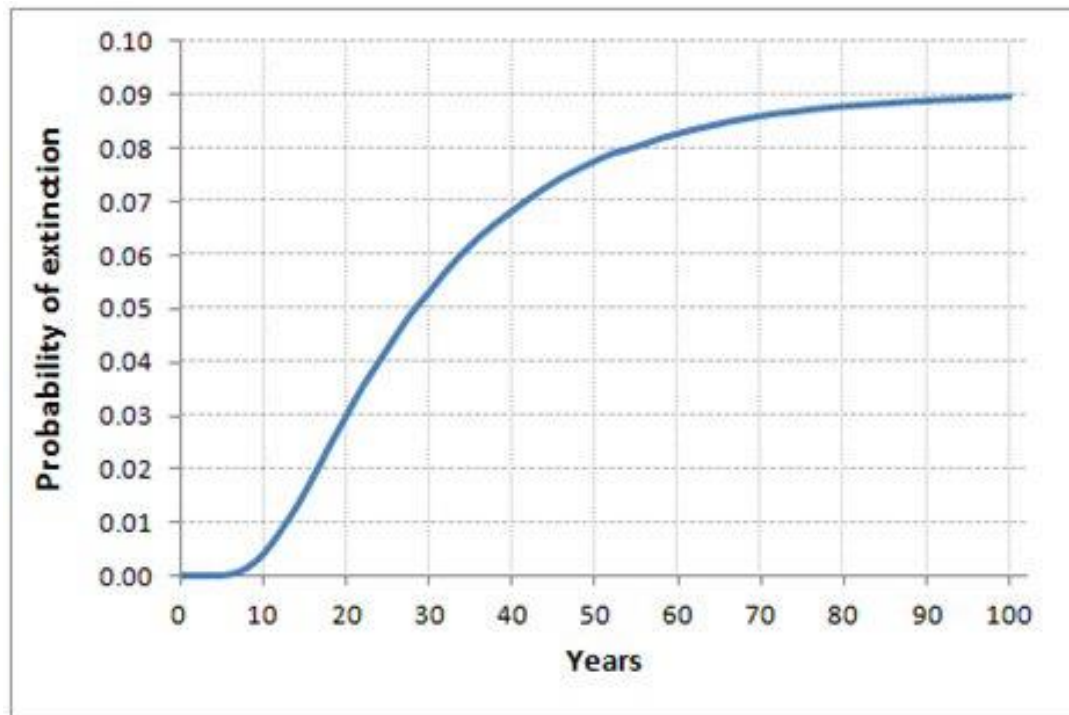measurement error, spatial variation, etc. should be subtracted. For example, if survival rates are based on census data, binomial variance representing demographic stochasticity can be subtracted from total observed variance (Akçakaya 2002); if the survival rates are based on a mark-recapture analysis, methods described by Gould and Nichols (1998) and White et al. (2002), or in the help file of Program MARK can be used to remove demographic/sampling variance.

If catastrophes are included in the model, only data from non-catastrophe years should be used when estimating the mean and variance of the model variable (such as survival, fecundity, or carrying capacity) that the catastrophe affects.

When probabilistic results are based on simulations, the number of replications or iterations determines the precision of these results. In most cases, the randomly sampled model parameters are statistically representative if the number of replications is in the 1,000 to 10,000 range.

9.4.3 Spatial variability

If different subpopulations of the taxon are spatially separated or have different demographic rates, these should be incorporated by making the model spatially explicit. Modelling such a taxon with a single-population model may underestimate the extinction probability. When multiple populations are included in the model, the correlation among the different populations is an important factor; ignoring it (i.e., assuming all populations to be independent) may underestimate the extinction probability.

9.5 Incorporating uncertainty

We suggest that all parameters be specified as ranges (or as distributions) that reflect uncertainties in the data (lack of knowledge or measurement errors). In addition, uncertainties in the structure of the model can be incorporated by building multiple models (e.g., with different types of density dependence). There are various methods of propagating such uncertainties in calculations and simulations (Ferson et al. 1998). One of the simplest methods is to build best-case and worst-case models (e.g., Akçakaya and Raphael 1998). A best-case (or optimistic) model includes a combination of the lower bounds of parameters that have a negative effect on viability (such as variation in survival rate), and upper bounds of those that have a positive effect (such as average survival rate). A worst-case or pessimistic model includes the reverse bounds. The results from these two models can be used as upper and lower bounds on the estimate of extinction risk, which in turn can be used to specify a range of threat categories (see Annex 1 of IUCN 2001, 2012b).

9.6 Documentation requirements

Any Red List assessment that relies on criterion E should include a document that describes the quantitative methods used, as well as all the data files that were used in the analysis. The document and accompanying information should include enough detail to allow a reviewer to reconstruct the methods used and the results obtained.

The documentation should include a list of assumptions of the analysis, and provide explanations and justifications for these assumptions. All data used in estimation should be either referenced to a publication that is available in the public domain, or else be included with the listing documentation. The uncertainties in the data should be documented.

https://www.iucnredlist.org/resources/redlistguidelines

Contents

Guidelines for Usi...
Categories...

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Prepared by the Standar...
of the IUCN Species...

Citation: IUCN Standards and Petitions C...
Red List Categories and Criteria. Version 1...
Committee. Downloadable from
https://www.iucnredlist.org/documents/...

Key terms and Concepts exercise (20 minutes)

1. Work in groups of 2-3 people.

2. You will be given a card with a Red List term on it.

3. You have 20 minutes to:

    - Discuss the meaning of the term within your group.

    - Give **one example** (real or fictional) that demonstrates the term, explaining what it means in your own words

4. After 20 minutes, each group will present their example.

Location
Example: