2025 Bi H2 Q3

Section: Evolution

Topic: Speciation

Question Summary:

Cichlid fish populations show different male colours at different water depths. Females choose mates based on colour at different depths. The question asks about isolation barriers, importance for speciation, predicting distribution, method error, comparing trends, and how to prove separate species.

Worked Solution:

(a)(i) The isolation barrier is behavioural. Females in shallow water only mate with blue males and
females in deep water only mate with red males.

(a)(ii) Isolation barriers prevent gene flow between populations. Without gene flow, mutations and
selection act independently, allowing the populations to diverge and eventually form new species.

(b)(i) The number of red male fish increases sharply with depth. From the table, red males rise from
6650 at 30-40 m to 9210 at 40-50 m and 11570 at 50-60 m. The next band will likely increase again.
A reasonable prediction is about 14000 red males at 60-70 m.

(b)(ii) Cameras may not count accurately because some fish may be hidden, outside the field of view,

or misidentified due to poor visibility.

(b)(iii) Blue males decrease steadily with depth. Red males increase steadily with depth. At shallow
depths almost all males are blue; at deep depths almost all males are red.

(c) To prove they are different species, test whether individuals from the two groups can interbreed
and produce fertile offspring. If they cannot, they are separate species.

Final Answers:

(a)(i) Behavioural isolation.
(a)(ii) Prevents gene flow so populations diverge into new species.
(b)(i) About 14000 red males at 60-70 m.
(b)(ii) Camera counts may miss or misidentify fish.
(b)(iii) Blue males decrease with depth; red males increase with depth.
(c) Show that they cannot interbreed to produce fertile offspring.

Revision Tips:

- Isolation barriers can be geographical, ecological or behavioural. Here it is behavioural because mate choice differs.
- No gene flow is essential for speciation.
- Always look for trends in tables before predicting values.
- Species test: fertile offspring rule.