

2024 Bi H2 Q3

Section: DNA and the Genome

Topic: Evolution

Question Summary

The question investigates how two colour forms of cichlid fish in Lake Victoria may become separate species. It examines the role of isolation barriers, how environmental depth influences distribution, and how species status can be confirmed experimentally.

Worked Solution

- (a)(i) The isolation barrier is **behavioural** — females only breed with males of a particular colour.
- (a)(ii) Isolation barriers **prevent gene flow** between populations, allowing independent mutation and selection, leading to new species.
- (b)(i) As depth increases, the number of red males continues to rise. A reasonable prediction for 60–70 m is about **13,000** red males.
- (b)(ii) Counting from video may be inaccurate if fish move between depth bands or are missed in poor visibility.
- (b)(iii) Blue males dominate in shallow water but decline rapidly with depth, while red males are scarce near the surface and dominate deeper waters.
- (c) To confirm speciation, place individuals from both populations

together. If they cannot interbreed to produce fertile offspring, they are **separate species**.

Final Answer

- (a)(i) Behavioural isolation | (a)(ii) Prevents gene flow enabling speciation
- (b)(i) $\approx 13,000$ red males at 60–70 m
- (b)(ii) Fish movement or poor visibility $\rightarrow$ inaccurate counts
- (b)(iii) Blue in shallow / red in deep water
- (c) Cannot interbreed $\rightarrow$ different species

Revision Tips

- Speciation requires isolation, mutation, and natural selection acting independently in each group.
- Barriers may be geographical, ecological, or behavioural.
- Behavioural isolation arises from differences in mating signals or courtship preferences.
- A species is defined by its members' ability to produce fertile offspring.

Reproductive isolation (sexual selection by colour)

Blue males



Females



Females

Deep



Females

Shallow