Lake Sturgeon Mitigation at the Proposed Keeyask Hydro Facility: Concerns and Advice for the Proponents

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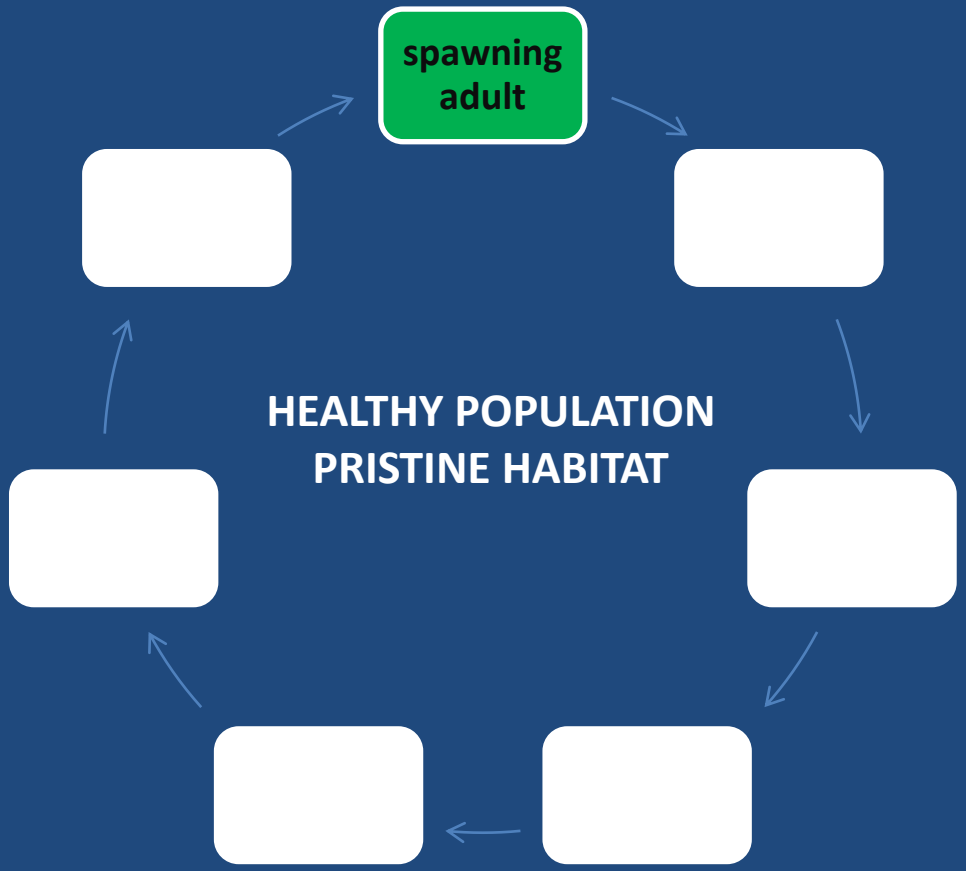
Outline

- review of lake sturgeon life history stages, terminology, and general vulnerability to mortality
- concern(s) related to proposed lake sturgeon stocking program
- concerns(s) related to marking hatchery-reared lake sturgeon prior to stocking
- concern(s) related to feasibility of creating and maintaining juvenile lake sturgeon habitat
- concern(s) related to lake sturgeon entrainment

Lake Sturgeon Life History

- lake sturgeon have different life “stages”, each having unique behavioural patterns, vulnerabilities and dietary/habitat requirements

Wild Lake Sturgeon Life History



MORTALITY RISK HIGH MOD-HIGH LOW-MOD LOW

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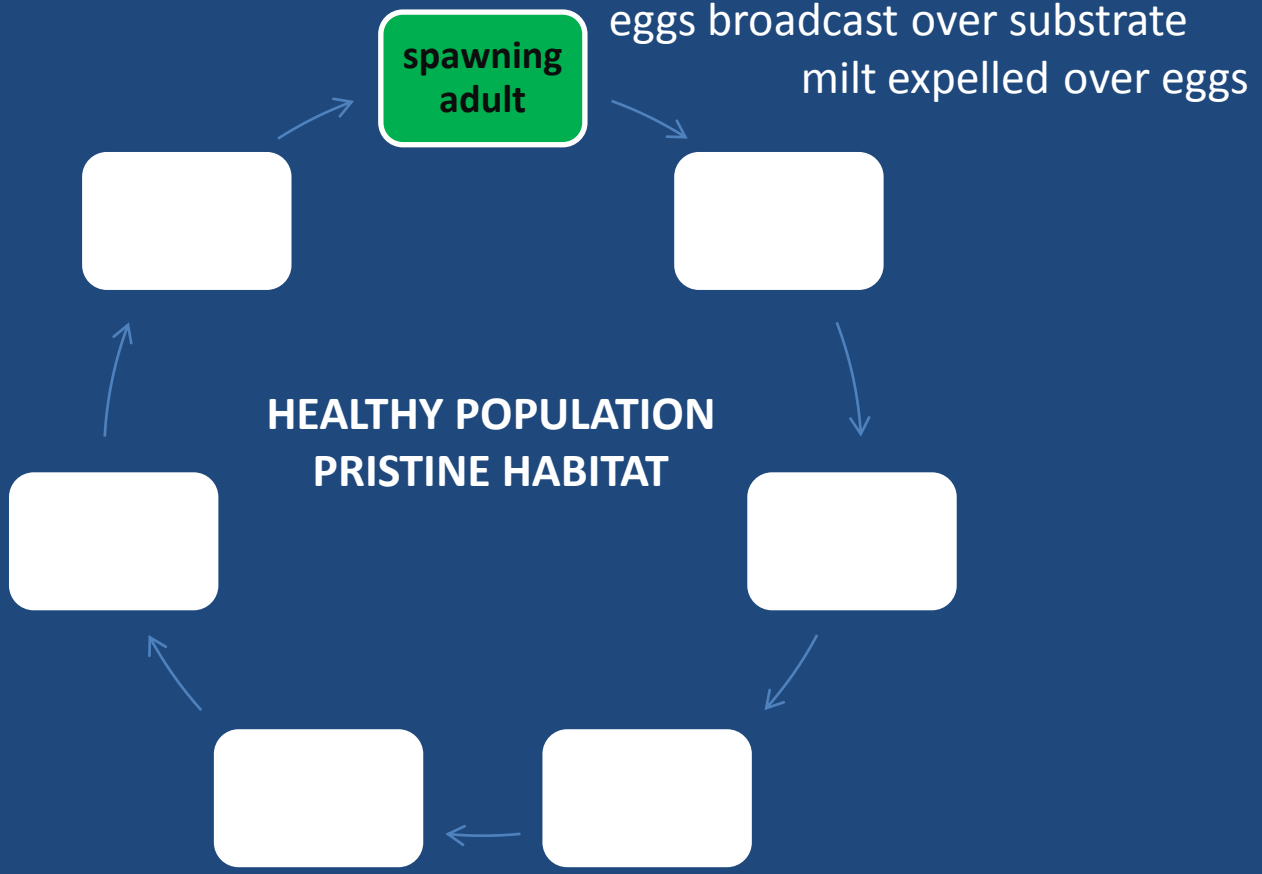

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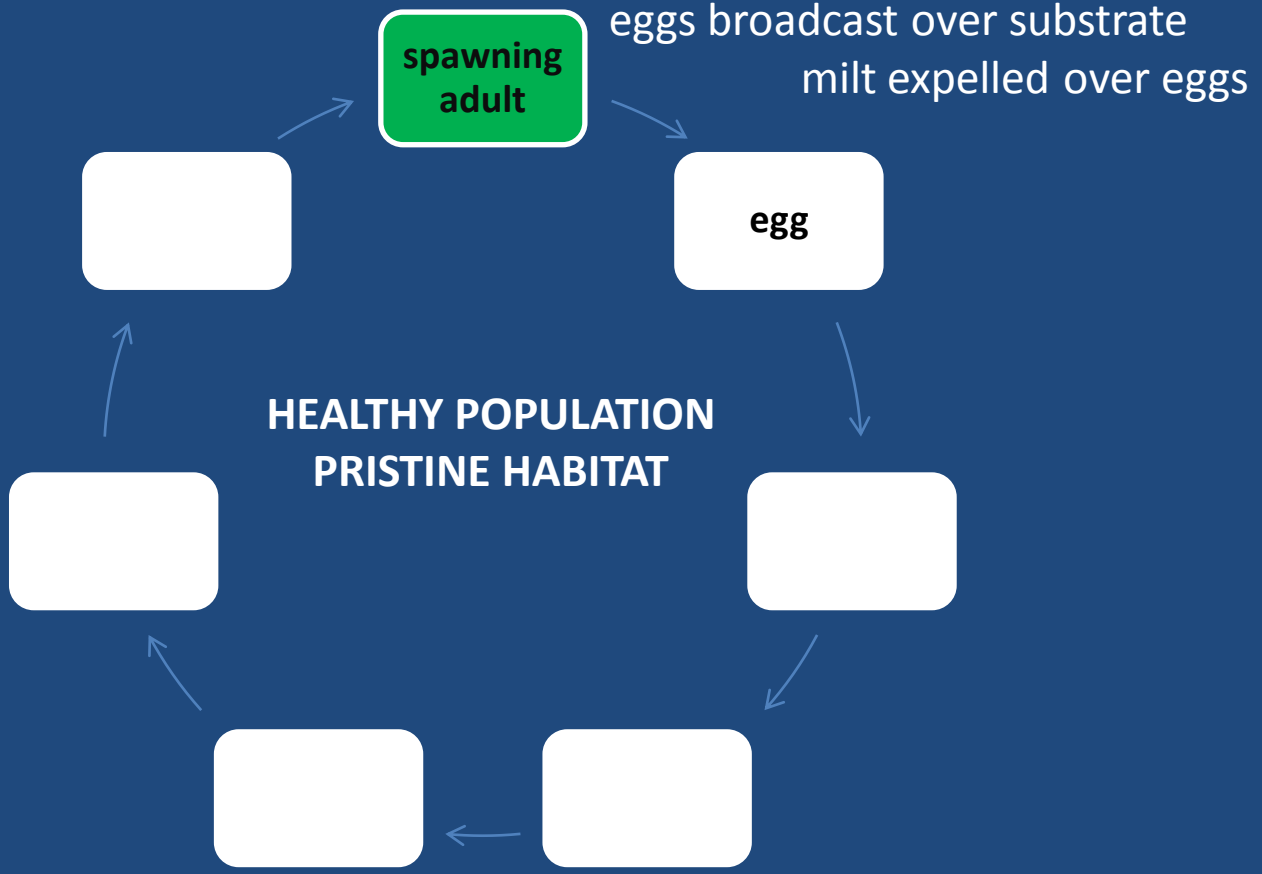

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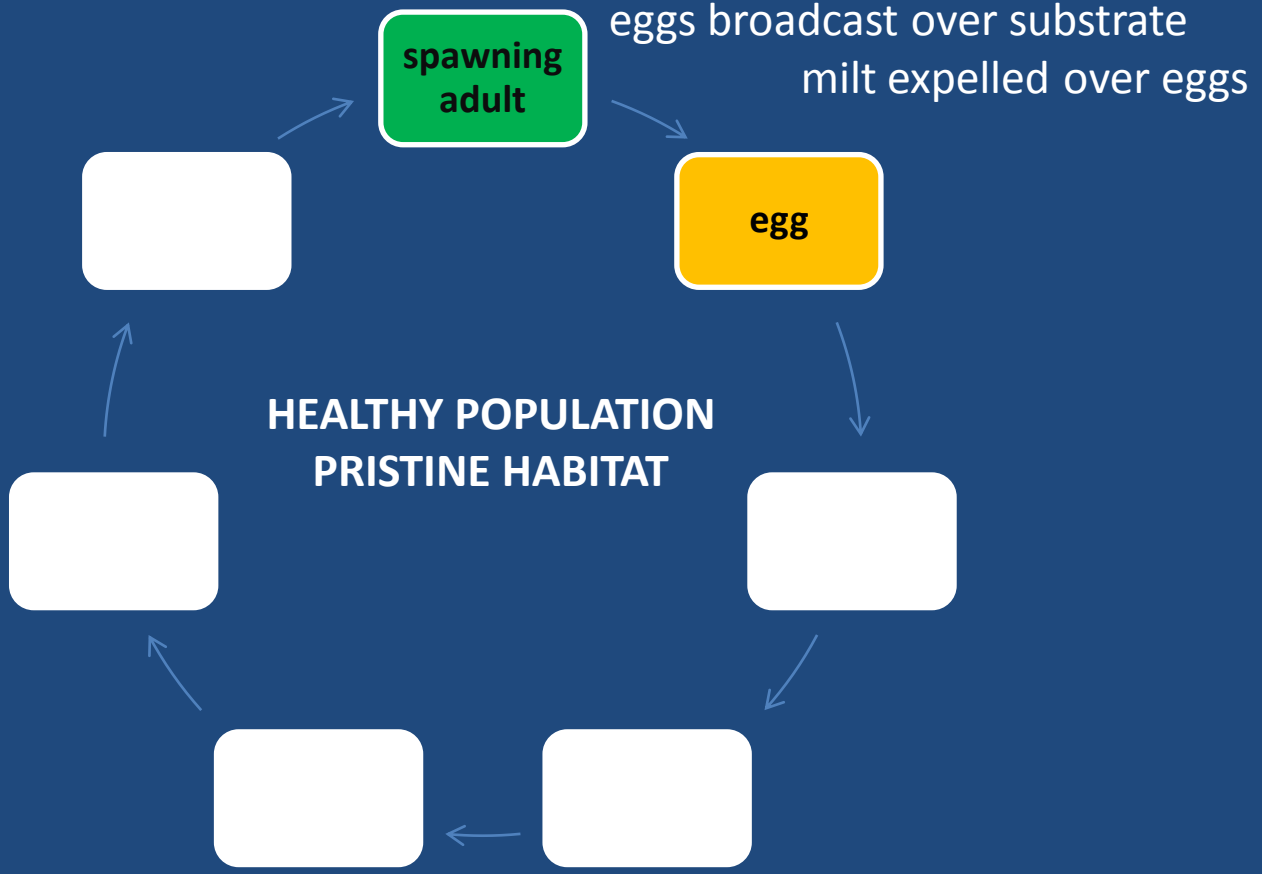

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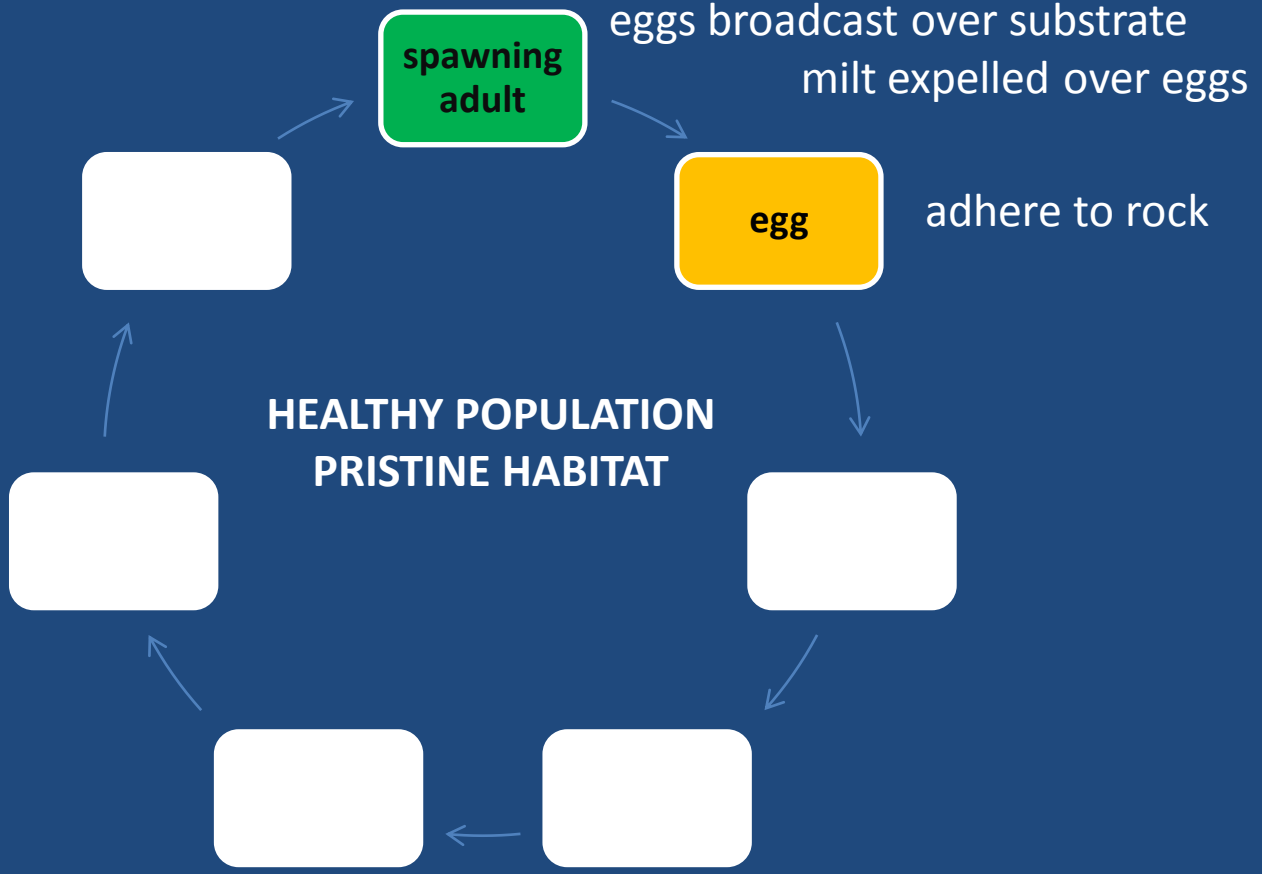

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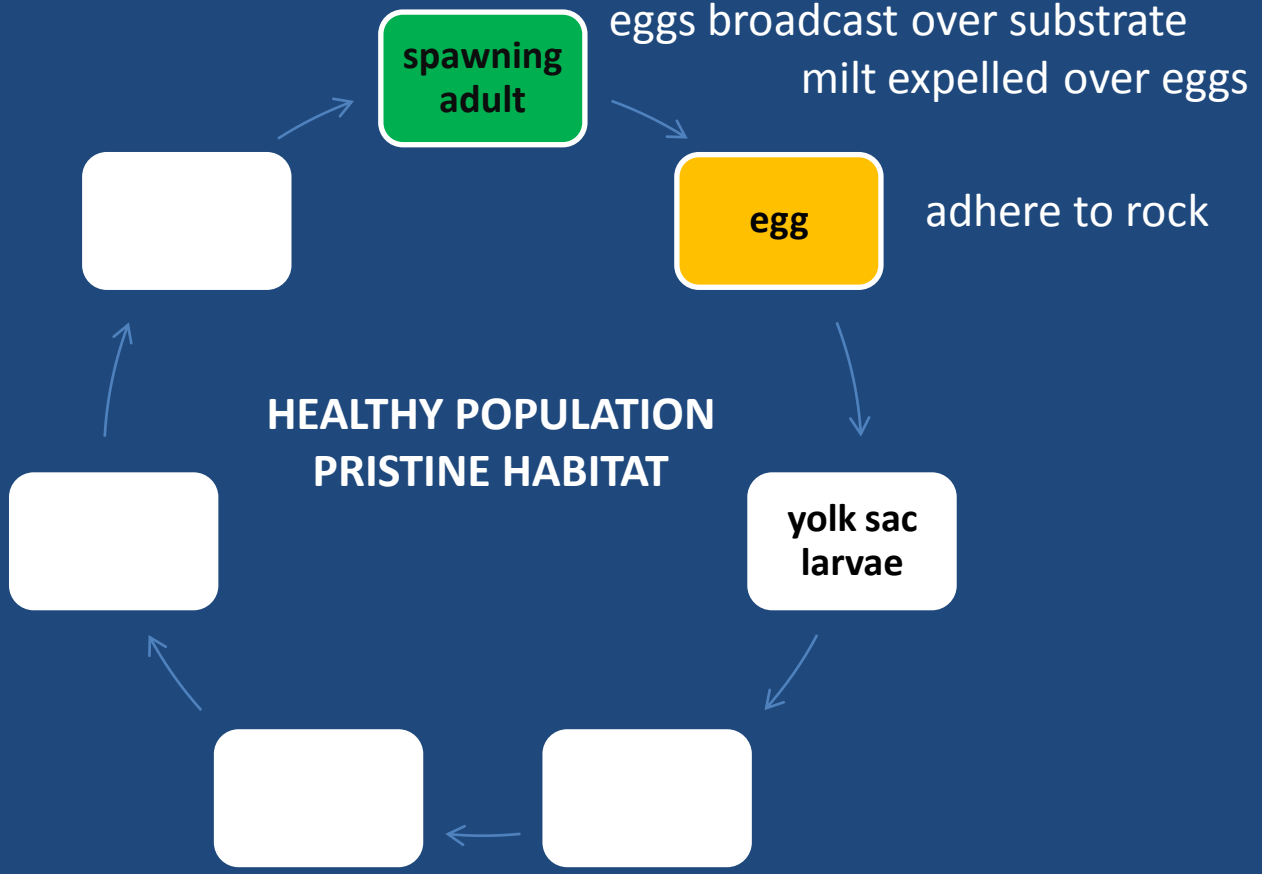

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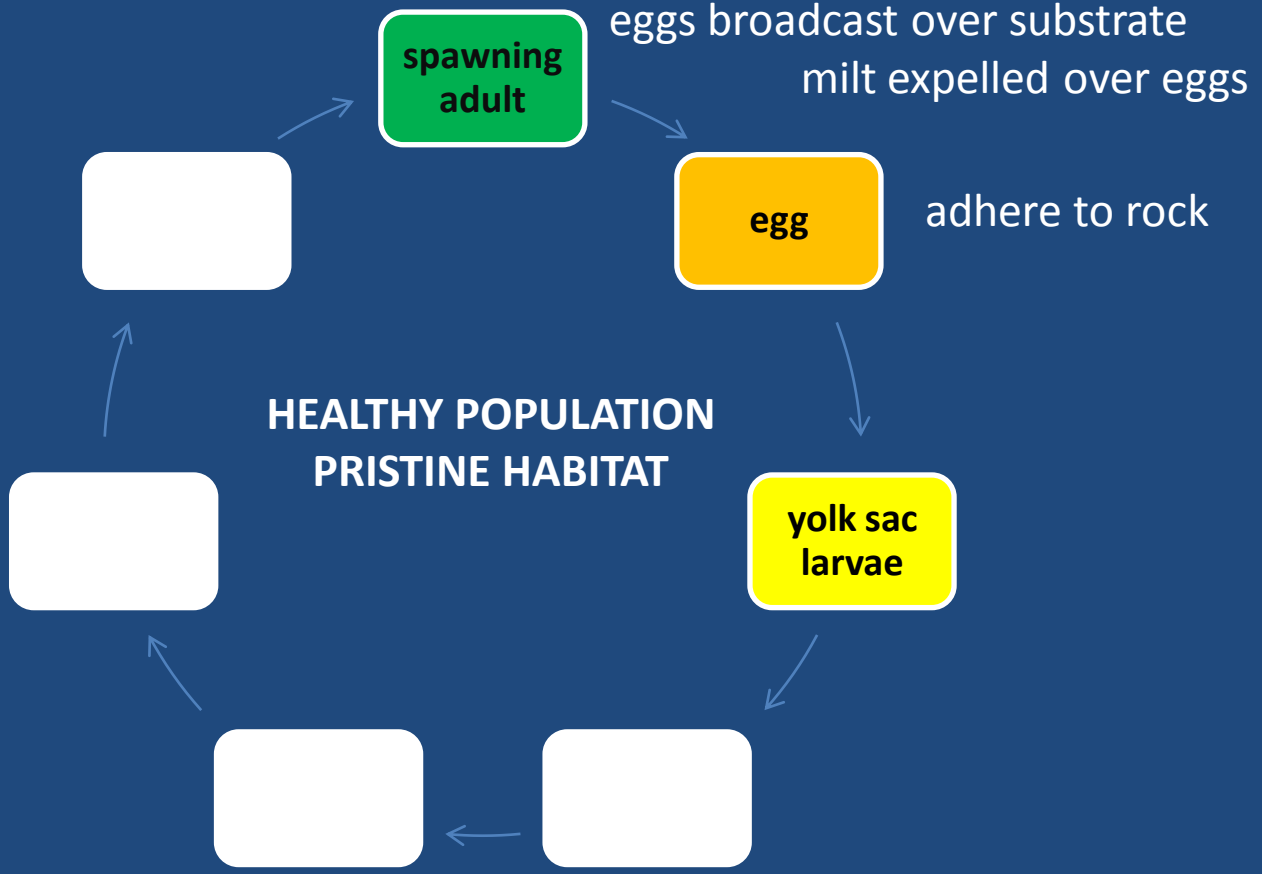

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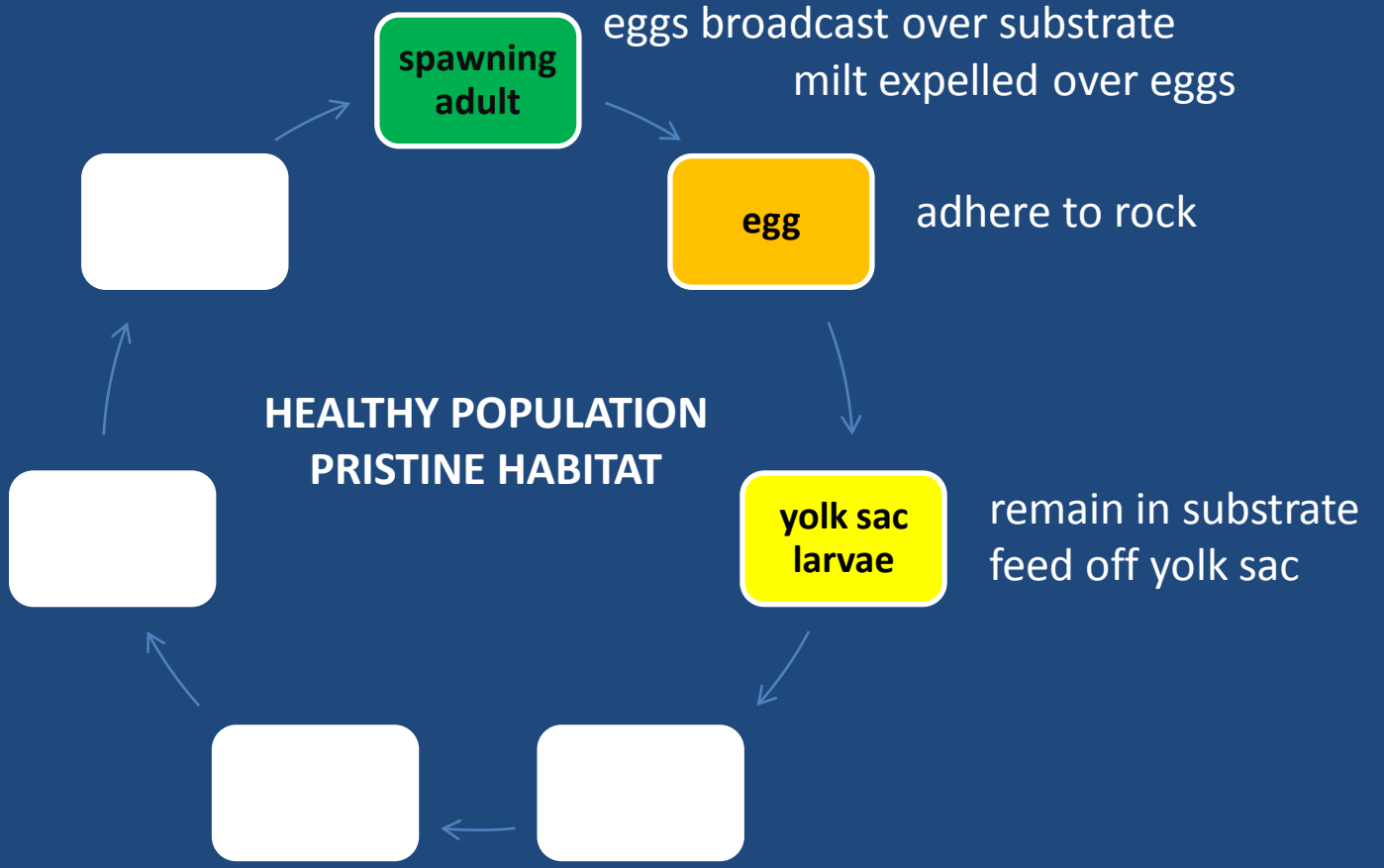

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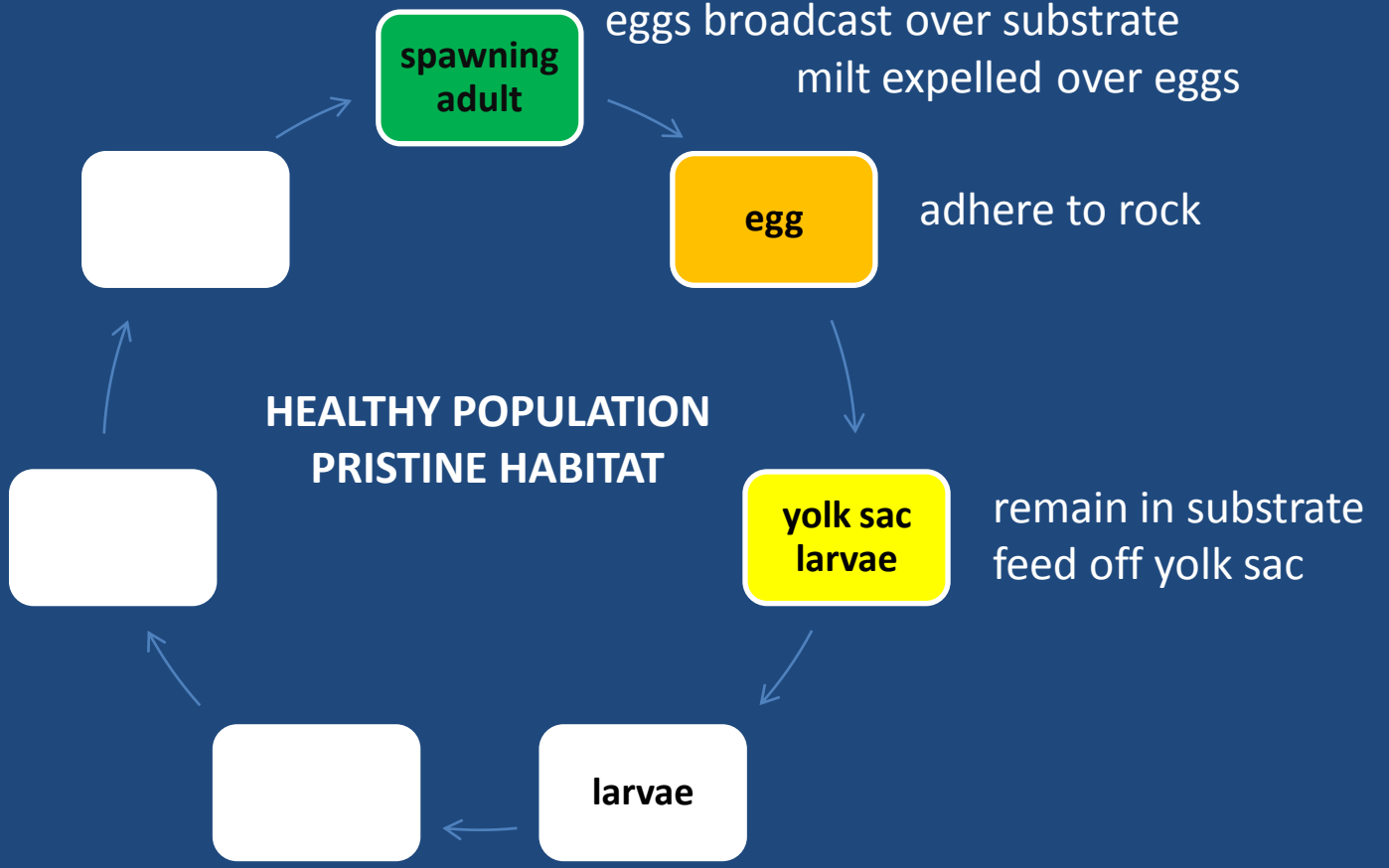

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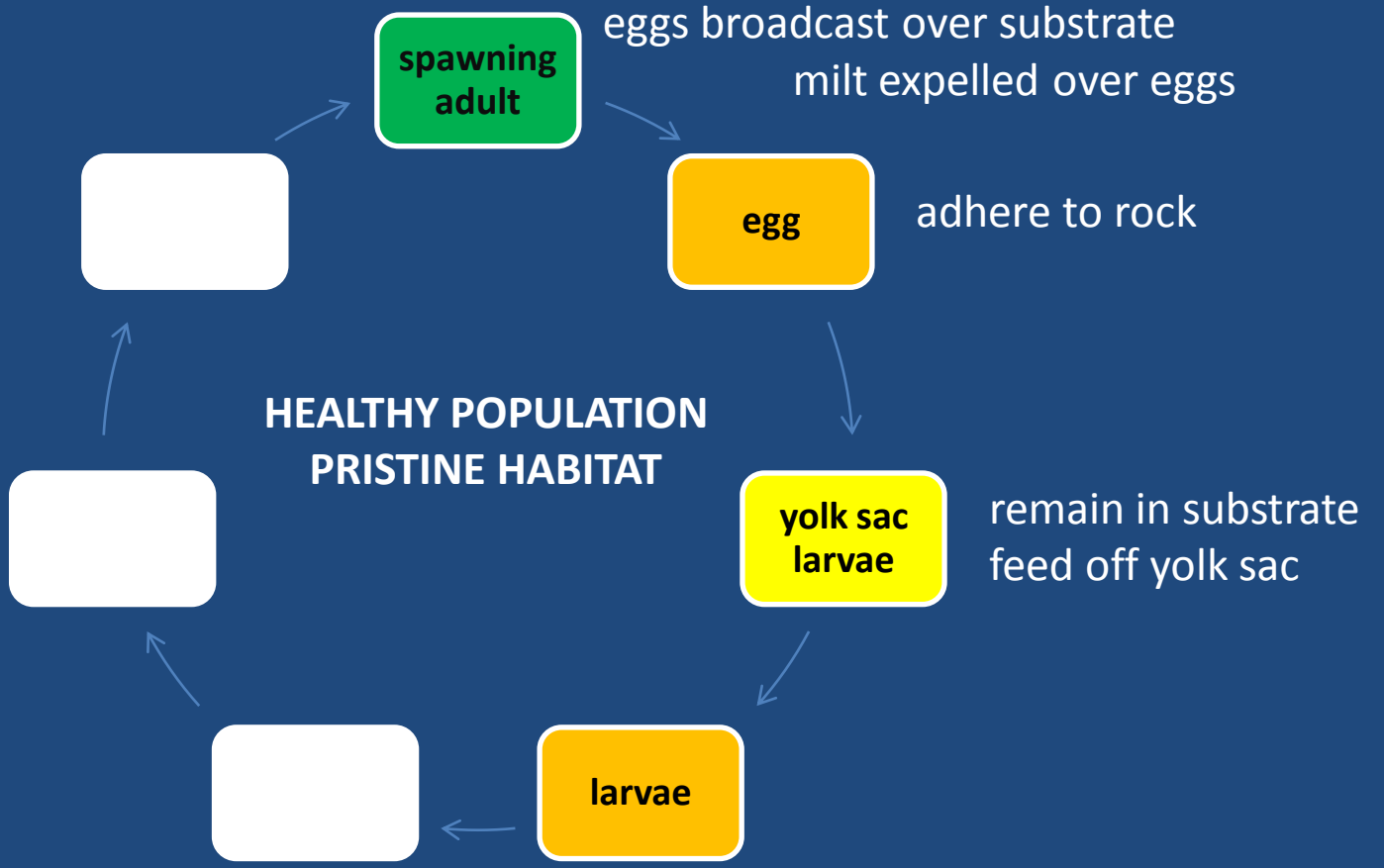

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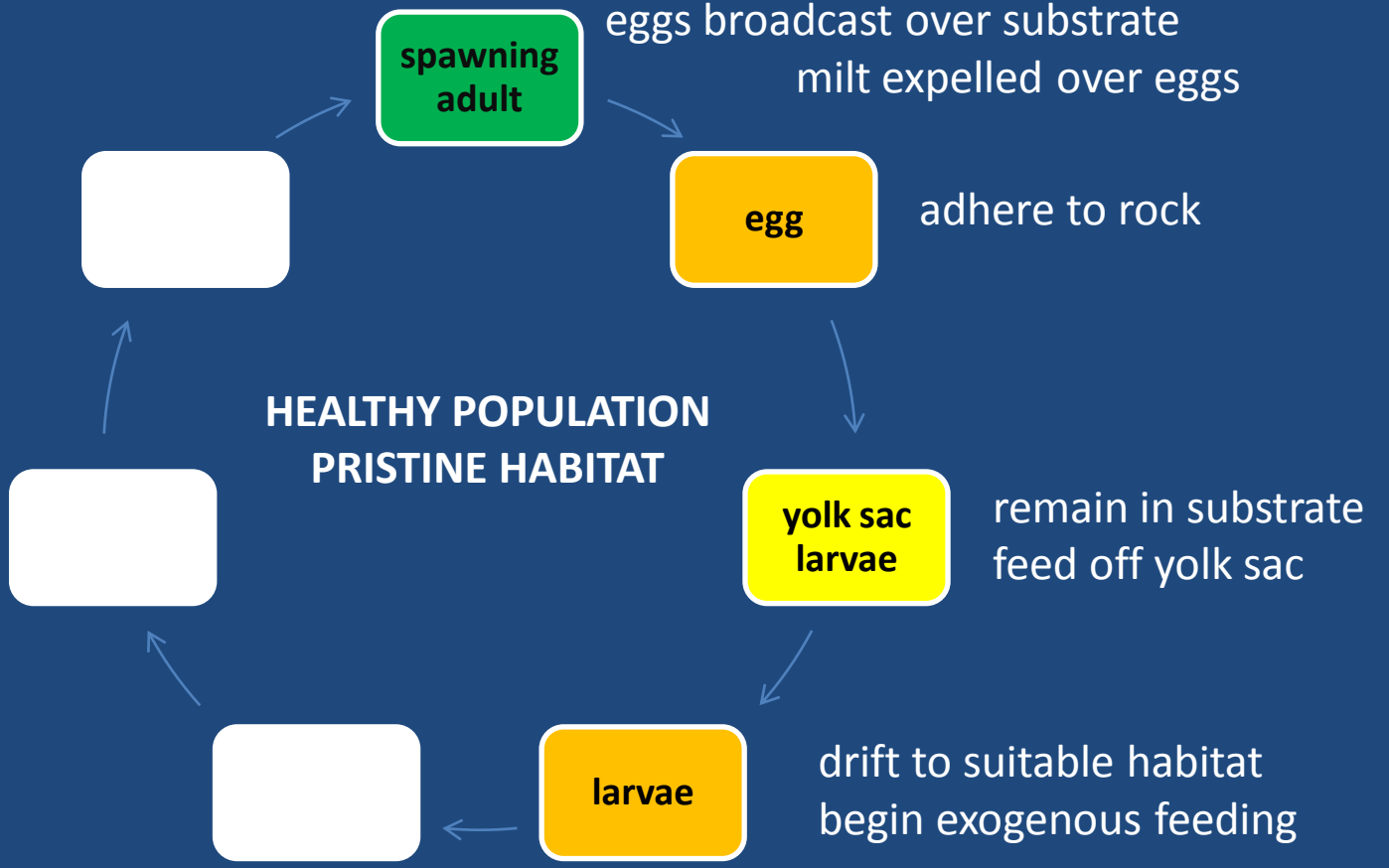

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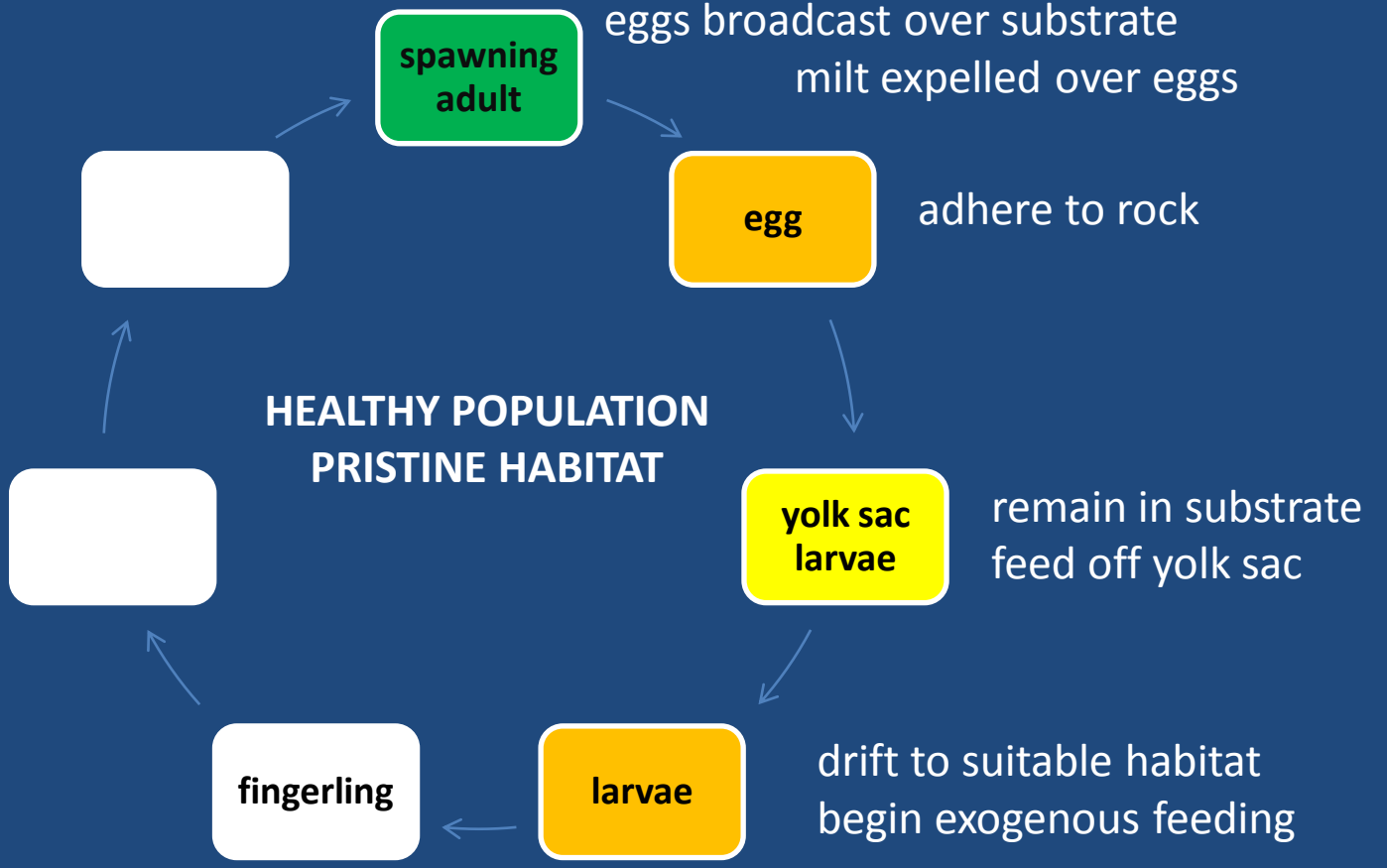

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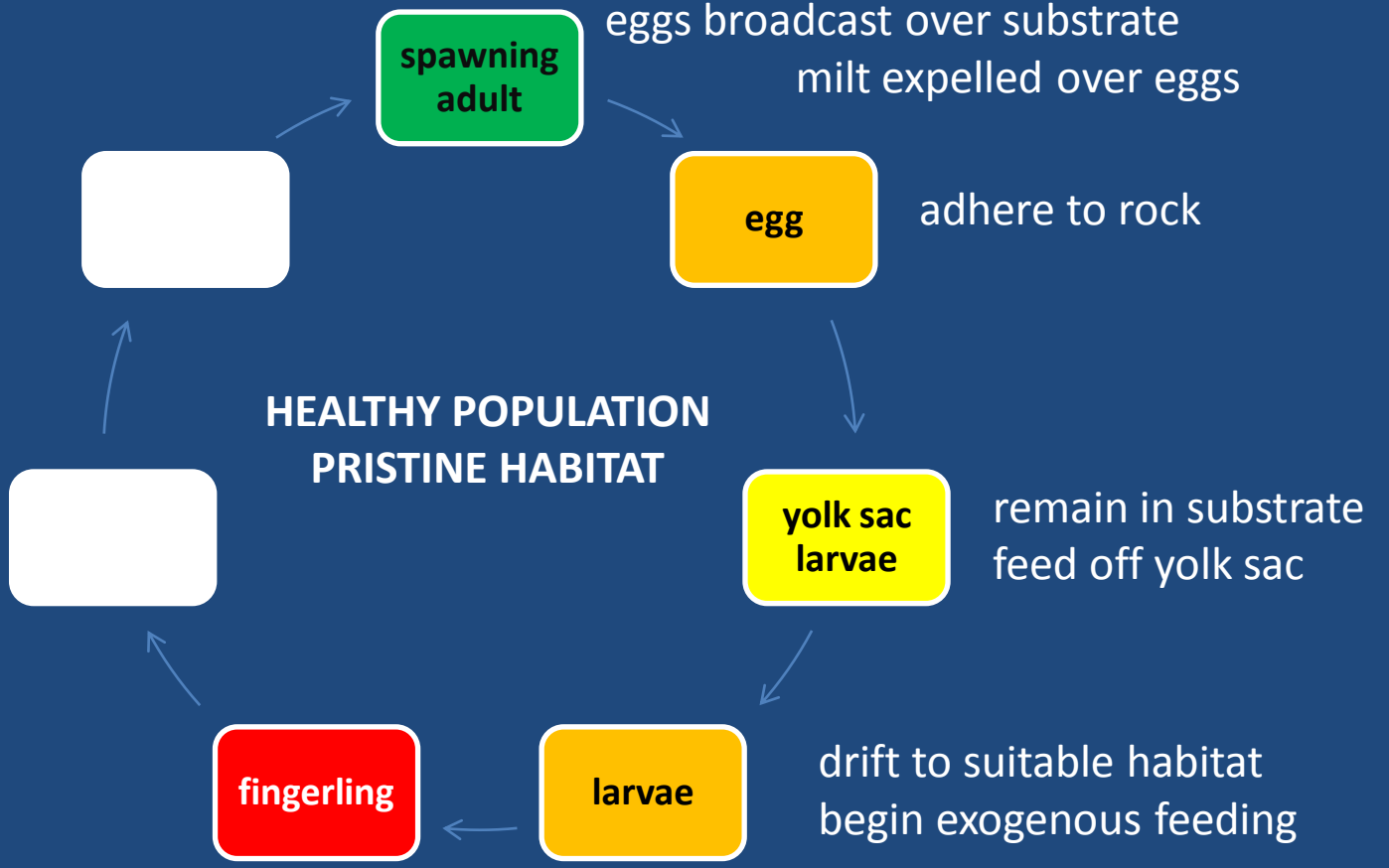

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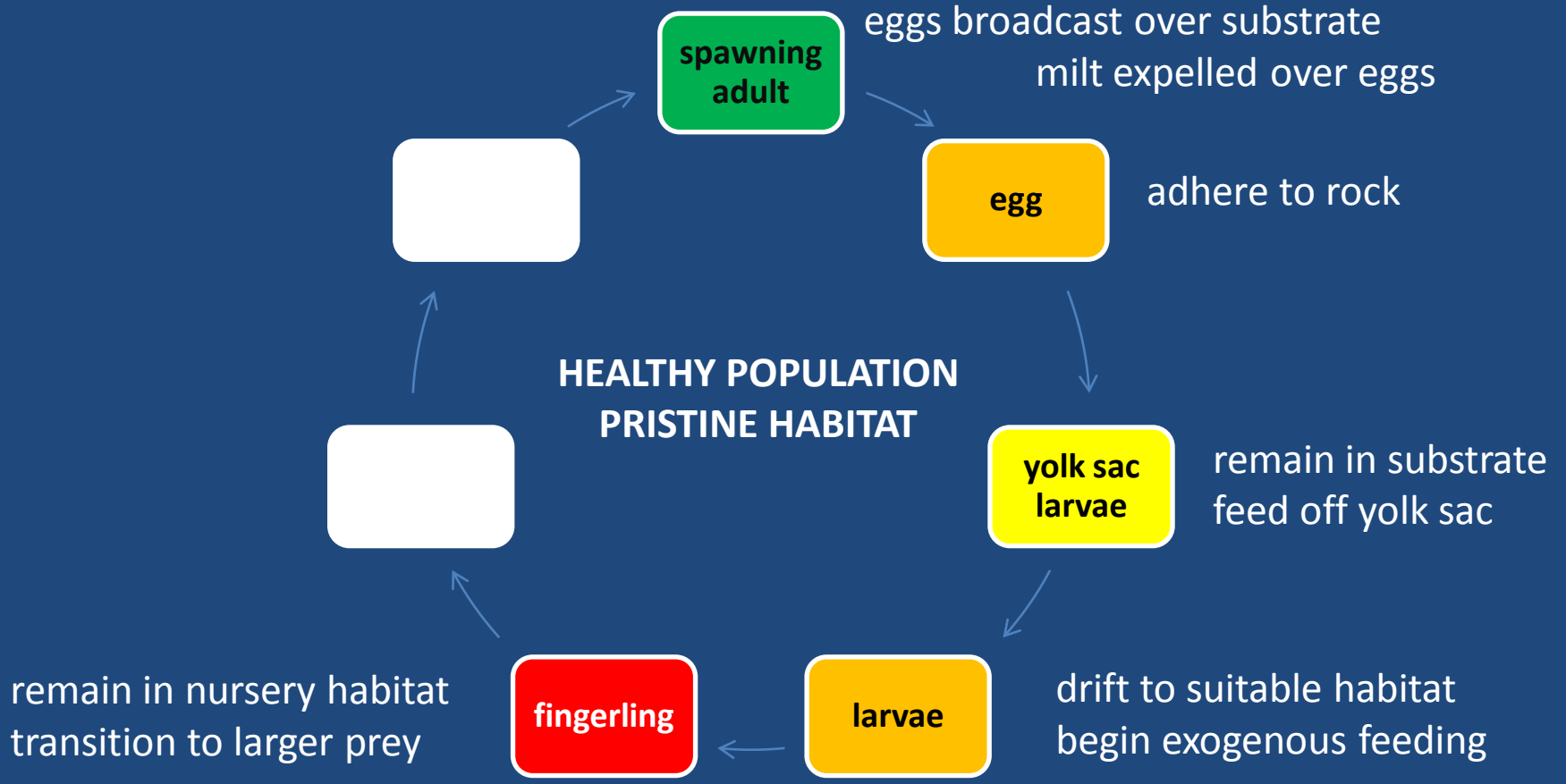

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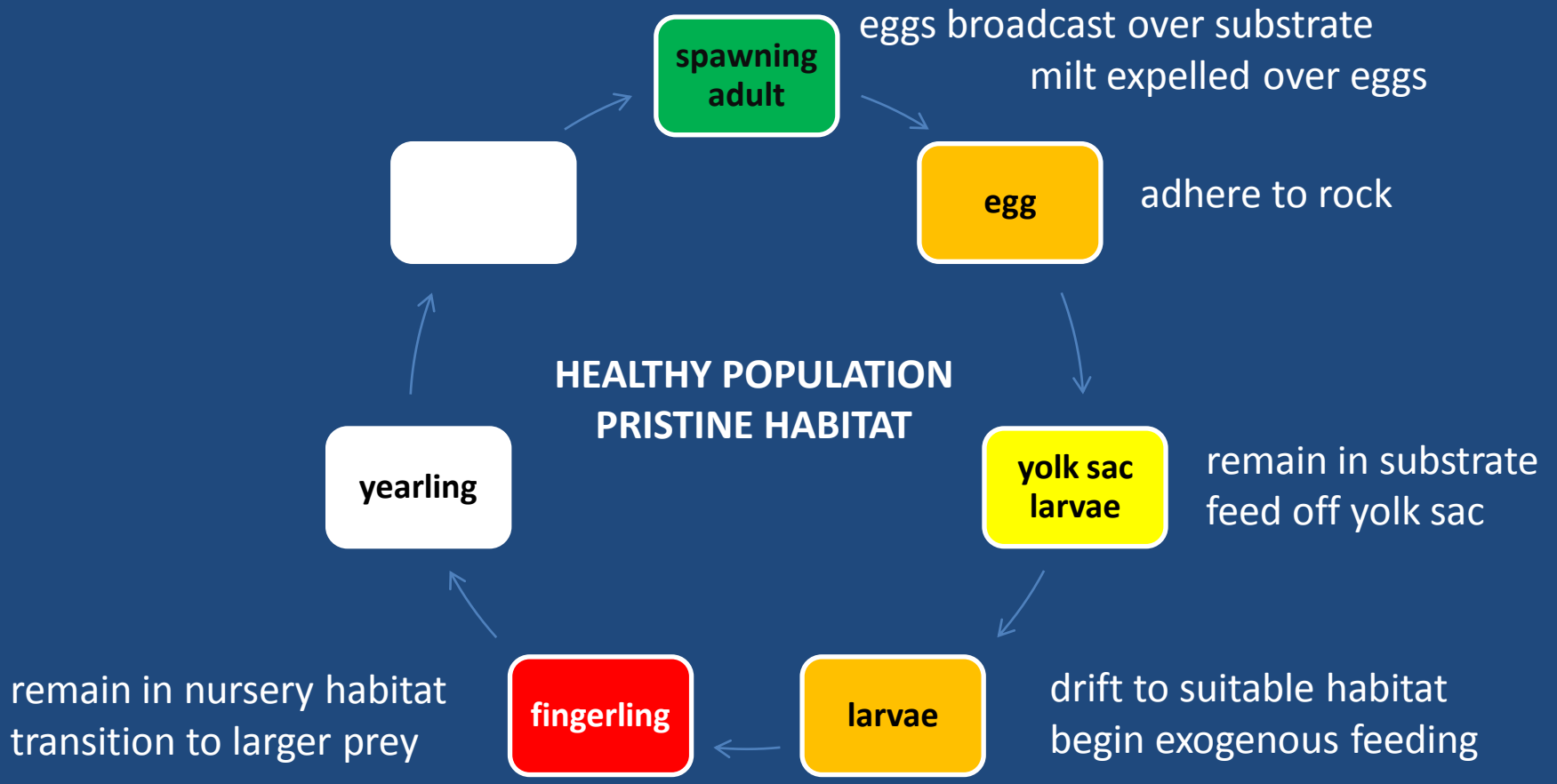

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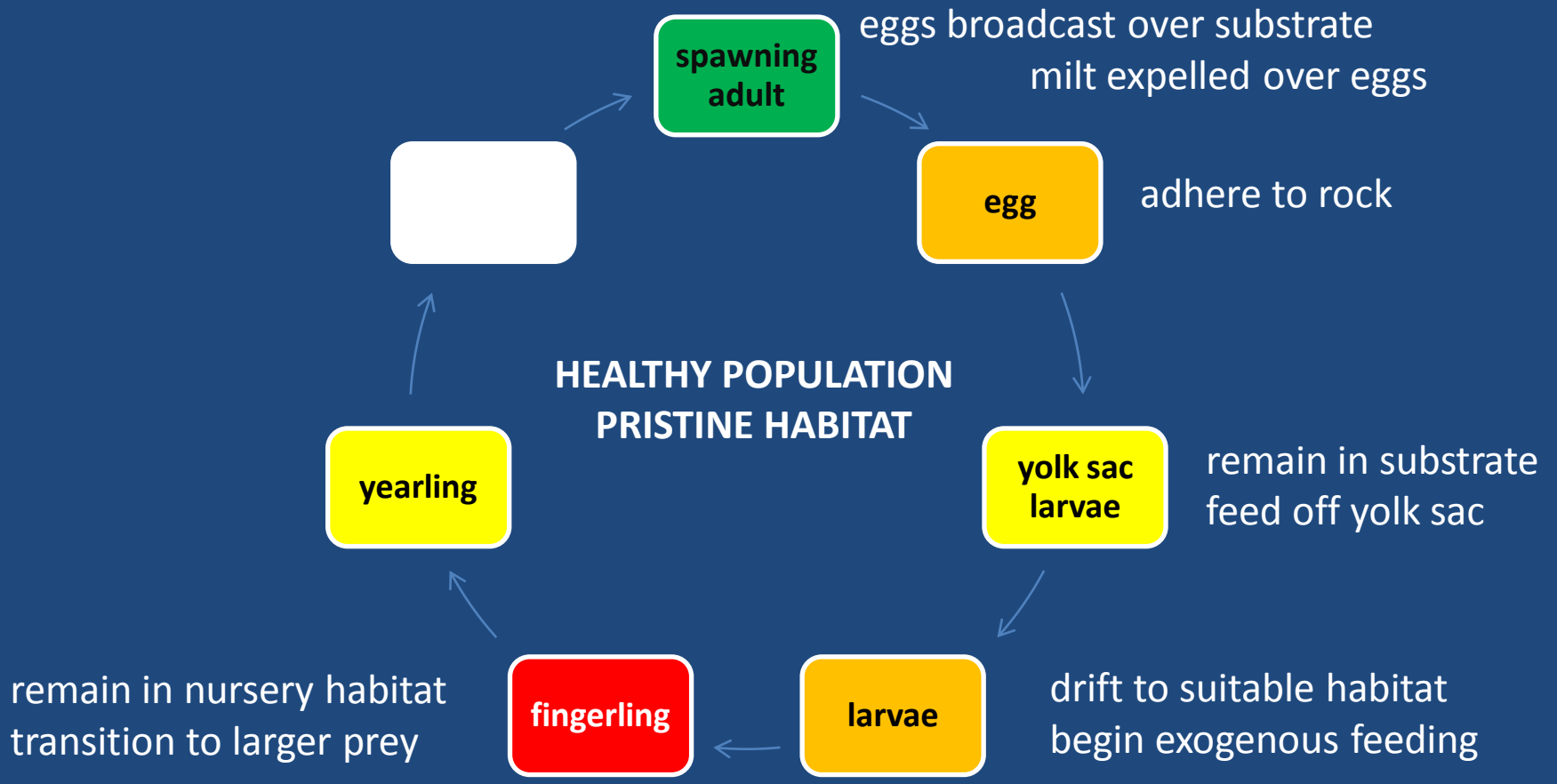

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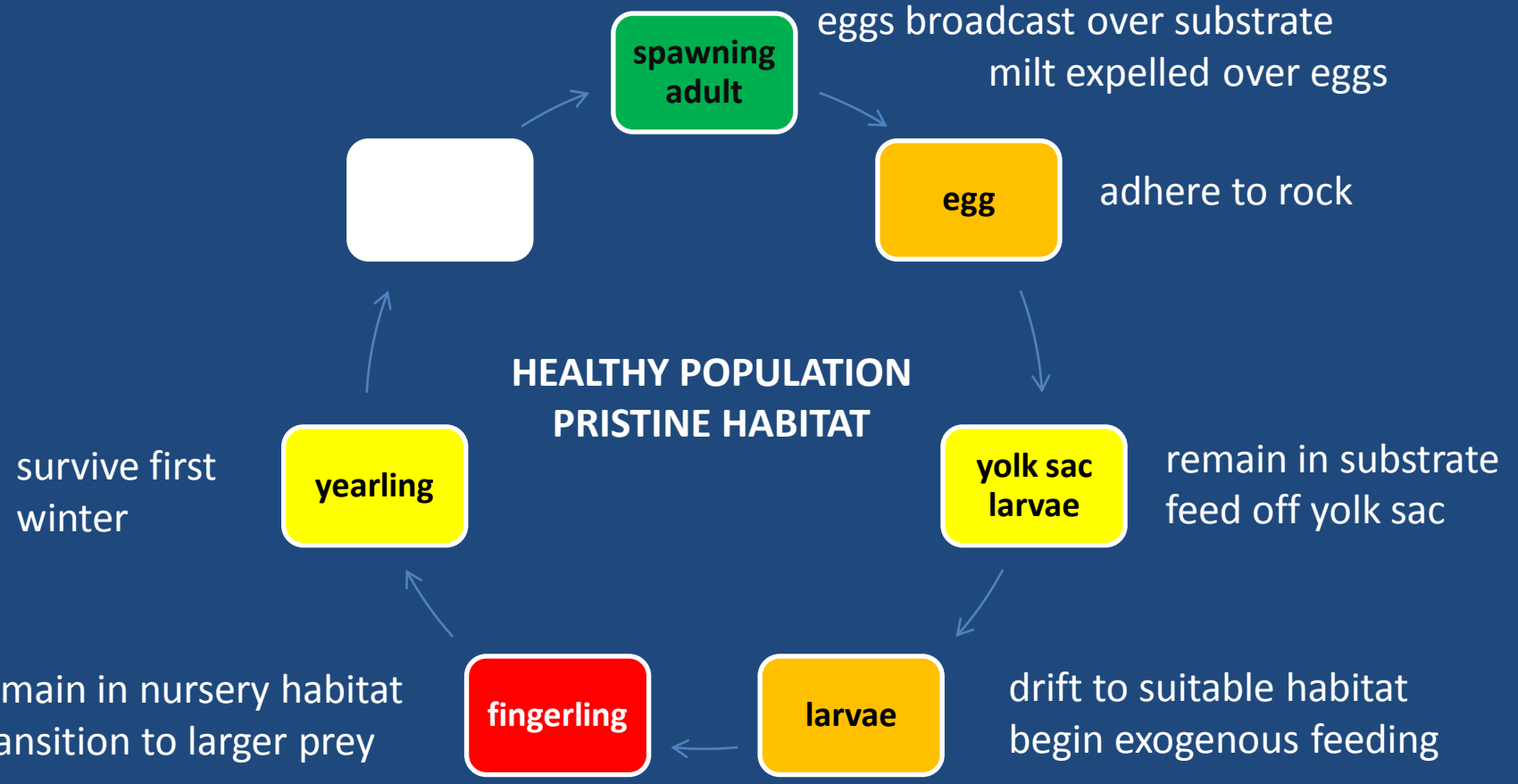

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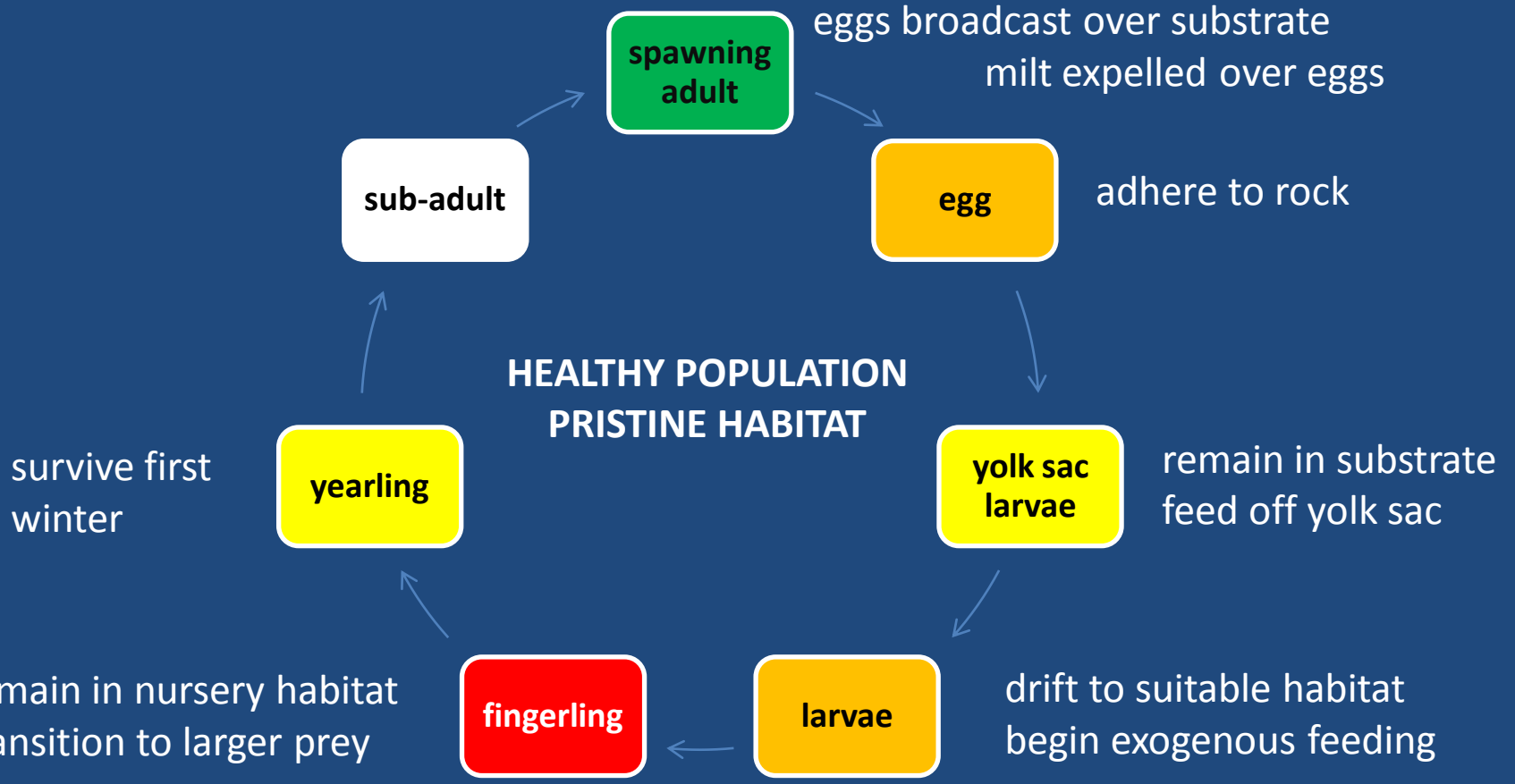

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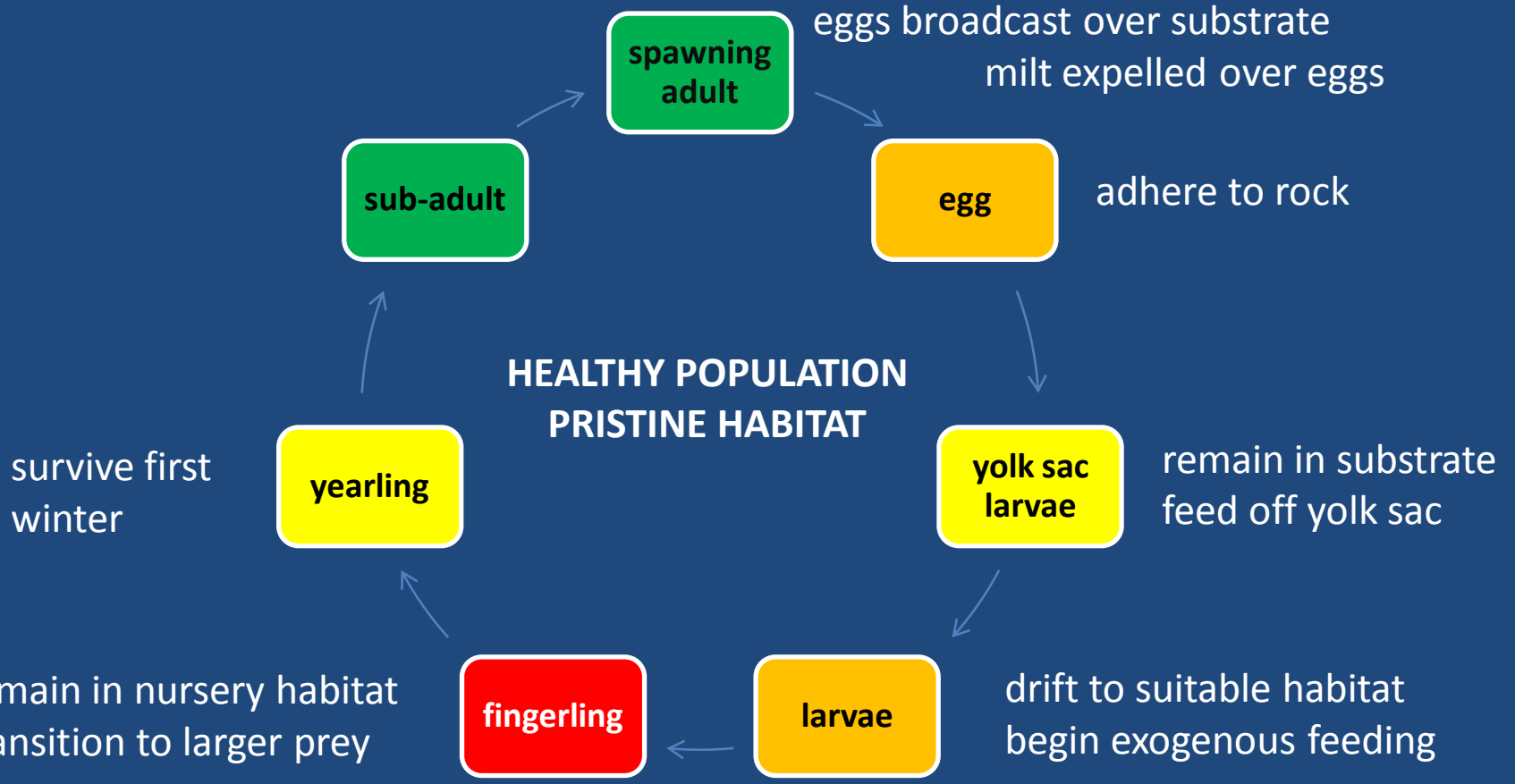

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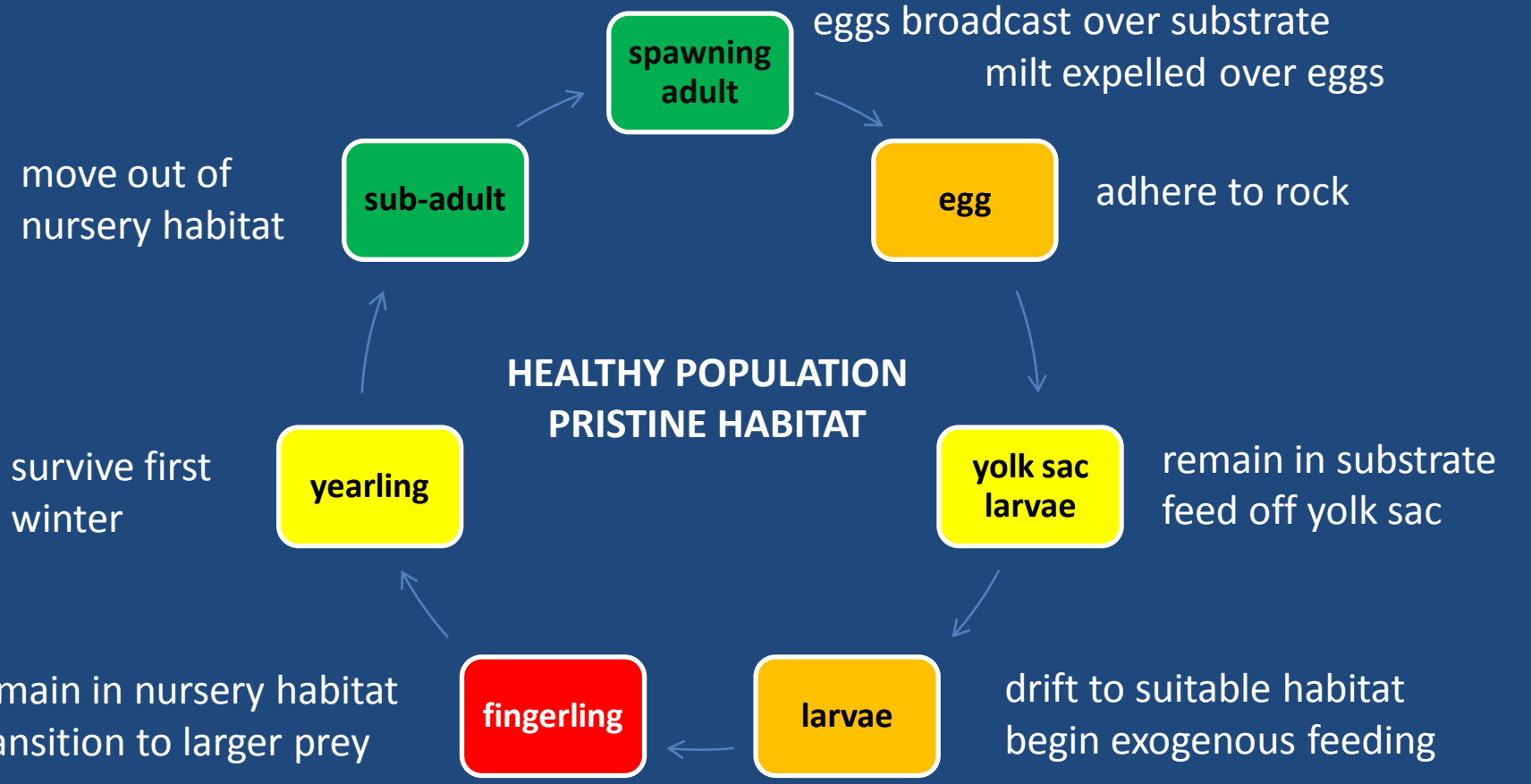

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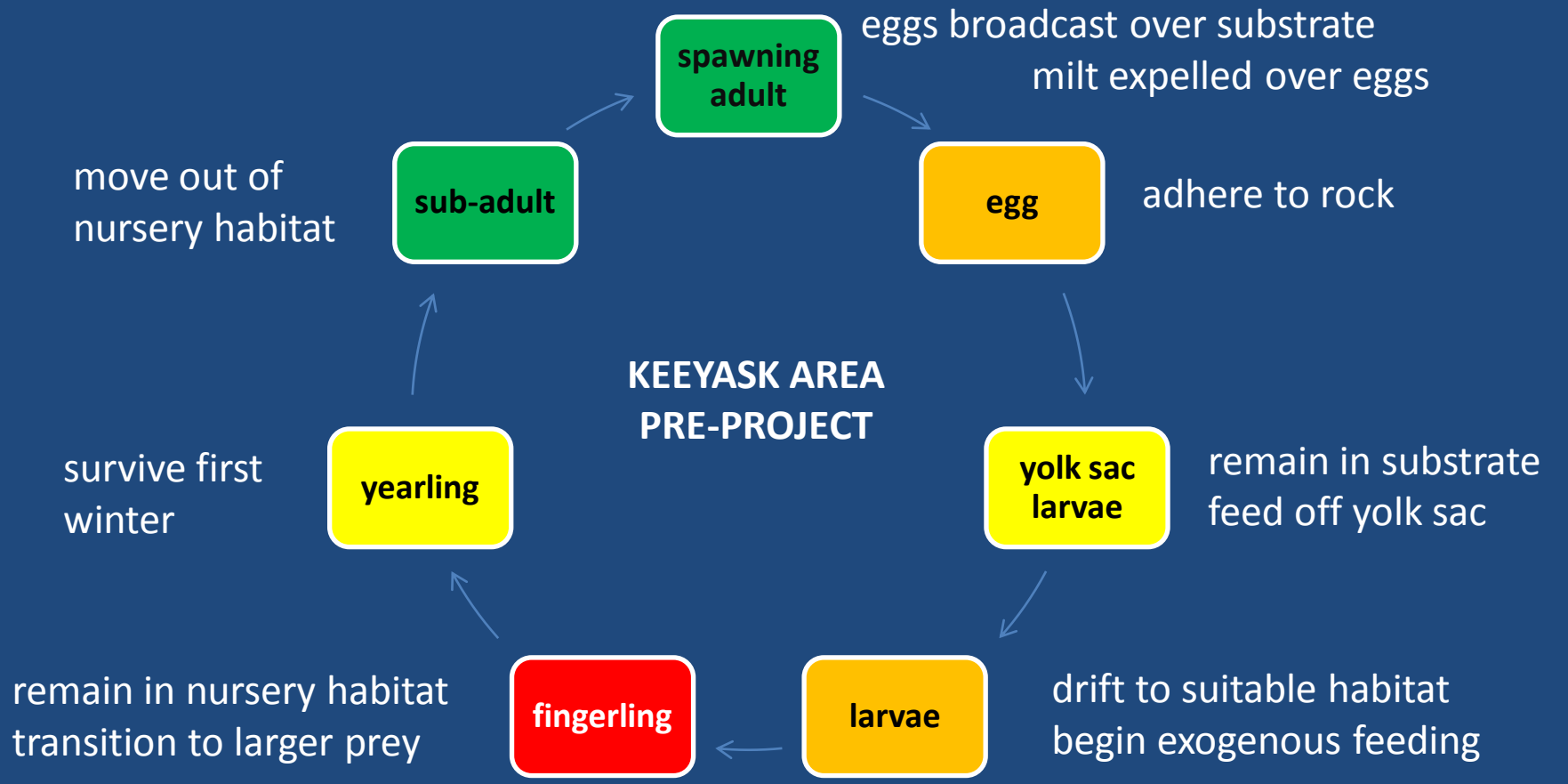

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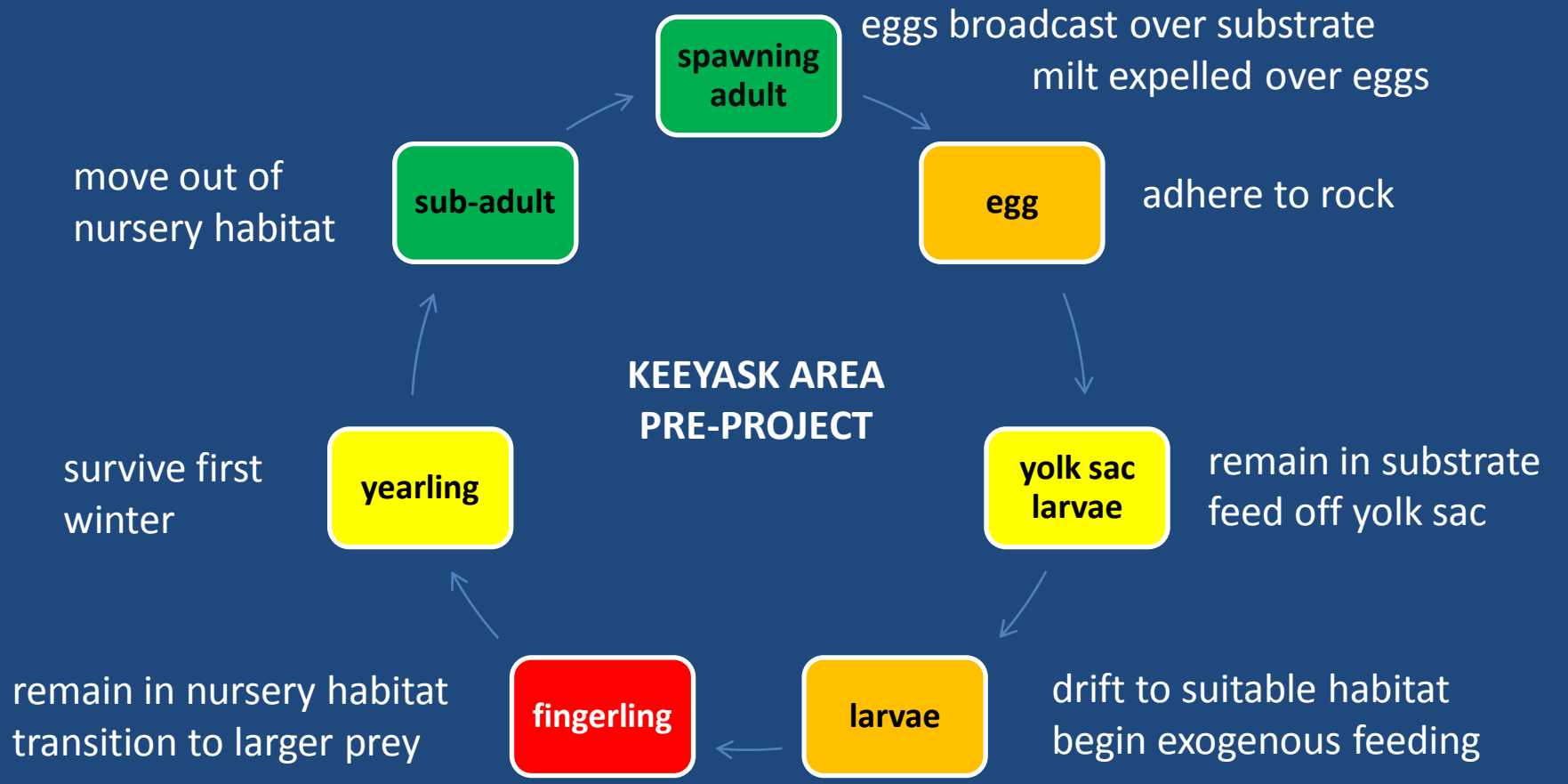

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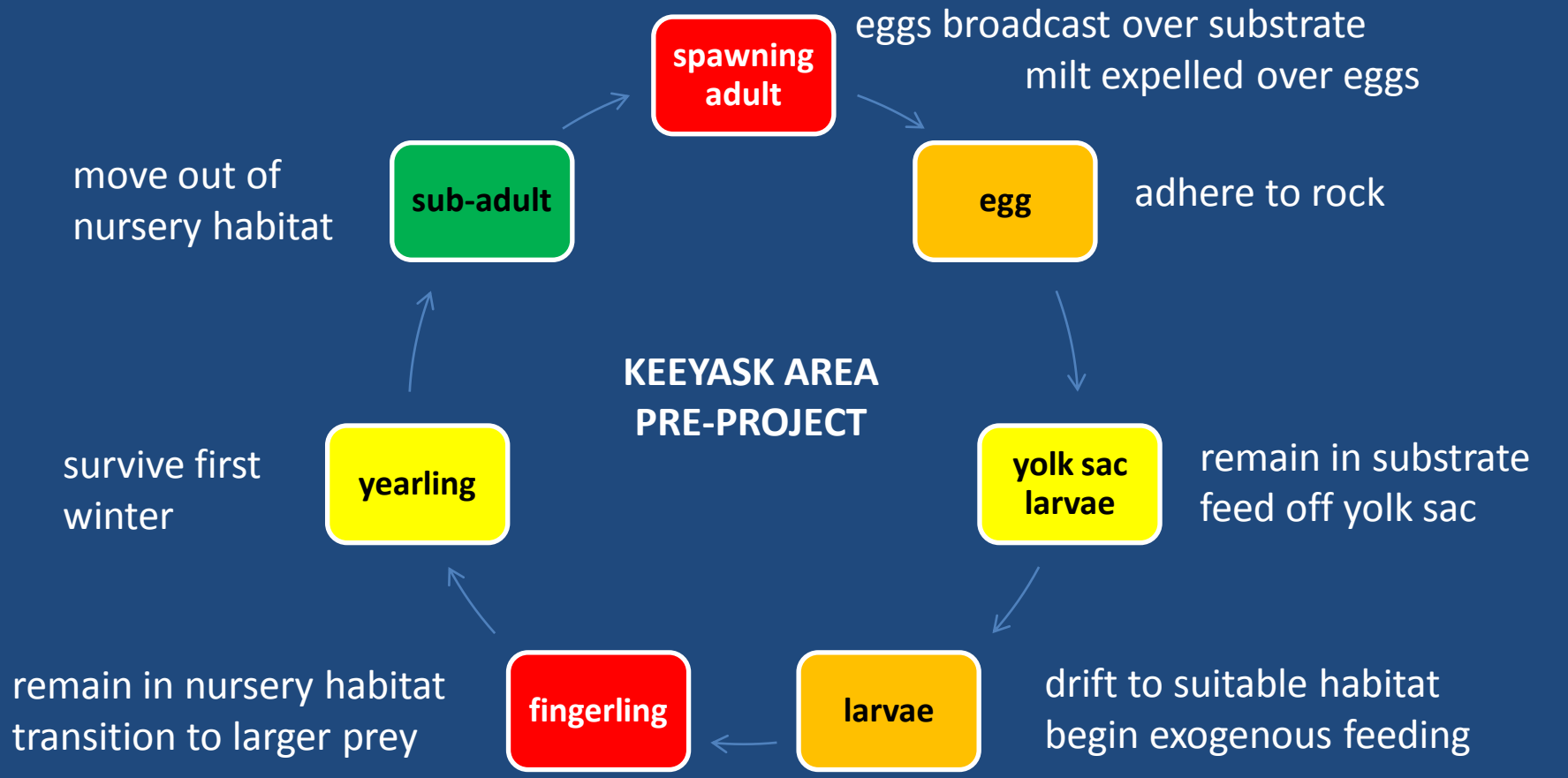

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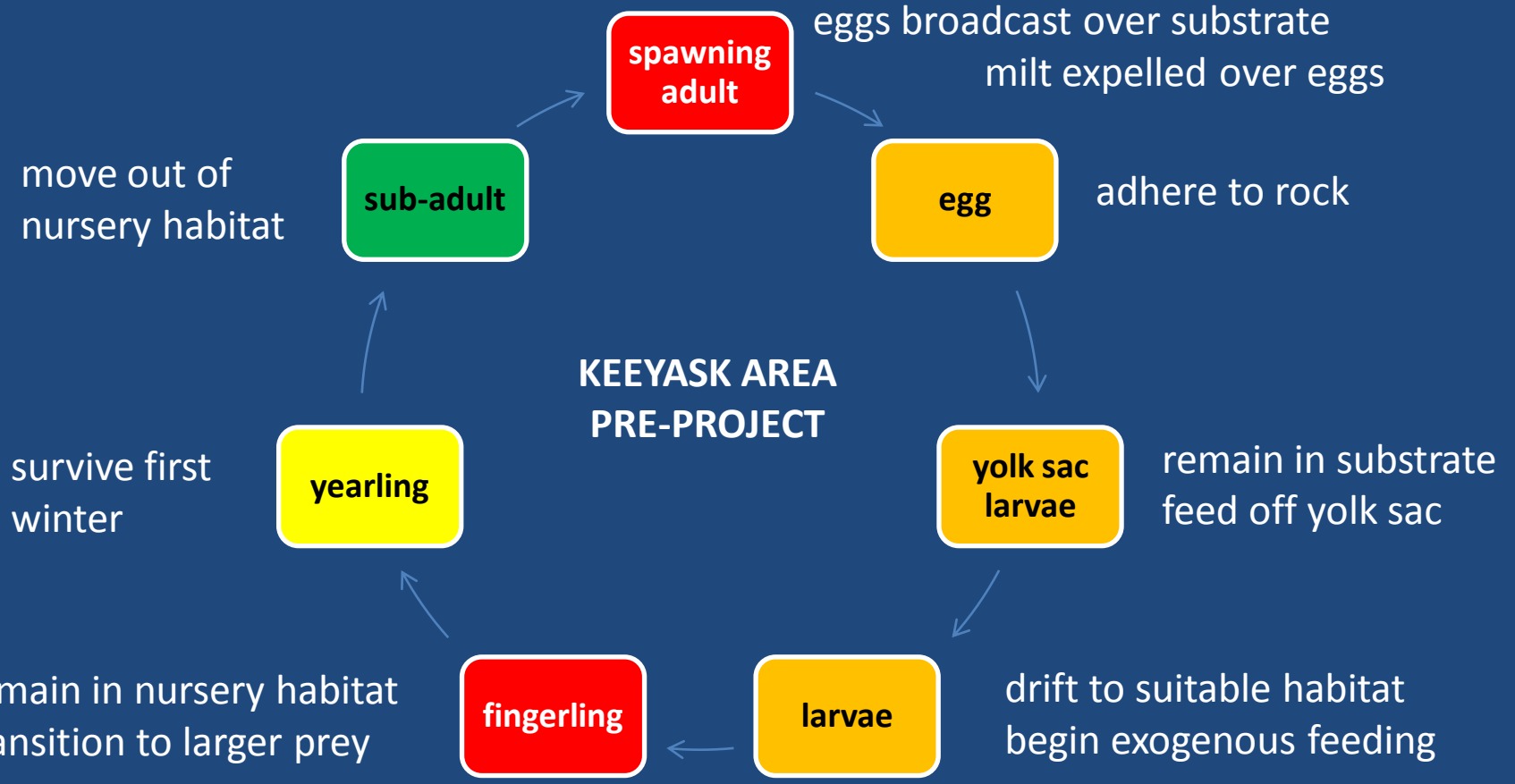

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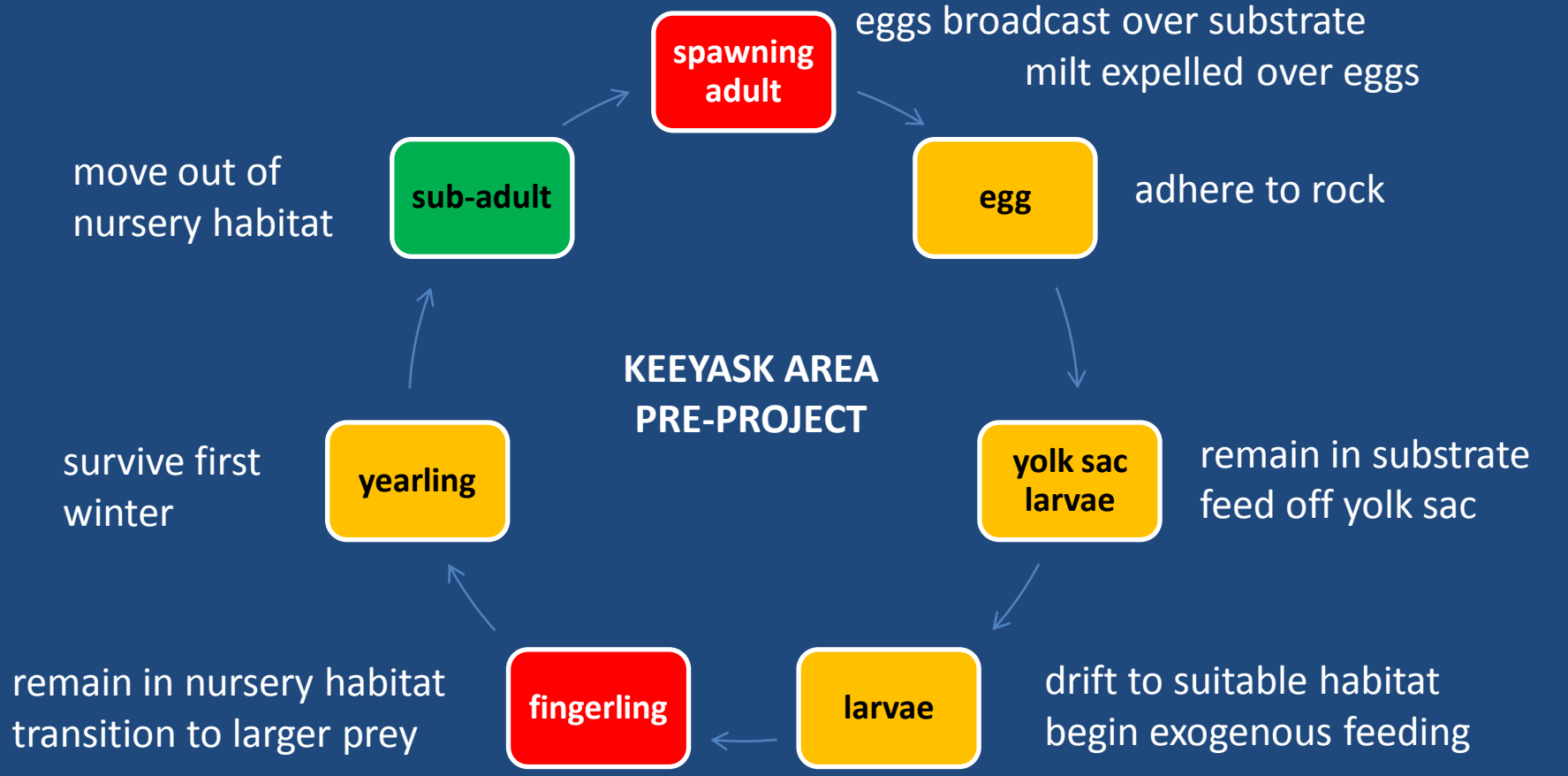

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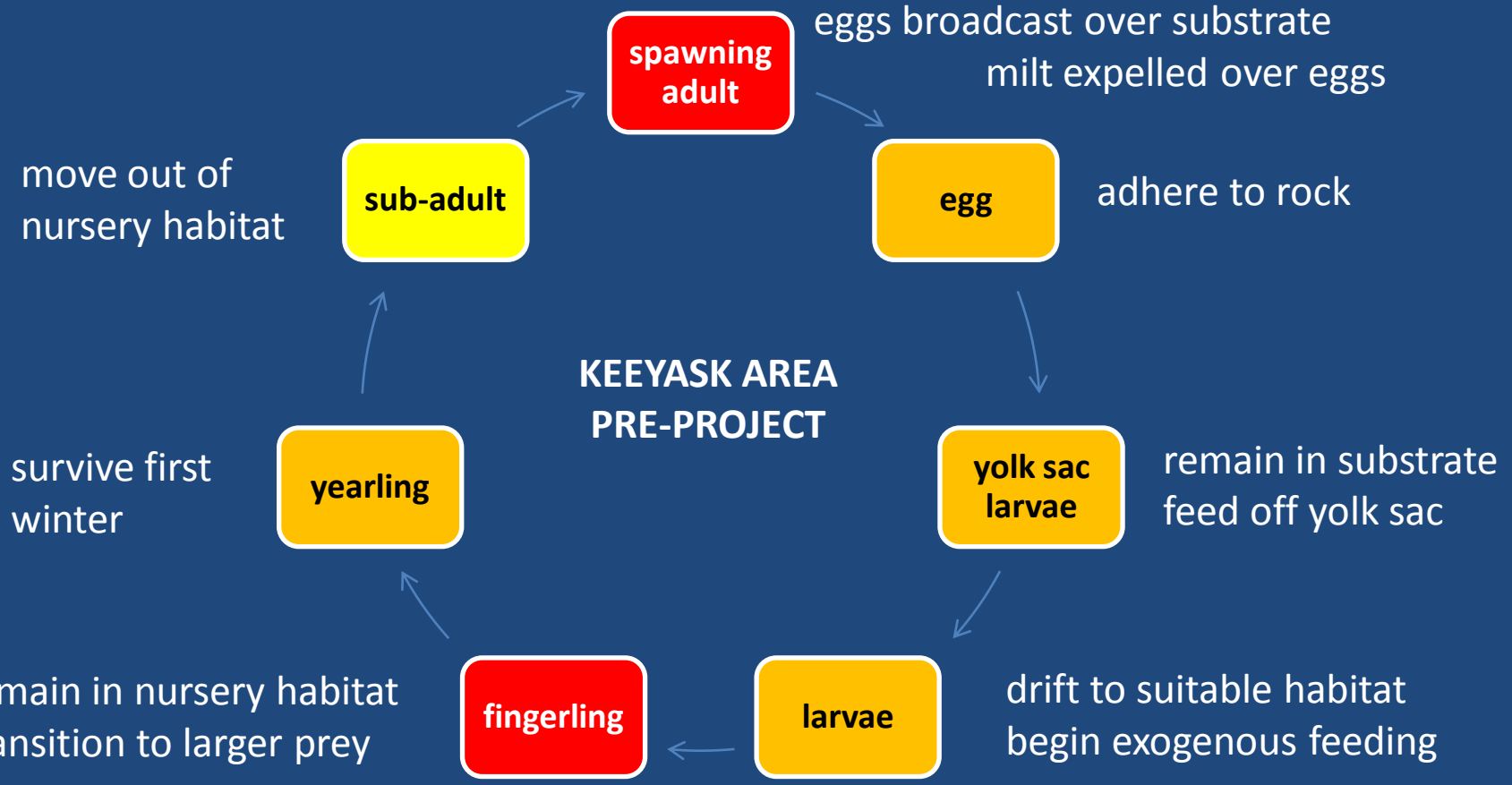

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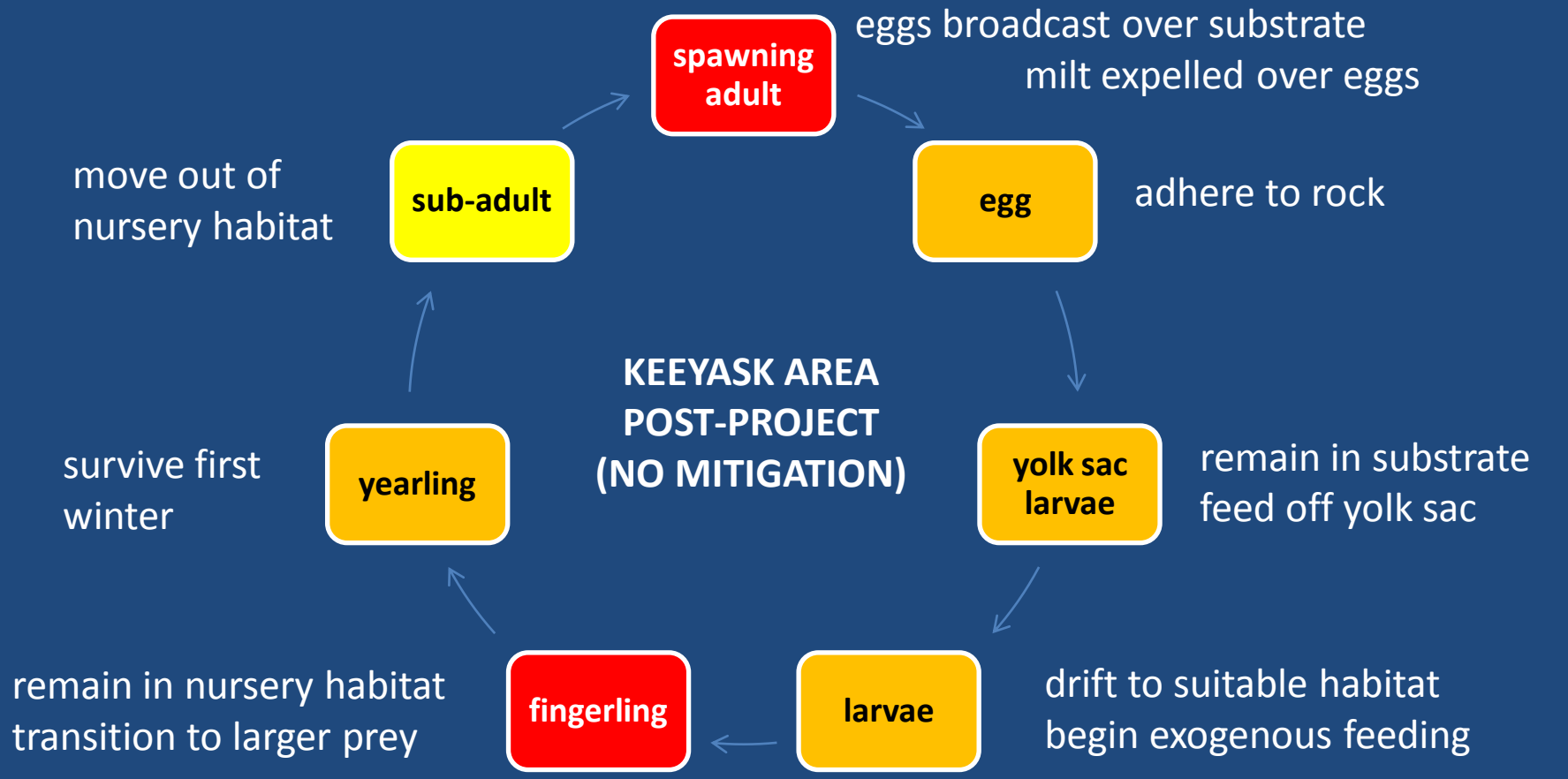

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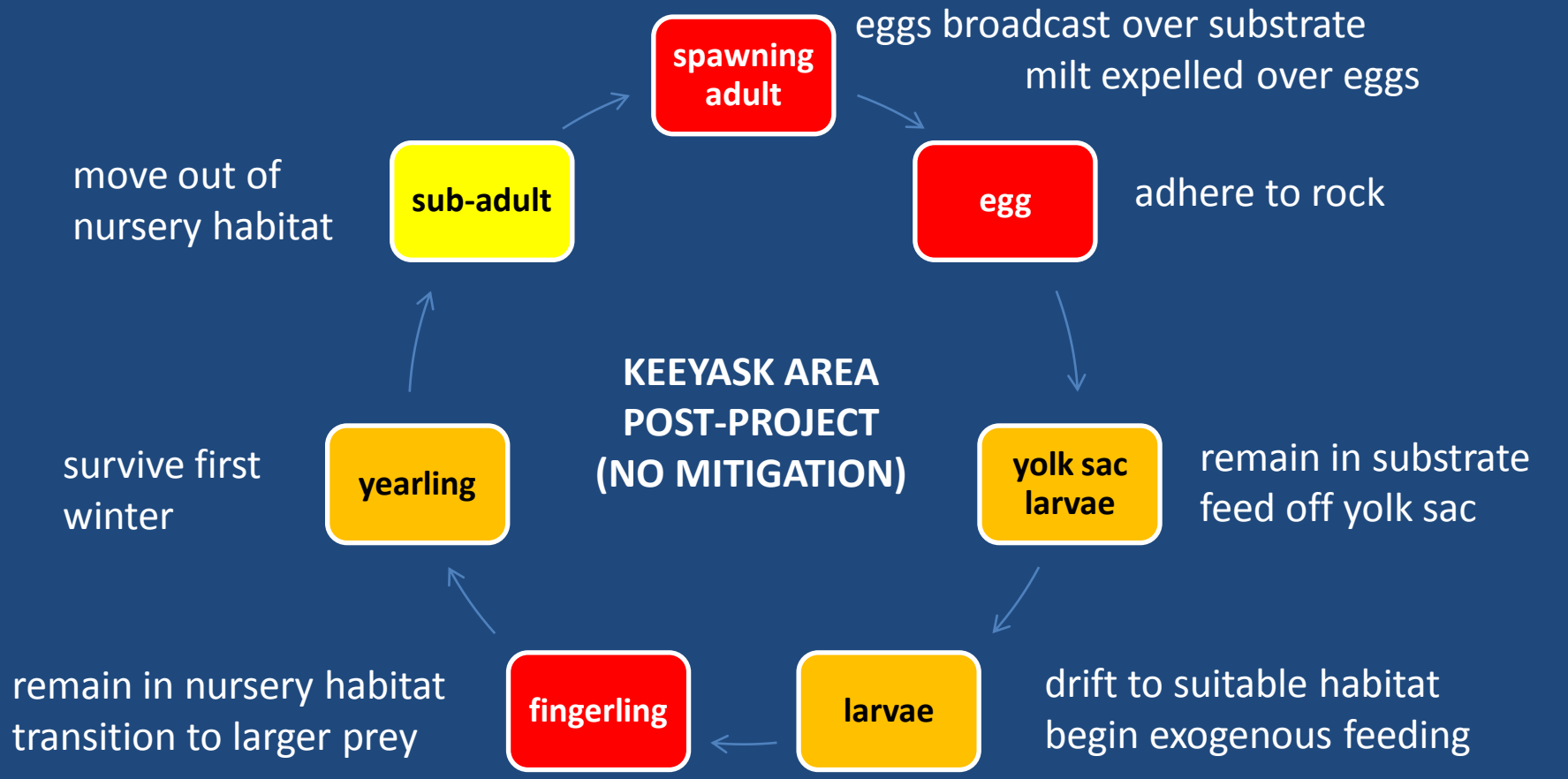

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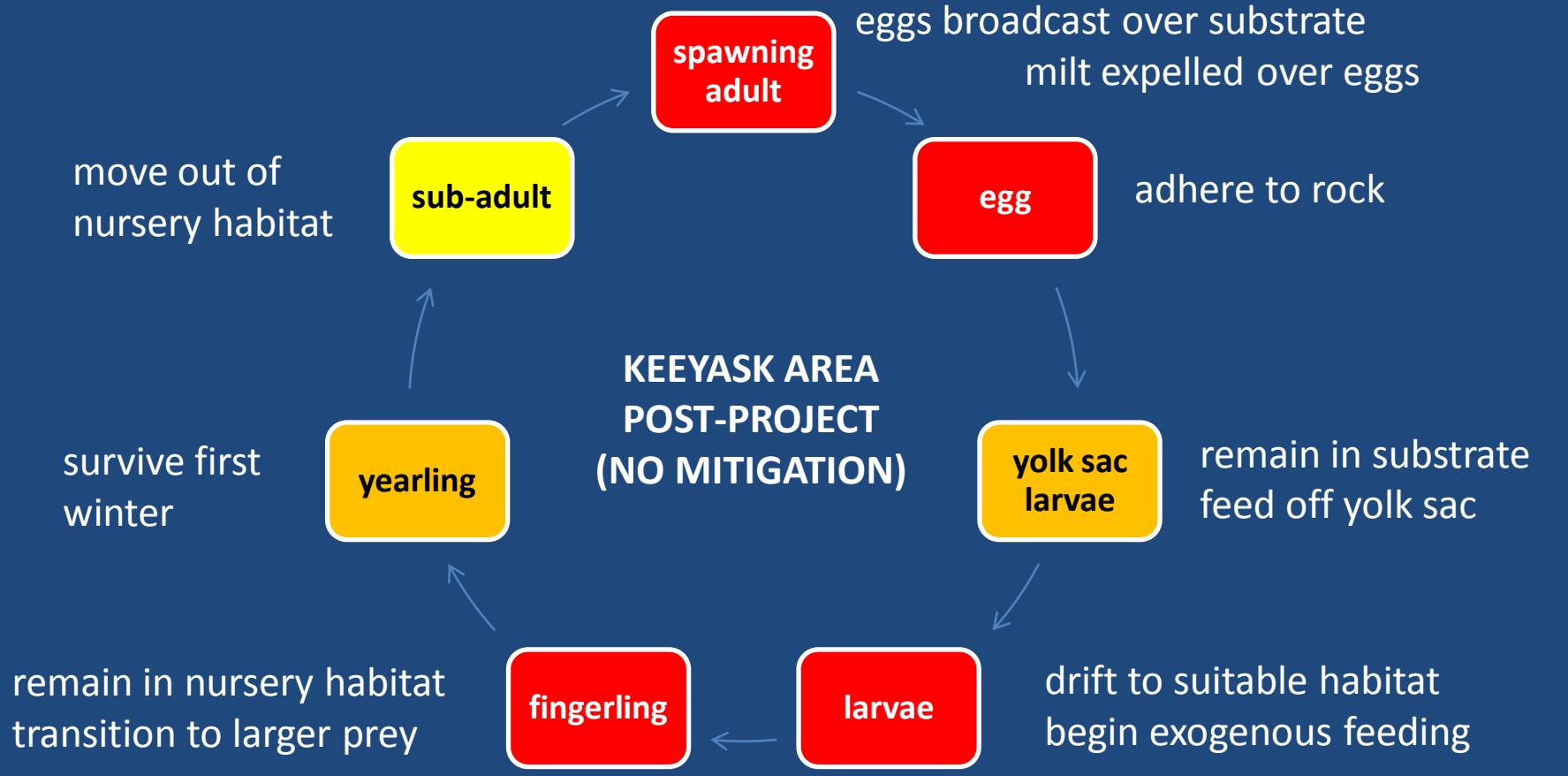

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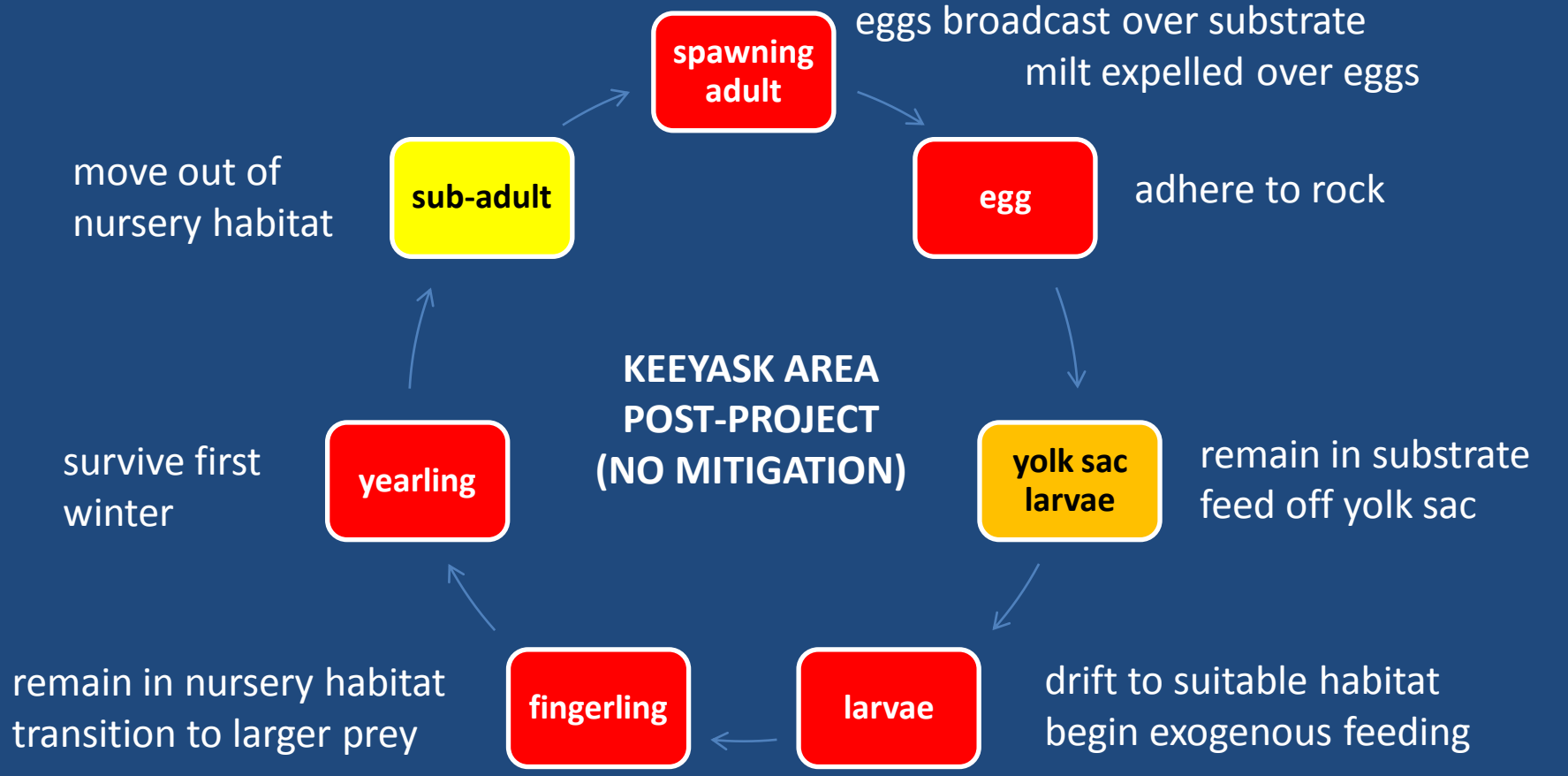

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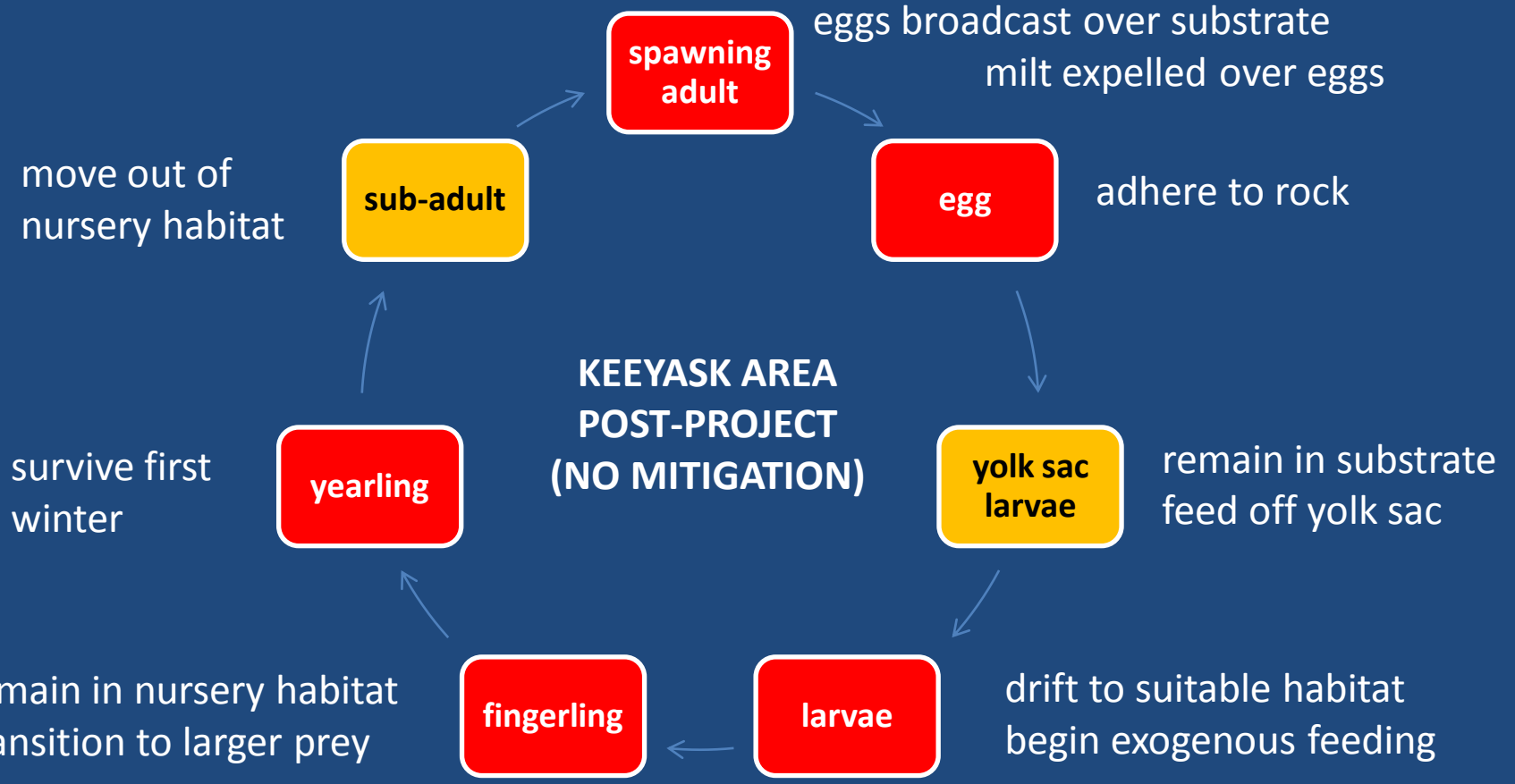

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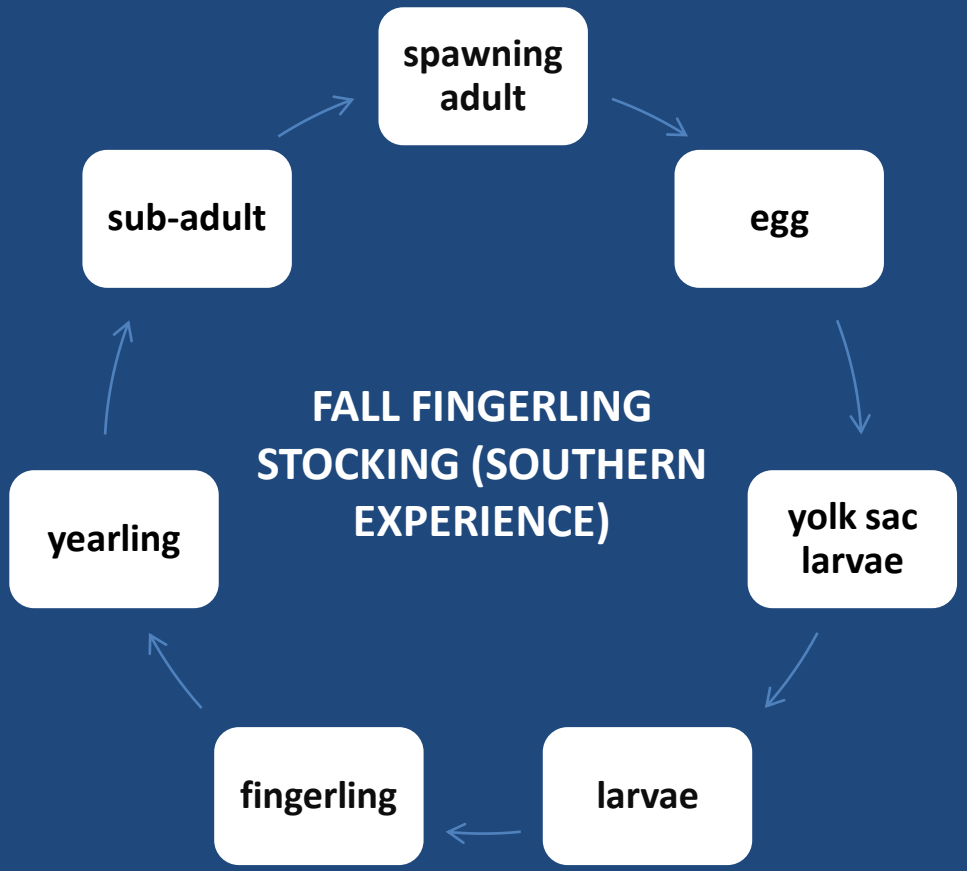
Lake Sturgeon Stocking

- lake sturgeon stocking (in general) is a reasonable means of mitigating losses that might occur due to construction at Keeyask….

Hatchery Lake Sturgeon Life History



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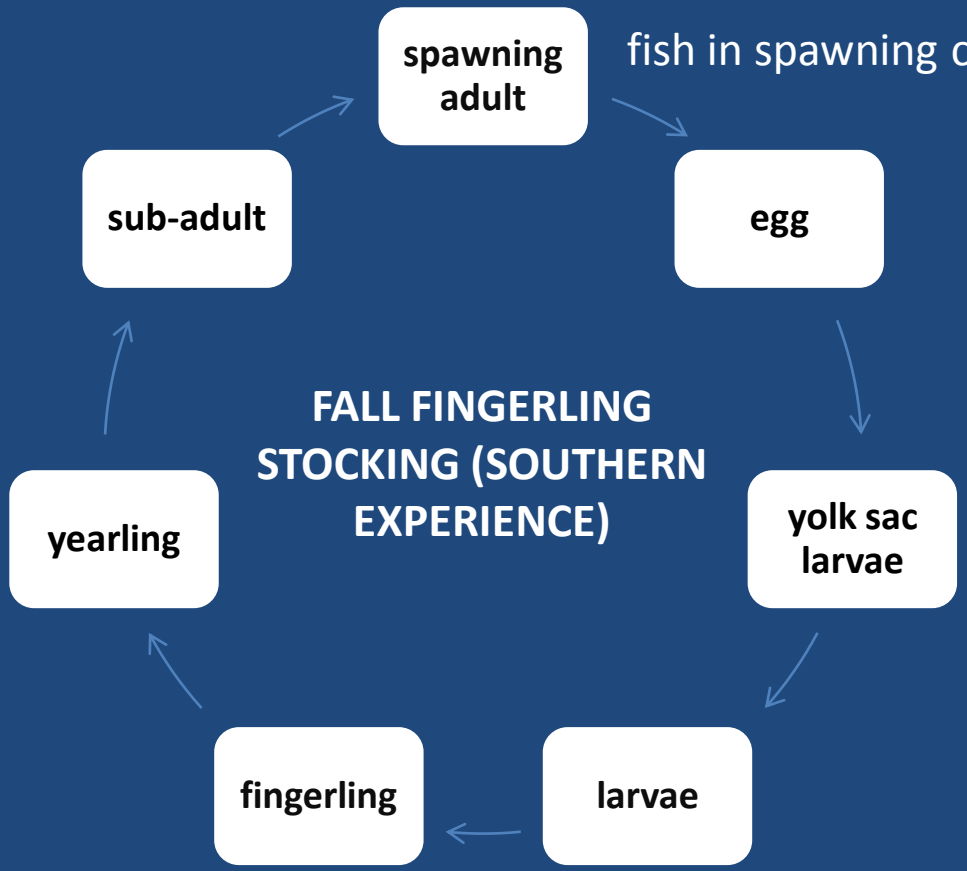

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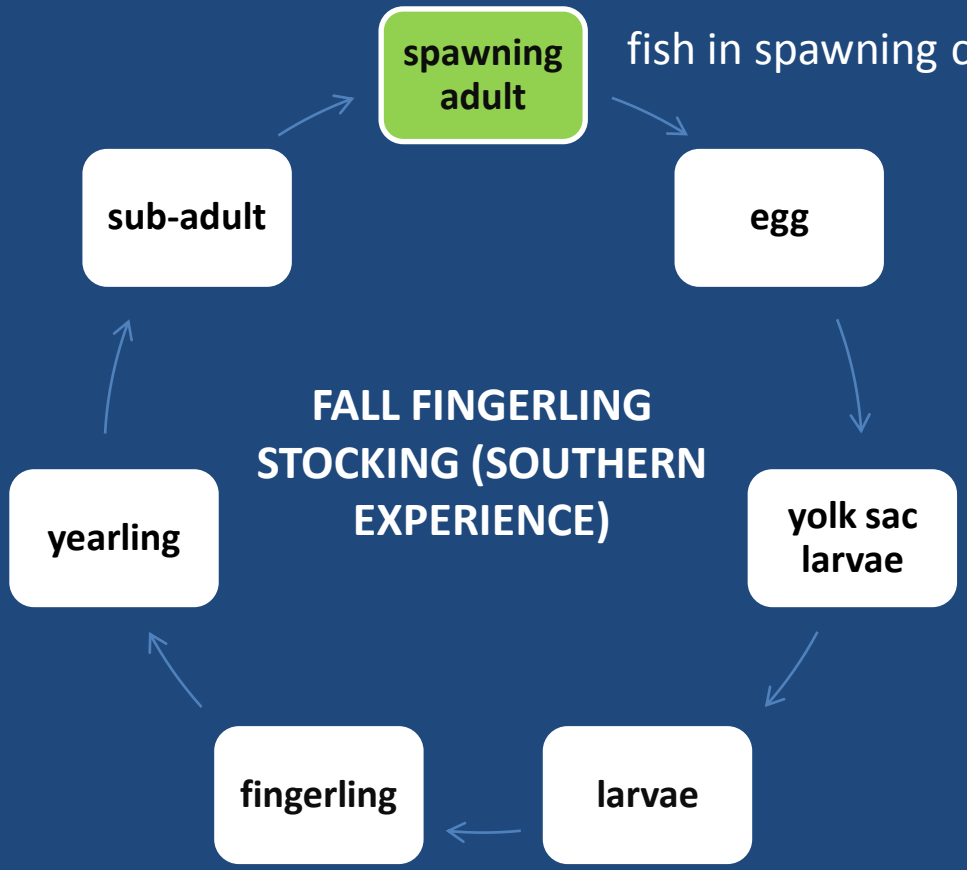

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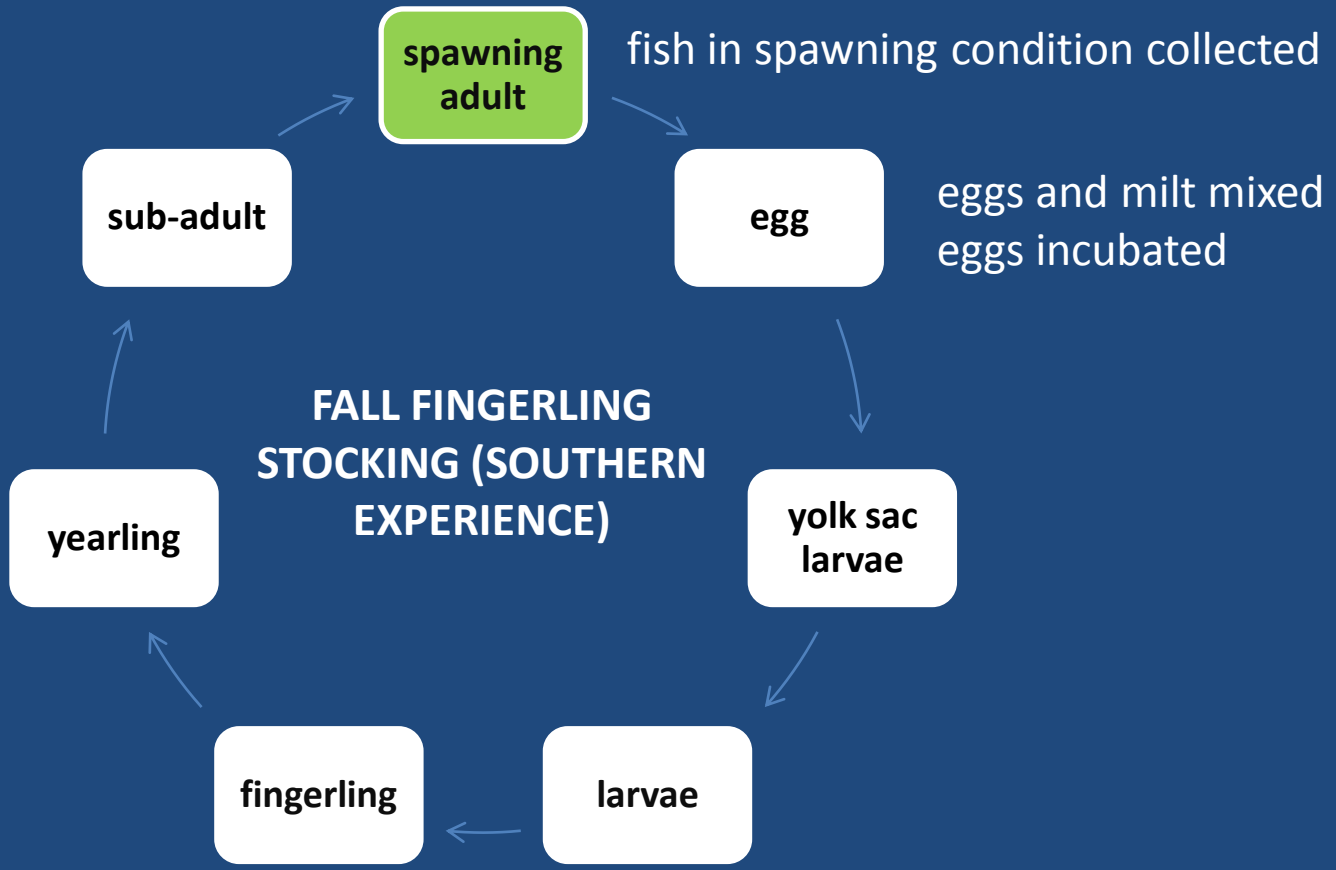

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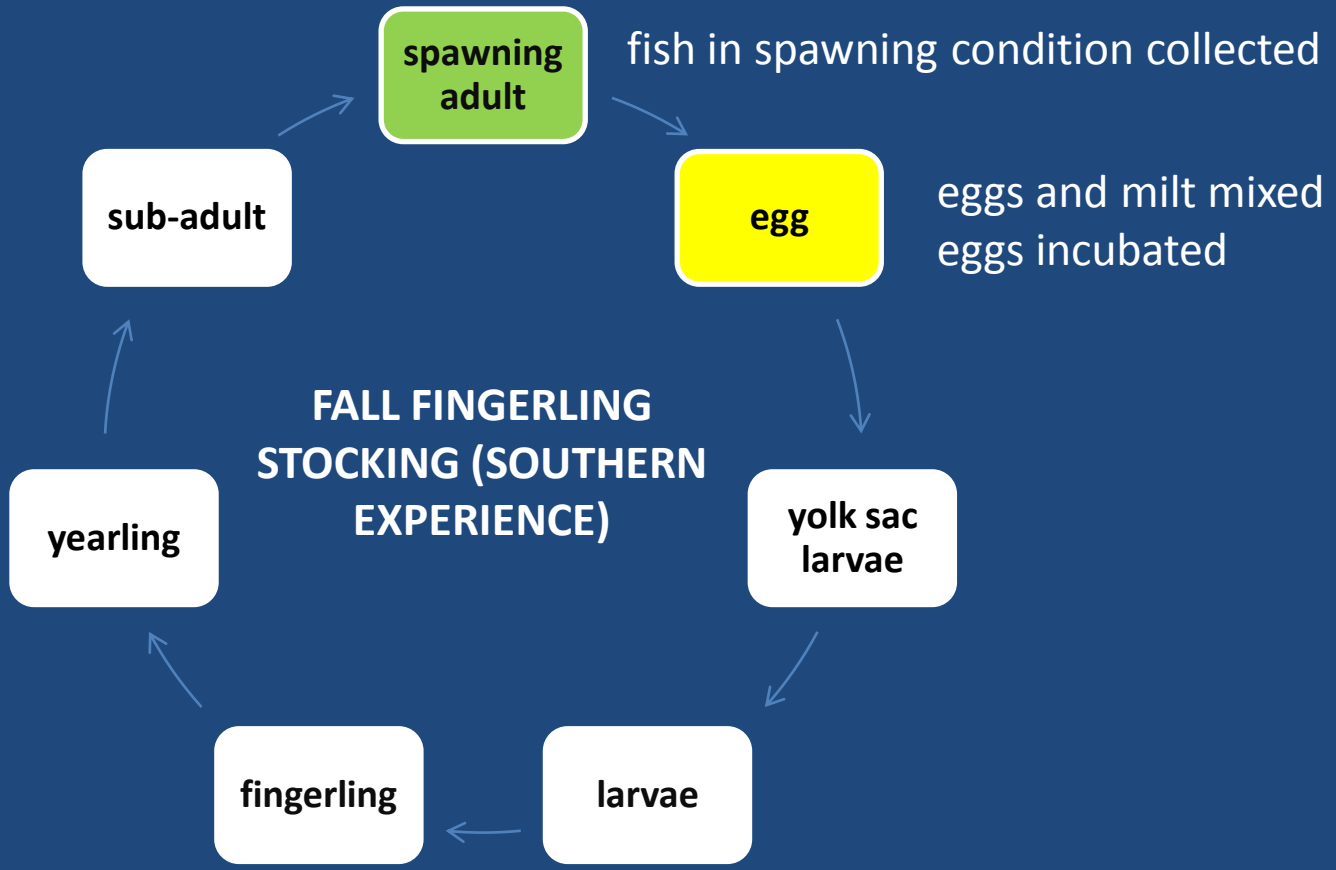

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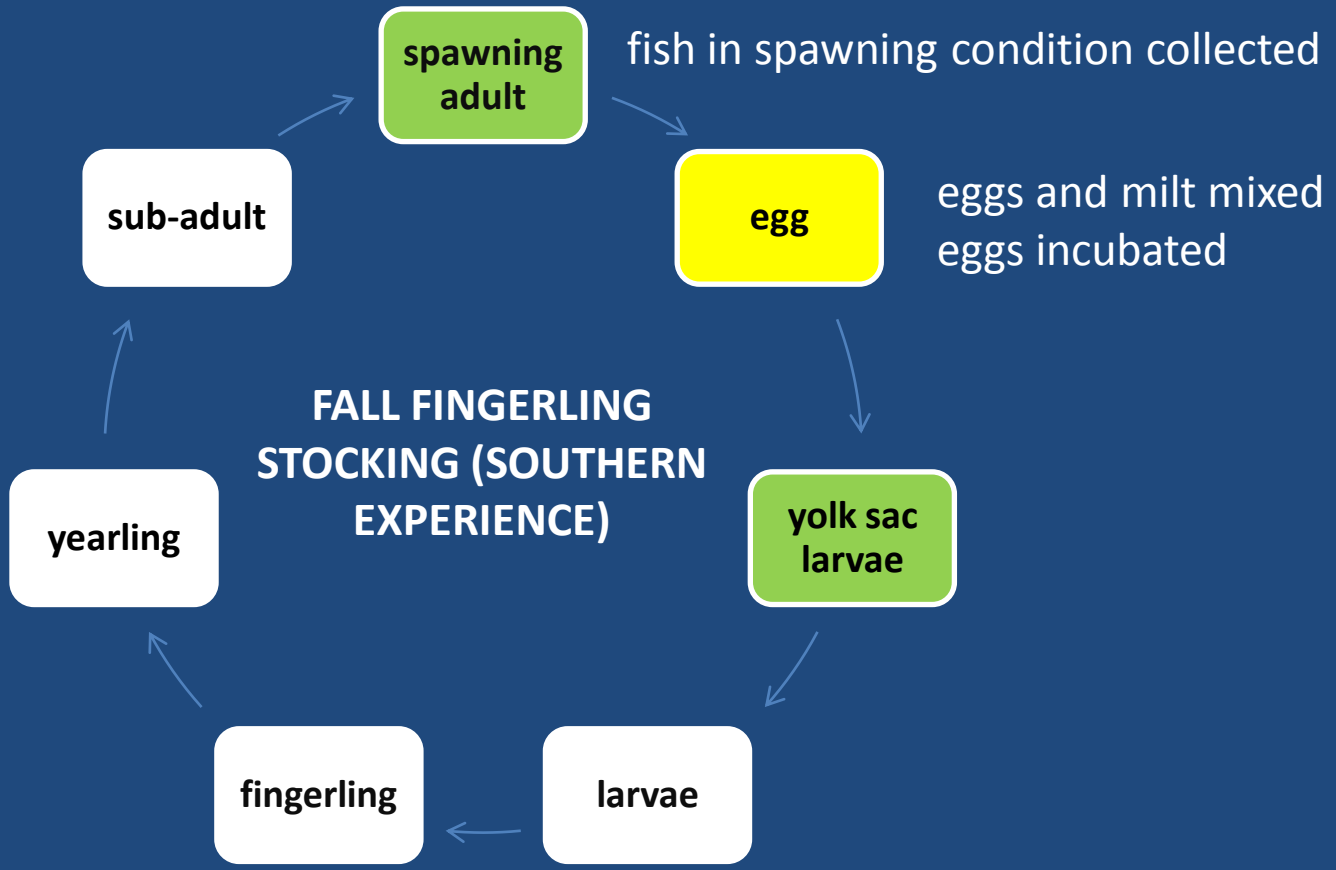

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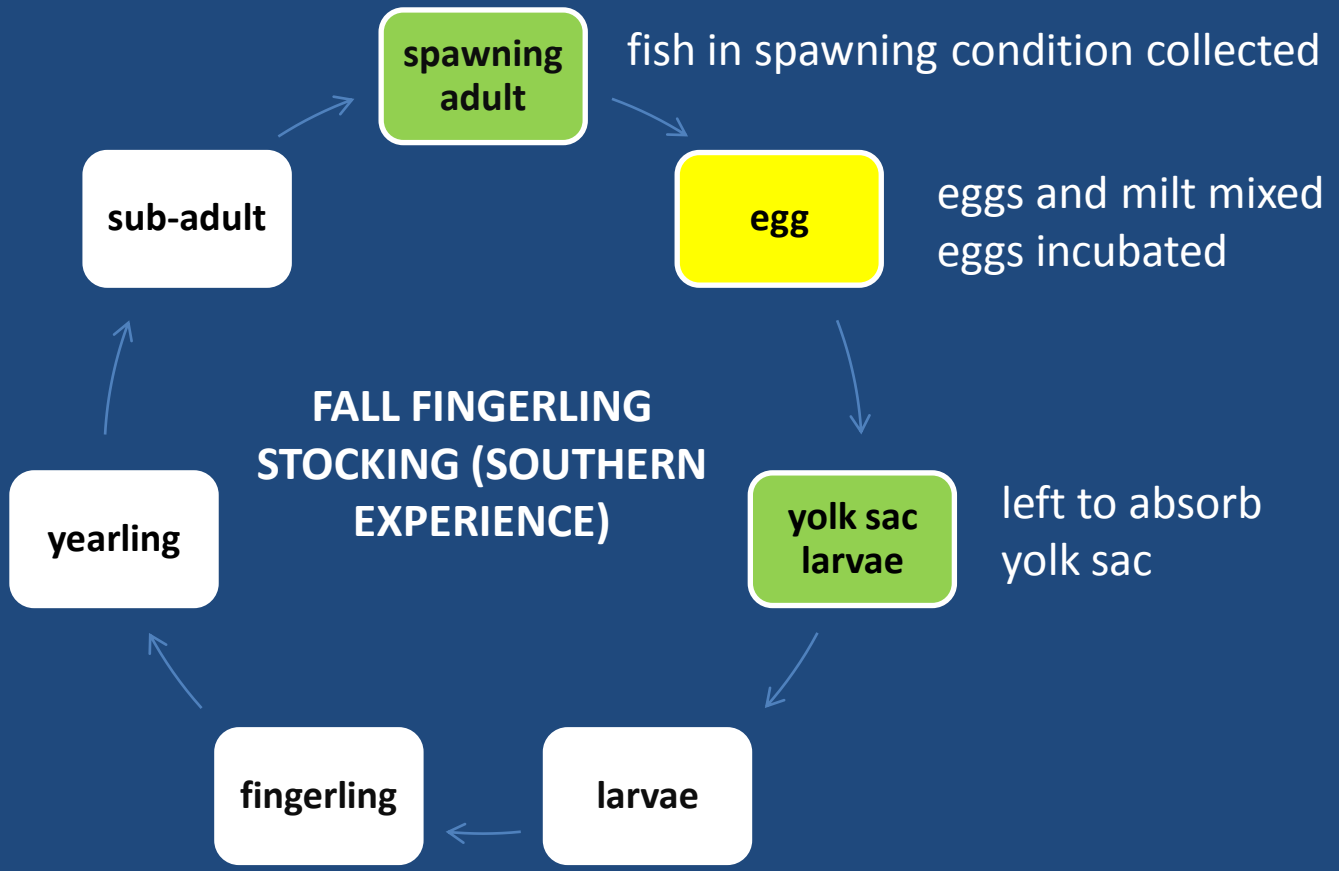

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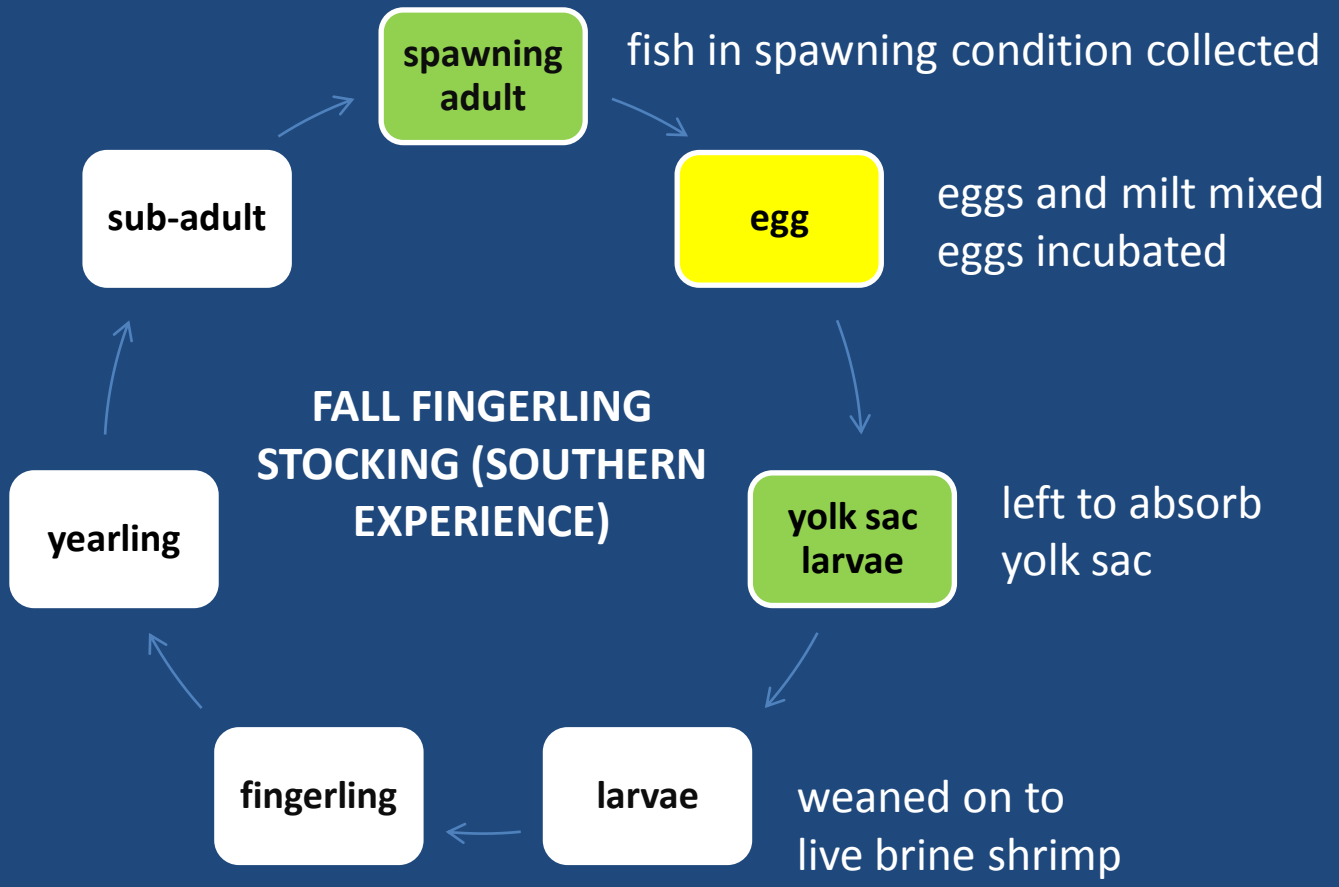

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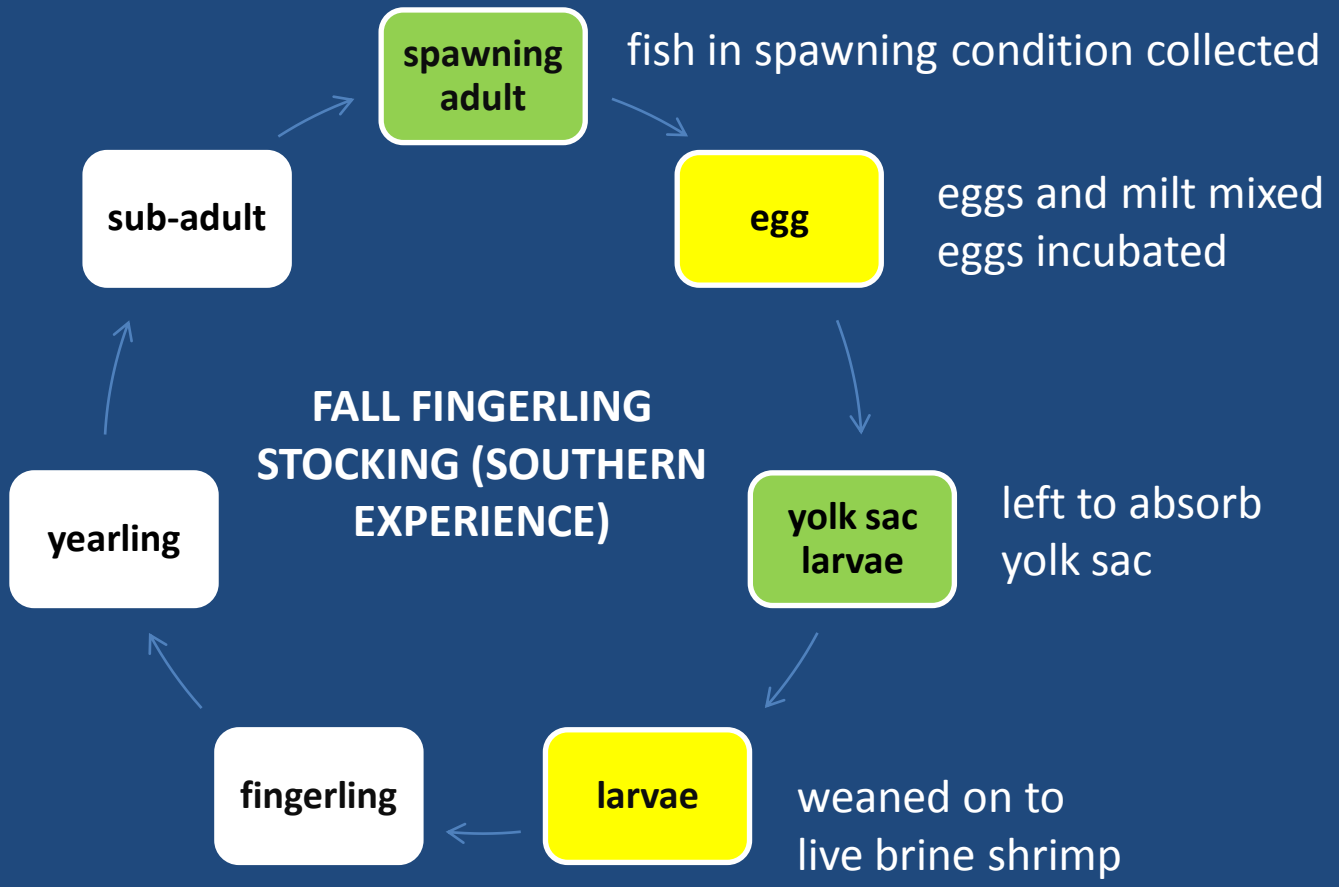

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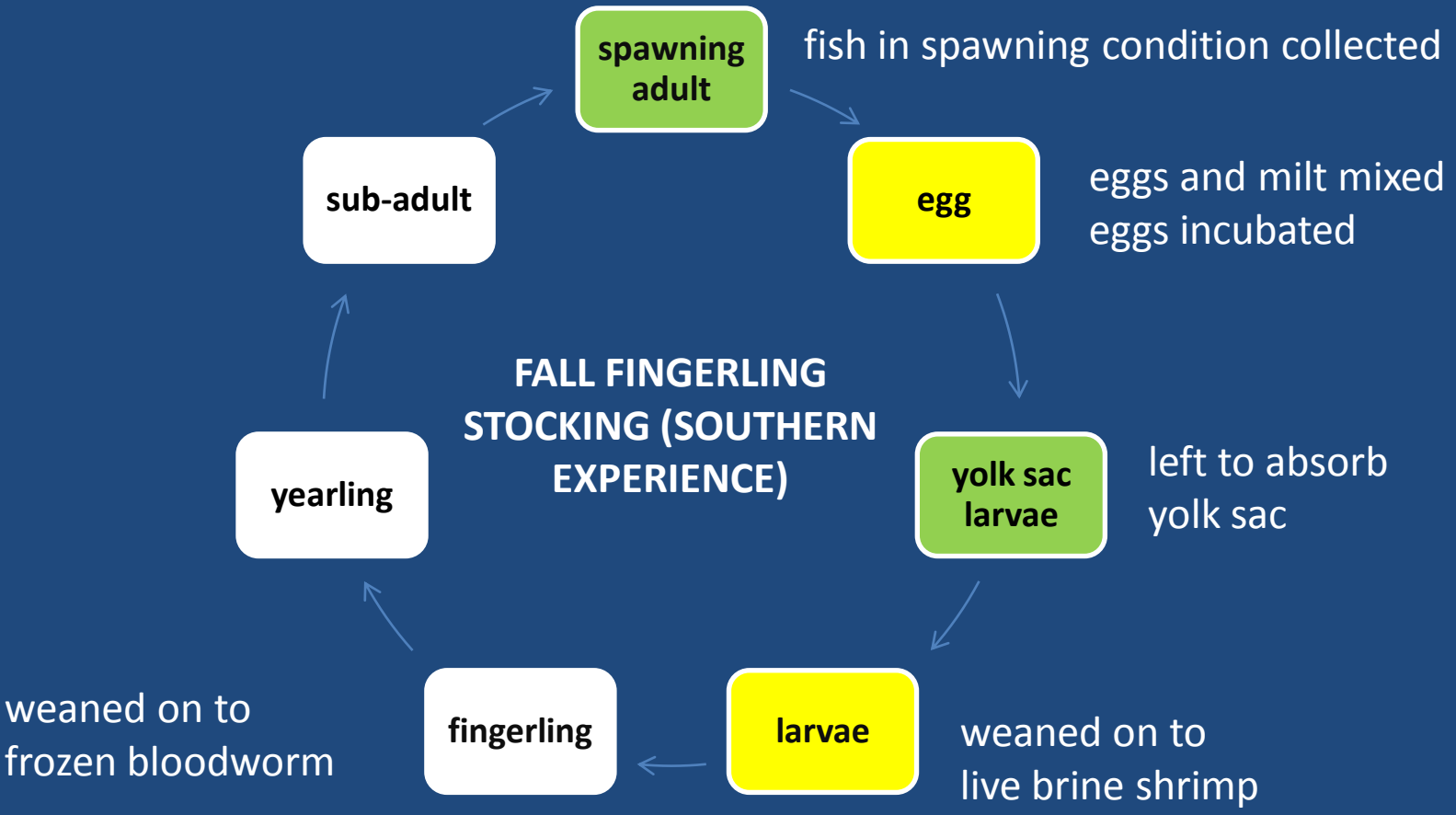

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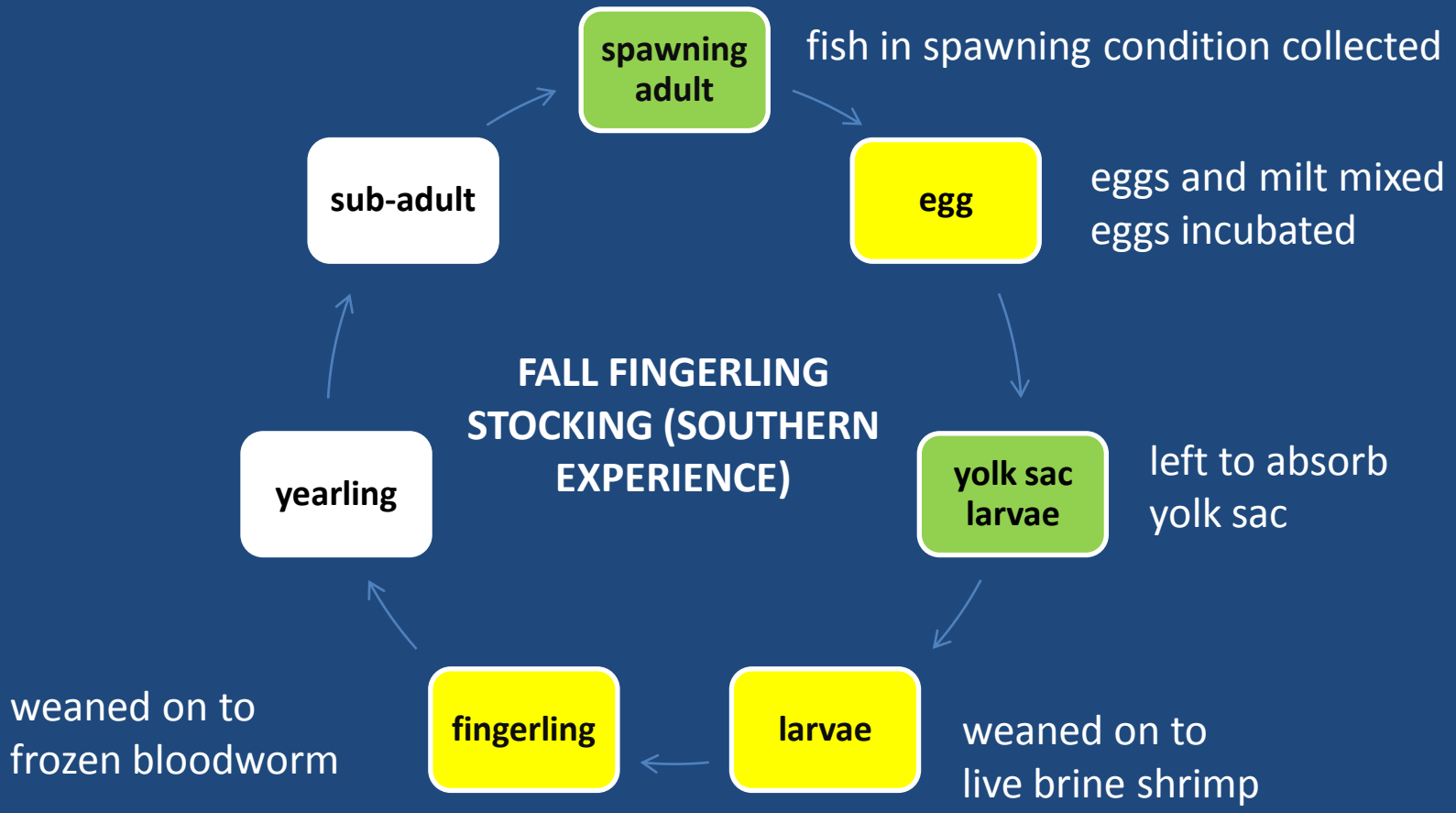

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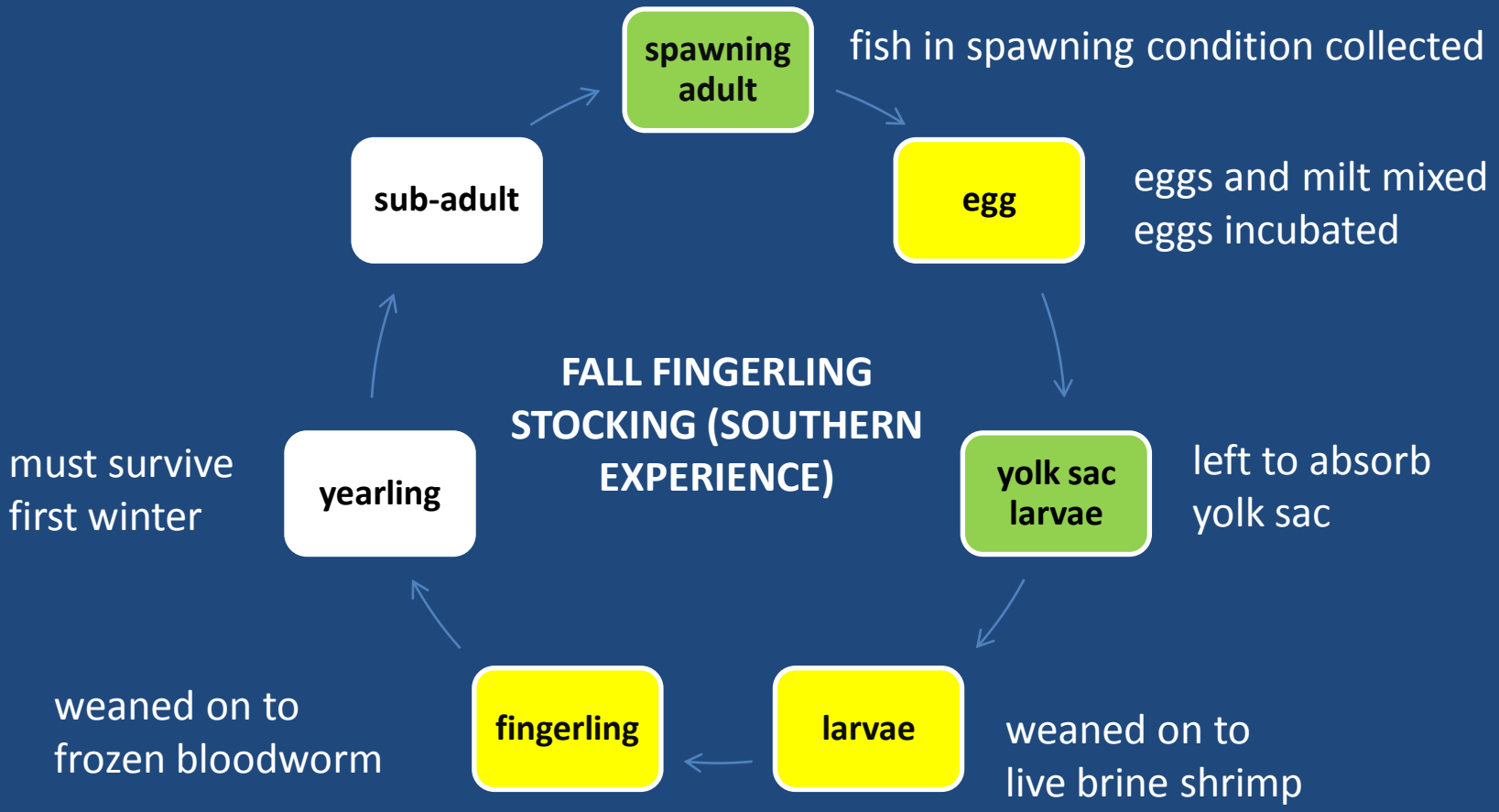

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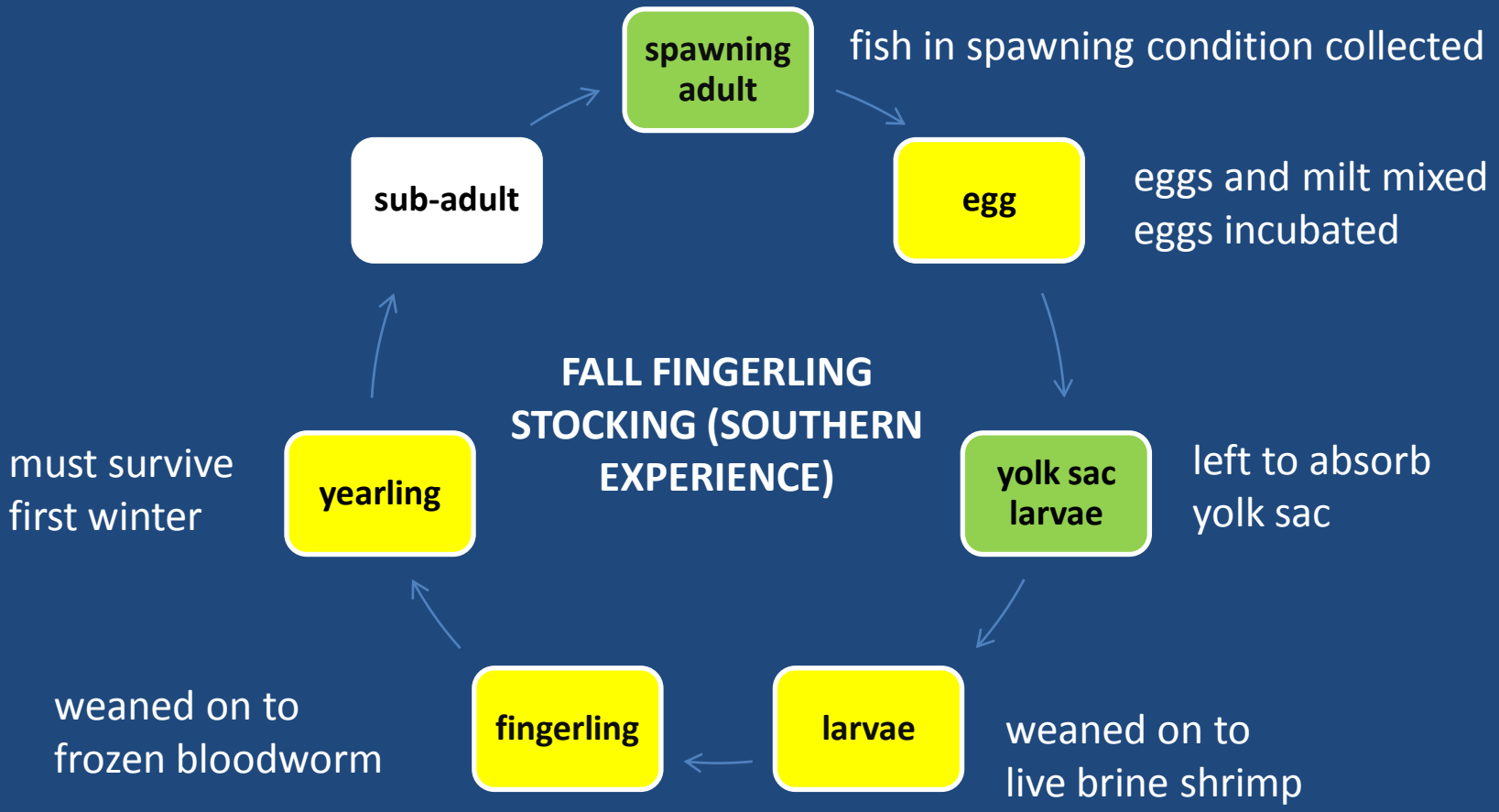

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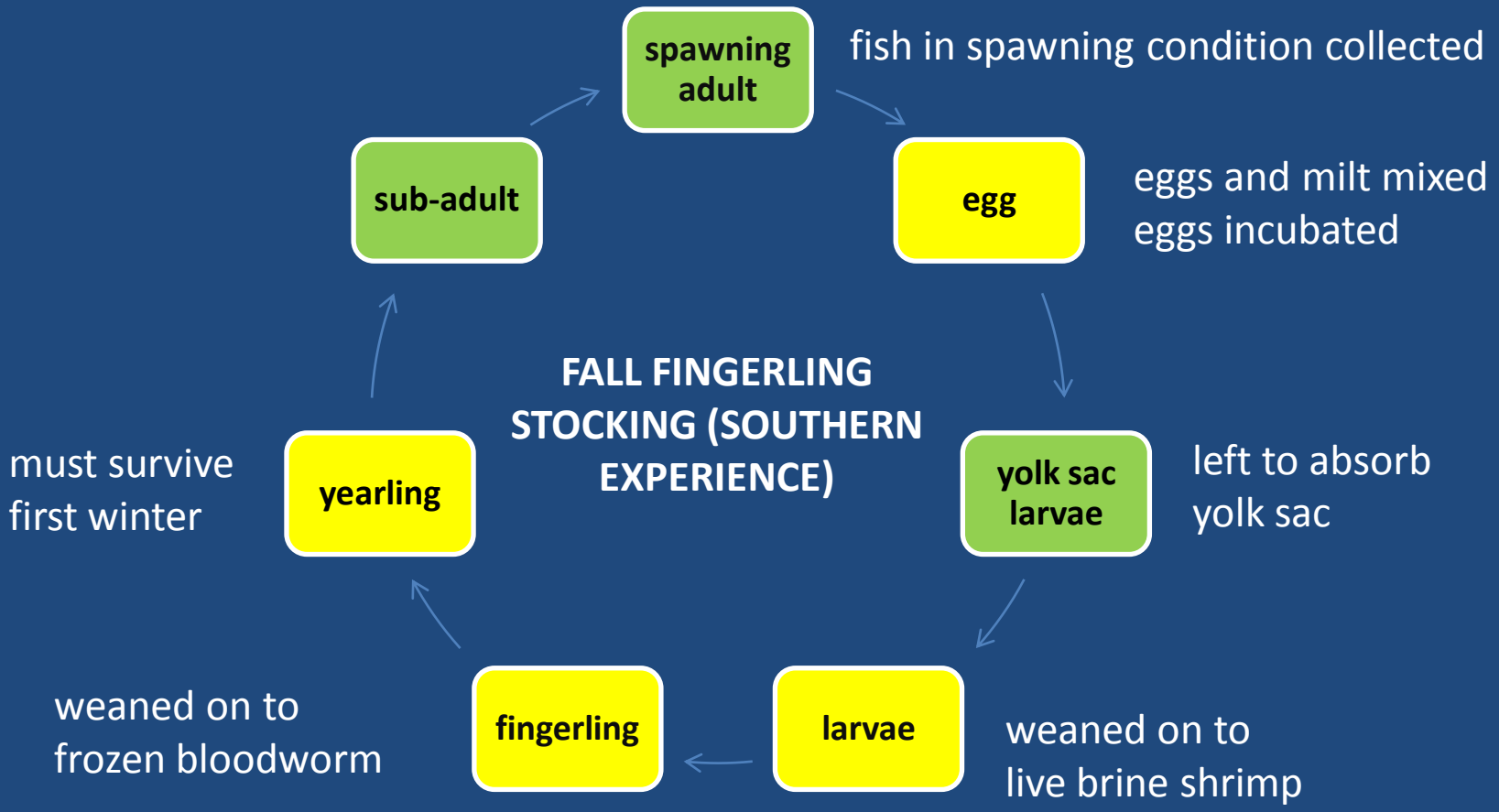


Lake Sturgeon Stocking

- however….
  - there appears to be no track record of consistently successful lake sturgeon production in Manitoba

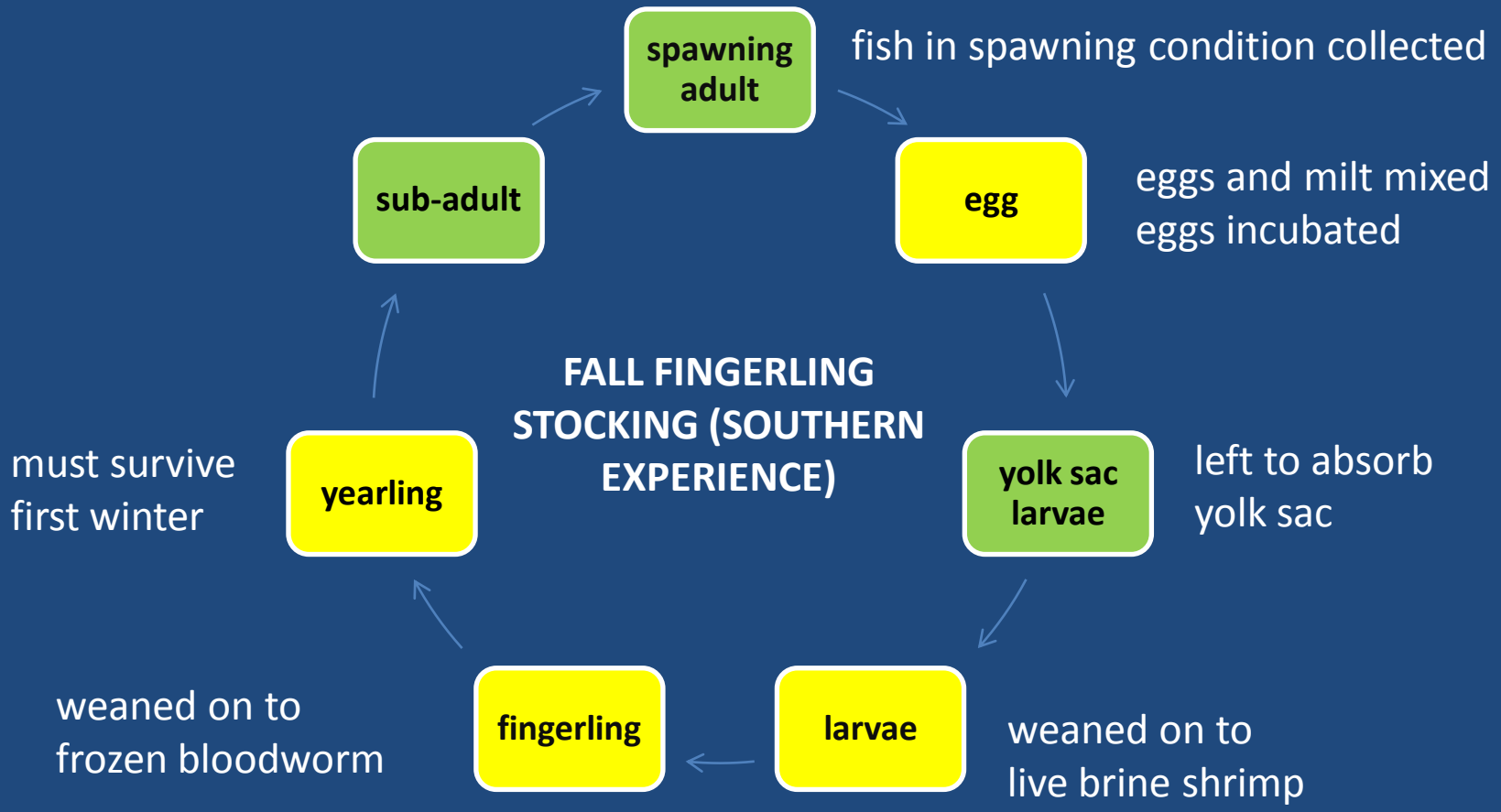
Lake Sturgeon Stocking

- however….
  - lake sturgeon rearing in Manitoba (in apparent contrast to that in US hatcheries) has been fraught with difficulties, despite considerable effort and expense

Lake Sturgeon Stocking

- however….
  - survival rates for fish in Manitoba hatcheries have been highly variable from year to year, with no consistent indication of reasons for good and bad outcomes

Hatchery Lake Sturgeon Life History



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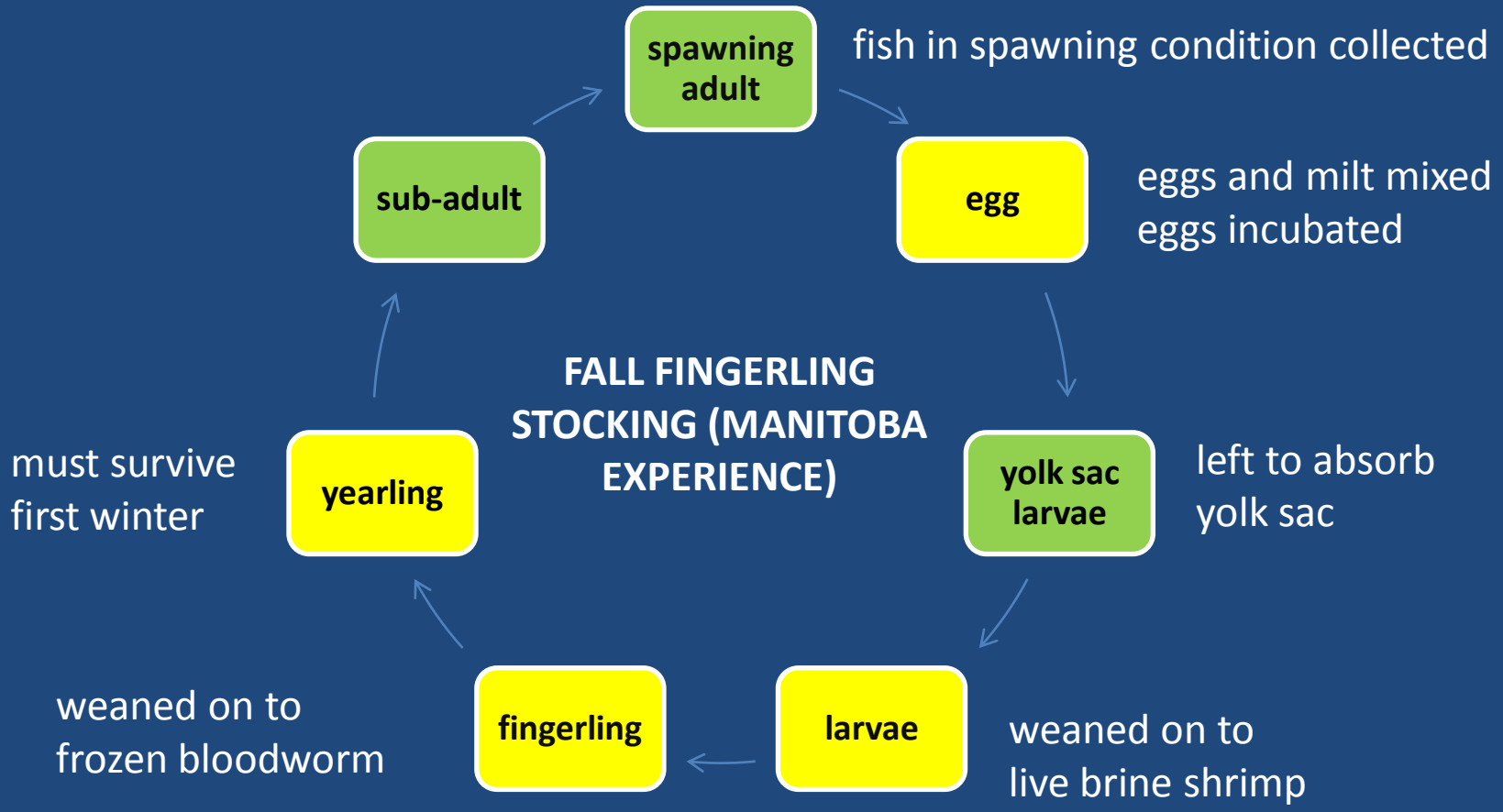

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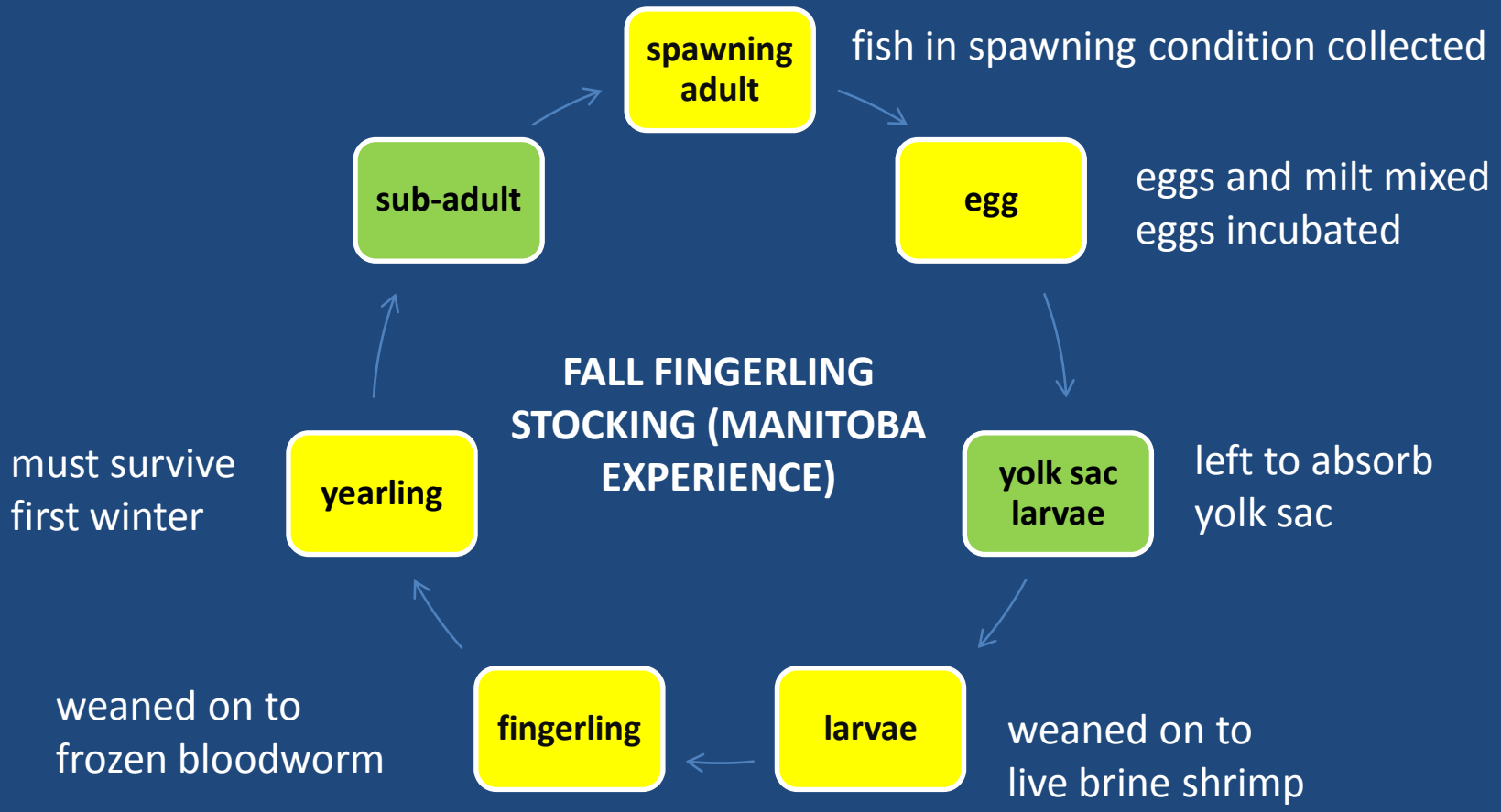

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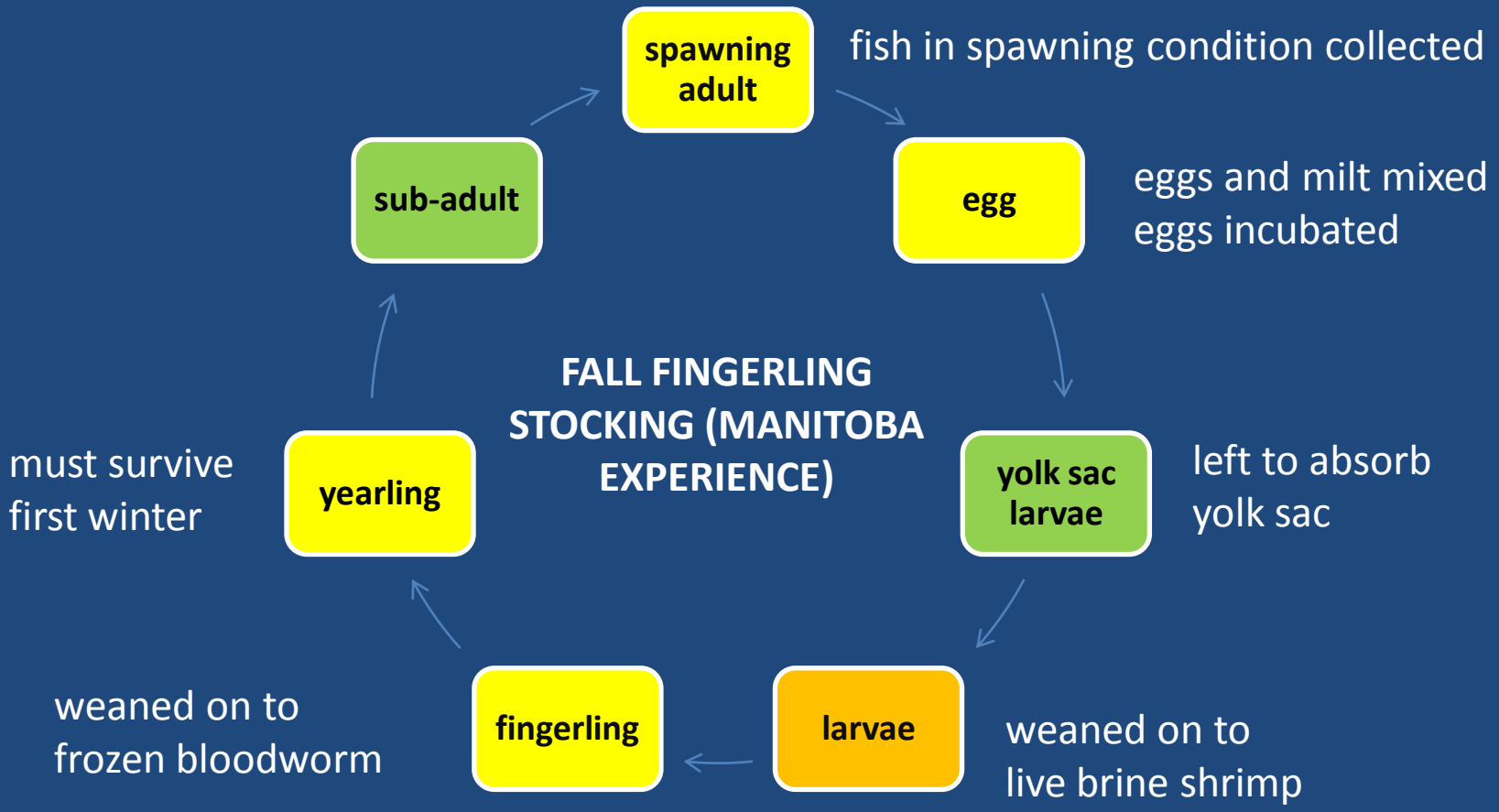

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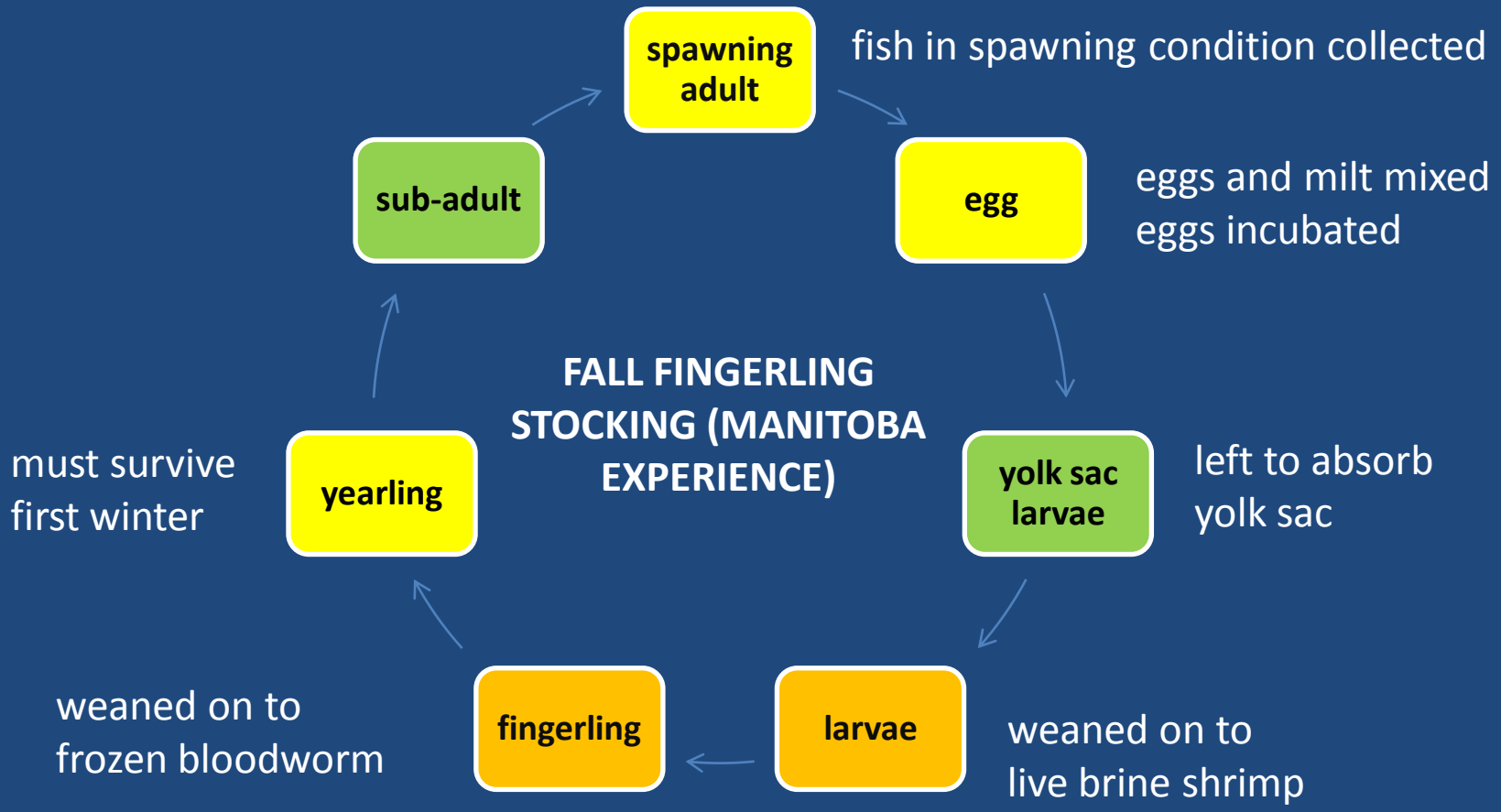

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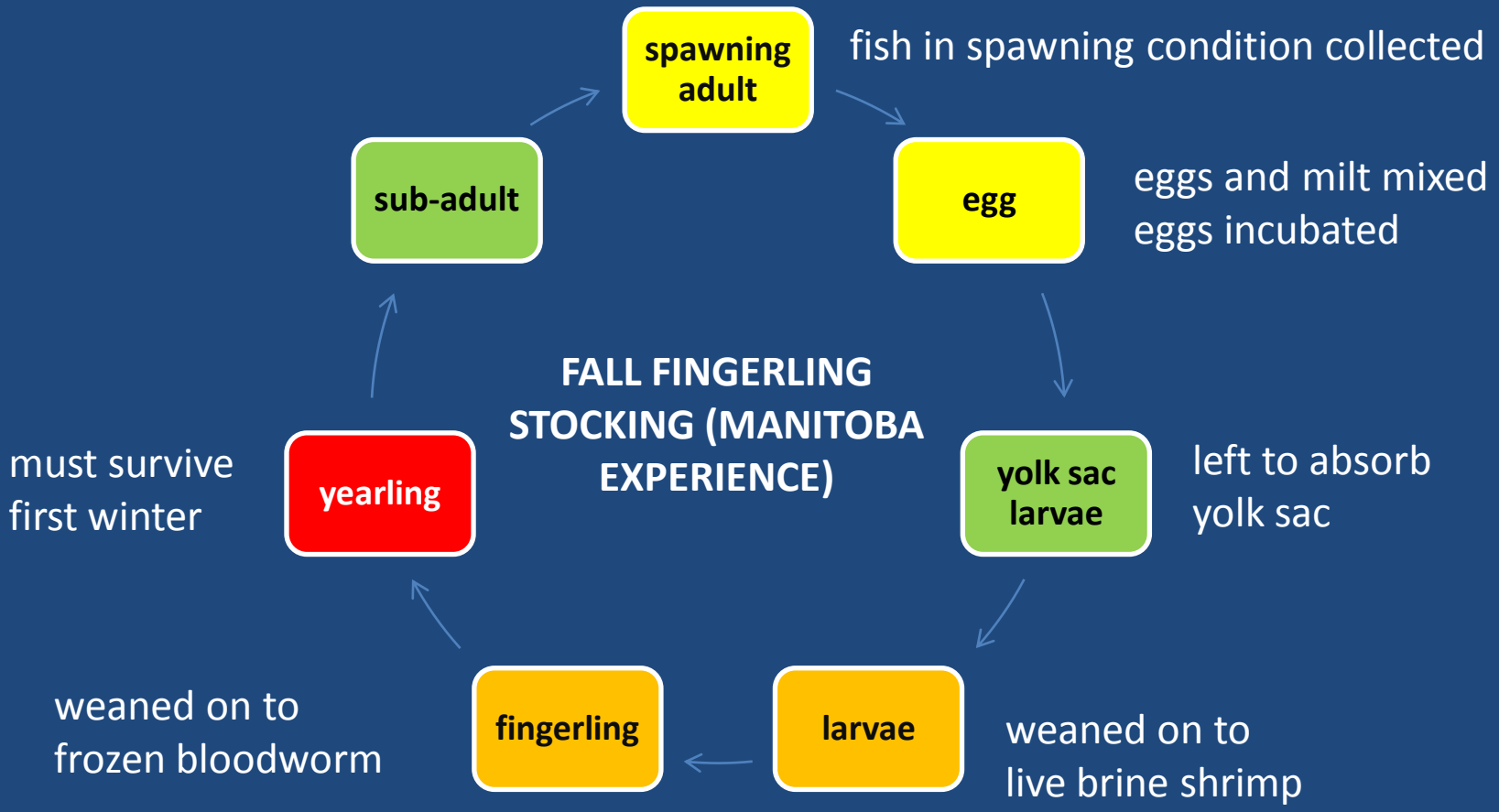


Lake Sturgeon Stocking

- therefore…
  - proponents should use caution, and perhaps temper their expectations, with respect to their ability to consistently produce adequate numbers of fish for stocking efforts
  - proponents should not be overly confident that research (on disease etc.) will alleviate this situation

Lake Sturgeon Stocking

- furthermore…
  - there appears to be little (or no) evidence that “fingerling” lake sturgeon, stocked into rivers in northern latitudes (i.e. anywhere in Canada) in the fall, are able to survive winter conditions in reasonable numbers

Lake Sturgeon Stocking

- furthermore…
  - there is some evidence (from Winnipeg River studies) that fall stocked fish may have difficulty finding sufficient food to even maintain their body weight…

Lake Sturgeon Stocking

- furthermore…
  - there is some evidence (from Winnipeg River studies) that fall stocked fish may not survive their first winter in the wild in numbers sufficient to create a viable population

Lake Sturgeon Stocking

- furthermore…
  - there is some evidence (from Winnipeg River studies) that large, yearling lake sturgeon are able to survive and thrive after being stocked in the spring

Lake Sturgeon Stocking

- therefore…
  - proponents should use caution in extrapolating survival rates reported in southern (i.e. USA) systems to northern rivers where conditions are considerably more difficult

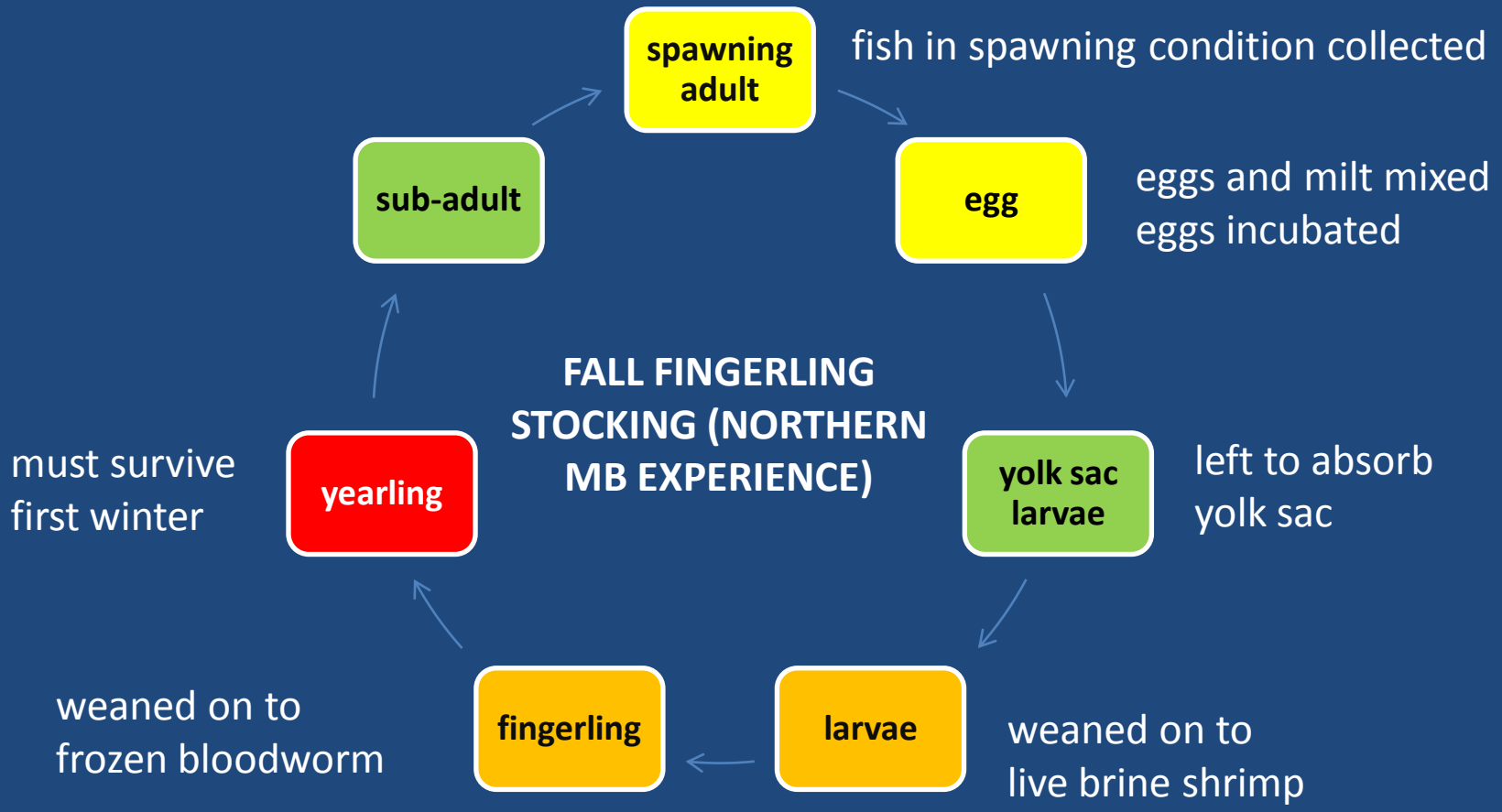
Lake Sturgeon Stocking

- therefore…
  - only the largest (perhaps 10%) of fingerlings should be stocked in the fall since (a) they can be expected to be most likely to survive, and (b) will be best able to carry implanted PIT tags

Lake Sturgeon Stocking

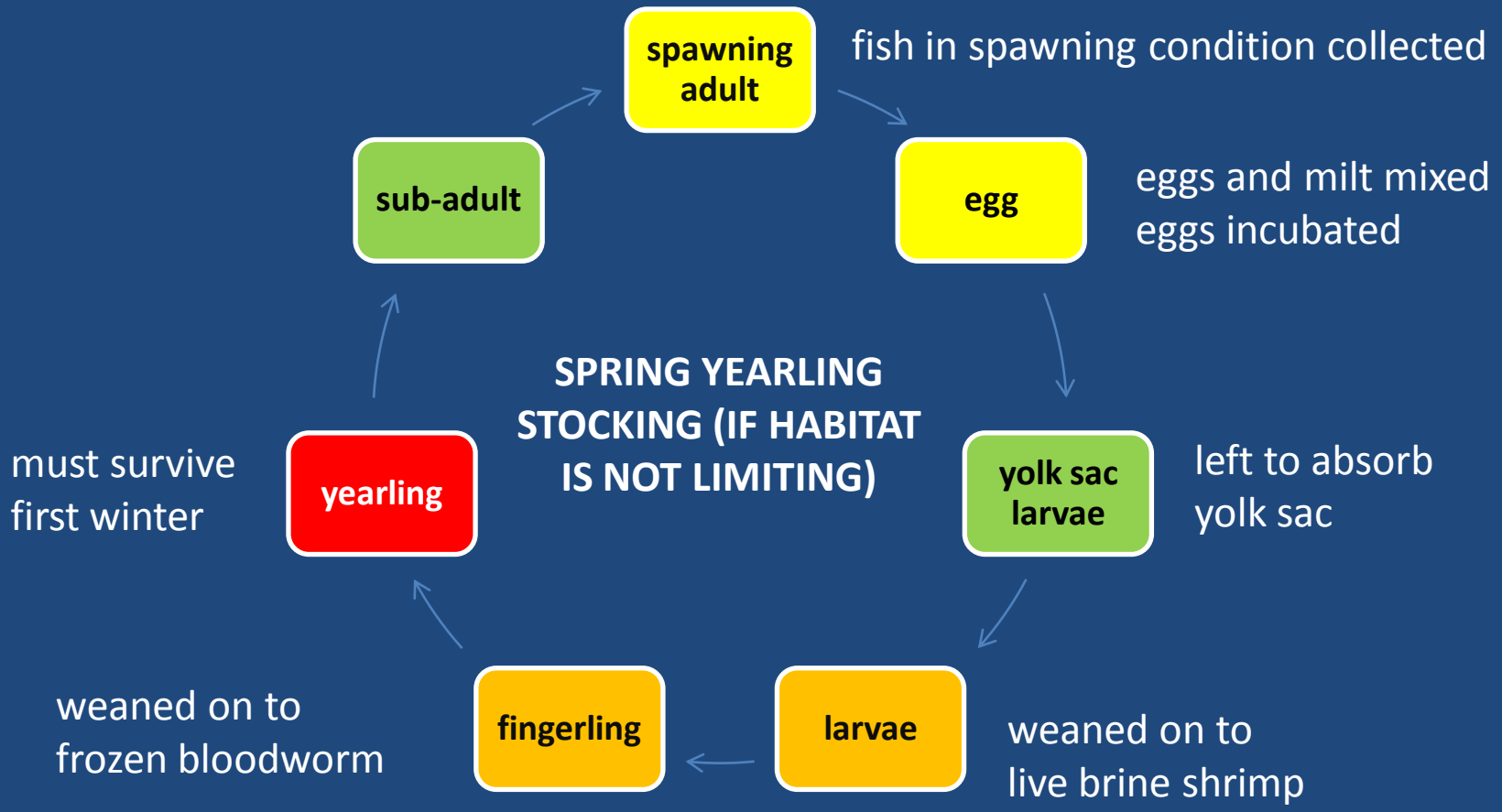
- therefore…
  - remaining smaller lake sturgeon should be held over the winter at moderate water temperatures and “grown out” until spring at which time they should be equipped with PIT tags and released

Hatchery Lake Sturgeon Life History



MORTALITY RISK HIGH MOD-HIGH LOW-MOD LOW

Hatchery Lake Sturgeon Life History



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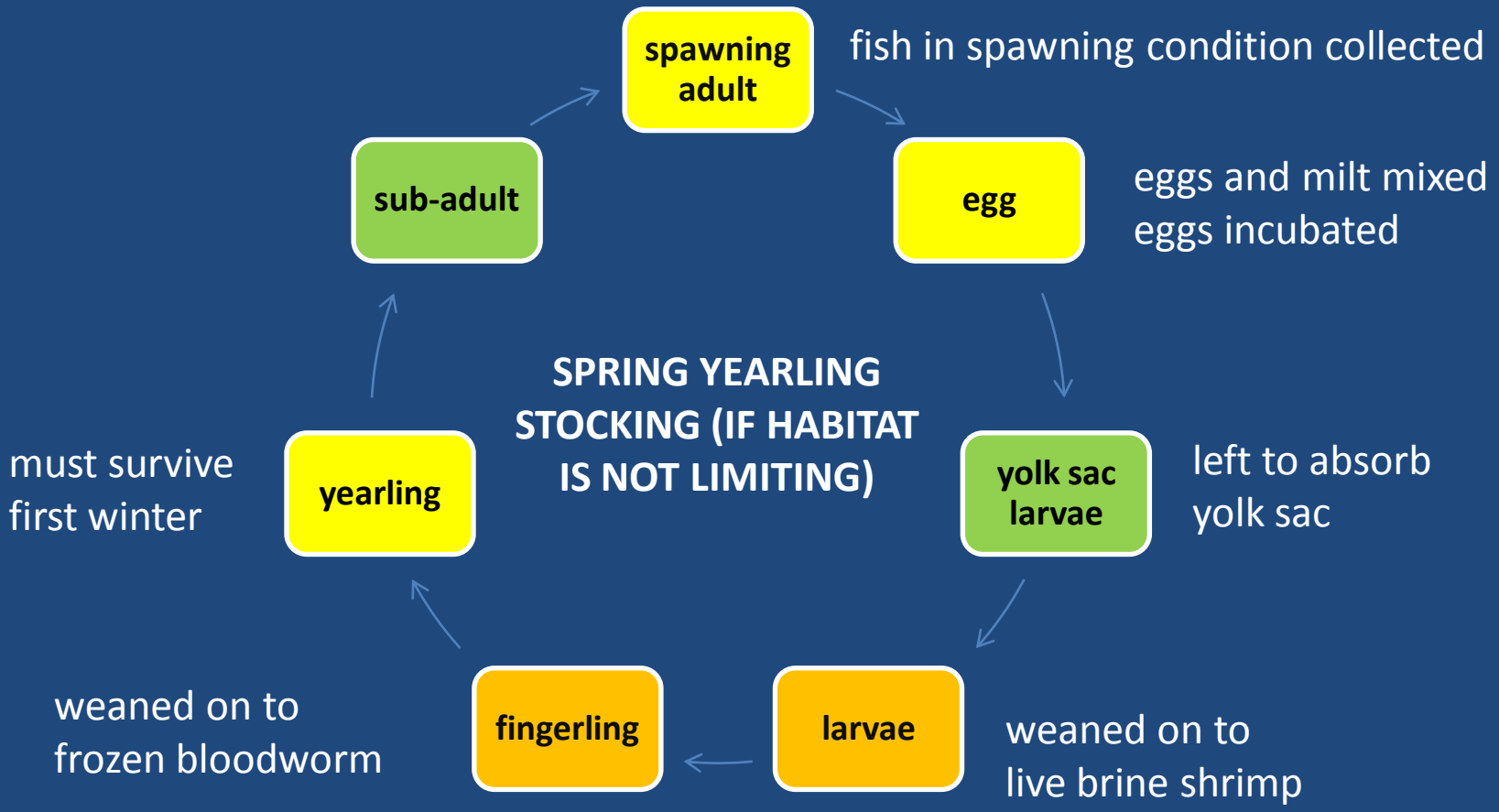
Hatchery Lake Sturgeon Life History



Lake Sturgeon Marking

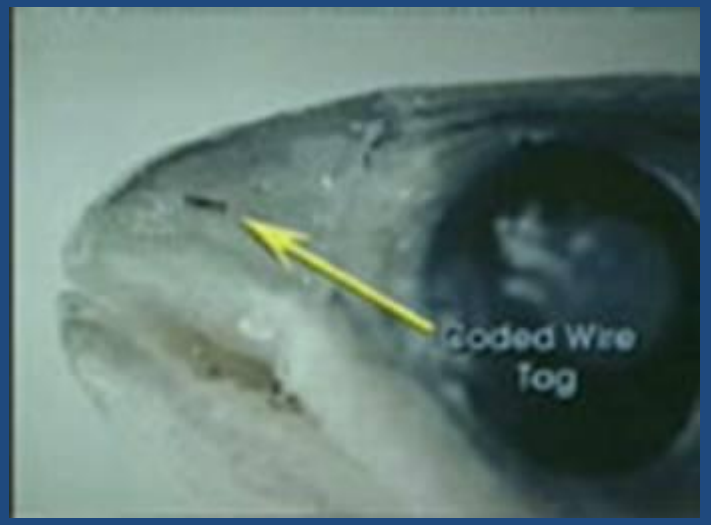
- the proponents are correct in making it a priority that all stocked lake sturgeon are marked, so that (1) the program can be quantitatively assessed, and (2) domestic fish can be distinguished from wild individuals

Lake Sturgeon Marking

- however…
  - with the exception of PIT tags, the proposed marking techniques have one (or more) of the following drawbacks…
    - lake sturgeon must be injured/maimed prior to release or upon re-capture

Lake Sturgeon Marking

- however…
  - with the exception of PIT tags, the proposed marking techniques have one (or more) of the following drawbacks…
    - lake sturgeon must be killed after re-capture to retrieve the unique code assigned to them



Lake Sturgeon Marking

- however…
  - with the exception of PIT tags, the proposed marking techniques have one (or more) of the following drawbacks…
    - the marks identify individuals as hatchery reared, and perhaps suggest an approximate release time, but are useless for establishing critical population parameters (e.g. growth rate)

Lake Sturgeon Marking

- however…
  - with the exception of PIT tags, the proposed marking techniques have one (or more) of the following drawbacks…
    - the marks last an indeterminate (or short) period of time after which the origin of the fish becomes impossible to determine

Lake Sturgeon Marking

- PIT tags…
  - are the mark of choice for serious hatchery evaluation programs (e.g. Pacific salmonids)

Lake Sturgeon Marking

- PIT tags…
  - give every fish stocked a unique code that can be referenced to establish when the fish was stocked and how much it weighed when stocked or last captured

Lake Sturgeon Marking

- PIT tags…
  - are inert, last indefinitely, are relatively inexpensive, and can be interrogated simply and quickly (i.e. in the boat), without stressing the fish

Lake Sturgeon Marking

- therefore…
  - ALL stocked lake sturgeon should be equipped with PIT tags prior to release, and NO hatchery reared fish should be placed in the system without this mark

Lake Sturgeon Marking

- therefore…
  - yearling fish stocked in the spring should be “double tagged” with PIT tags and Floy tags to evaluate PIT tag loss rates and allow fishers to contribute to data collection

Juvenile Lake Sturgeon Habitat

- the proponents rightly anticipate that juvenile habitat will likely be a limiting factor in establishing a viable and self-sustaining population

Juvenile Lake Sturgeon Habitat

- the proponents indicate that juvenile habitat (like spawning habitat) will be created to avoid life history bottlenecks

Juvenile Lake Sturgeon Habitat

- however…
  - juvenile lake sturgeon habitat has never been created in a large river…anywhere…and plans to do so must be considered entirely experimental with a probability of success that cannot be predicted with any certainty

Juvenile Lake Sturgeon Habitat

- however…
  - juvenile lake sturgeon habitat will be much more difficult to maintain as it will be highly affected by flow changes (siltation if flow declines and removal if flow increases)

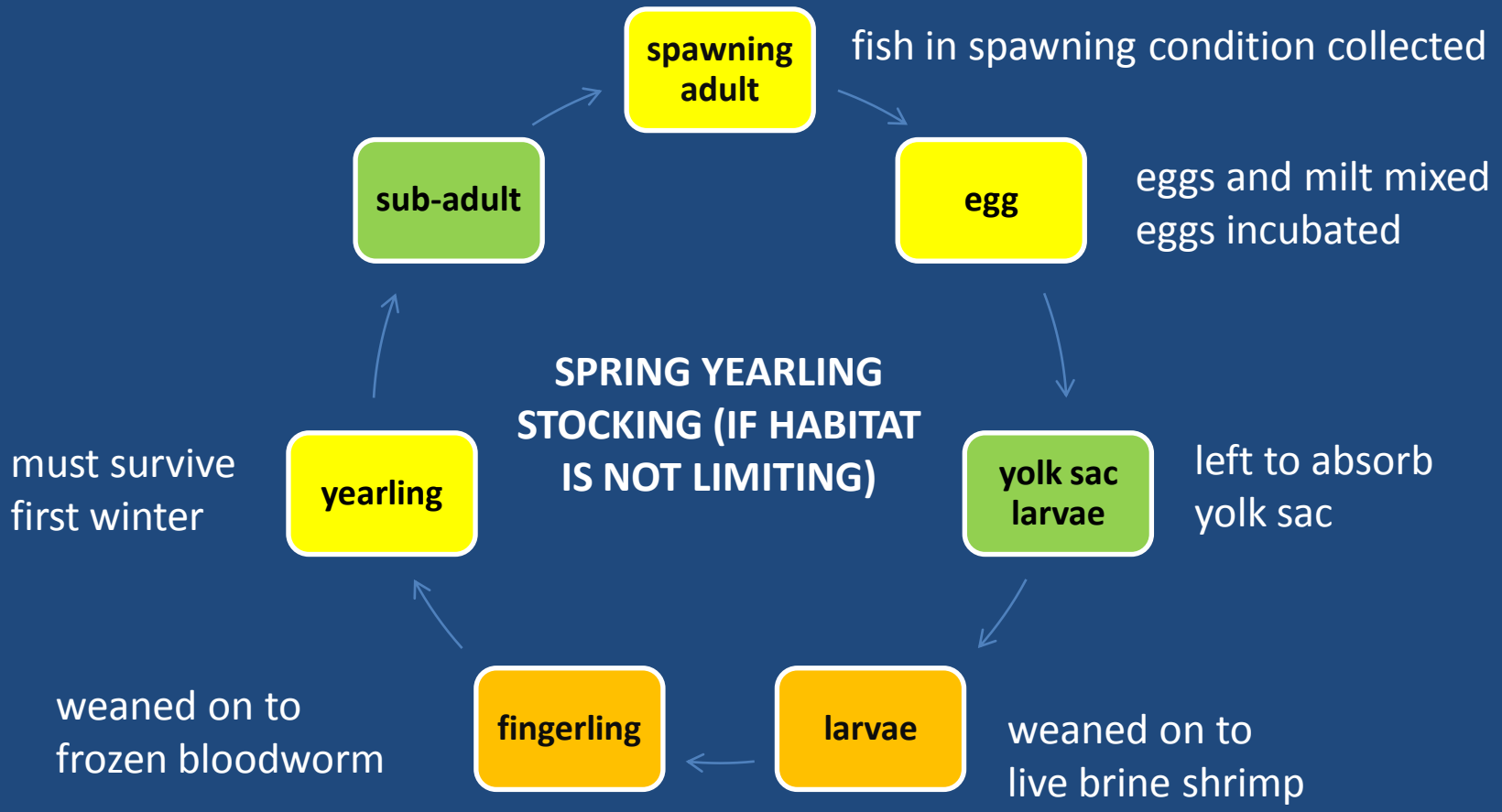
Juvenile Lake Sturgeon Habitat

- however…
  - juvenile lake sturgeon habitat will have to be infiltrated by the “right” type of invertebrate community…

Juvenile Lake Sturgeon Habitat

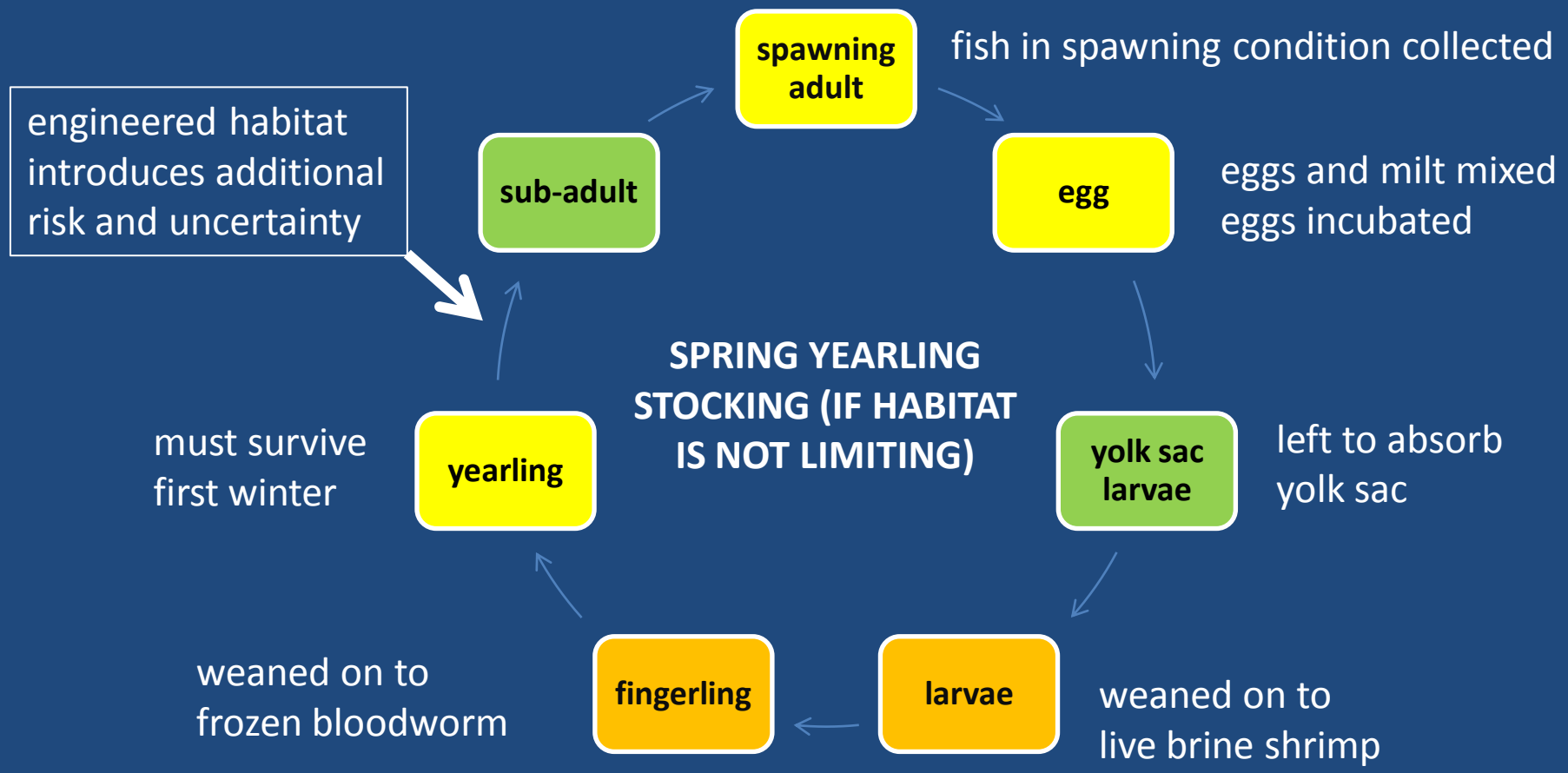
- however…
  - juvenile lake sturgeon must be able to find and willing to use this artificially placed habitat …

Hatchery Lake Sturgeon Life History



MORTALITY RISK HIGH MOD-HIGH LOW-MOD LOW

Hatchery Lake Sturgeon Life History



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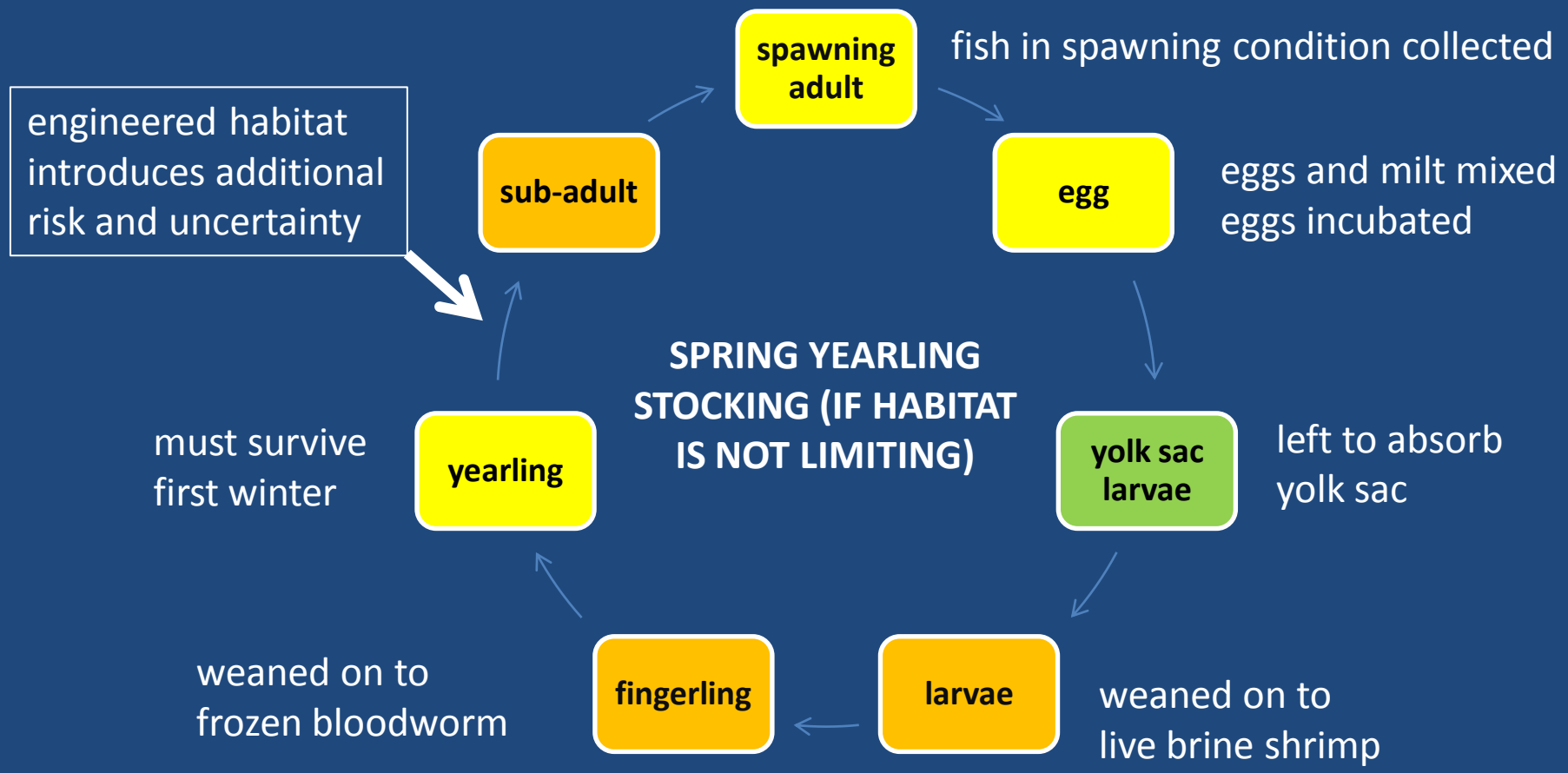
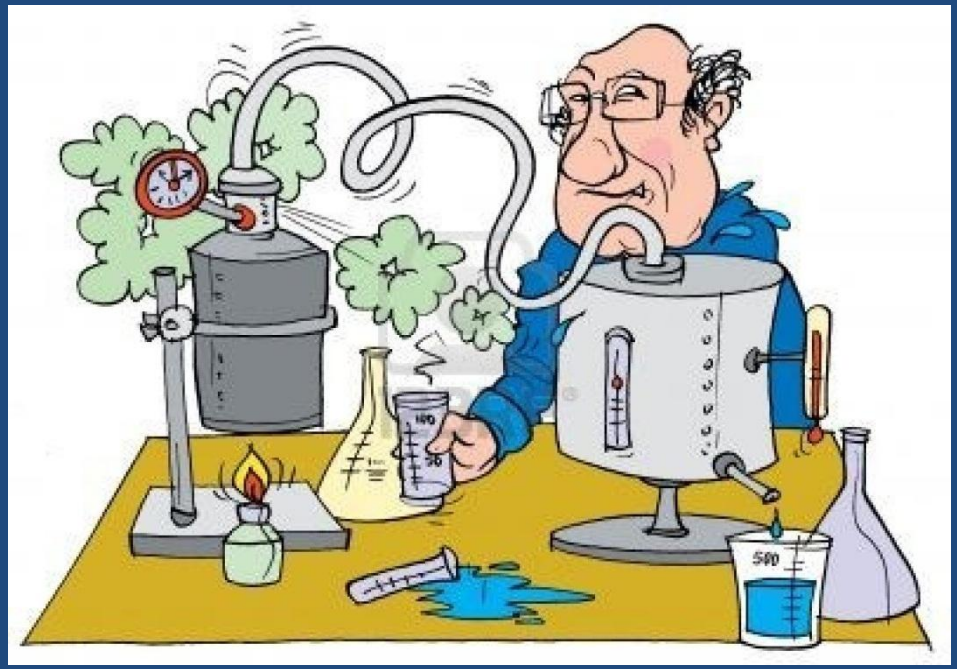
Hatchery Lake Sturgeon Life History



Juvenile Lake Sturgeon Habitat

- therefore…
  - proponents should consider the placement of juvenile habitat a worthwhile experiment (no more no less) and have no expectations with respect to success



Juvenile Lake Sturgeon Habitat

- therefore…
  - proponents should have a back up plan if placement of juvenile habitat is unsuccessful and existing natural habitat is insufficient

Lake Sturgeon Entrainment

- the proponents have designed the spillways and turbines in a way that provides little (or no) protection against actual entrainment of lake sturgeon, choosing instead to attempt to minimize injury and mortality associated with occurrences of downstream passage

Lake Sturgeon Entrainment

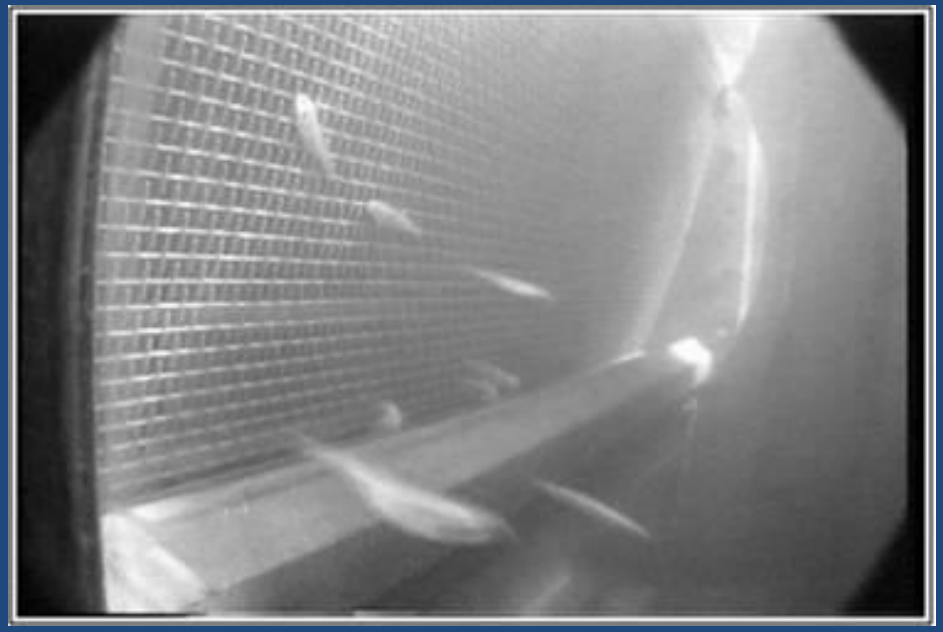
- however…
  - comprehensive studies investigating the probability of lake sturgeon entrainment at the proposed facility in relation to population size are lacking

Lake Sturgeon Entrainment

- however…
  - comprehensive studies investigating the probability of lake sturgeon injury and mortality relative to fish size are lacking (although the general rule is that vulnerability increases with fish size)

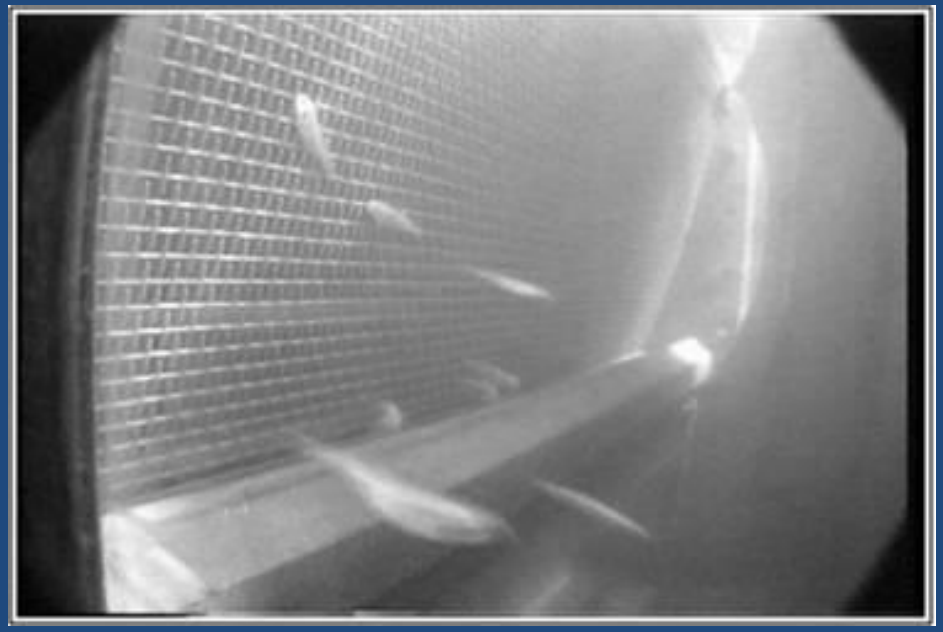
Lake Sturgeon Entrainment

- however…
  - comprehensive studies investigating the probability of lake sturgeon impingement on trash racks relative to flow rates and fish size are lacking



Lake Sturgeon Entrainment

- however…
  - comprehensive studies investigating the probability of lake sturgeon escaping impingement on trash racks relative to flow rates and fish size are lacking



Lake Sturgeon Entrainment

- therefore…
  - plans for (and feasibility of) these types of studies should be outlined in advance by the proponents

Lake Sturgeon Entrainment

- therefore…
  - possible monitoring systems and programs (ideally not involving small sub-samples of tagged fish) should be investigated and carried out (where possible) at spillways, trash racks, and turbine outlets, through the life of the project as (presumably) lake sturgeon numbers increase

Lake Sturgeon Entrainment

- therefore…
  - thought should be given towards preventing entrainment (through trash rack spacing, angled racks, behavioural deterrents etc.) and minimizing injuries to maximize protection for large lake sturgeon

Summary

- lake sturgeon are difficult to rear and complete or partial failures can occur at several points between egg fertilization and integration into the population
- juvenile habitat creation introduces additional risk and uncertainty

Summary

- all lake sturgeon released should be equipped with individually unique codes so that the data needed for adaptive management will be available
- more consideration should be given to safely preventing downstream entrainment of large lake sturgeon at spillways and intakes