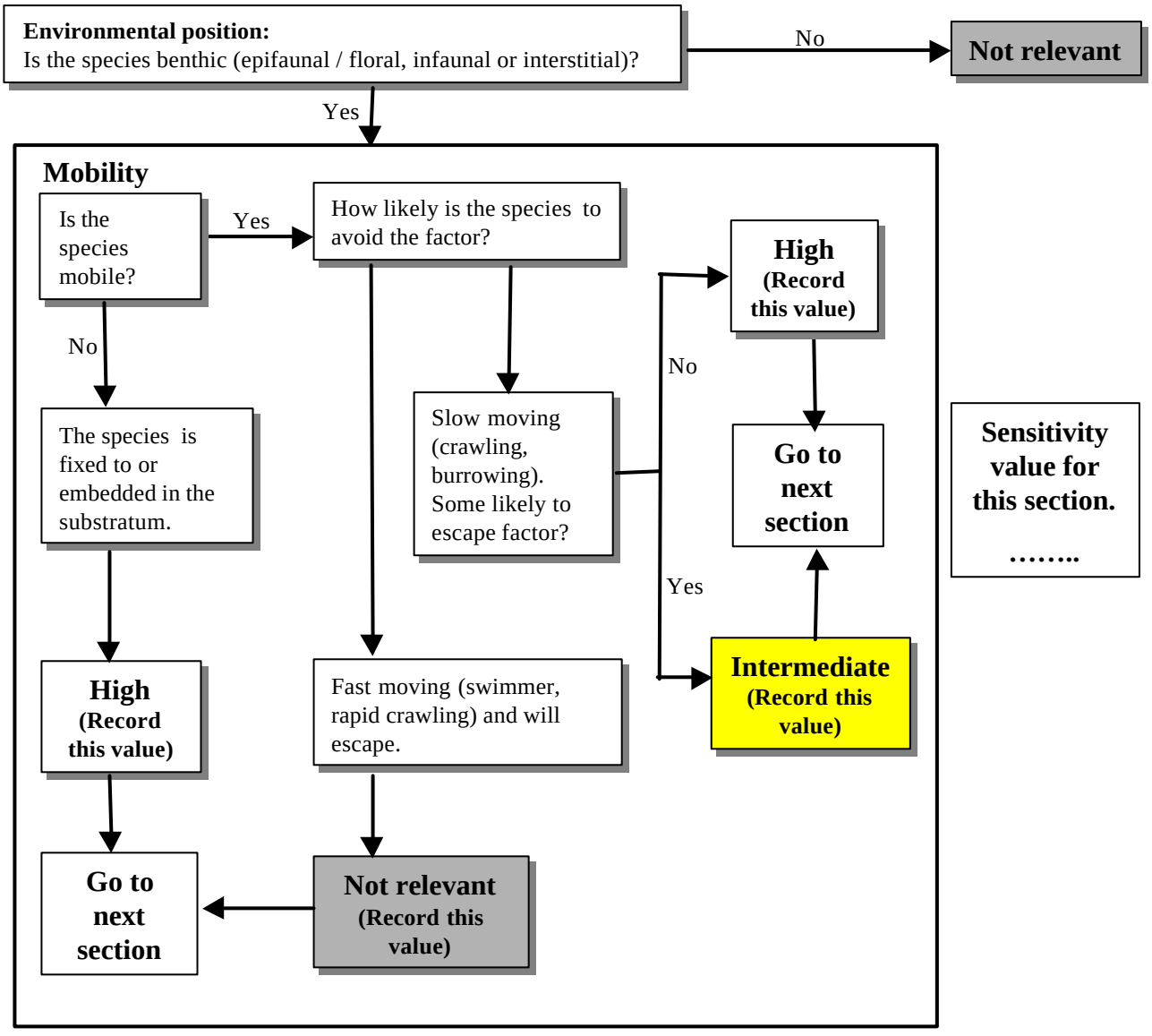
Appendix 16. Decision trees for the assessment of species sensitivity to environmental factors

Factor: **Substratum loss**
Description: The physical removal of the substratum inhabited or required by the species or community in question.
Benchmark: All of substratum occupied by the species or biotope under consideration is removed. A single event is assumed for sensitivity assessment. Once the activity or event has stopped (or between regular events) suitable substratum remains or is deposited. Species or community recovery assumes that the substratum within the habitat preferences of the original species or community is present.



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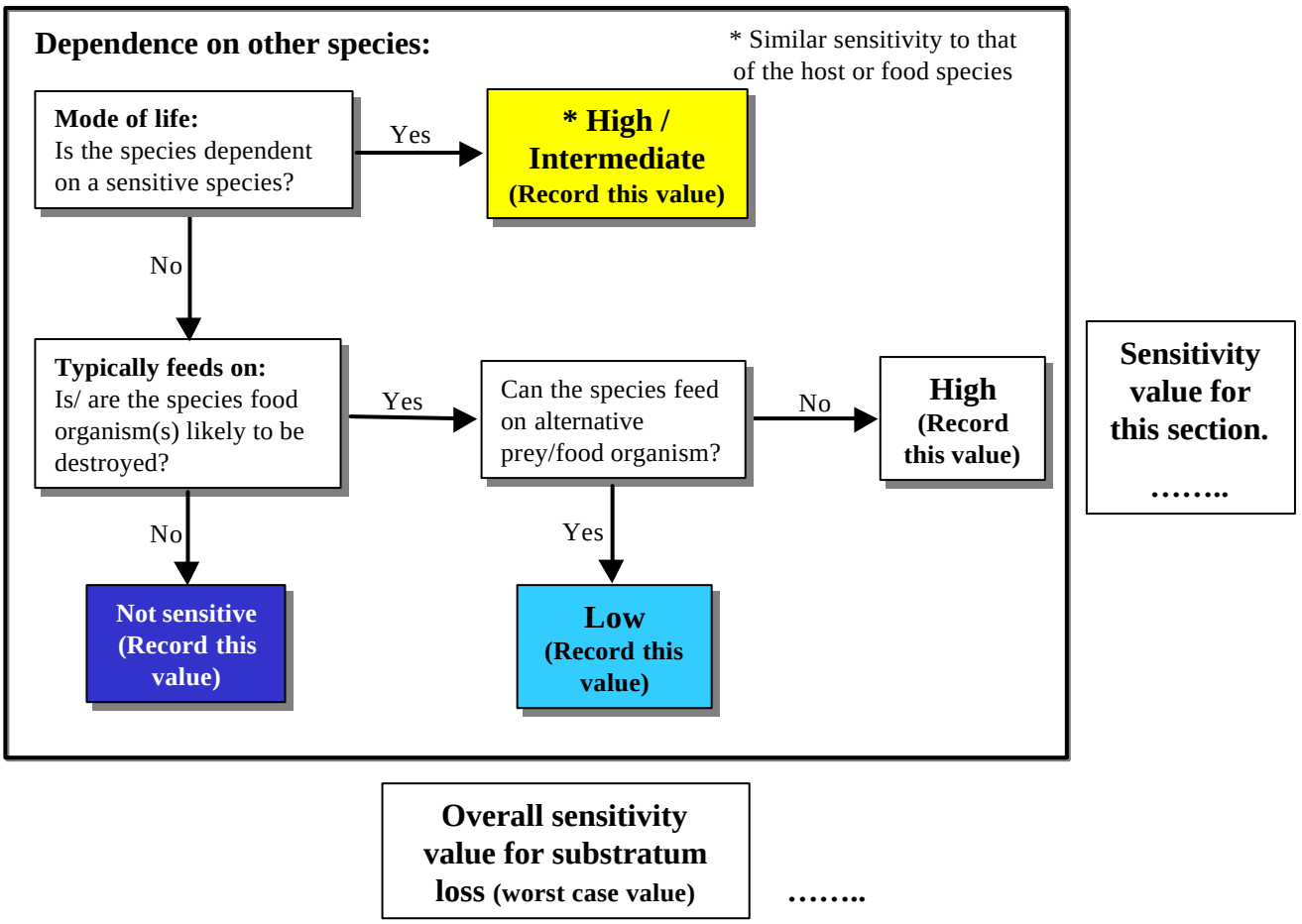
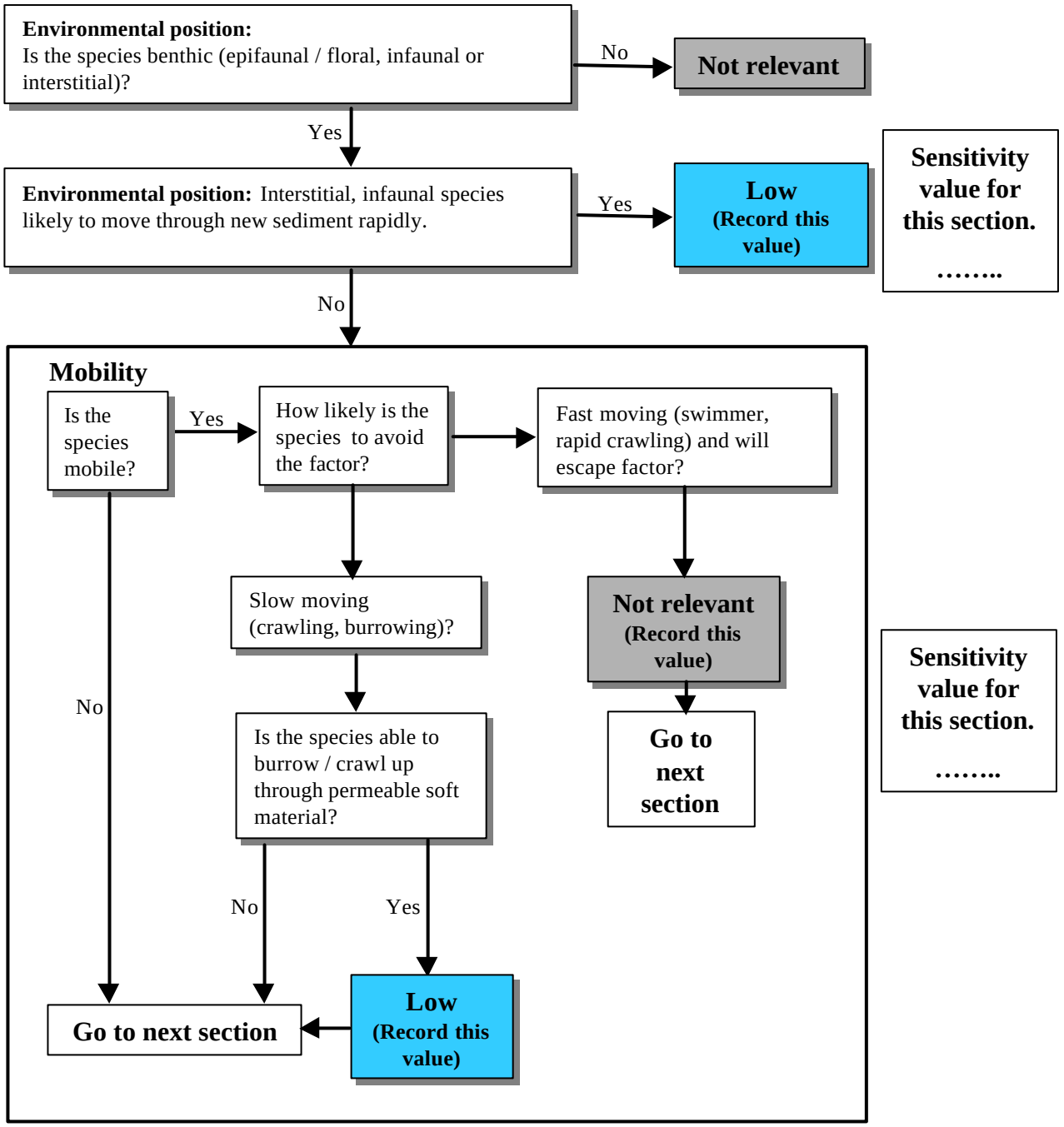

Dependence on other species:
* Similar sensitivity to that of the host or food species
Mode of life: Is the species dependent on a sensitive species?
Yes
* High / Intermediate (Record this value)
No
Typically feeds on: Is/ are the species food organism(s) likely to be destroyed?
Yes
Can the species feed on alternative prey/food organism?
No
High (Record this value)
No
Not sensitive (Record this value)
Yes
Low (Record this value)
Sensitivity value for this section.
……..
Overall sensitivity value for substratum loss (worst case value)
……..

Factor: **Smothering**
Description: The physical covering of the species or community and its substratum with additional sediment (silt), spoil, detritus, litter, oil or man-made objects.
Benchmark: All of the population of a species or an area of a biotope is smothered by sediment to a depth of 5 cm above the substratum for one month. **Impermeable** materials, such as concrete, oil or tar, are likely to have a greater effect.



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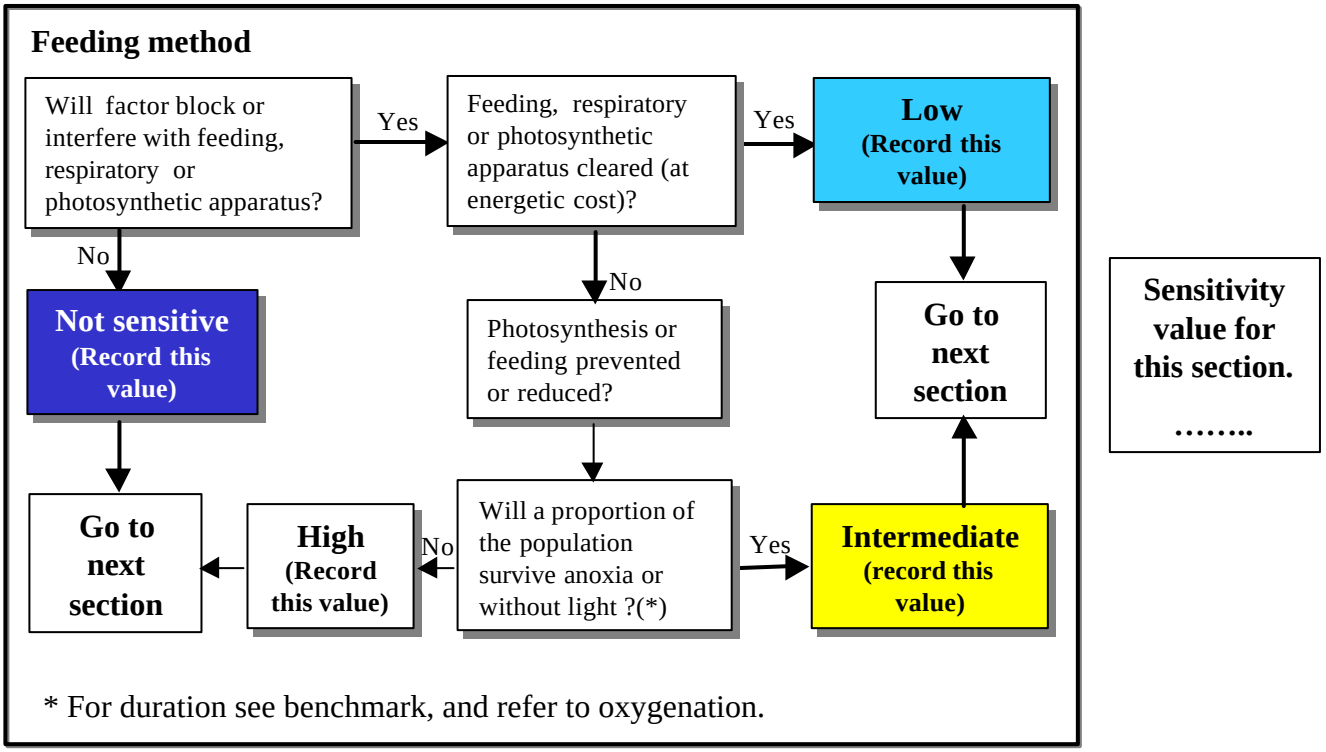

Sensitivity value for this section.

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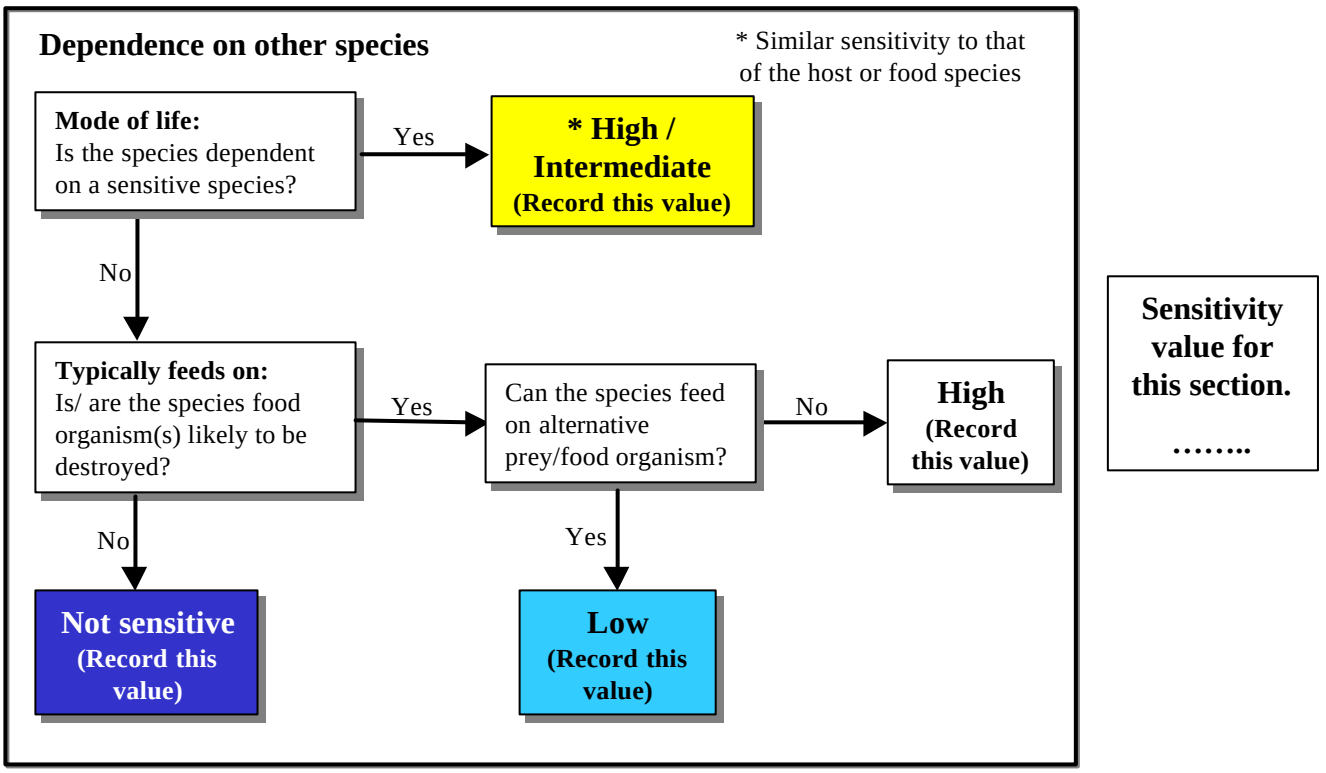


Sensitivity value for this section.

……..

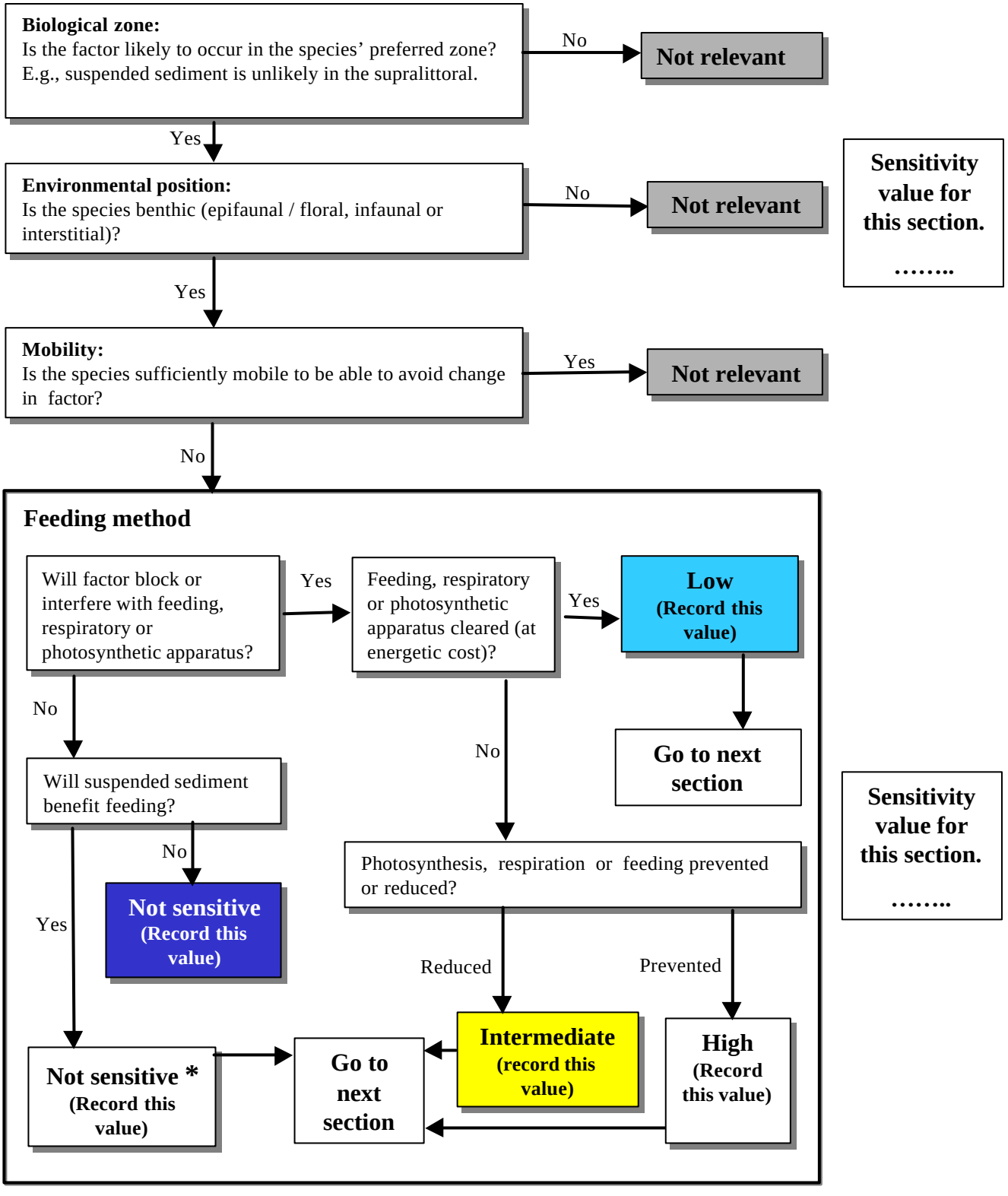
Overall sensitivity value for smothering (worst case value)

…….

Factor: **Changes in suspended sediment**

Description: Changes in the concentration of suspended matter in the water column. The rate of siltation is dependent on the availability of suspended sediment, its particle size range and the water flow rate.

Benchmark: An arbitrary short term, acute change in background suspended sediment concentration e.g., a change of 100mg/l for 1 month. The resultant light attenuation effects are addressed under turbidity, and the effects of rapid settling out of suspended sediment are addressed under smothering.



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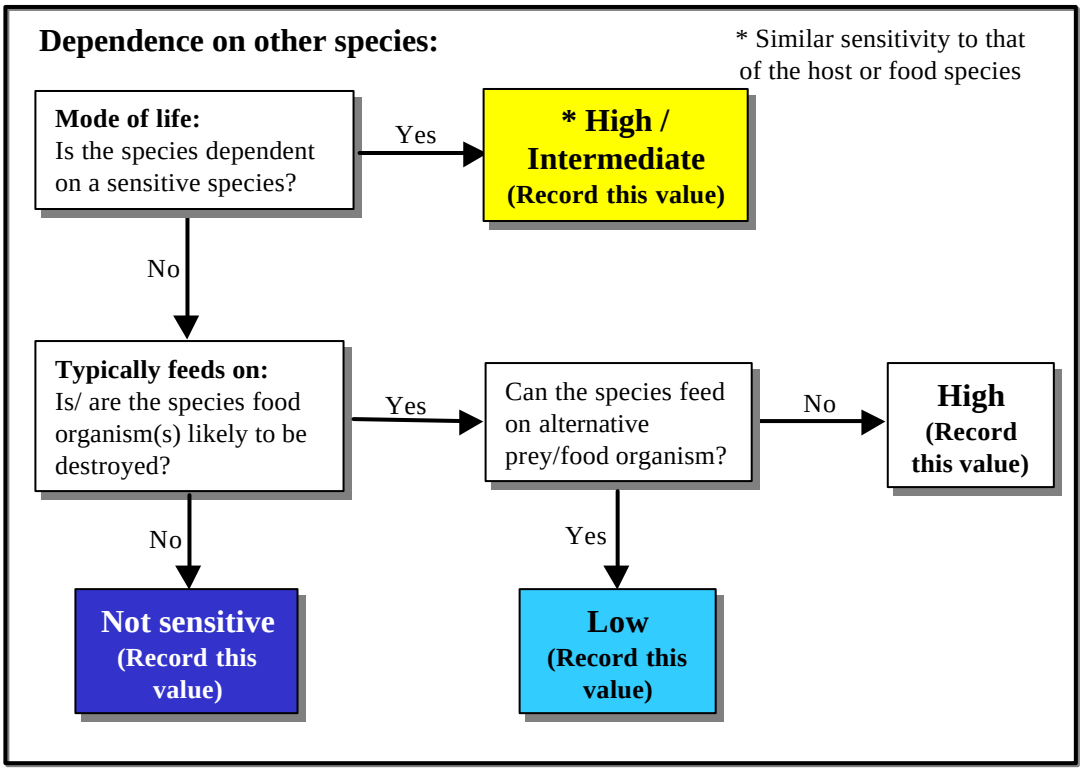


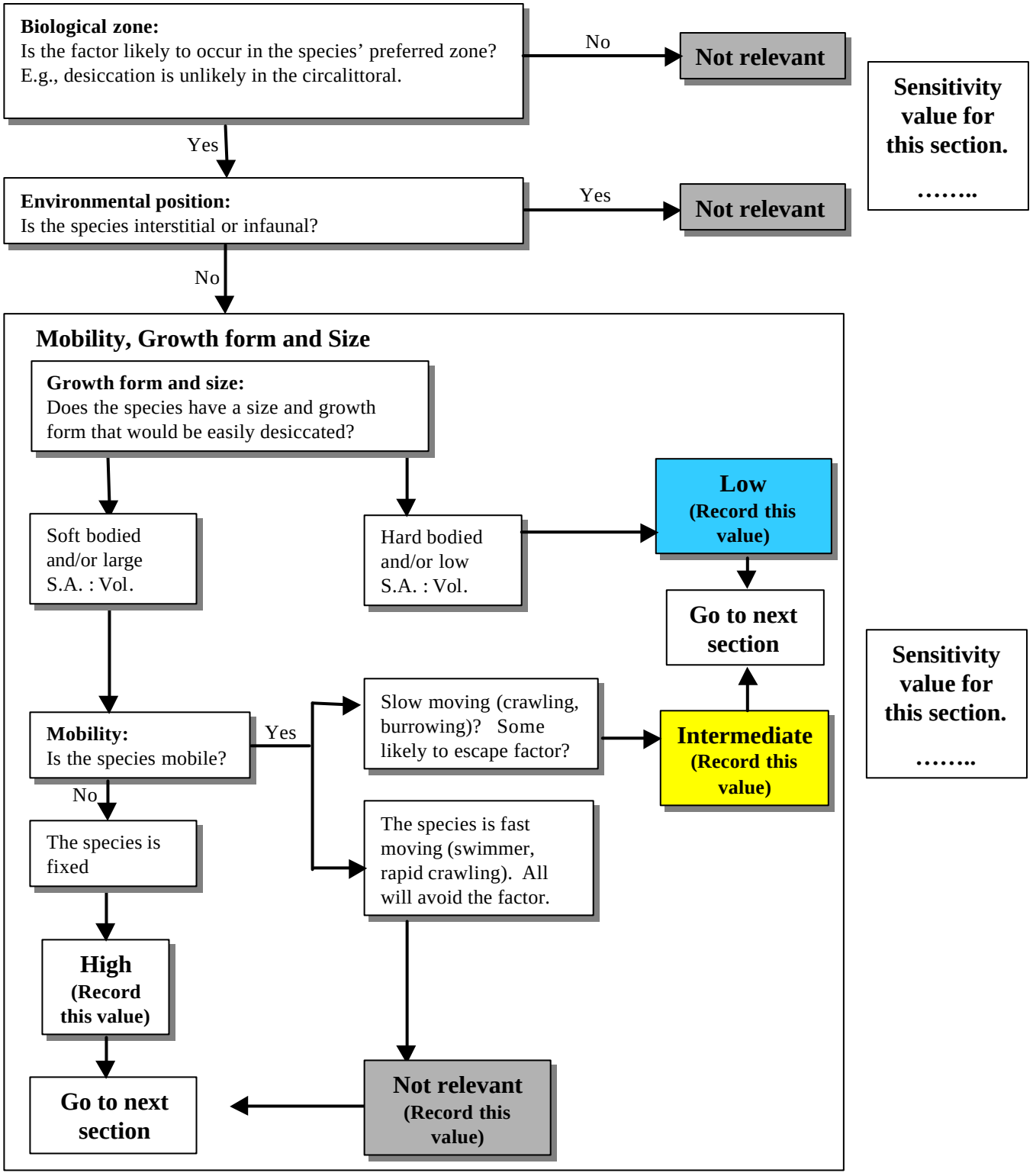
Sensitivity value for this section.

……..

Overall sensitivity value for suspended sediment (worst case value)

……..

Factor: **Desiccation**
Description: The removal of water or drying.
Benchmark: 1). A normally subtidal, demersal or pelagic species including intertidal migratory or under-boulder species is continuously exposed to air and sunshine for 1 hour.
2). A normally intertidal species or community is exposed to a change in desiccation equivalent to a change in position of one vertical biological zone on the shore, e.g., from upper eulittoral to the mid eulittoral or from sublittoral fringe to lower eulittoral.



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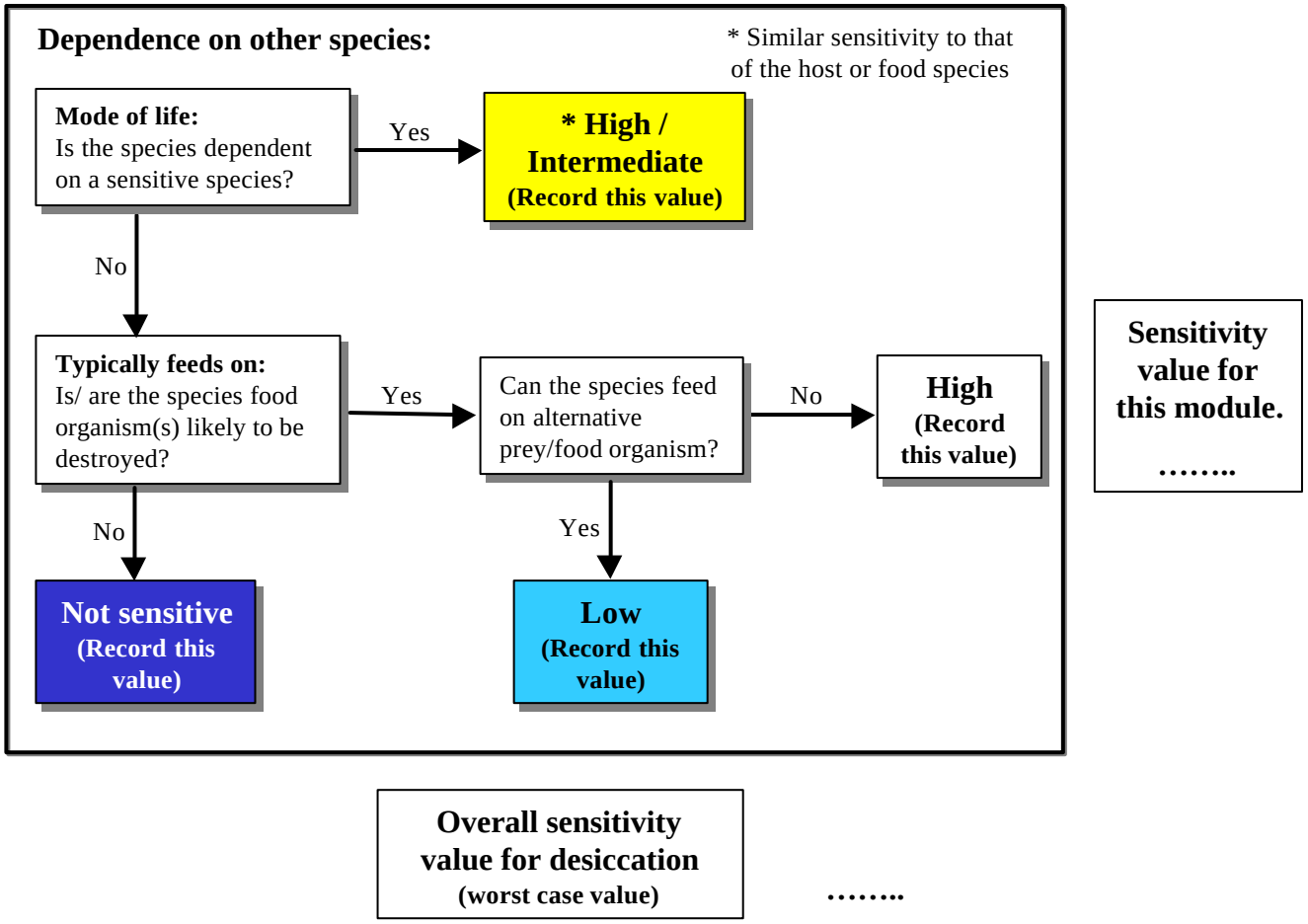
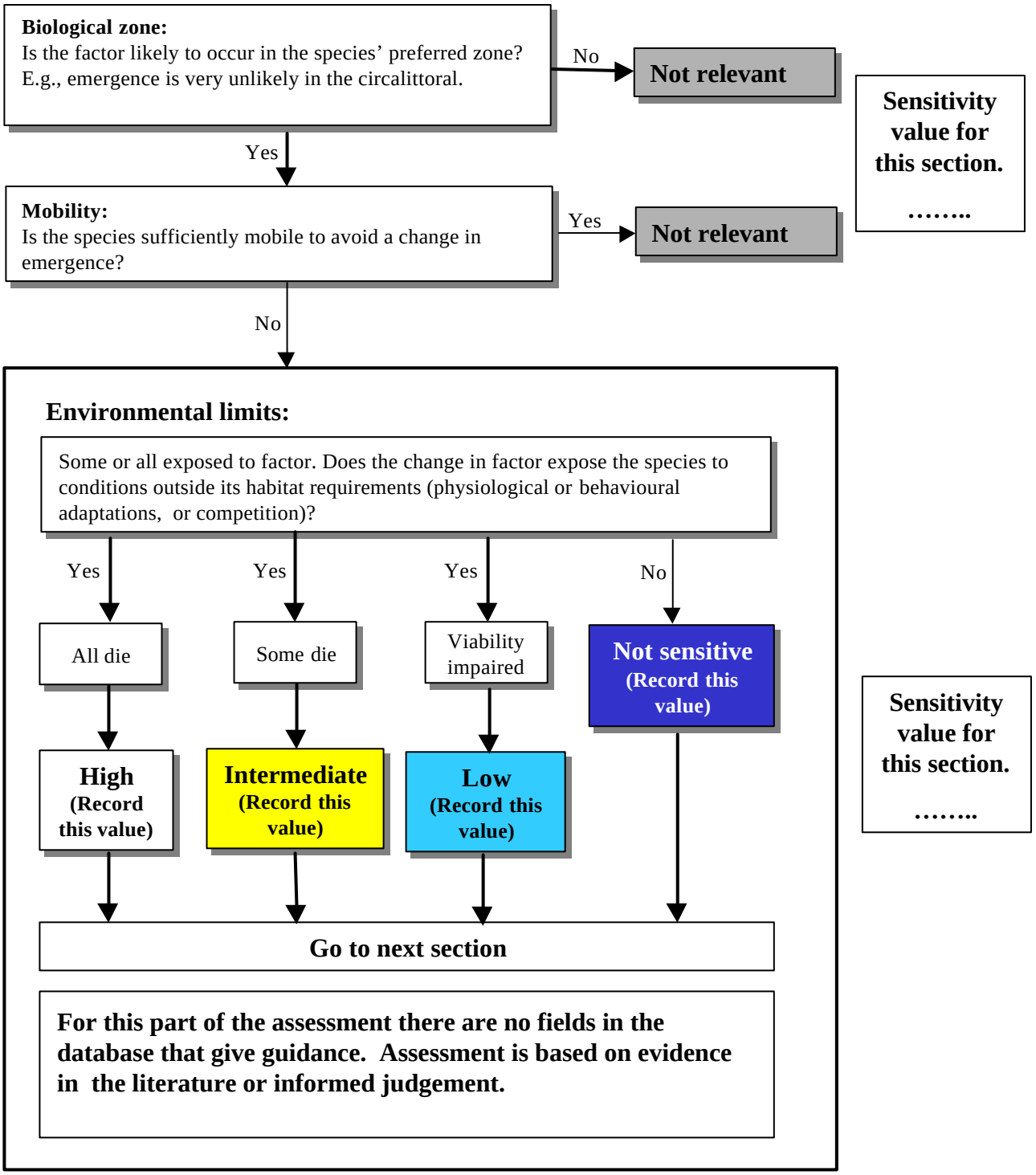

Dependence on other species:
* Similar sensitivity to that of the host or food species
Mode of life:
Is the species dependent on a sensitive species?
Yes
* High / Intermediate
(Record this value)
No
Typically feeds on:
Is/ are the species food organism(s) likely to be destroyed?
Yes
Can the species feed on alternative prey/food organism?
No
High
(Record this value)
No
Yes
Not sensitive
(Record this value)
Low
(Record this value)
Sensitivity value for this module.
……..
Overall sensitivity value for desiccation
(worst case value)
……..

Factor: **Changes in emergence regime**
Description: The time spent emersed and exposed to air.
Benchmark: A 1 hour change in the time covered or not covered by the sea for a period of 1 year.



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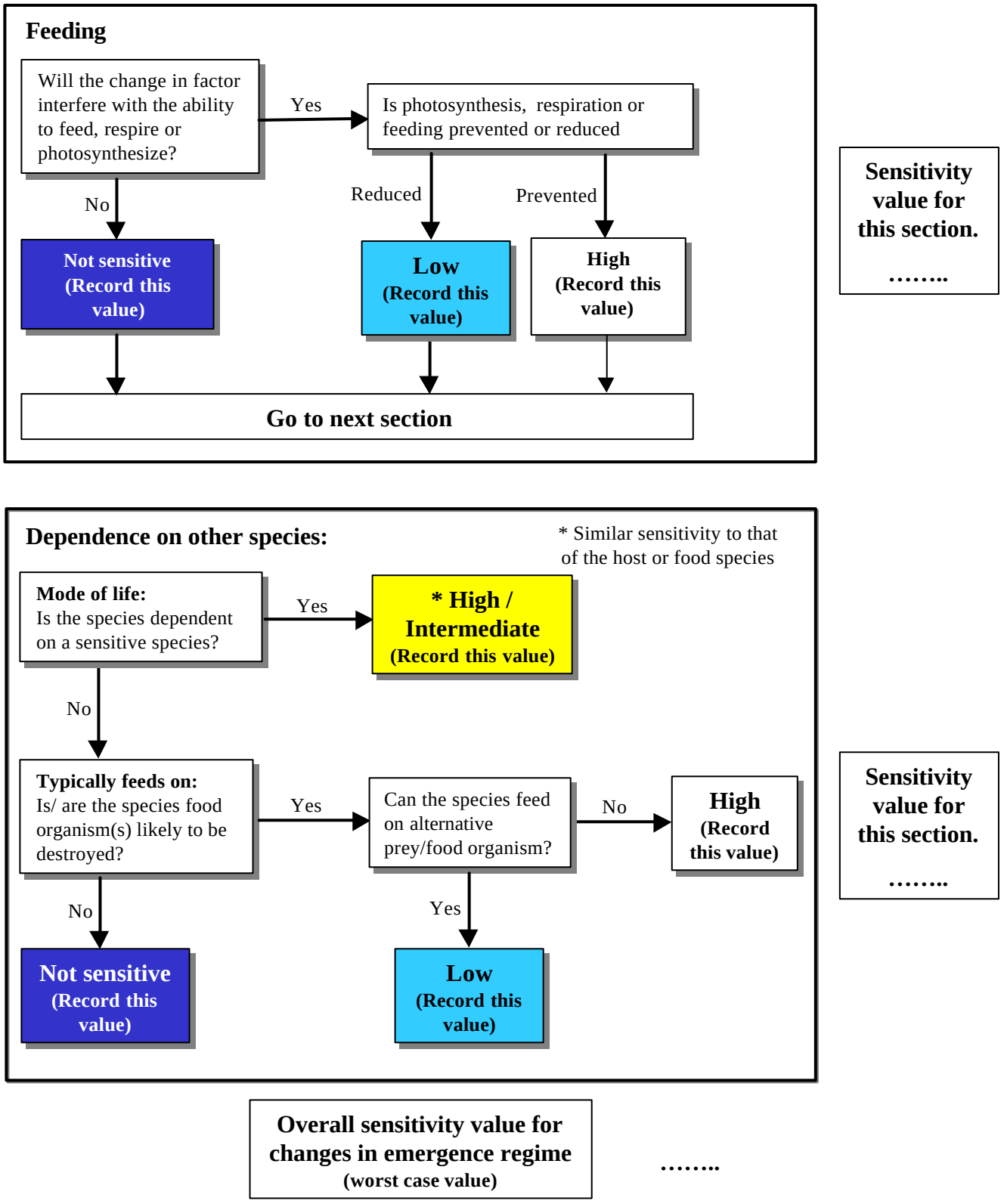
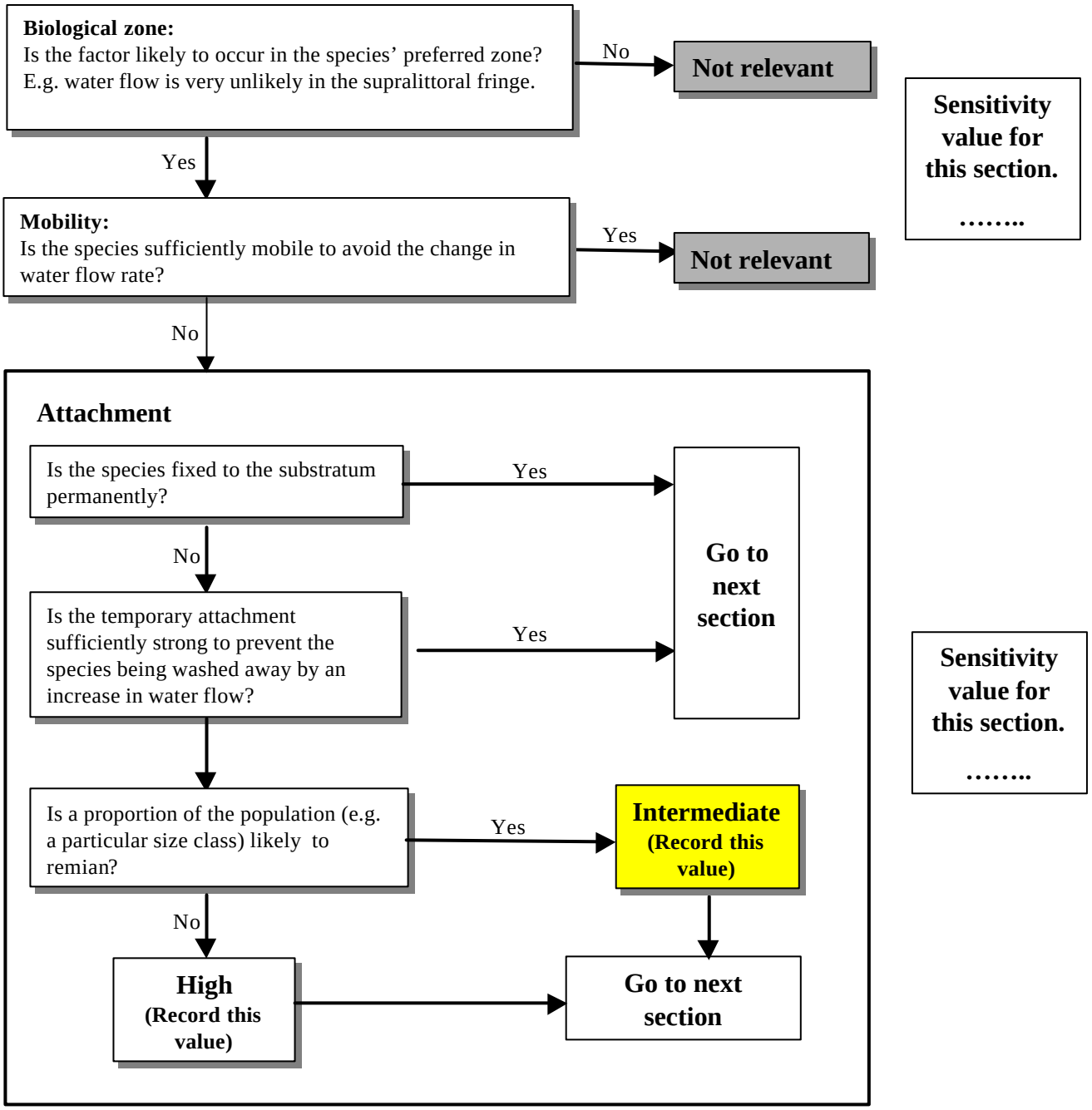

Feeding
Will the change in factor interfere with the ability to feed, respire or photosynthesize?
Yes
Is photosynthesis, respiration or feeding prevented or reduced
No
Reduced
Prevented
Not sensitive (Record this value)
Low (Record this value)
High (Record this value)
Go to next section
Sensitivity value for this section.
……..
Dependence on other species:
* Similar sensitivity to that of the host or food species
Mode of life: Is the species dependent on a sensitive species?
Yes
* High / Intermediate (Record this value)
No
Typically feeds on: Is/ are the species food organism(s) likely to be destroyed?
Yes
Can the species feed on alternative prey/food organism?
No
High (Record this value)
No
Yes
Not sensitive (Record this value)
Low (Record this value)
Sensitivity value for this section.
……..
Overall sensitivity value for changes in emergence regime (worst case value)
……..

Factor: **Changes in water flow rate**
Description: The movement of water associated with the rise and fall of the tide (tidal streams), prevailing winds and ocean currents.
Benchmark: A change of two categories in water flow rate for one year (see *MarLIN* glossary) for 1 year. For example from moderately strong (1-3 knots) to very weak (negligible).



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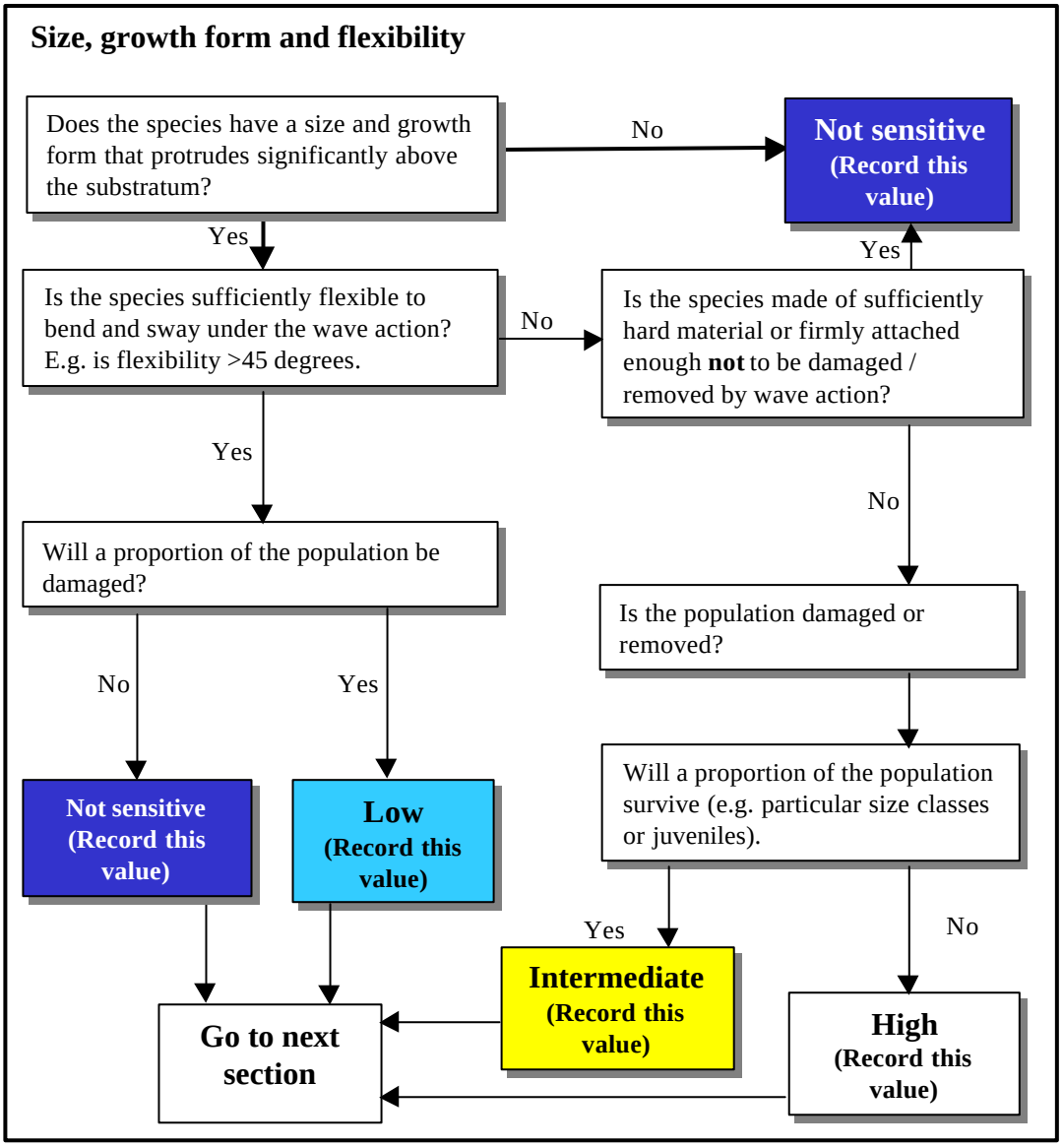

Sensitivity value for this section.

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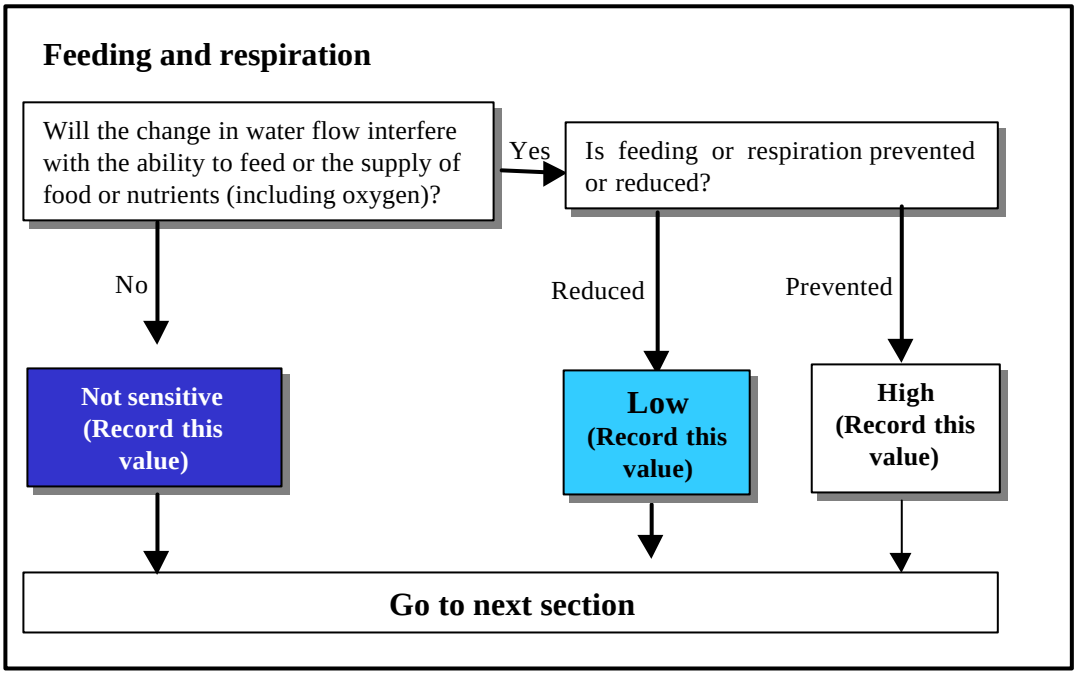

Sensitivity value for this section.

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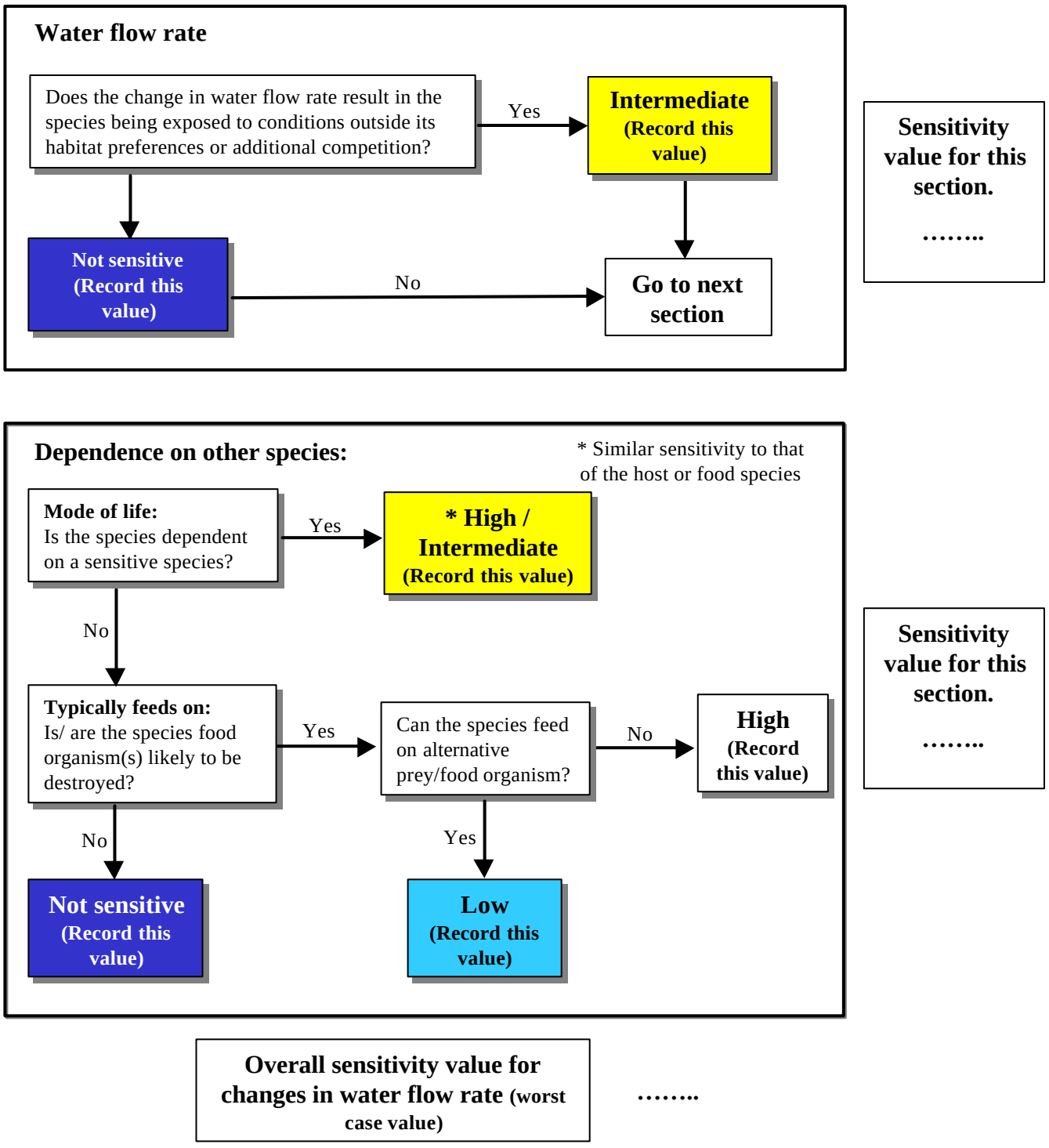
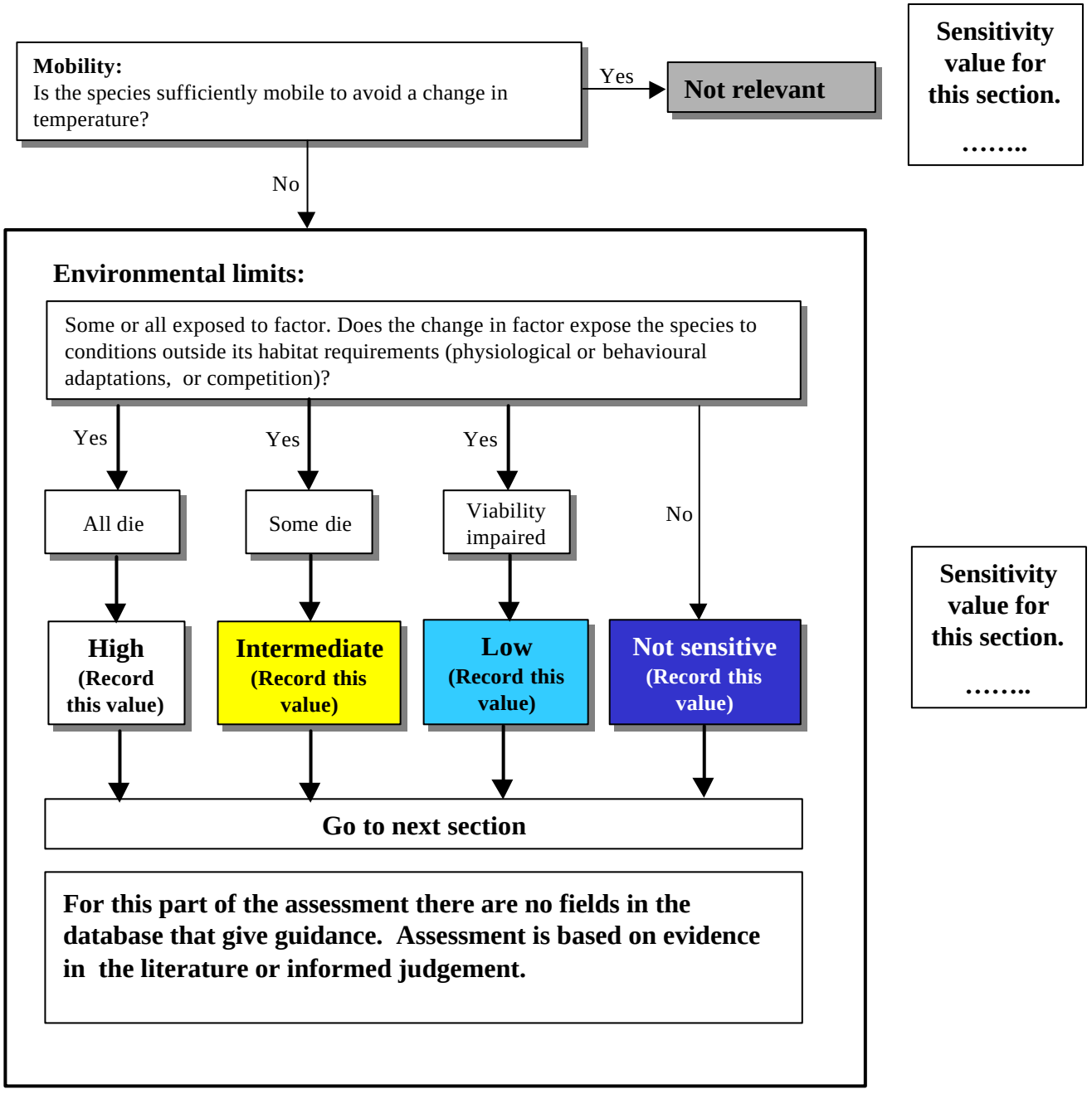

Water flow rate
Does the change in water flow rate result in the species being exposed to conditions outside its habitat preferences or additional competition?
Yes
Intermediate (Record this value)
Not sensitive (Record this value)
No
Go to next section
Sensitivity value for this section.
……..
Dependence on other species:
* Similar sensitivity to that of the host or food species
Mode of life: Is the species dependent on a sensitive species?
Yes
* High / Intermediate (Record this value)
No
Typically feeds on: Is/ are the species food organism(s) likely to be destroyed?
Yes
Can the species feed on alternative prey/food organism?
No
High (Record this value)
No
Yes
Not sensitive (Record this value)
Low (Record this value)
Sensitivity value for this section.
……..
Overall sensitivity value for changes in water flow rate (worst case value)
……..

Factor: **Changes in temperature**
Description:. A change in the ambient temperature of seawater, or in air temperature during emersion
Benchmark: 1) A short term, acute change in temperature; e.g., a 5 ° C change in the temperature range for 3 consecutive days. This definition includes 'short term' thermal discharges.
2) A long term, chronic change in temperature; e.g. a 2 ° C change in the temperature range for a year. This definition includes 'long term' thermal discharges.

For intertidal species or communities, the range of temperatures includes the air temperature regime for that species or communities.



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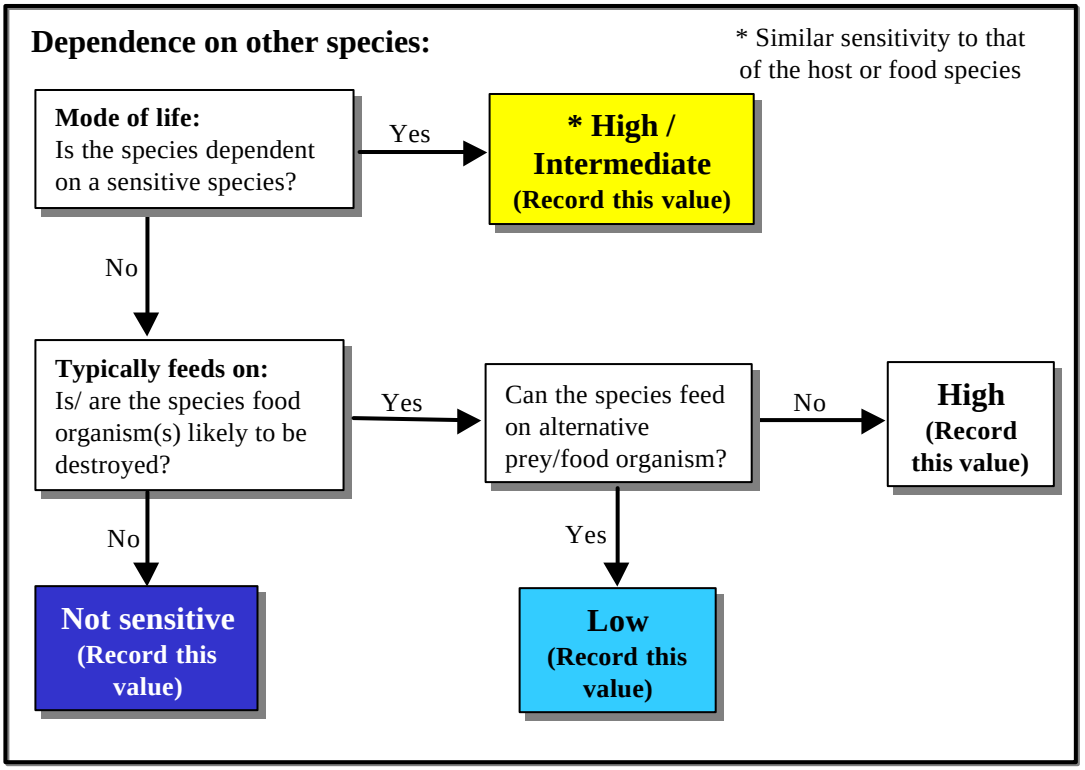


Sensitivity value for this section.

……..

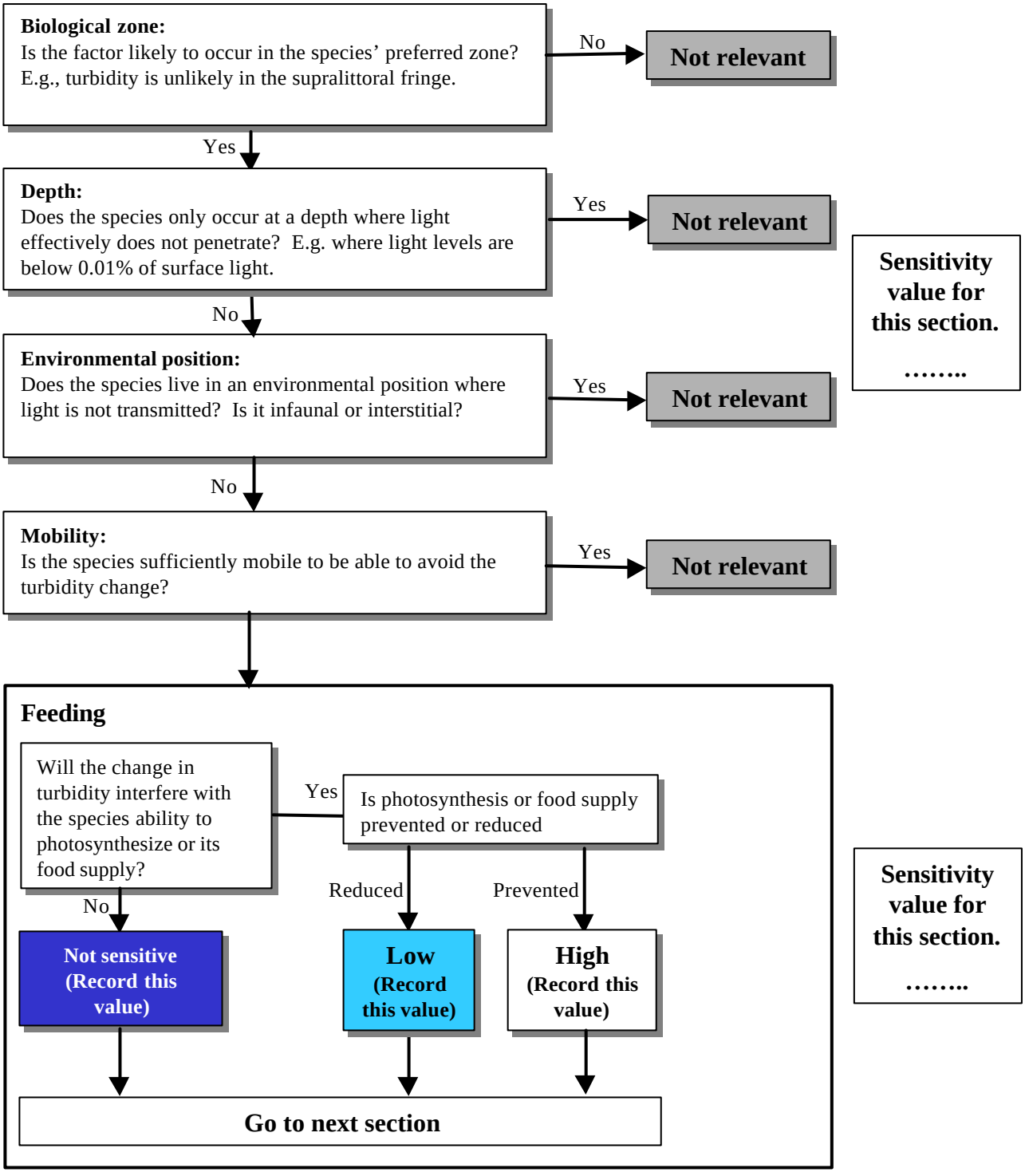
Overall sensitivity value for changes in temperature (worst case value)

……..

Factor: **Changes in turbidity**

Description:. The turbidity (clarity or opacity) of water is dependent on the concentration of substances that absorb or scatter light; for example, inorganic or organic particulates (suspended matter), plankton and dissolved substances.

Benchmark: 1) A short term, acute change; e.g., two categories of the water clarity scale (see glossary) for one month, i.e. from medium to extreme turbidity.
2) A long term, chronic change; e.g., one category of the water clarity scale (see glossary) for one year, i.e. from low to medium turbidity.



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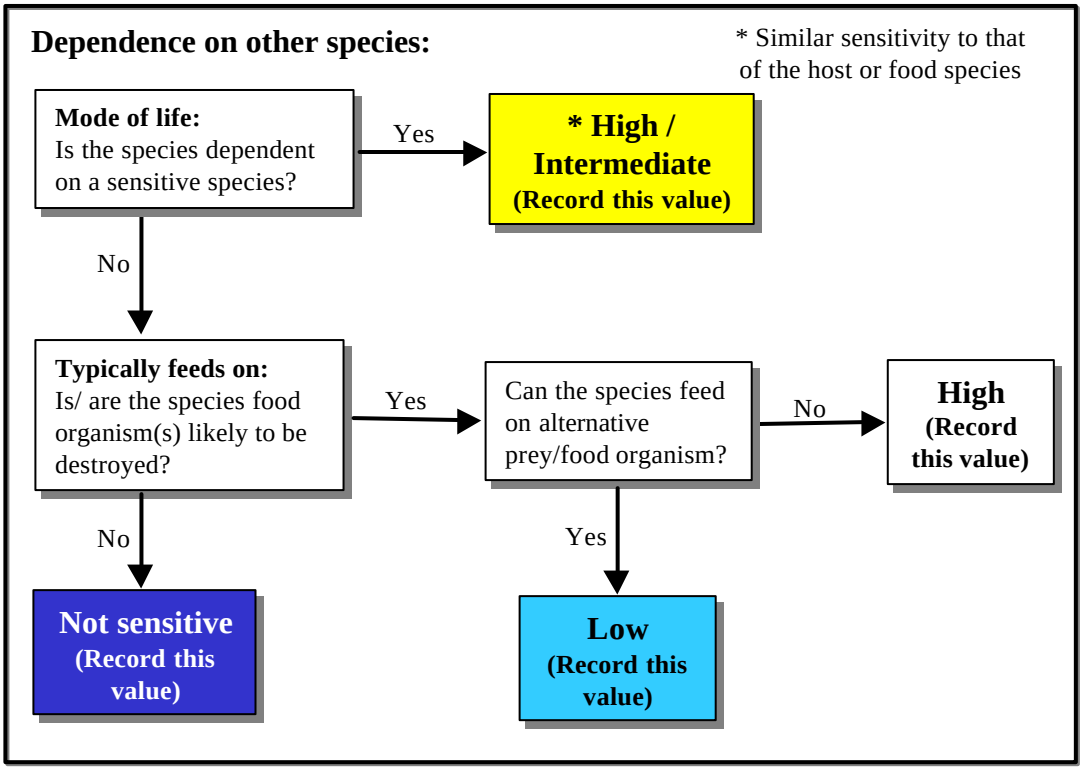


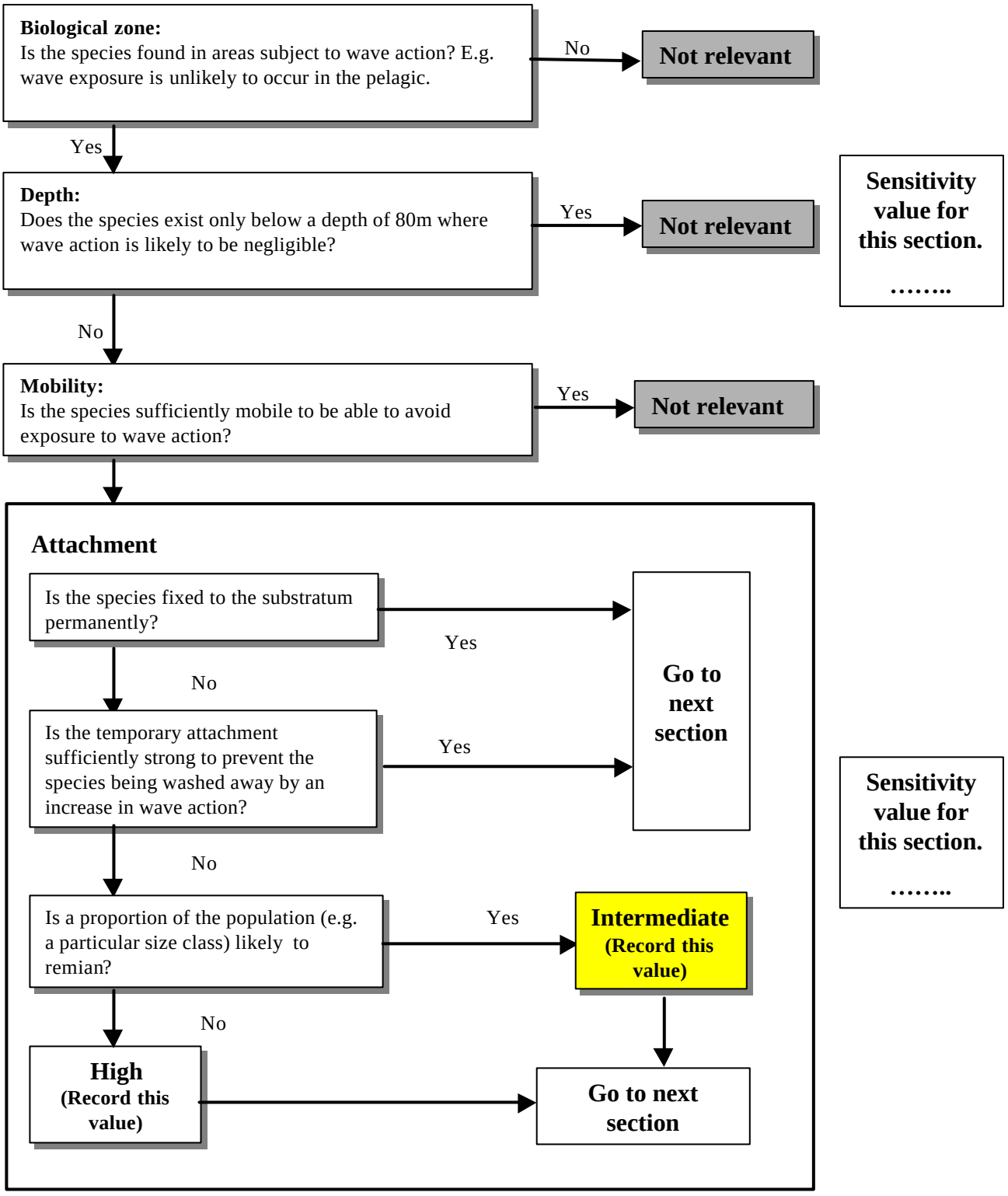
Sensitivity value for this section.

……..

Overall sensitivity value for changes in turbidity (worst case value)

……..

Factor: **Changes in wave exposure**
Description: Exposure on an open shore is dependent upon the distance of open seawater over which wind may blow to generate waves (the fetch) and the strength and incidence of the winds.
Benchmark: A change of two ranks on the wave exposure scale (see glossary) e.g. from Exposed to Extremely exposed for a period of 1 year.



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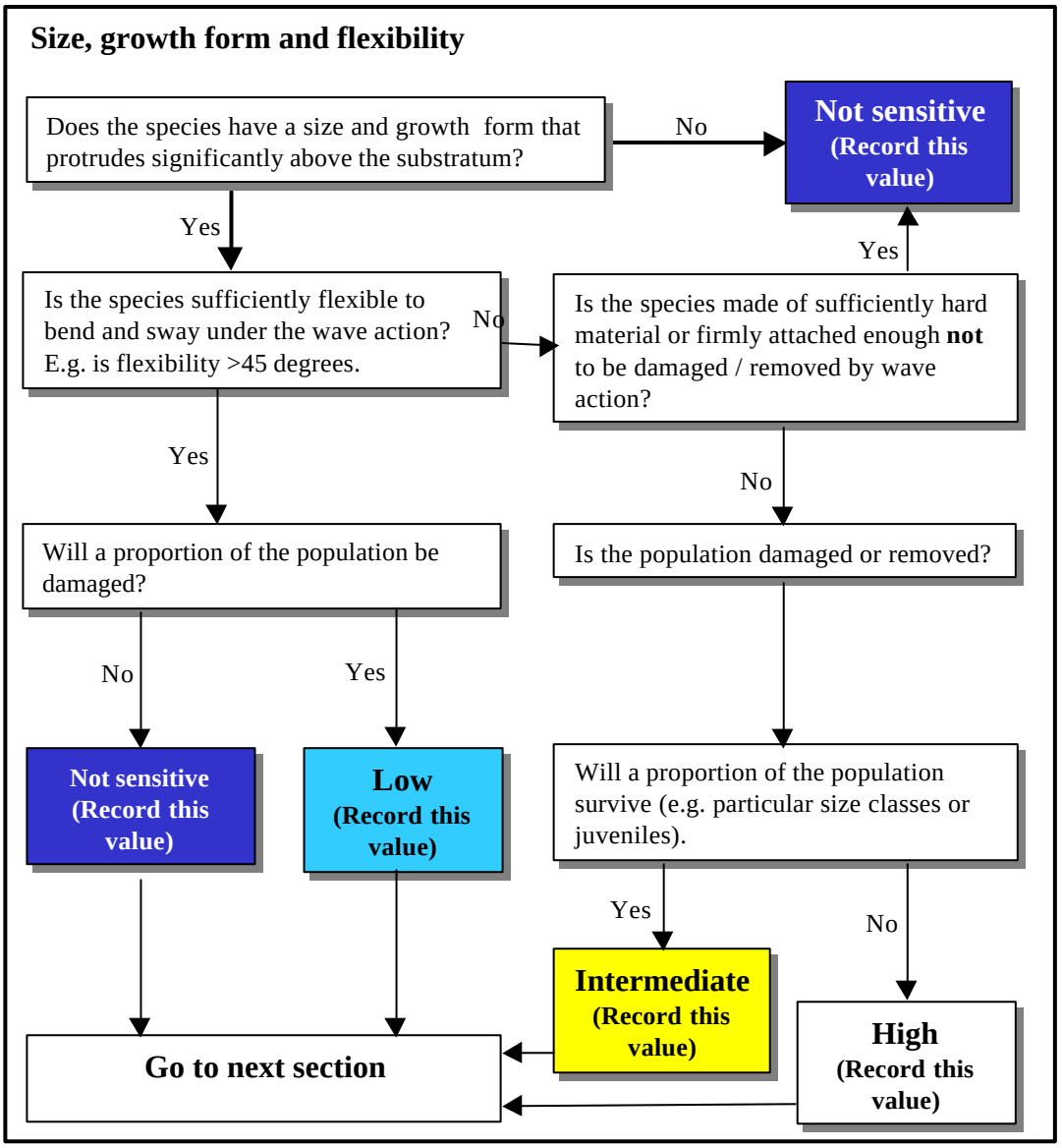

Sensitivity value for this section.

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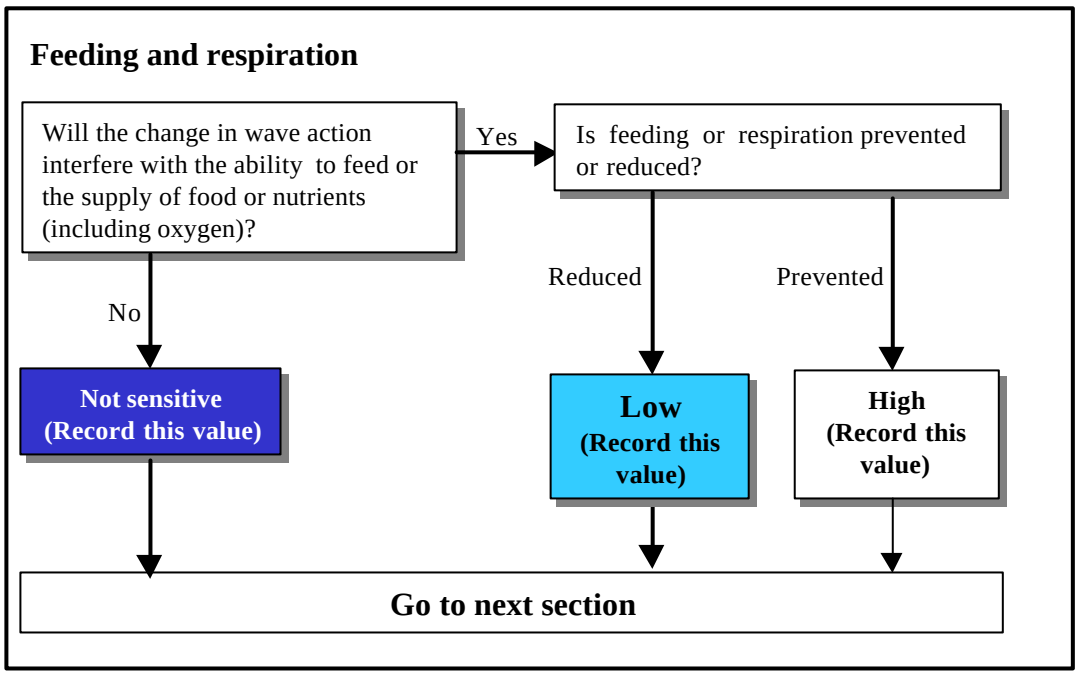

Sensitivity value for this section.

……..

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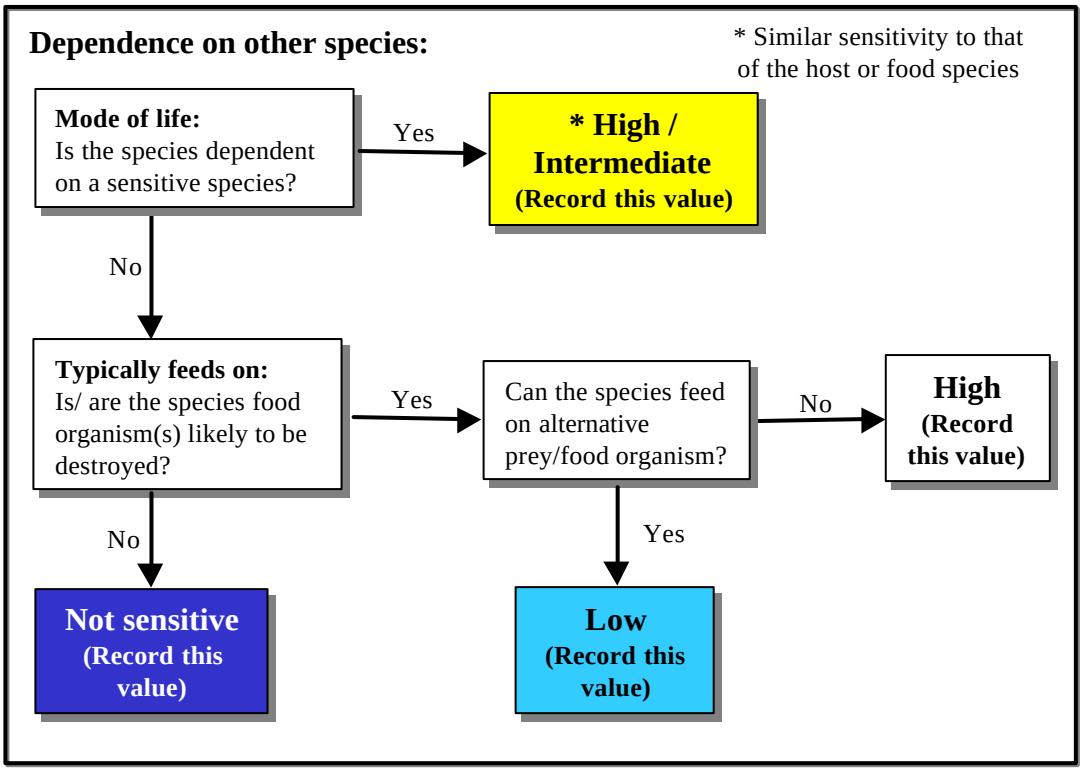


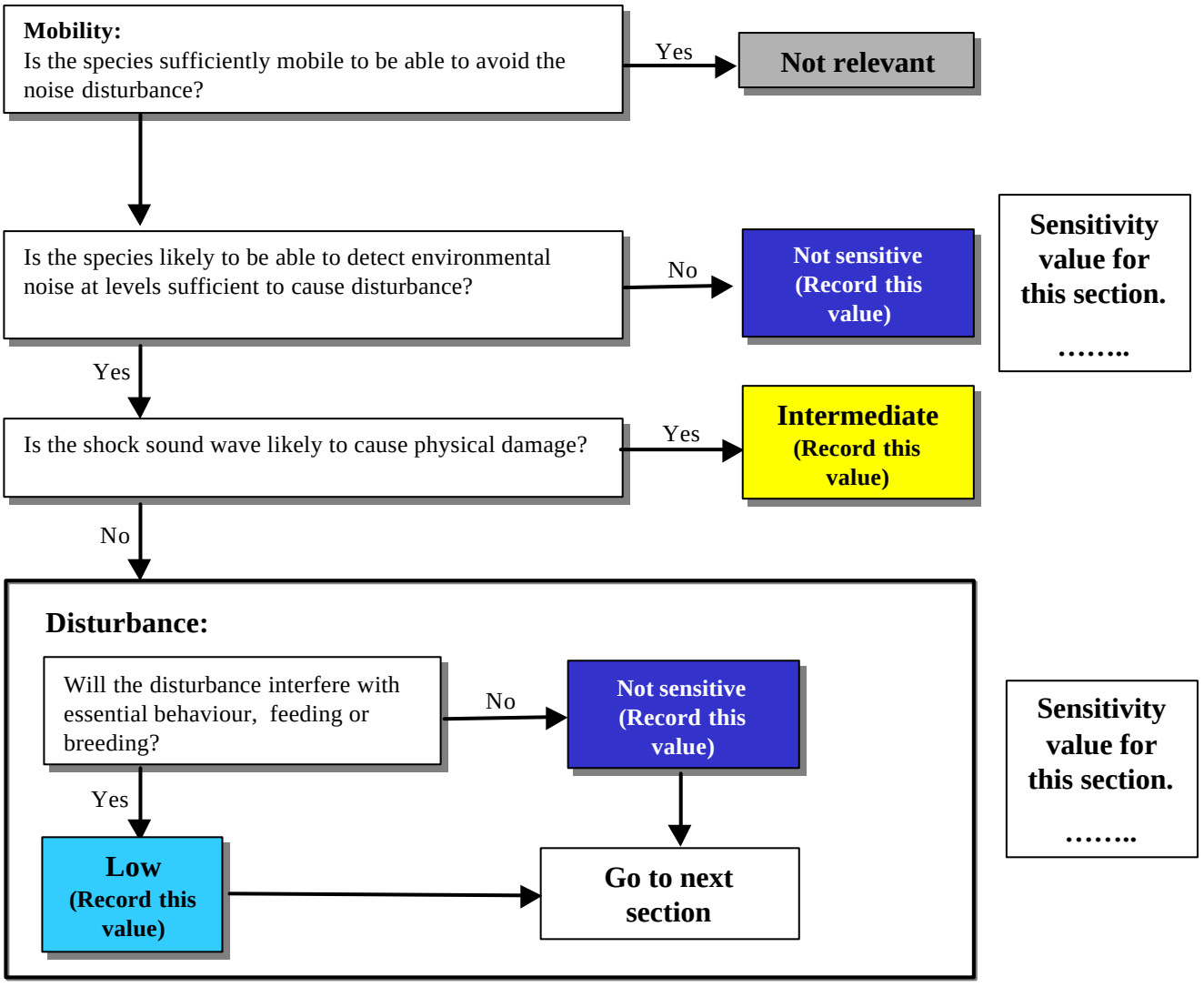
Sensitivity value for this section.

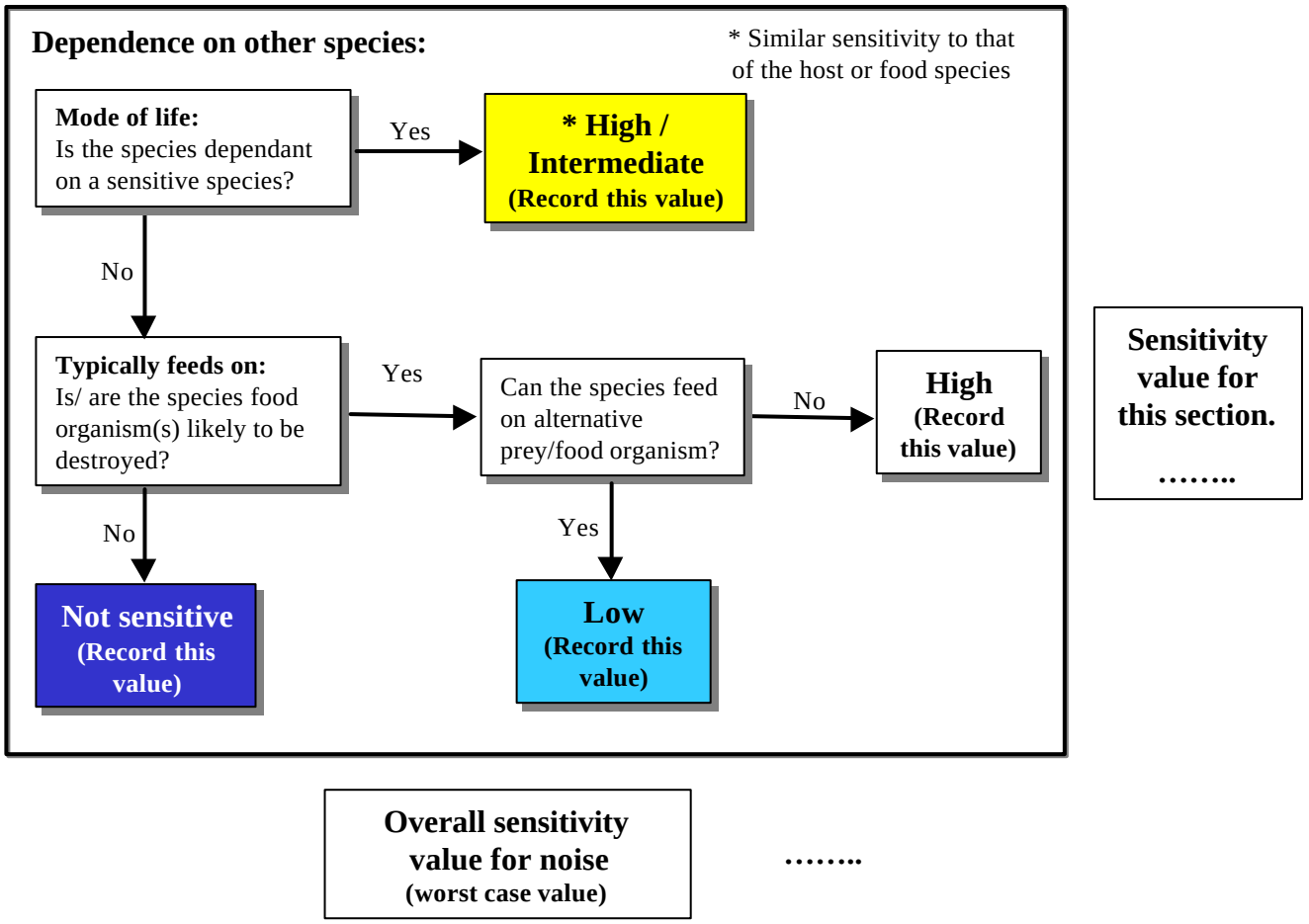
……..

Overall sensitivity value for changes in wave exposure (worst case value)

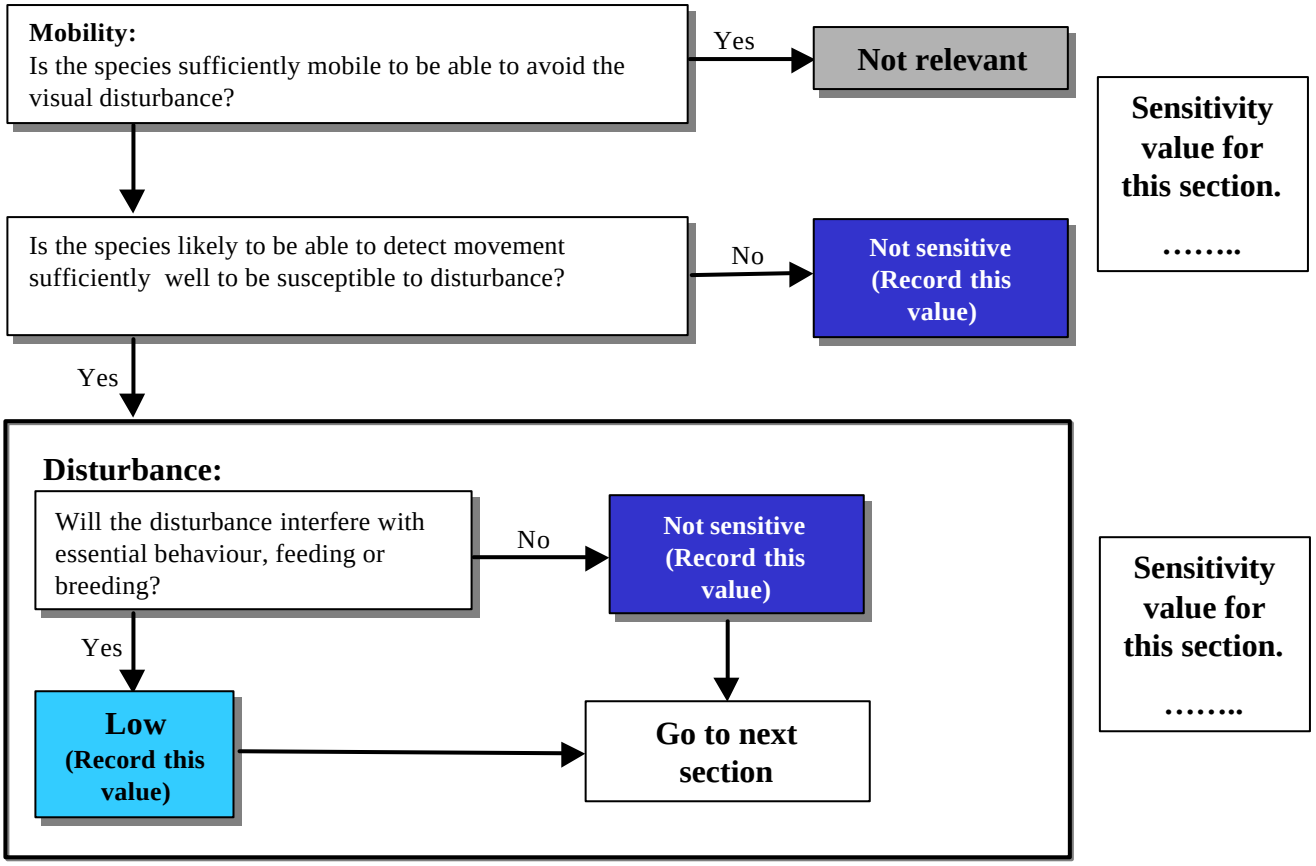
……..

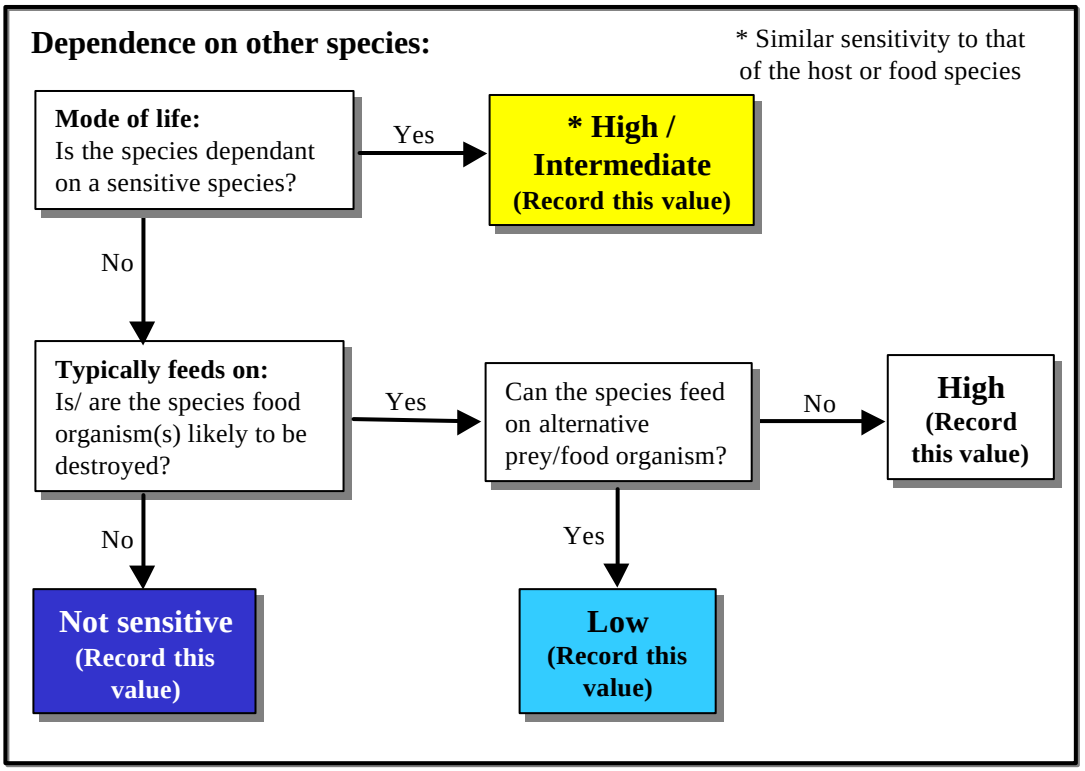
Factor: **Noise**
Description: Generally defined as unwanted or disruptive sound**.**
Benchmark: **Underwater noise levels:** e.g., the regular passing of a 30 metre trawler at 100 metres or a working cutter-suction transfer dredge at 100 metres for 1 month during important feeding or breeding periods.
Atmospheric noise levels: e.g., the regular passing of a Boeing 737 passenger jet 300 metres overhead for 1 month during important feeding or breeding periods




Dependence on other species:
* Similar sensitivity to that of the host or food species
Mode of life:
Is the species dependant on a sensitive species?
Yes
* High / Intermediate
(Record this value)
No
Typically feeds on:
Is/ are the species food organism(s) likely to be destroyed?
Yes
Can the species feed on alternative prey/food organism?
No
High
(Record this value)
No
Yes
Not sensitive
(Record this value)
Low
(Record this value)
Sensitivity value for this section.
……..
Overall sensitivity value for noise
(worst case value)
……..

Factor: **Visual disturbance**
Description: This benchmark applies only to species that have sufficient visual acuity to resolve moving objects or at least differentiate between rapid changes in light intensity (as in a moving shadow).
Benchmark: The continuous presence for one month of moving objects not naturally found in the marine environment (e.g., boats, machinery, and humans) within the visual envelope of the species or community under consideration.





Sensitivity value for this section.

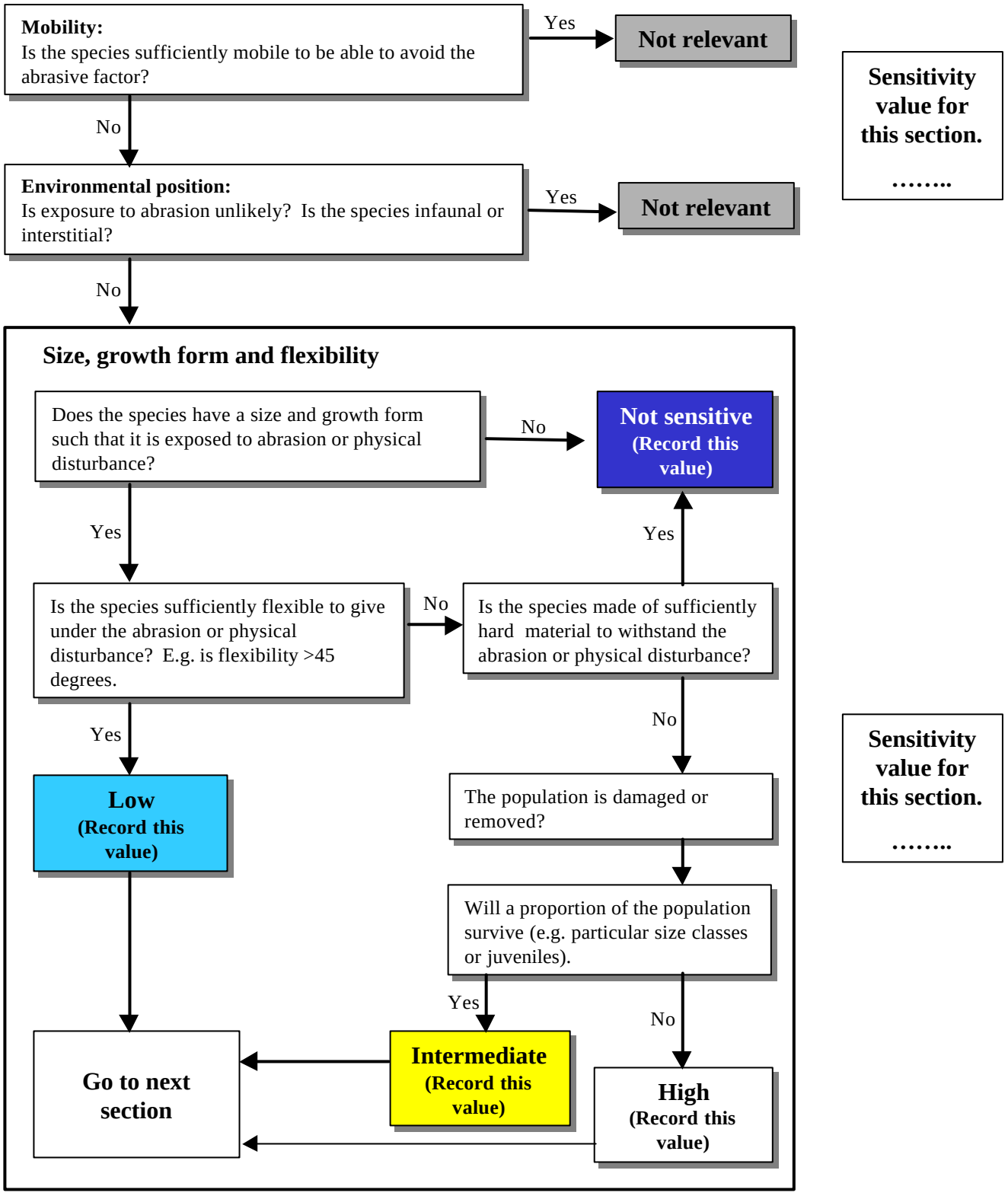
……..

Overall sensitivity value for visual disturbance (worst case value)

……..

Factor: **Abrasion and physical disturbance**
Description: The mechanical interference or rubbing of the organism of interest.
Benchmark: This factor includes mechanical interference, crushing, physical blows against, or rubbing and erosion of the organism or habitat of interest.
Force equivalent to a standard boat anchor landing on or being dragged across the organism e.g., a 5 -10 kg anchor and its chain (used by a 7-8m boat). A single event is assumed for assessment.

Where trampling is relevant, the evidence and trampling intensity will be reported in the rationale.



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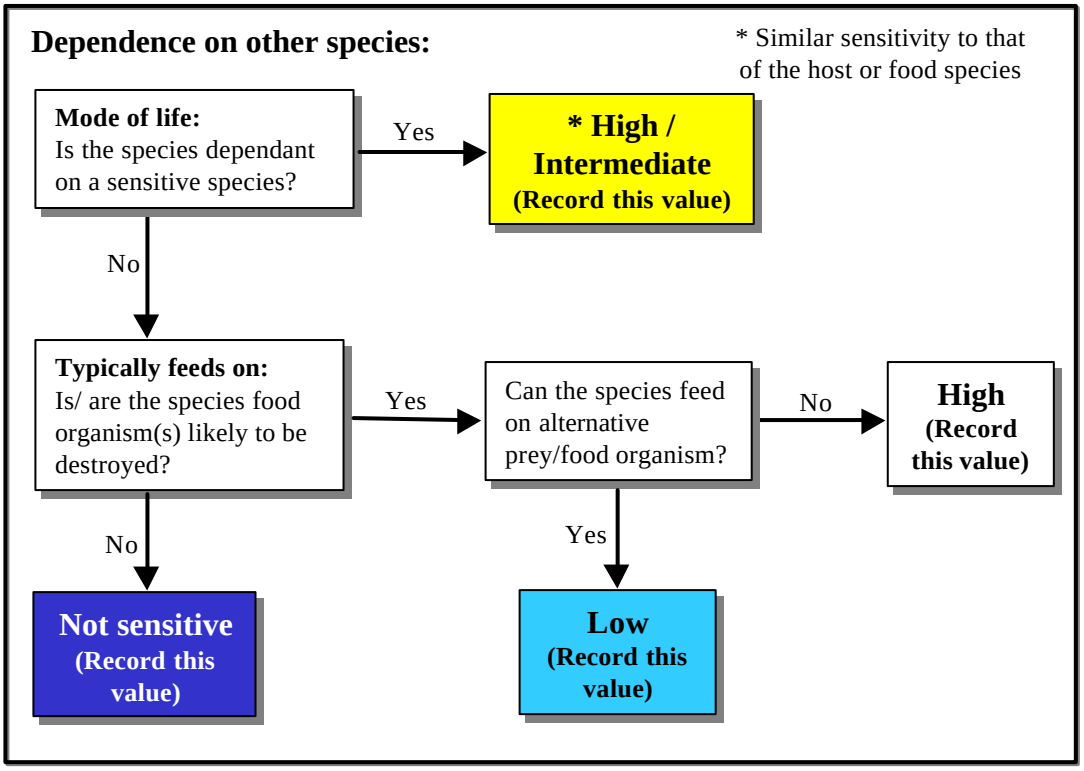


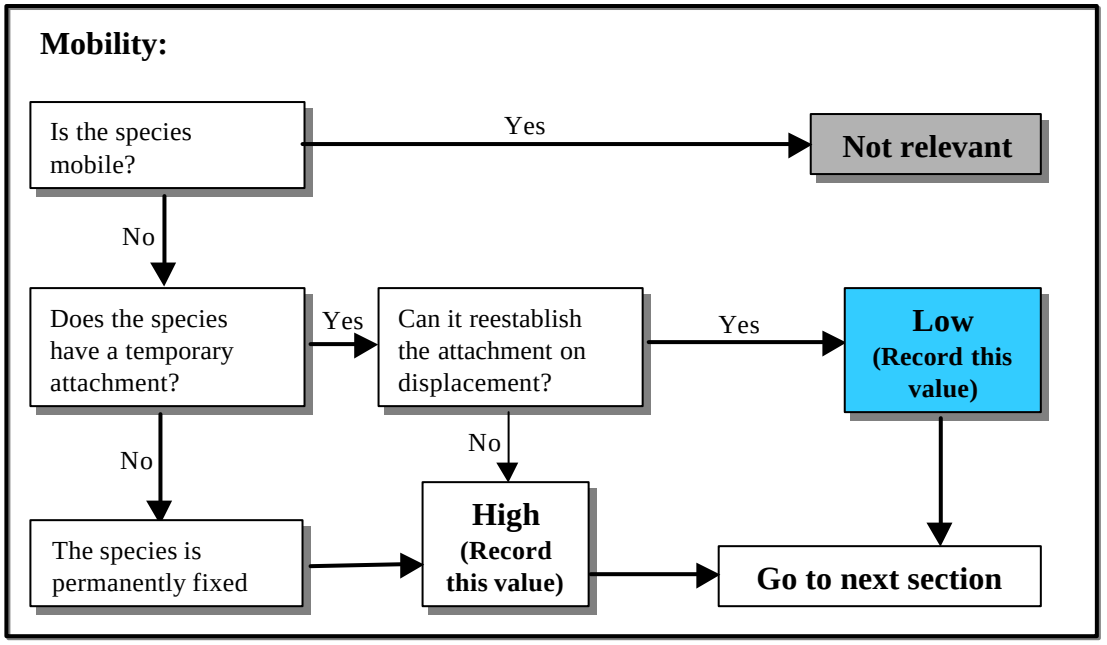
Sensitivity value for this section.

……..

Overall sensitivity value for abrasion and physical disturbance (worst case value)

……..

Factor: **Displacement**
Description: Physical removal or transportation of the species or community of interest.
Benchmark: Removal of the organism from the substratum and displacement from its original position onto a suitable substratum. A single event is assumed for assessment.



Sensitivity value for this section.
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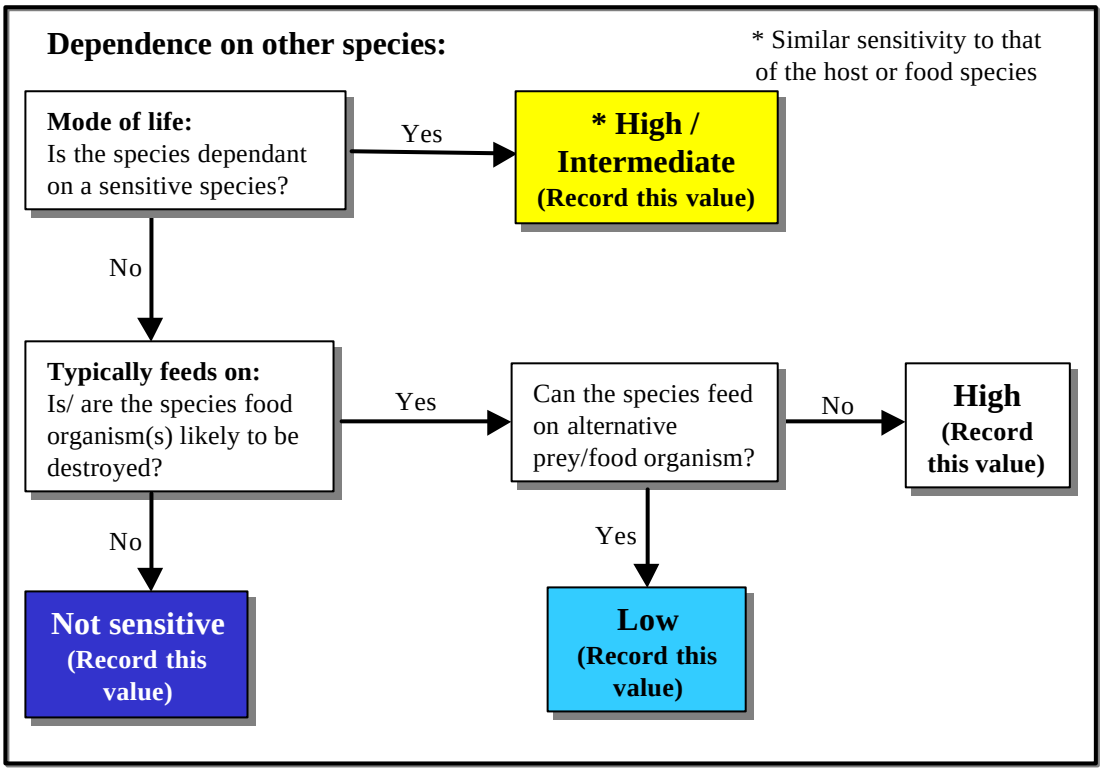


Sensitivity value for this section.
……..

Overall sensitivity value for displacement
(worst case value)

……..

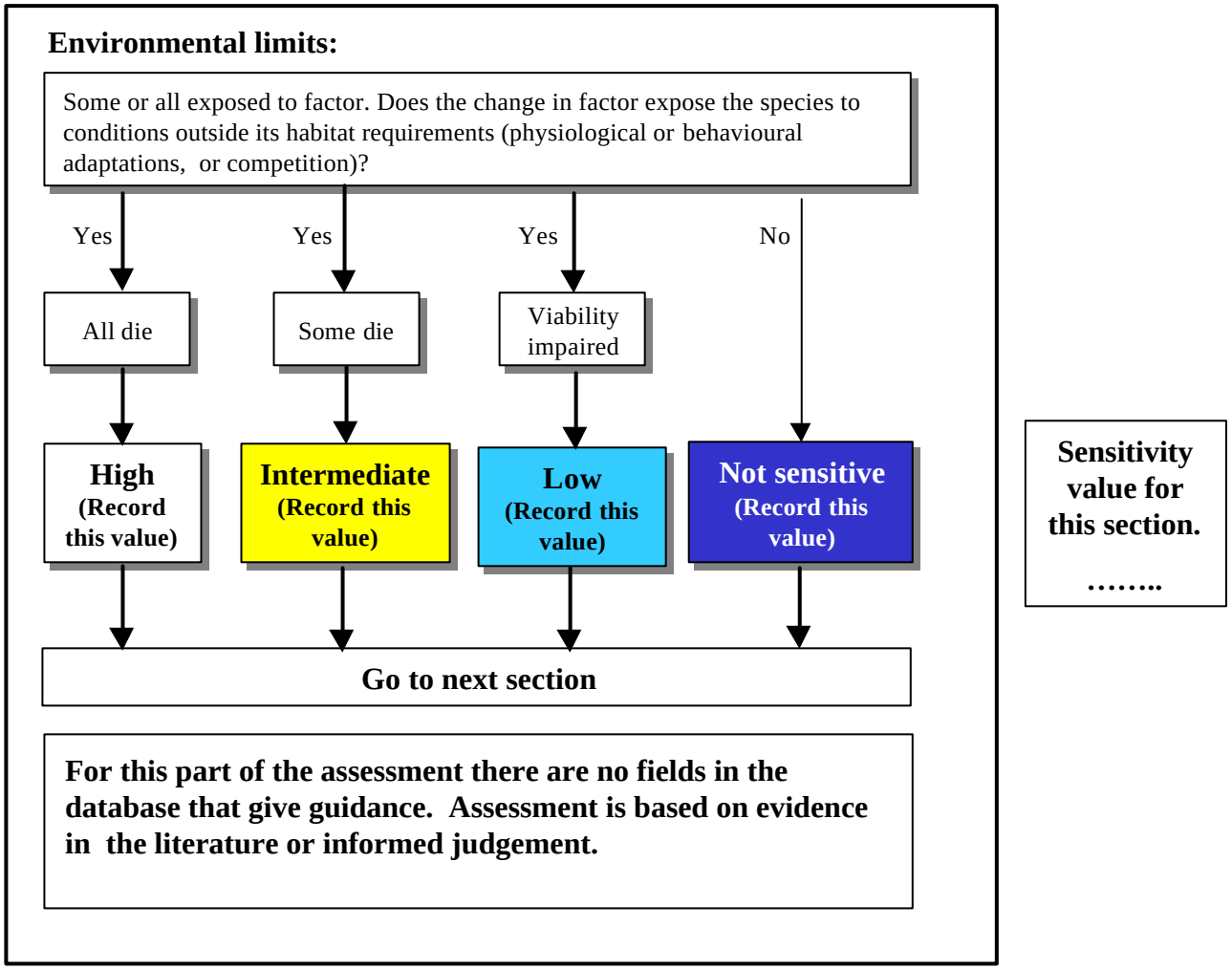
Factor: **Synthetic compound contamination**

Description: Synthetic chemicals are by definition man-made and include, for example, organotins (tributyl tin, triphenyl tin), pesticides (lindane, atrazine, dichlorvos, DDT), organochlorides, organophosphates, solvents (carbon tetrachloride, chloroform) and poly-chlorinated biphenyls (PCBs).

Benchmark: Sensitivity is assessed against the available evidence for the effects of contaminants on the species (or closely related species at low confidence) or community of interest. For example:

- evidence of mass mortality of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as high sensitivity;
- evidence of reduced abundance, or extent of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as intermediate sensitivity;
- evidence of sub-lethal effects or reduced reproductive potential of a population of the species or community of interest will be assessed as low sensitivity.

The evidence used is stated in the rationale. Where the assessment can be based on a known activity then this is stated. The tolerance to contaminants of species of interest will be included in the rationale when available, together with relevant supporting material.



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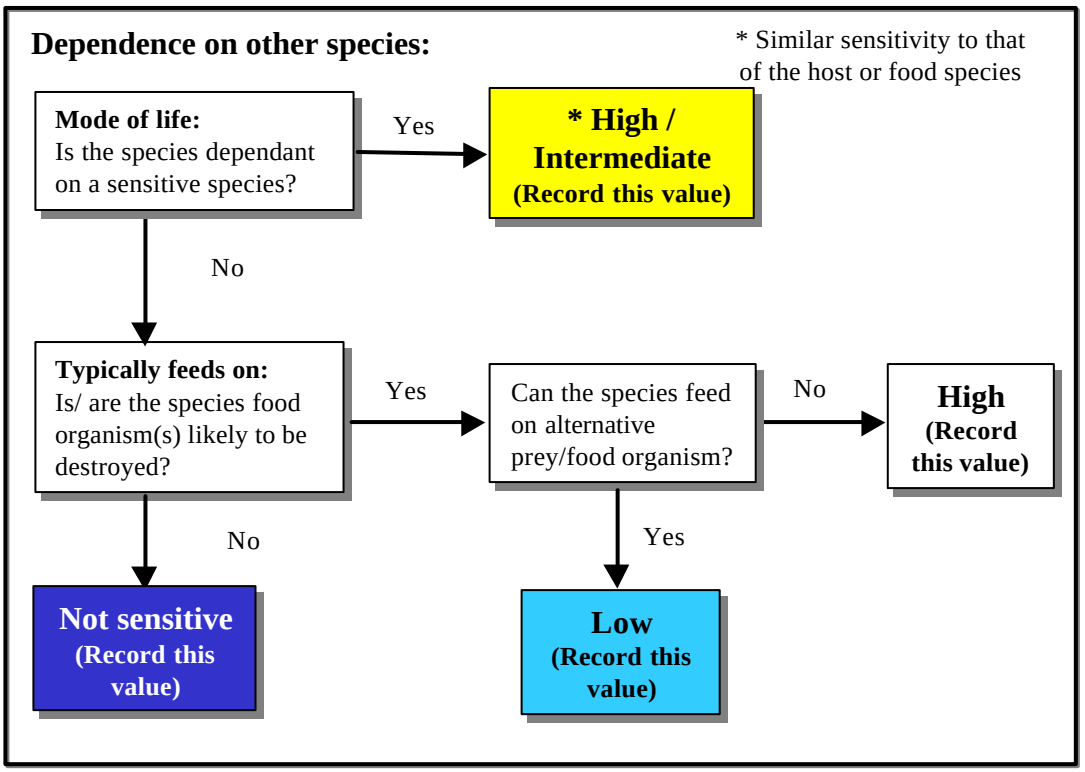


Sensitivity value for this section.

……..

Overall sensitivity value for synthetic contaminants
(worst case value)

……..

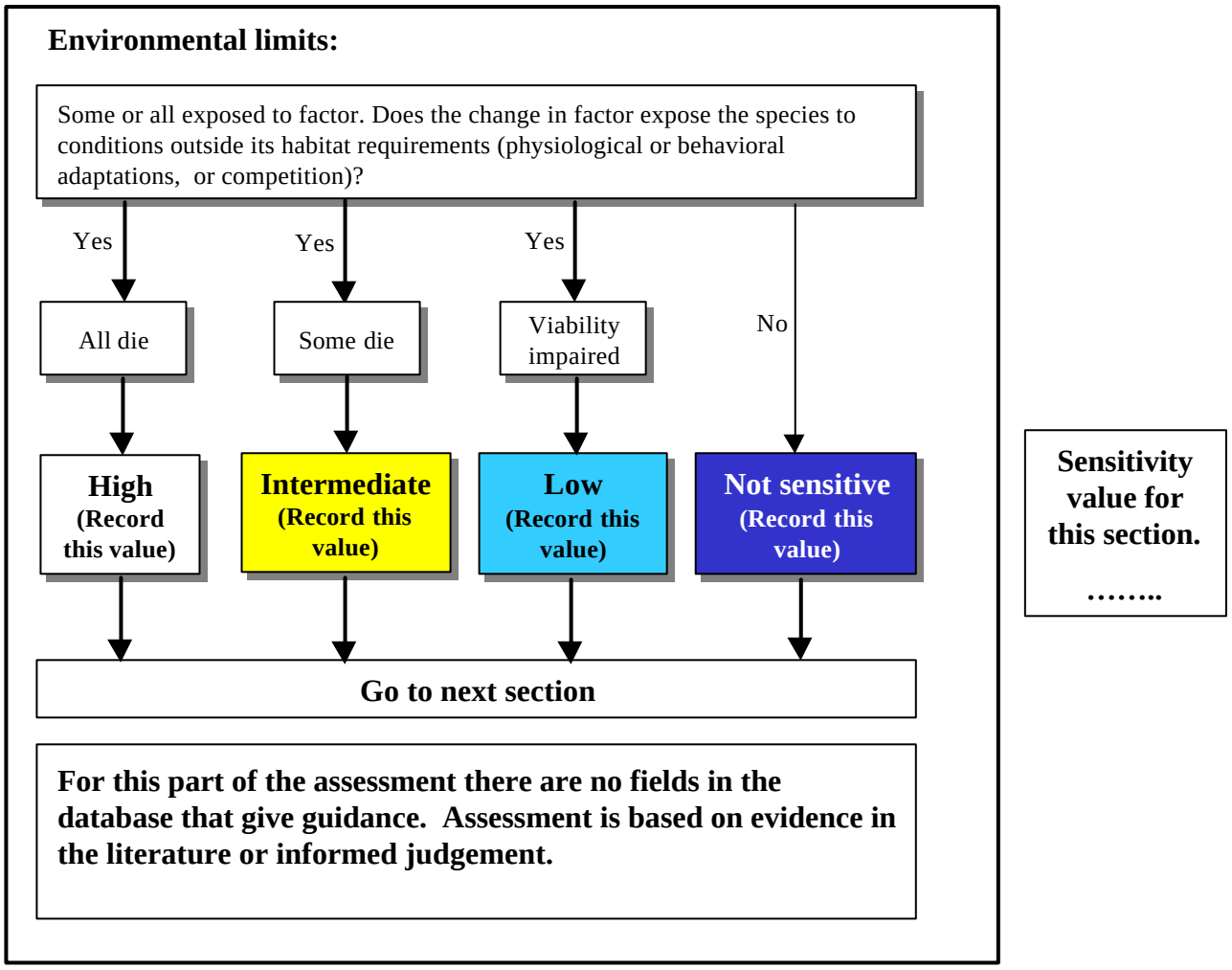
Factor: **Heavy metal contamination**

Description: Heavy metals include, for example, Arsenic (As), Cadmium (Cd), Mercury (Hg), Lead (Pb), Zinc (Zn) and Copper (Cu).

Benchmark: Sensitivity is assessed against the available evidence for the effects of contaminants on the species (or closely related species at low confidence) or community of interest. For example:

- evidence of mass mortality of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as high sensitivity;
- evidence of reduced abundance, or extent of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as intermediate sensitivity;
- evidence of sub-lethal effects or reduced reproductive potential of a population of the species or community of interest will be assessed as low sensitivity.

The evidence used is stated in the rationale. Where the assessment can be based on a known activity then this is stated. The tolerance to contaminants of species of interest will be included in the rationale when available, together with relevant supporting material.



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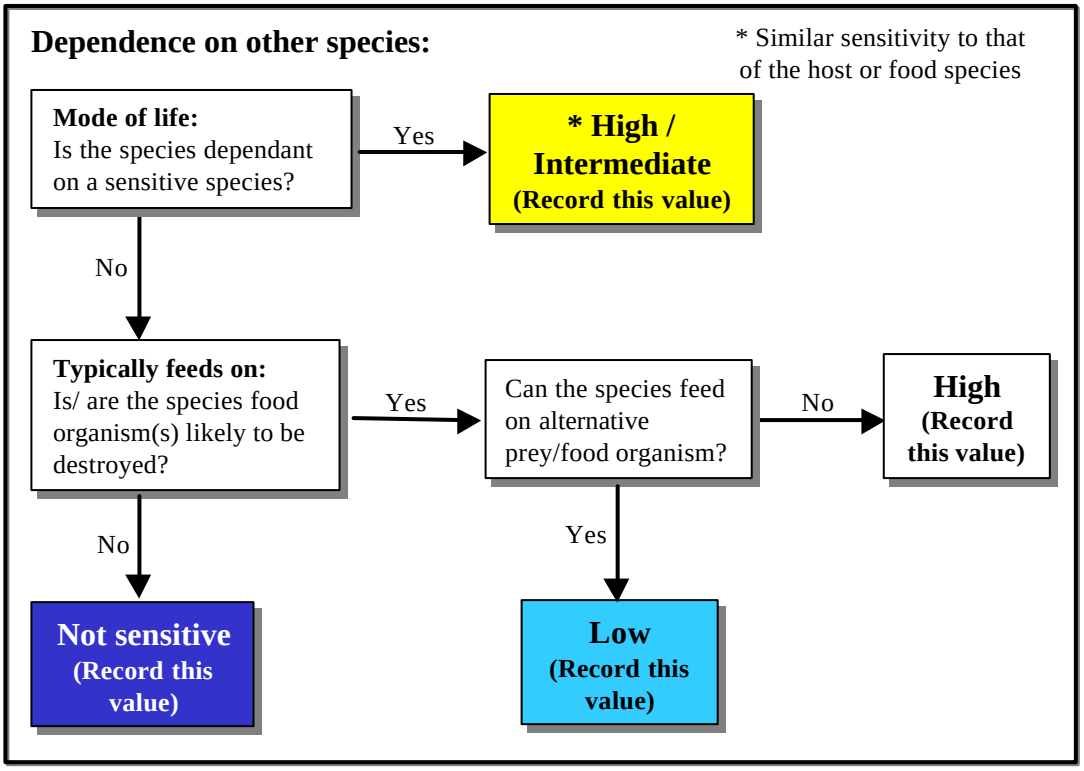


Sensitivity value for this section.

……..

Overall sensitivity value for heavy metal contamination (worst case value)

……..

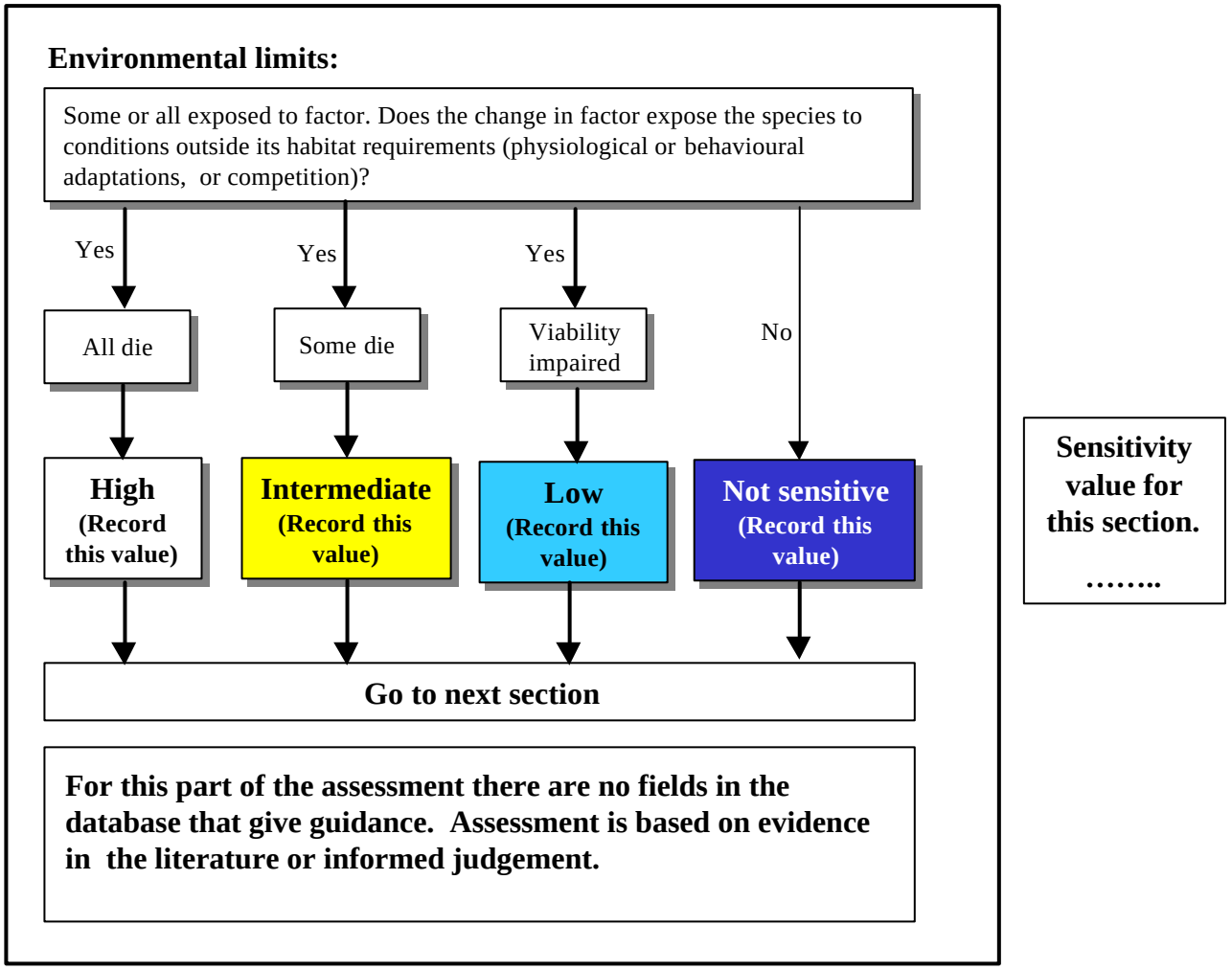
Factor: **Hydrocarbon contamination**

Description: Hydrocarbons include, for example, oils (crude and fuel oils) and poly aromatic hydrocarbons (PAHs).

Benchmark: Sensitivity is assessed against the available evidence for the effects of contaminants on the species (or closely related species at low confidence) or community of interest. For example:

- evidence of mass mortality of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as high sensitivity;
- evidence of reduced abundance, or extent of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as intermediate sensitivity;
- evidence of sub-lethal effects or reduced reproductive potential of a population of the species or community of interest will be assessed as low sensitivity.

The evidence used is stated in the rationale. Where the assessment can be based on a known activity then this is stated. The tolerance to contaminants of species of interest will be included in the rationale when available, together with relevant supporting material.



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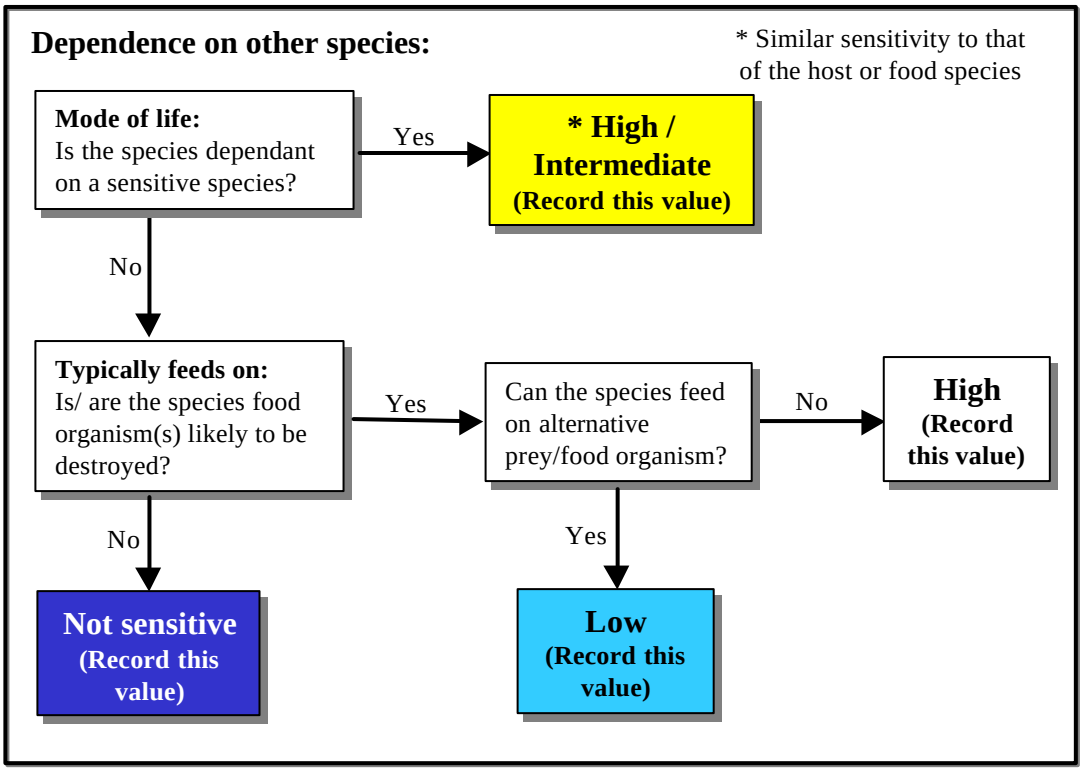


Sensitivity value for this section.

……..

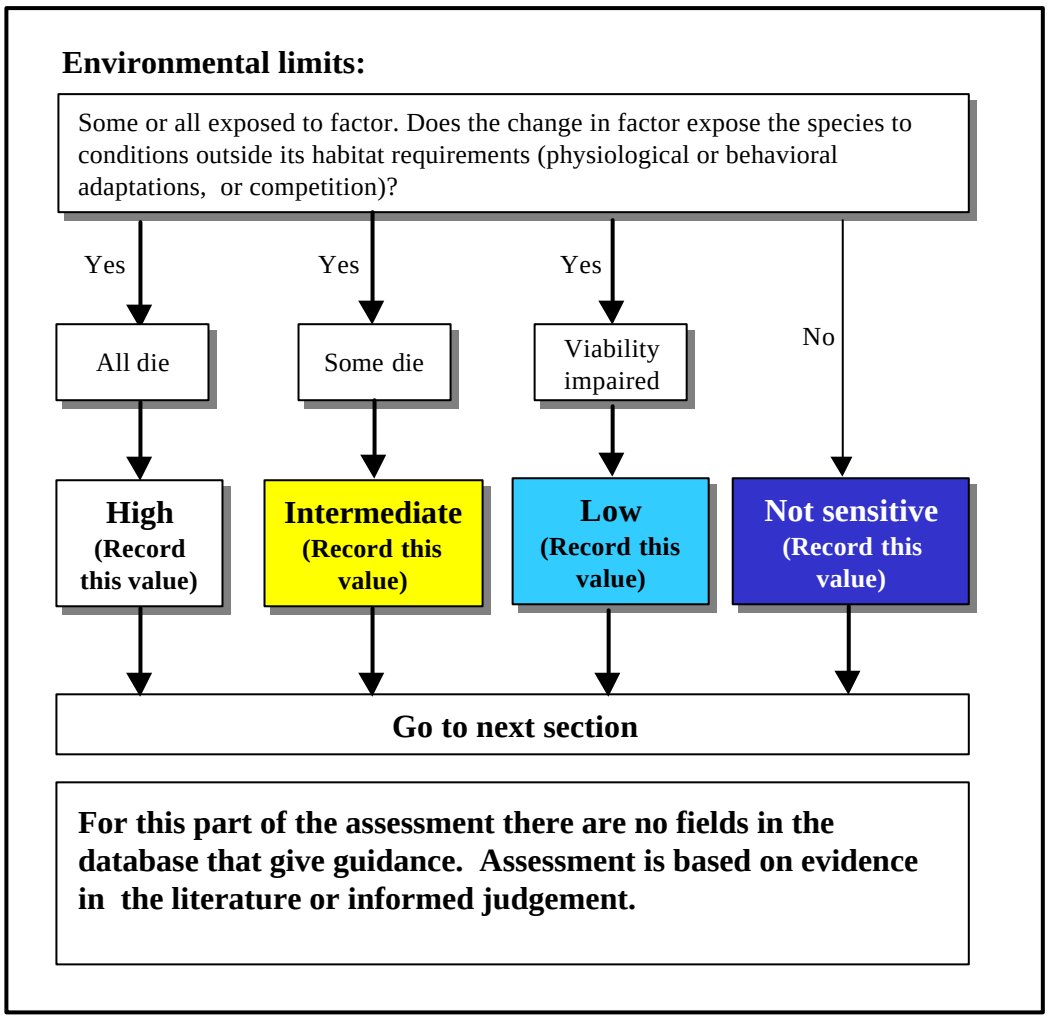
Overall sensitivity value for hydrocarbon contamination (worst case value)

……..

Factor: **Radionuclide contamination**
Description: Isotopes of elements that emit alpha, beta or gamma radiation.
Benchmark: Sensitivity is assessed against the available evidence for the effects of contaminants on the species (or closely related species at low confidence) or community of interest. For example:

- evidence of mass mortality of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as high sensitivity;
- evidence of reduced abundance, or extent of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as intermediate sensitivity;
- evidence of sub-lethal effects or reduced reproductive potential of a population of the species or community of interest will be assessed as low sensitivity.

The evidence used is stated in the rationale. Where the assessment can be based on a known activity then this is stated. The tolerance to contaminants of species of interest will be included in the rationale when available, together with relevant supporting material.



Sensitivity value for this section.

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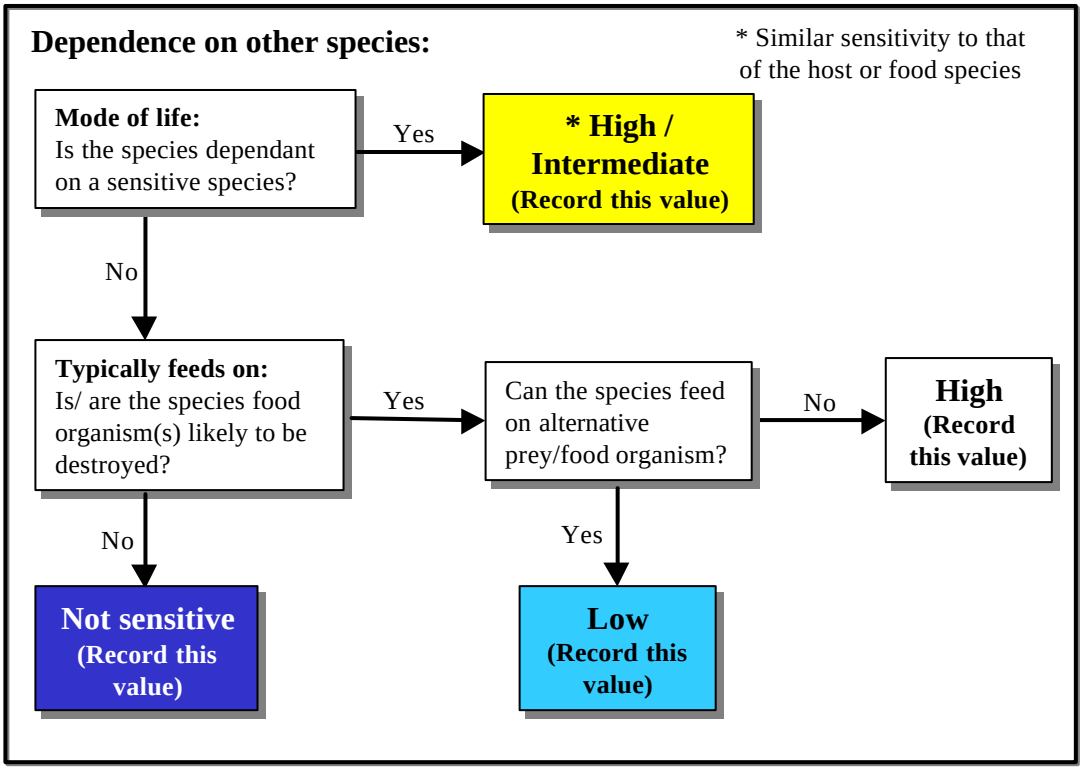


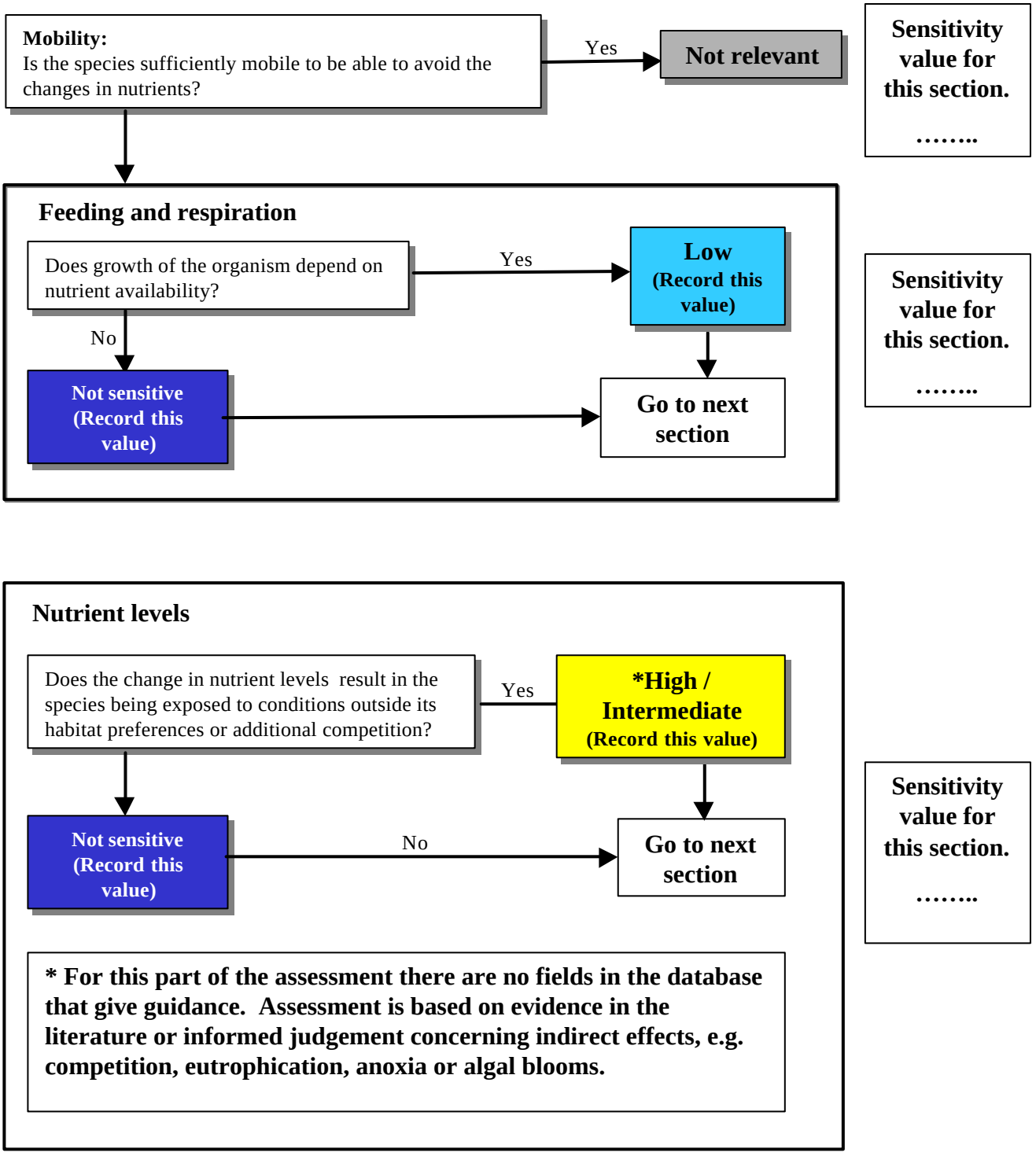
Sensitivity value for this section.

……..

Overall sensitivity value for radionuclide contamination (worst case value)

……..

Factor: **Changes in nutrient levels**
Description: Nutrients include substances required for growth, for example, nitrogen, phosphorus, silicon, and micro-nutrients (heavy metals and vitamins).
Benchmark: A change of total nitrogen of 3 mg/l and/or phosphorus of 0.3 mg/l as an annual average. Alternatively, a 50% increase of nutrients as an annual average.



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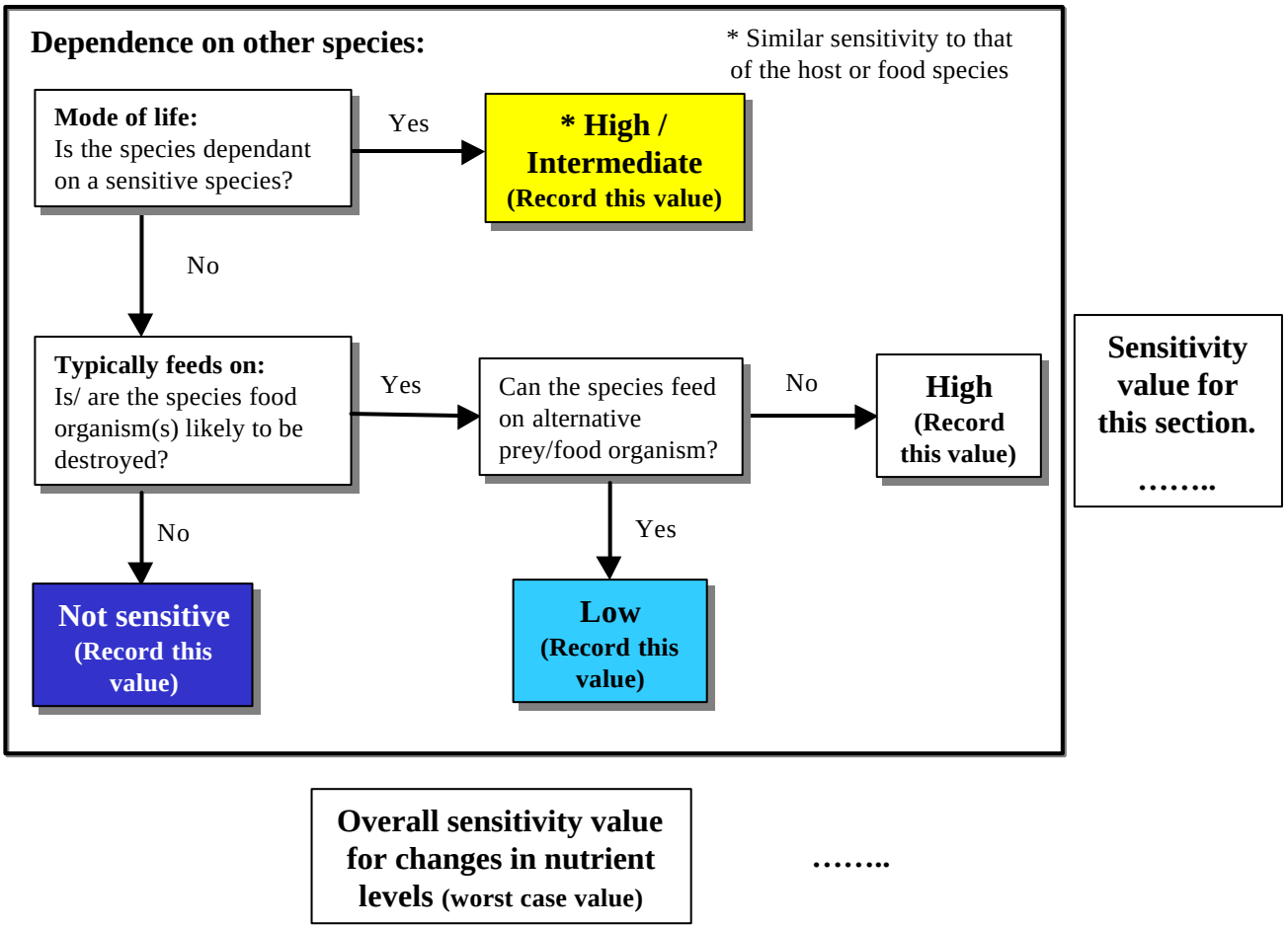
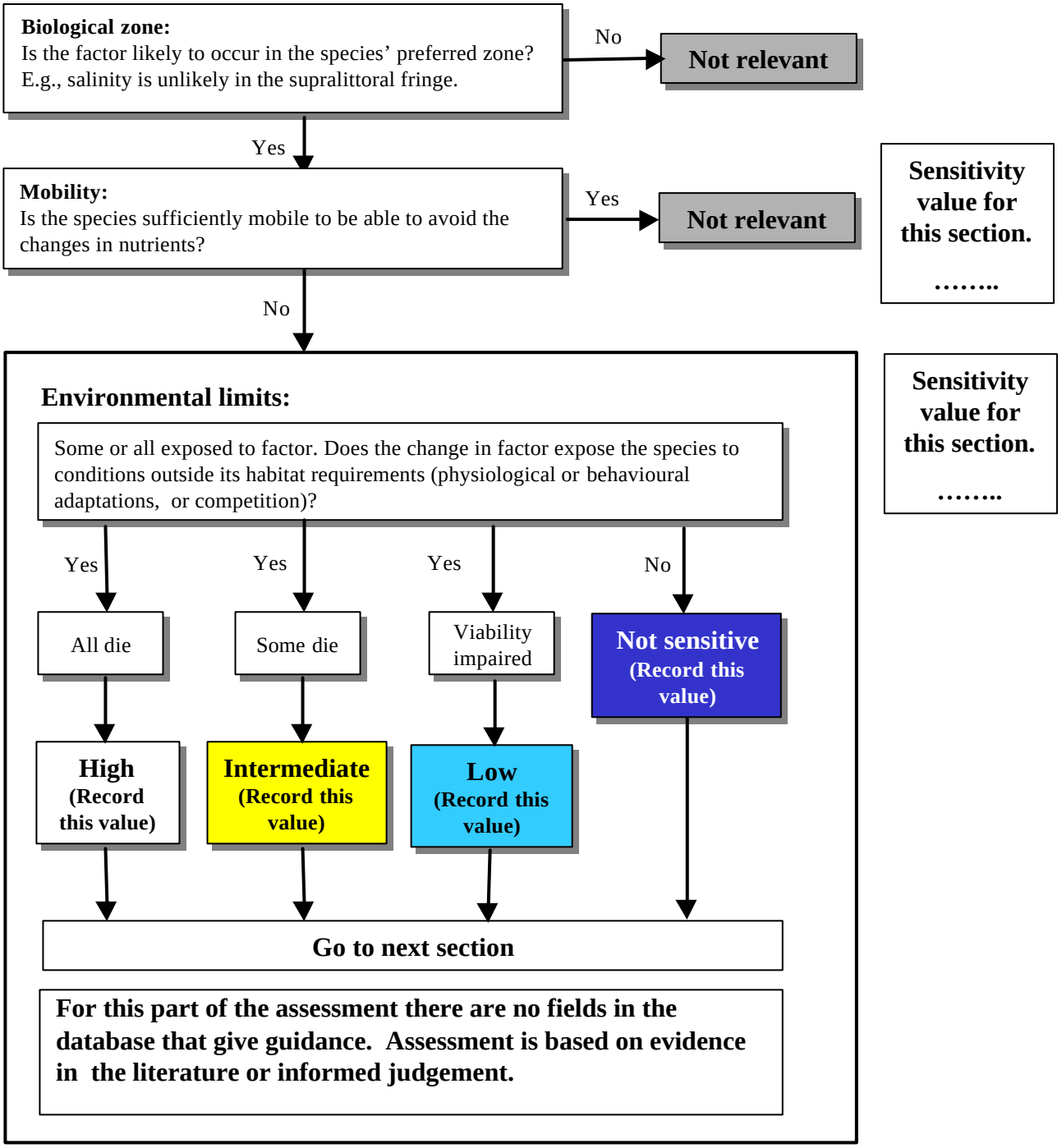

Dependence on other species:
* Similar sensitivity to that of the host or food species
Mode of life: Is the species dependant on a sensitive species?
Yes
* High / Intermediate (Record this value)
No
Typically feeds on: Is/ are the species food organism(s) likely to be destroyed?
Yes
Can the species feed on alternative prey/food organism?
No
High (Record this value)
No
Yes
Not sensitive (Record this value)
Low (Record this value)
Sensitivity value for this section.
……..
Overall sensitivity value for changes in nutrient levels (worst case value)
……..

Factor: **Changes in salinity**
Description: Salinity is a measure of the amount of dissolved salts in the water.
Benchmark: 1) A short term, acute change; e.g., a change of two categories from the MNCR salinity scale for one week (see *MarLIN* glossary) i.e. from full to reduced.
2) A long term, chronic change; e.g., a change of one category from the MNCR salinity scale for one year (see *MarLIN* glossary) i.e. from reduced to low.



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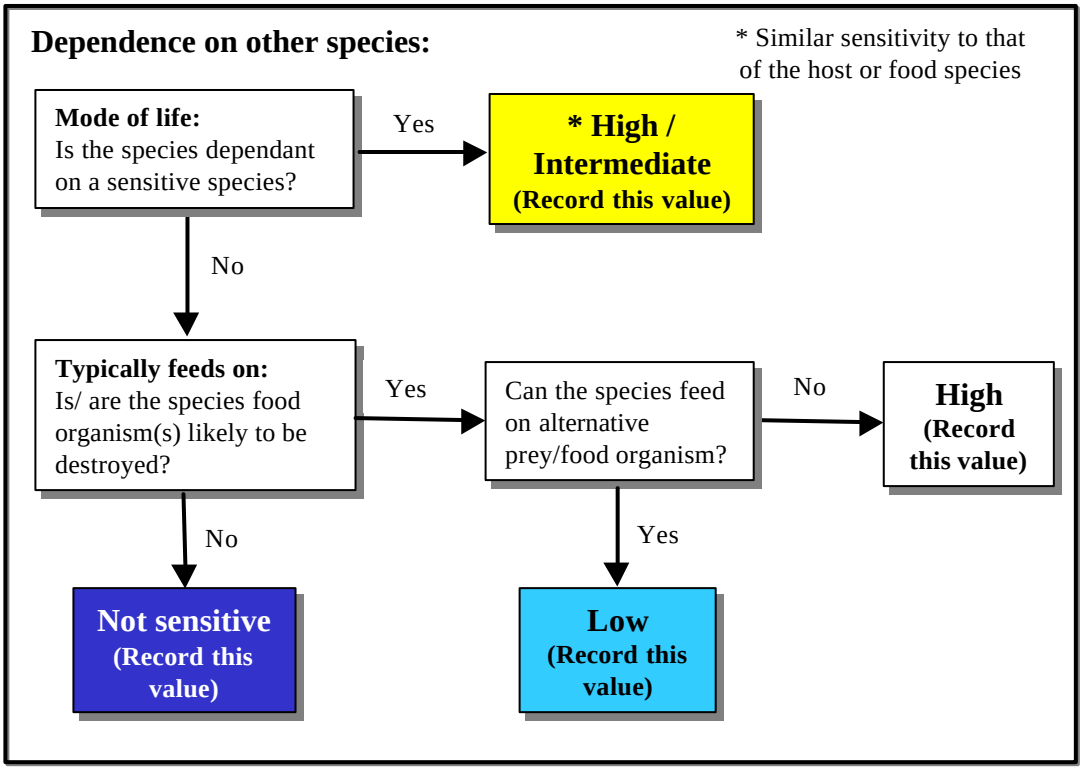


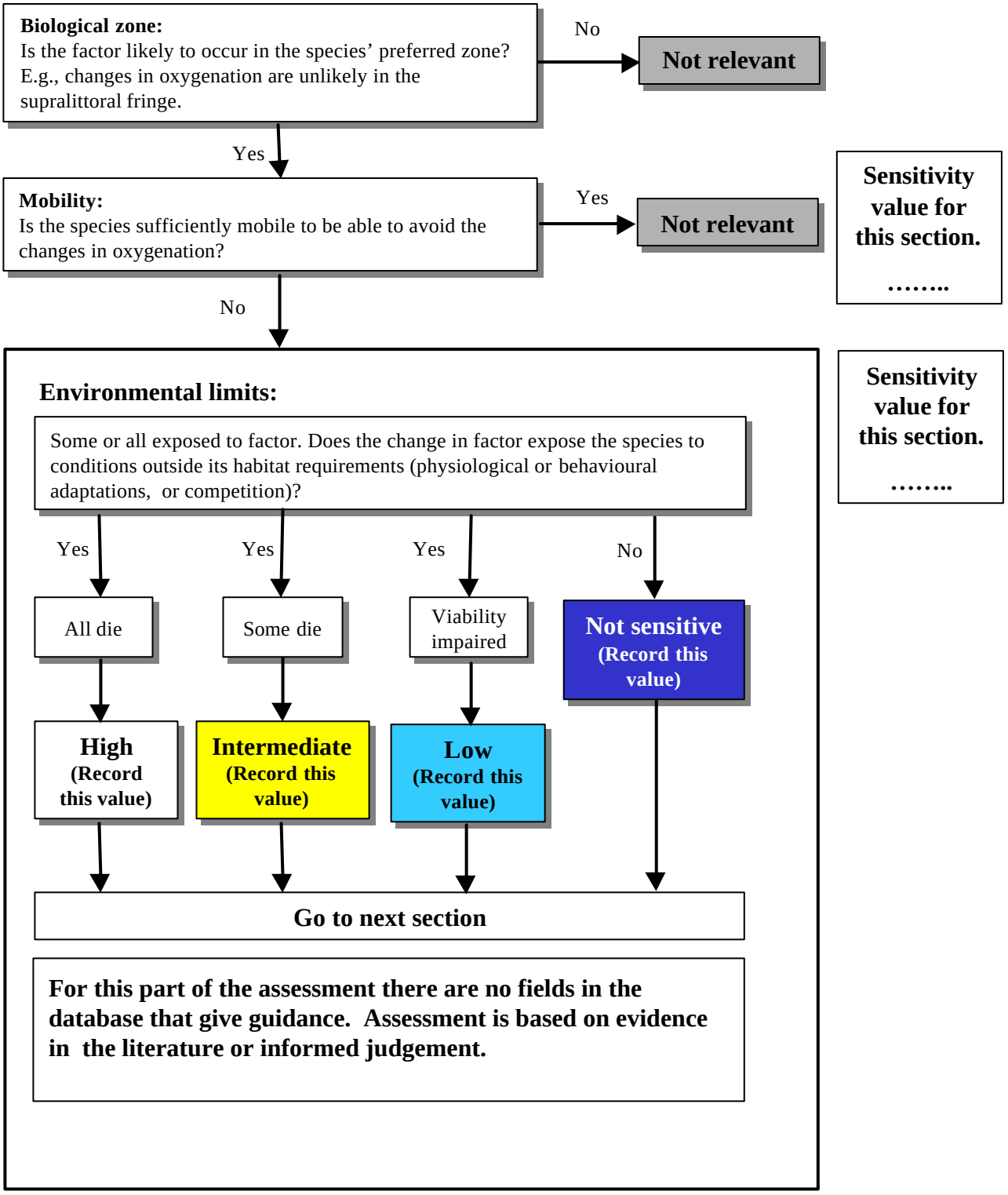
Sensitivity value for this section.

……..

Overall sensitivity value for changes in salinity (worst case value)

……..

Factor: **Changes in oxygenation**
Description: Oxygenation is a measure of the amount of dissolved oxygen in water.
Benchmark: Exposure to dissolved oxygen concentration of 2 mg/l for 1 week.



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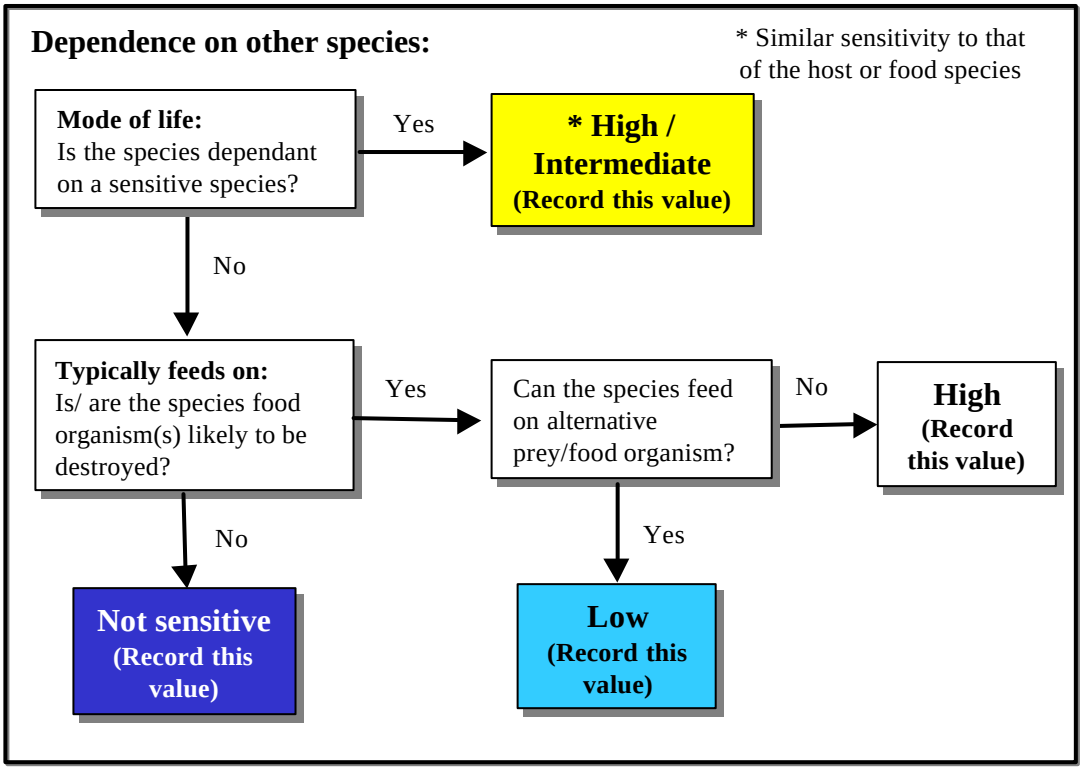
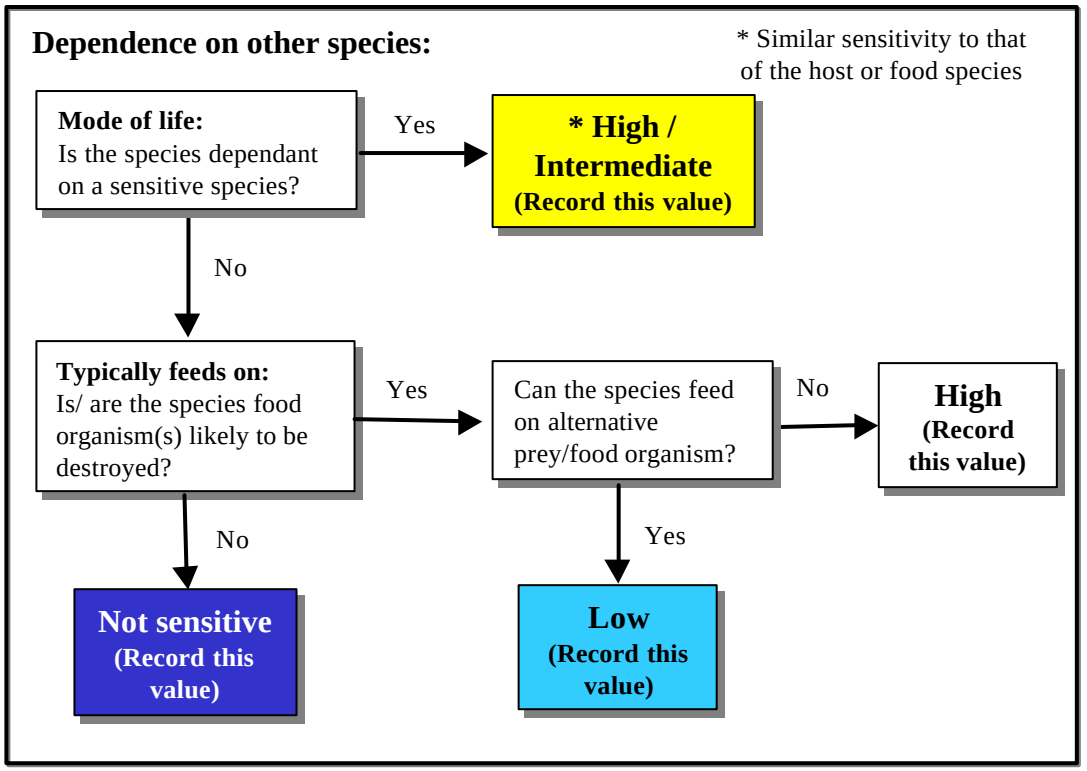


Sensitivity value for this section.

……..

Overall sensitivity value for changes in oxygenation (worst case value) **……..**

Factor: **Microbial pathogens / parasites**
Description: By definition, disease causes a reduction in fitness of the organism so all species automatically score as sensitive to disease.
Benchmark: Sensitivity can only be assessed relative to a known, named disease. Likely to cause partial loss of a population and will be assessed of intermediate sensitivity.



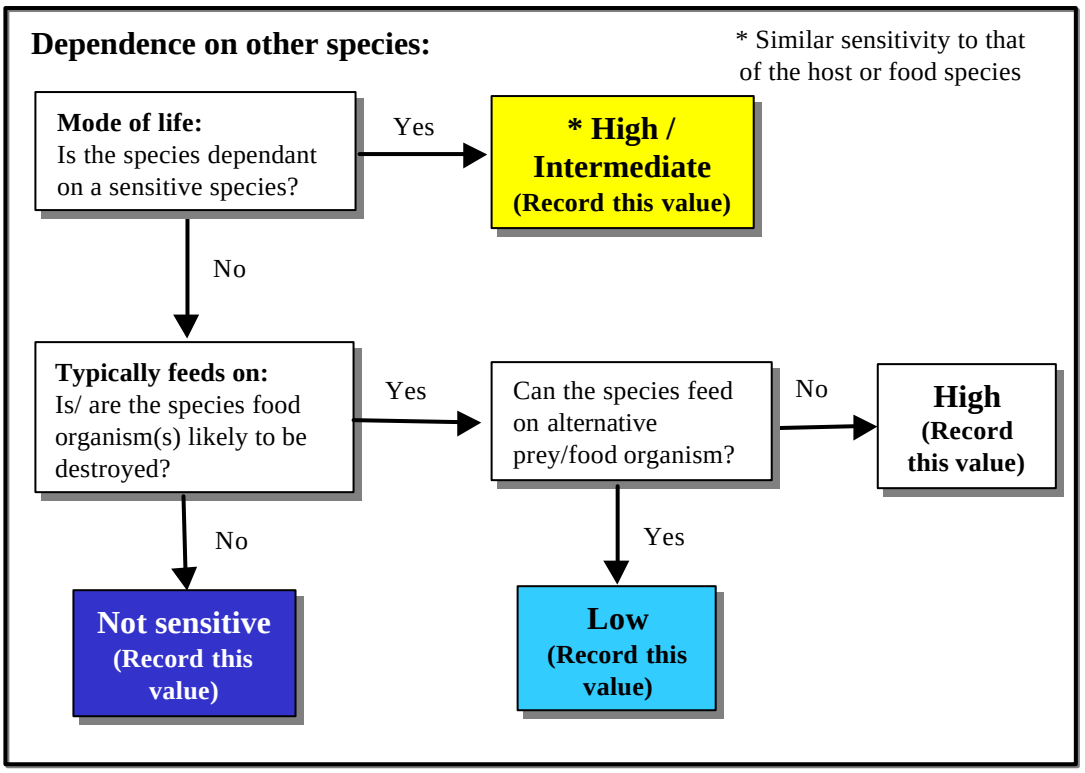
Sensitivity value for this section.

……..

Overall sensitivity value for changes in parasites / disease (worst case value) **……..**

An assessment can only be made for known parasites or diseases that a species can contract. No fields in the database can be used for further guidance. Assessment based on literature, pers. comm., expert judgement etc.

Factor: **Introduction of non-native species**
Description: Sensitivity is assessed against a specific alien or non-native species that already occurs in Britain and/or Ireland that is most likely to have an adverse effect and indicate the species being considered in the 'notes' section.
Benchmark: Sensitivity assessed against the likely effect of the introduction of alien or non-native species in Britain or Ireland.



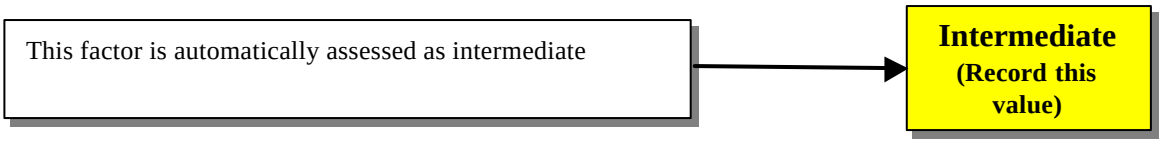
Sensitivity value for this section.

……..

Overall sensitivity value for changes in non-native species (worst case value) **……..**

An assessment can only be made for known alien species that affect the species. No fields in the database can be used for further guidance. Assessment based on literature, pers. comm., expert judgement etc.

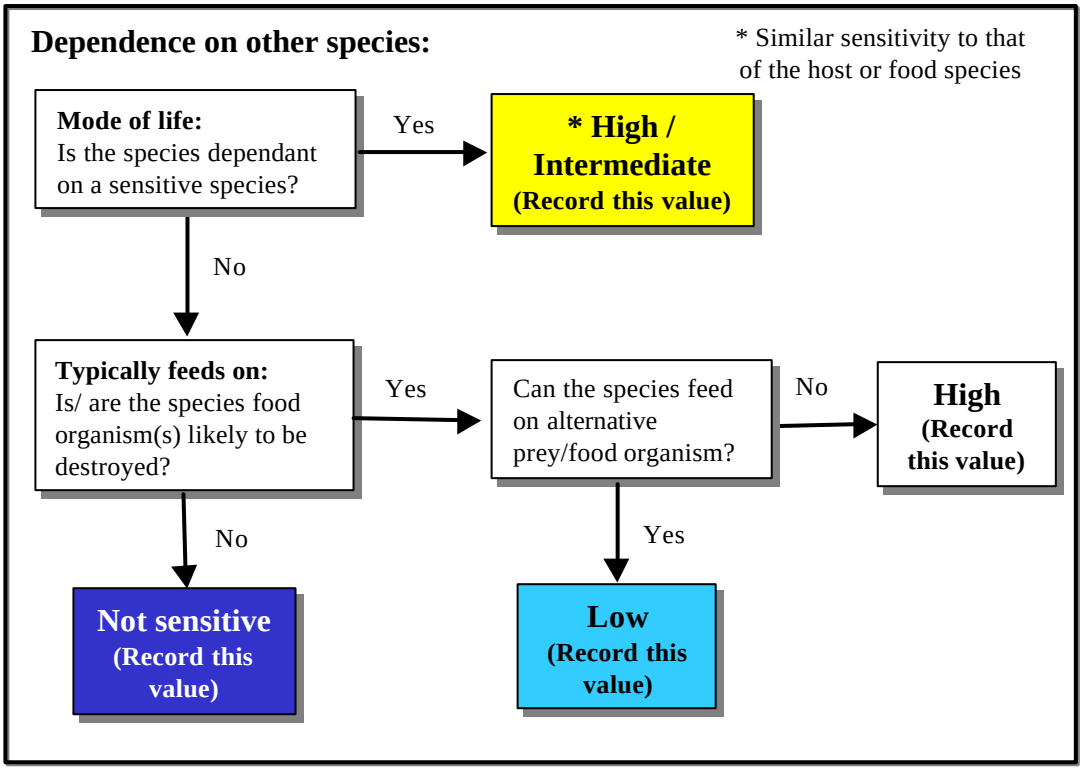
Factor: **Selective extraction of this species**
Description: A species is bound to be sensitive to its removal and will automatically be assessed as 'intermediate'.
Benchmark: Extraction removes 50% of the species from the area under consideration.
The habitat remains intact or recovers rapidly.



Overall sensitivity value for selective extraction of other species (worst case value)

……..

Factor: **Selective extraction of other species**
Description: the species will be regarded as sensitive if the targeted species is a host for the species being considered, an obligate food source, or if it creates the habitat required by the species or community under consideration.
Benchmark: A species that is a required host or prey for the species under consideration (and assuming that no alternative host exists) or a keystone species in a biotope is removed.



Sensitivity value for this section.

……..

Overall sensitivity value for changes in oxygenation (worst case value) **……..**