

Do terrestrial protected areas conserve freshwater fish diversity? Results from the Western Ghats of India

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APPENDIX 1 Details of measurement of ecological variables in the three major land-use types (protected areas, rubber and mixed plantations, crop agriculture and rural/urban areas) of the study area.

Variable (unit; category)	Measurement/delineation ¹	Protected areas	Rubber & mixed plantations	Crop agriculture, rural/urban areas
Elevation (m; lowlands, midlands, highlands)	GIS	Midlands–highlands, (90–1,700 m)	Midlands (50–200 m)	Lowlands–midlands (0–150 m)
Stream order (category)	GIS, toposheets	Small to moderate (1–4)	Small to moderate (3–5)	Moderate to large (3–7)
Slope (degrees)	GIS	Steep sloping, rocky hill faces	Gradual	Very low
Substrate (category)	Observation	Rocky in highlands, sandy/rocky in midlands	Muddy & sandy, occasionally rocky	Predominantly muddy & sandy, rarely rocky
Canopy cover (%)		High (50–90%)	Moderate (10–70%)	Low (0–10%)
Protection status (observation)	GIS	Wildlife Sanctuary or Reserve Forest	Unprotected private property	Unprotected revenue lands
Distance from dam reservoir (m)	GIS	Upstream in catchments above dam reservoirs ²	Surroundings & downstream of dam reservoir areas	Furthest from dam reservoir areas, but supplied by canals
Land cover type (observation)	GIS, toposheets	Evergreen to deciduous forest, Shola grasslands, teak plantations	Rubber, oil palm, fruit plantations, settlements	Plantation crops other than rubber, cereal & food crops, paddy, urban & rural areas

¹Geographical information software (GIS): *Idrisi v. 15.0* (ClarkLabs, Clark University, Worcester, USA) and *Google Earth* (Google, USA); toposheets: Survey of India at 1:25,000 and 1:50,000, published in 1989–1990

²There are no dams on the Ithikkara and Vamanapuram rivers

APPENDIX 2 Datasheet used for interview surveys with local fishers.

Name Age and sex
 Occupation Date and time
 River Village/Town/District
 How are you dependent on the local water bodies?
 (directly/indirectly)
 Dependence of local people on fishing? Average catch and income?
 What fishing techniques are employed in the local river?
 What are the threats affecting local water sources and fishes?

ASSESSMENT OF THREATS TO FRESHWATER FISHES

Past

Present

Future

- a Habitat loss/degradation
 Deforestation by agriculture and plantations
 Human habitation (settlements/industries/towns)
 Aquaculture
- b Land management of non-agricultural areas
 Forest land (mention type of forest)
 Protected area/Reserve Forest status
 Revenue land
 Irrigation Department land (reservoir/canal area)
- c Agricultural management
 Rubber plantations
 Mixed fruit plantations (banana, areca, coconut, tapioca, etc.)
 Oil palm plantations
 Eucalyptus/teak plantations
- d Resource extraction
 Mining (sand/gravel/boulder/other)
 Direct abstraction of water
 Dams and hydroelectric power projects
 Industrial offtake
 Fisheries (artisanal-subsistence/industrial)
 Harvesting for medicine/materials
 Exploitation for aquarium trade
 Destructive fishing methods (dynamiting, poisoning, etc.)
- e Human disturbance
 Settlements, tourism
 Water transportation
 Pilgrimage
 Pollution (industrial/domestic/agricultural/sewage)
- f Fish communities and populations
 Species diversity
 Population abundance/demographics
 Sizes caught
- g Invasive alien species
- h Natural disasters (floods/cyclones/drought)
- i Climate change