

River Ecology with special focus on Flow-species ecology relationship

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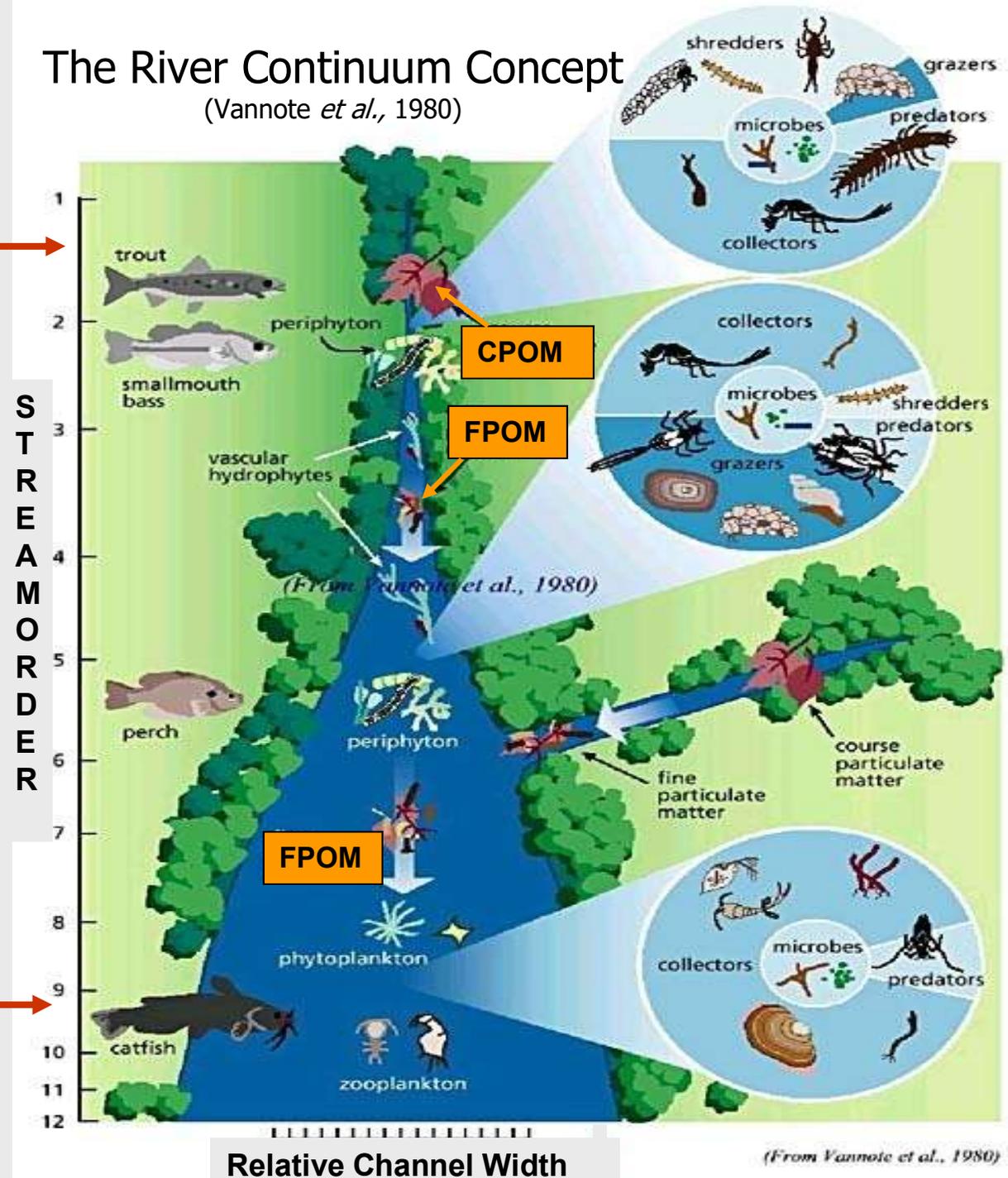
The River Continuum Concept

(Vannote *et al.*, 1980)

Links between land & aquatic communities are strongest in headwaters

Landuse, which influence the terrestrial-aquatic interface, can affect biotic components and their community dynamics

Links between biotic communities are strongest in large river



(From Vannote *et al.*, 1980)

Role of river flow in aquatic ecology

- Rejuvenate & restore river ecology
- Provides oxygen-rich water
- Brings food resources to aquatic organisms



Role of river flow in aquatic ecology

- Adequate river flow is very important for **Reophilic** species



Role of river flow in aquatic ecology

- Aquatic animals get environmental clue for attaining physiological stimulus to achieve reproductive success



Role of river flow in aquatic ecology

- Provides access to habitat connectivity and reaching spawning ground

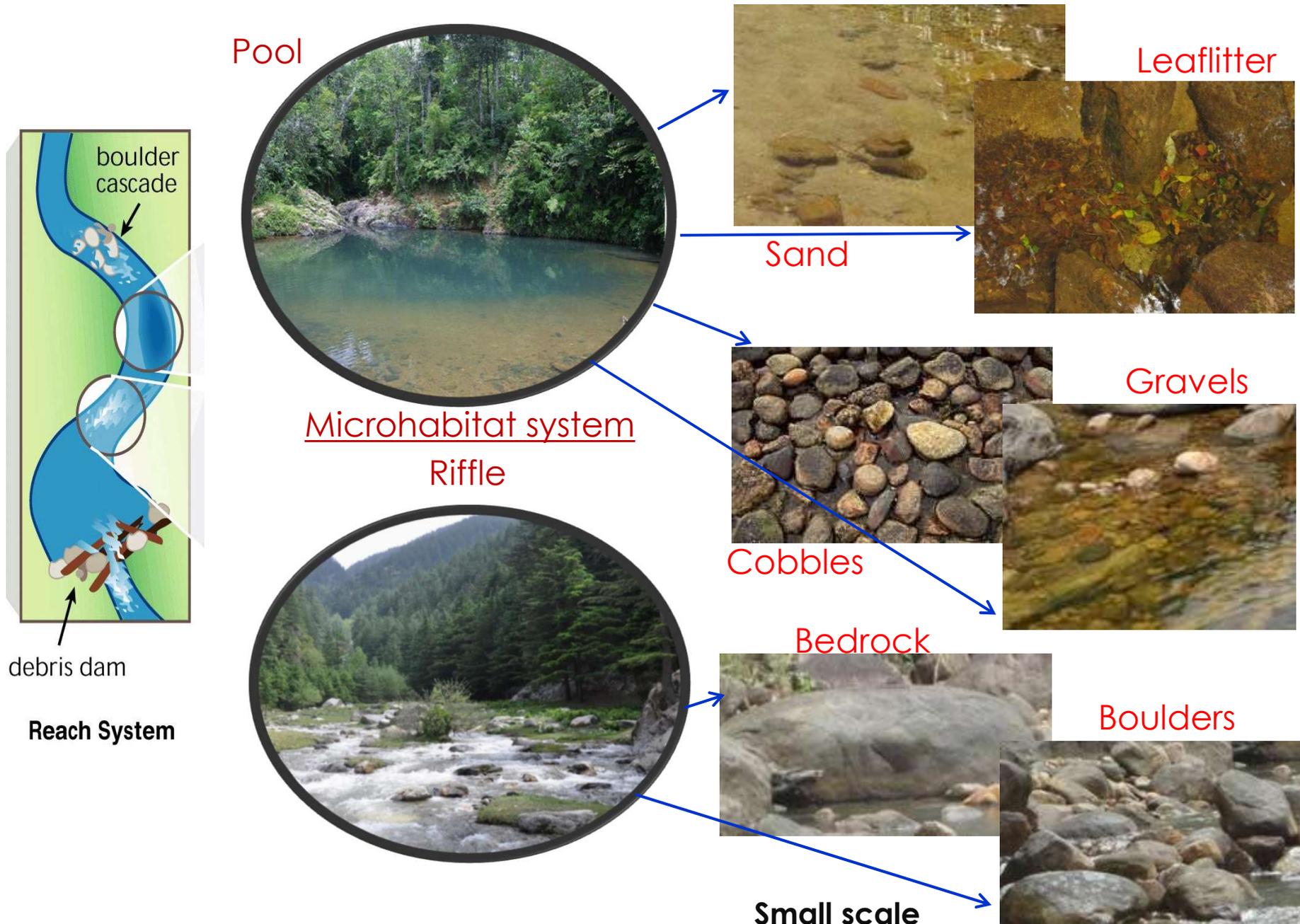


Role of river flow in aquatic ecology

- Flow facilitate lateral channel connectivity and allow fishes to access spawning habitat



- Adequate flow creates multiple microhabitats



Freshwater flow for sustaining Mangrove Ecosystem

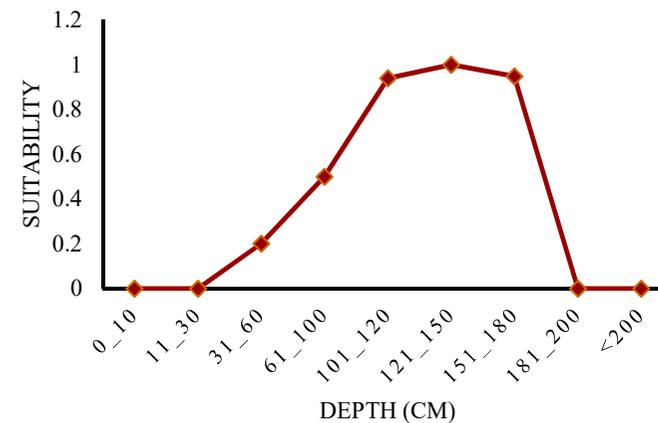
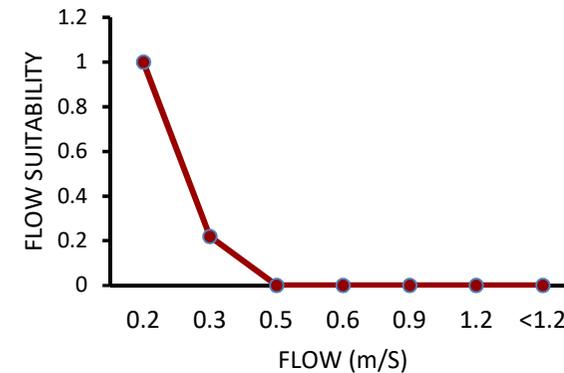
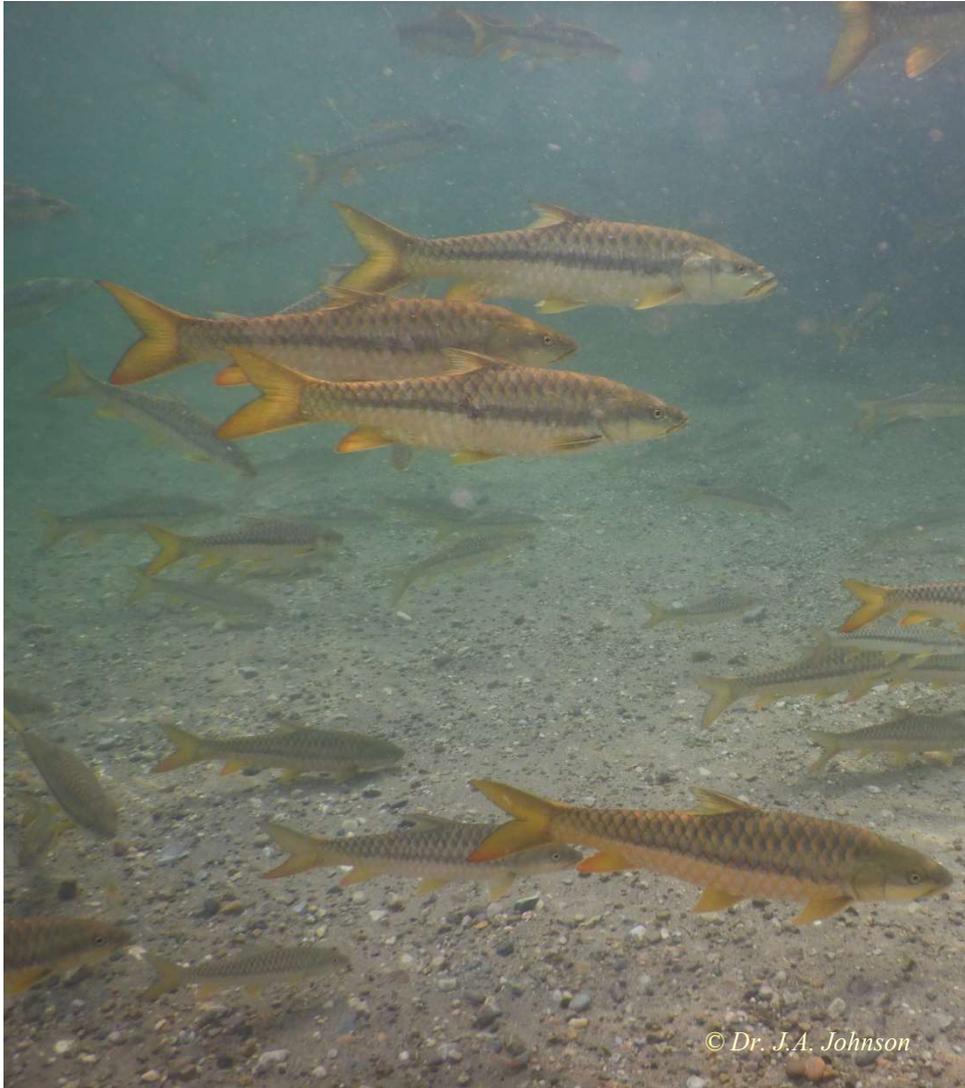


Ecology of different aquatic species

- Golden Mahseer - adults

Adults live in pool habitat – depth of the water column is the major habitat requirement for adults.

Suitable depth & flow at pool habitats – 120-180 cm; 0.2 m/Sec during lean season (pre-monsoon)

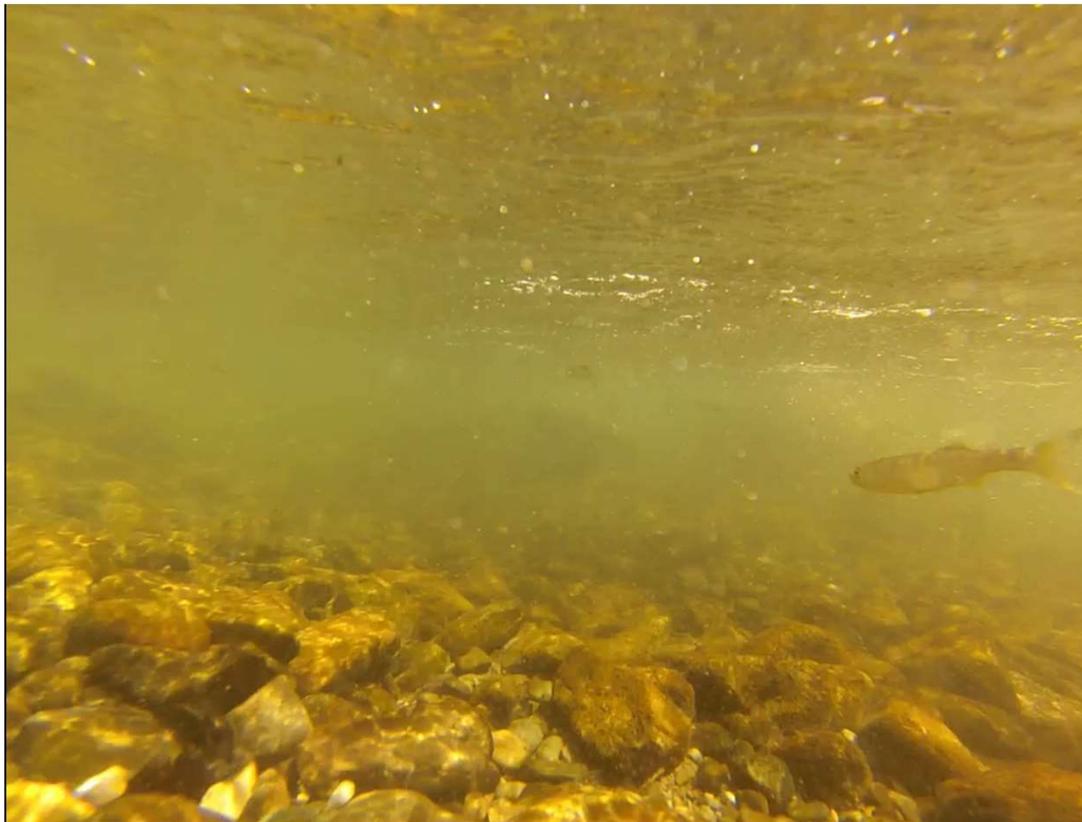


Ecology of different aquatic species

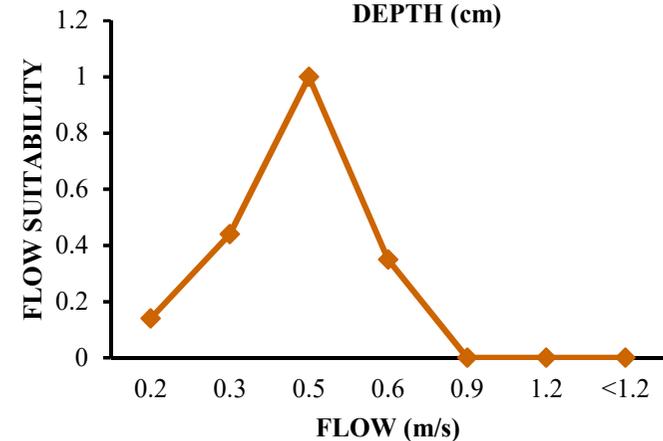
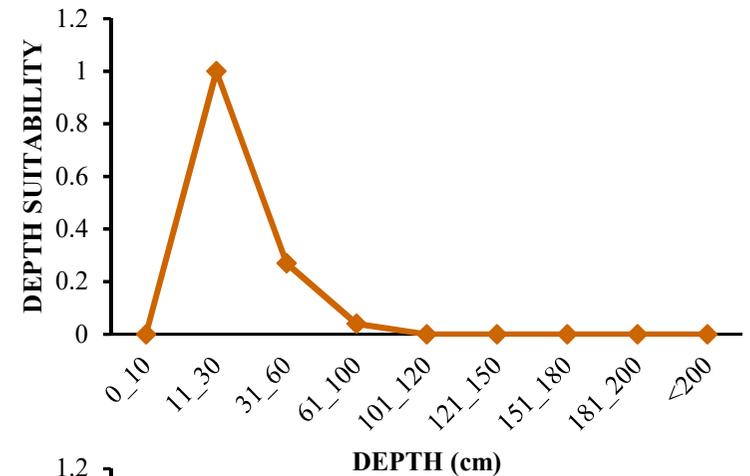
- Golden Mahseer – young-ones

Young mahseers live in riffle habitat – they are reophilic, flow is the major habitat requirement – lives in riffle habitat.

Suitable depth & flow at riffle habitats – 30-60 cm; 0.3 to 0.5 m/Sec



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Ecology of different aquatic species

Bangana dero



© Dr. J.A. Johnson

Raiamas bola



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Both species prefer riffle/ run habitats & flow is the major habitat requirement for these species

Depth & flow requirement at riffle/ run section – 60 to 90 cm; 0.1 to 0.2 m/Sec.

Ecology of different aquatic species

- Gangetic Dolphin/ Gharial



Dolphin: Adults live in deep pool habitat – water depth is major limiting factor.

Depth should be > 3 m



Gharial: Depth usage is 2 – 3 m in pools, similar to Dolphin. In addition, it requires sandy beach & gentle river bank slope

Ecology of different aquatic species

- Turtles



Turtles – require islands and exposed sand banks. Flow & depth do not influence their distribution



Basking area & Nesting beaches are very important

Birds

Very few birds are flow dependent – eg. White-Bellied Heron



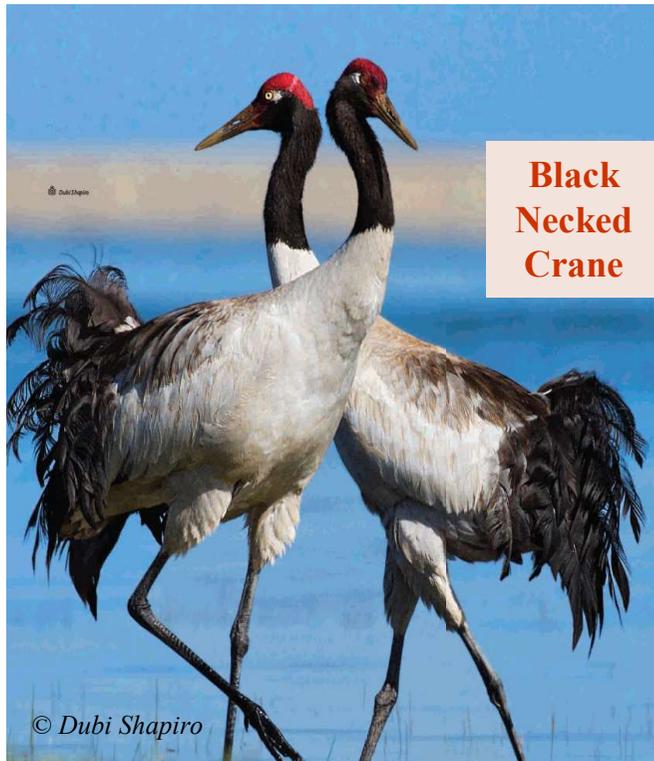
Critically endangered species – only 200 individual left in wild, India has ~20 individuals in Namdapha Tiger Reserve in Arunachal Pradesh, a only known habitat in India. Fish eating bird, exclusively forage in riffle habitat with velocity ranges from 0.3-0.5 m/Sec



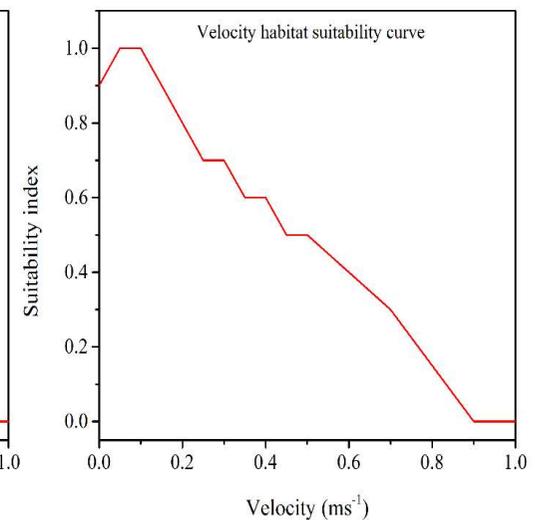
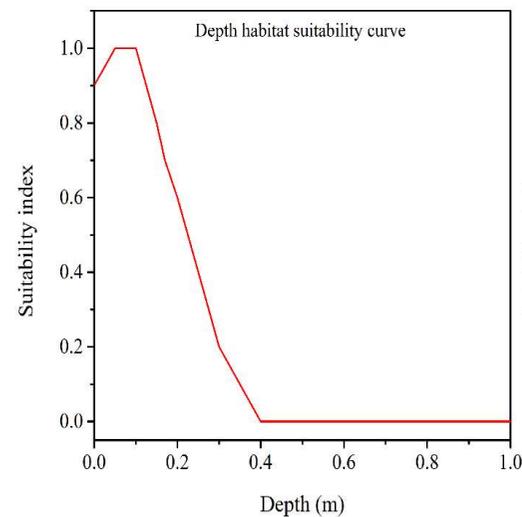
Birds

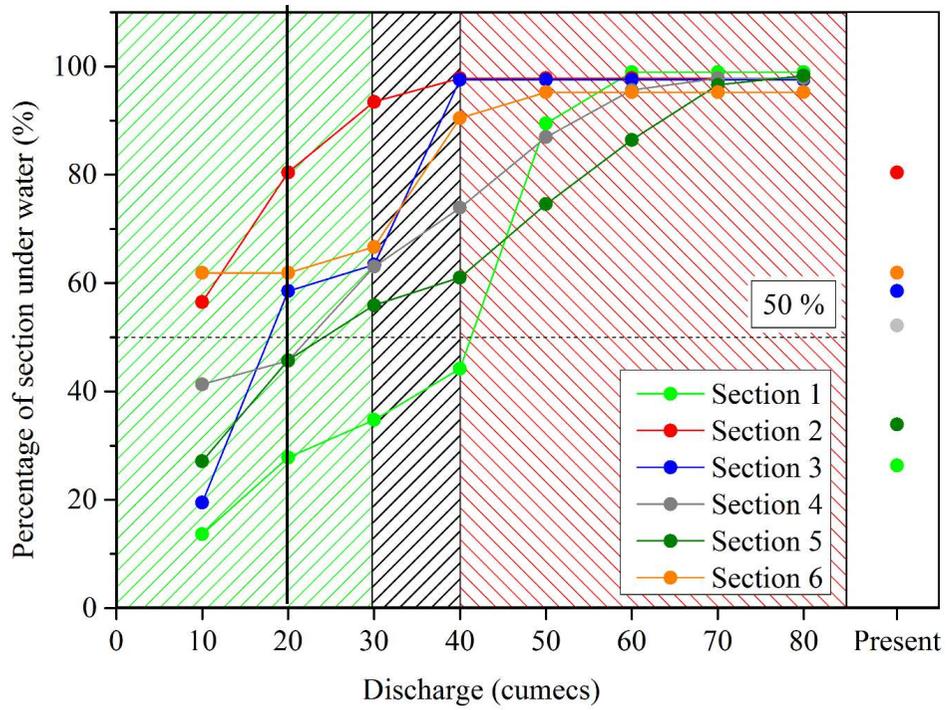
Black-Necked Crane (BNC) – Flow & depth do not influence BNC distribution, but they use open ground such as dry channel, gravel and sand beds.

ToR – “the Wildlife Institute of India to take up a detailed study of the habitat requirements of the Black-Necked Crane vis-a-vis the environmental flow at the Nayamjang Chu Project site”

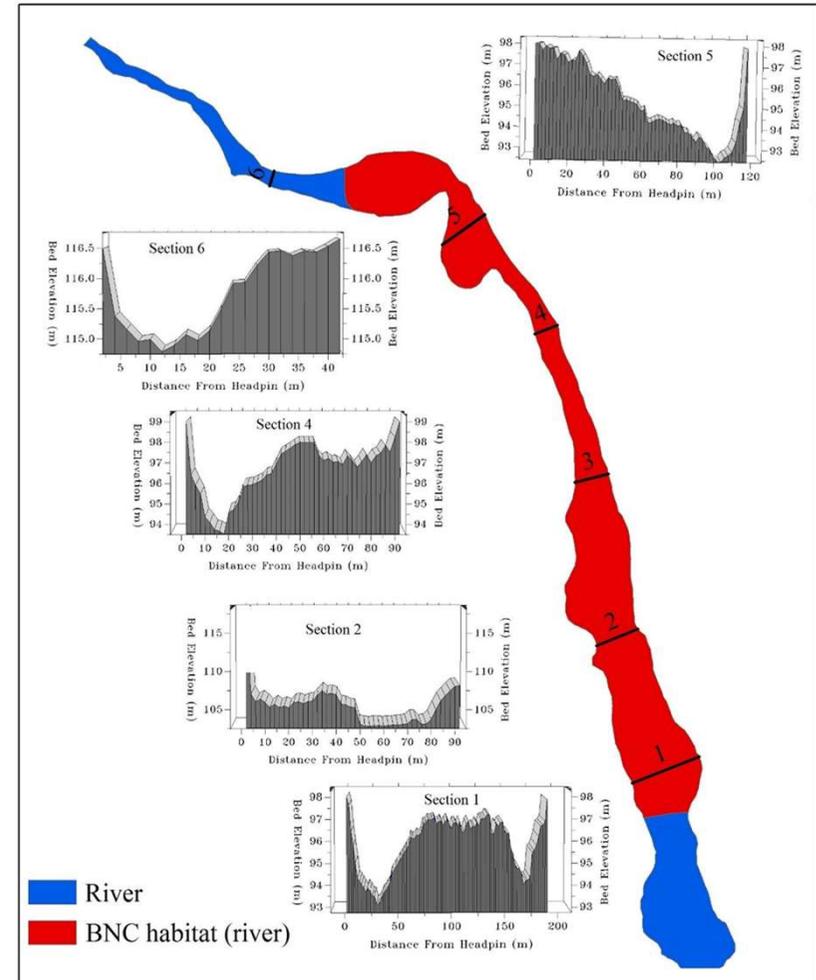


Nyamjang Chu River at Zemithang, Arunachal Pradesh





Section no.	Length (m)	Percentage section under water at different discharge values (cumecs)								
		Flow (Present)	10	20	30	40	50	60	70	80
1	190	26	13	27	34	44	89	98	98	98
2	92	80	56	80	93	97	97	97	97	97
3	82	58	19	58	63	97	97	97	97	97
4	92	52	41	45	63	73	86	95	97	97
5	118	33	27	45	55	61	74	86	96	98
6	42	61	61	61	66	90	95	95	95	95
Average		52	36	53	62	77	90	95	97	97



Conclusion

Points to be considered during e-flow estimation

- Identify **flow indicator species** & estimate the flow, depth requirement **at riffle section**
- In the case of large rivers, identify umbrella species, eg. Dolphin in Ganges
 - It is not a flow dependent species
 - Require deep pools >3 m deep
 - Estimated flow **should be maintain 3m deep pools** between crosssections
 - Ensure adequate connectivity between pool habitats
- In the case of Turtles - **islands and exposed river banks** are important habitats (not depth and flow) that needs to be considered while estimating e-flow
- River birds – **foraging grounds, sand bars and exposed river beds** are important habitats that need to be taken care



Thank You !

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