



BioRA DSS Workshop

Frogs and reptiles: Indicators, linked indicators and response curves

BioRA DSS Technical Workshop
Phnom Penh, Cambodia
15-19 February 2016
Presented by Hoang Minh Duc



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What is Herptiles?

- Amphibians



- Reptiles



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What is Herptiles?

- Quite diverse group

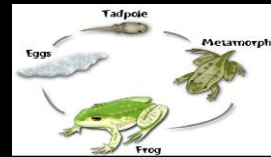
- In body size



- Habitat preference



- Life-circle



Why is Herptiles?

- play a pivotal role in ecosystem as primary / secondary/tertiary consumers in many food chains
- are the best biological pest controllers
- are a good food source in the LMB countries
- are useful in human medicine/leather industry
- are regarded as good ecological indicators (habitat fragmentation, ecosystem stress, impact of pesticides, and various anthropogenic activities)

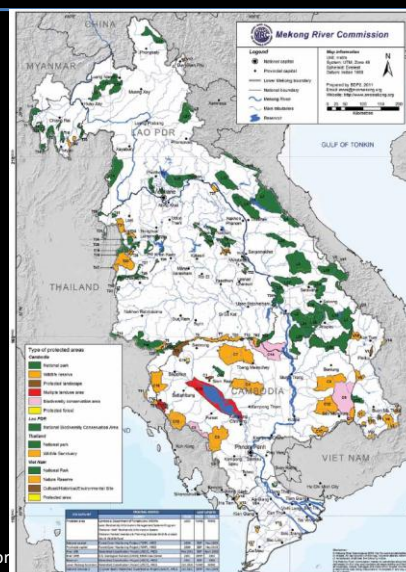
Herptiles in Lower Mekong Basin

- Current knowledge:
 - Amphibian: 316 species (AmphibiaWeb)
 - Reptile: 686 species (Reptile Database)
- Limitation
 - Very little information is available specifically along the Mekong mainstem.
 - Lack of information on population status and trend, and behavioural ecology of most species

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Herptiles in Lower Mekong Basin

- Limitation
 - Most studies focused on taxonomy, distribution, species composition (with additional info on population status, threats)
 - focused on protected areas or biodiversity hotspot
 - few studies focused on human exploitation, wildlife trade



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Our approach

- Focus on water-dependent species
- Information from published/unpublished documents were used:
 - Species with known ecological and behavioural characteristics that best represent a species guild were chosen as indicators
 - To assess the response of herpetofauna indicators to other linked indicators, general documented scientific principles related to herpetofauna were used
- Expert knowledge were used

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Our team

- Herpetofauna team
 - Dr. Hoang Minh Duc, Lead
 - Mr. Serewath Pich – Cambodia
 - Dr. Phaivanh Phiapalath – Lao PDR
 - Dr. Luu Hong Truong - Vietnam
 - Other members:
 - Mr. Anthony Stones
 - Regional herpetologists
- Team collaboration on CS
 - OSV – June 2015
 - pre-workshop in OSP to initiate DRIFT set-up
 - Presentation of indicators & trends by NCs
 - OSP – Sept 2015
 - Continue DRIFT calibration



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Selection of Indicators

No.	Indicator
RMiAmphi	Ranid and Microhylid amphibians
AquSerp	Aquatic serpents
AquTur	Aquatic turtles
SAquTur	Semi-aquatic turtles
Amphib	Amount of Amphibians available for human exploitation
SAquRep	Amount of Aquatic/semi-aquatic reptiles available for human exploitation
SpAmphib	Species richness of riparian/floodplain amphibians
SpRep	Species richness of riparian/floodplain reptiles

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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Ranid and microhylid amphibians	They are more water dependent, play important roles in the ecosystem and also form an important food source of local people	- <i>Hylarana nigrovittata</i> - <i>Hoplobatrachus rugulosus</i>



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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Aquatic serpents	<ul style="list-style-type: none"> - viviparous species - lives entirely in water - feeds mainly on fishes and other aquatic species. 	<i>Enhydris</i> spp <i>Cylindrophis rufus</i> *



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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Aquatic turtles	<ul style="list-style-type: none"> - live and feed mainly in water bodies - lay their eggs on sandbars or river/stream banks. 	<i>Amyda cartilaginea</i> <i>Malayemys subtrijuga</i>



Cua đĩnh - Asiatic softshell turtle
 Tên Khoa học: *Amyda cartilaginea*
 Photo: Nguyễn Ngọc Hưng/ĐLE



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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Semi-aquatic turtles	<ul style="list-style-type: none"> - live in grasslands, and riverine and swamp forests. - nest on sandbars and riverbanks and also in the tidal areas of large estuaries 	<i>Cuora amboinensis</i> <i>Heoesemys grandis</i>



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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Amphibian available for exploitation	<ul style="list-style-type: none"> - Large in size - Live in the floodland or along rivers 	<i>Hoplobatrachus rugulosus</i> , <i>Fejervarya limnocharis</i> , <i>F. cancrivora</i> (lowland) <i>Limnonectes</i> spp., <i>Ordorrana</i> spp. (upland)



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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Reptiles available for exploitation	<ul style="list-style-type: none"> - Provide food, traditional medicine for local consumption - skin, medicinal materials for trade 	Aquatic and semi-aquatic reptiles (turtles, snakes, lizards)



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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Species richness of riparian/FP amphibians (the number of different species represented in an ecological community region. It does not take into account the abundances of the species)	<ul style="list-style-type: none"> - Most amphibians are water-dependent species. They prefer living in calm areas within stream and wetlands, with low levels of water fluctuation and low sediment flows. - Changes in river and sediment flows will lead to changes in species richness of riparian and floodplain reptiles. 	All species live in relevant habitats

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Selection of Indicators at FA3 (Se Pang Fai)

Indicator	Description	Species
Species richness of riparian/FP reptiles (the number of different species represented in an ecological community region. It does not take into account the abundances of the species)	<ul style="list-style-type: none"> - Change in water volume, inundation depth, and timing of annual flood as well as erosion of sandbars and riverbanks and loss of riverine forests will cause habitat changes and reduce the diversity of riparian reptiles. - A long duration of the flooding season will increase the exposure of riparian reptiles to human pressure. 	All species live in relevant habitats

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DRIFT Herpetofauna Indicators

Herpetofauna indicators	Links
Ranid & microhylid amphibians	Hydro., Hydrau., Sed., Wqua., Geom., Veg., Macroin., Fish
Aquatic serpents	Hydro., Hydrau., Sed., Wqua., Geom., Veg., Fish
Aquatic Turtles	Hydro., Hydrau., Sed., Wqua., Geom., Veg., Macroin., Fish,
Semi-aquatic Turtles	Hydro., Hydrau., Sed., Geom., Veg., Fish.
Amphibians -human exploitation	Hydrau., Wqua
Reptile available for -human exploitation	Hydrau.
Species richness of riparian/FP amphibians	Hydro., Hydrau., Sed., Geom., Veg
Species richness of riparian/FP reptiles	Hydro., Hydrau., Sed., Geom., Veg, Fish

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Herptile indicators by Focus Areas

Indicator	Indicator Species	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8
Rapid & microhylid amphibians	<i>Rana nigrovittata</i>	P	P	P	P	P			
	<i>Hoplobatrachus rugulosus</i>		P	P	P	P	P	P	P
Aquatic serpents	<i>Cylindrophis ruffus</i>		P	P	P	P	P	P	P
	<i>Enhydryis bocourti</i>				P	P	P	P	P
Aquatic Turtles	<i>Amyda cartilaginea</i>		P	P	P	P	P	P	P
	<i>Malayemis subtrijuga</i>		P	P	P	P	P	P	P
Semi-aquatic Turtles	<i>Cuora amboinensis</i>			P	P	P	P	P	P
	<i>Heosemys grandis</i>			P	P	P	P	P	P
Quantity of amphibians - human exploitation	All species			P	P	P	P	P	P
Quantity of aquatic/semi-aquatic reptiles - human exploitation	All species			P	P	P	P	P	P
Species richness of riparian/FP amphibians		P	P	P	P	P	P	P	P
Species richness of riparian/FP reptiles		P	P	P	P	P	P	P	P

Linked indicators and reasons for selection: Aquatic serpent

Linked indicator	Reason
Flood volume in flooding season	Floods provide foods and support for the expansion of water snakes to new areas in the wet season. Years with higher flood volumes are good for snakes, but, if floods are very high, they may be displaced from or washed out of riparian habitats.
Wet season average channel velocity	Most water snakes prefer living in calm or slow moving water bodies (e.g., lakes, pools, littoral areas with vegetation). Therefore, stronger than average channel velocity is predicted to wash out water snakes away from their shelters.

Linked indicators and reasons for selection: Aquatic serpent

Linked indicator	Reason
Biomass riparian vegetation	Riparian vegetation provides shelter, ambush habitat (for foraging) and foods for aquatic and semi-aquatic snakes. When destroyed, many snakes will no longer survive. Biomass of riparian vegetation, especially of aquatic and semi-aquatic plants is linked to abundance of aquatic snakes.
Fish Biomass	Water snakes in the LMB are among the top predators, feeding predominantly on fishes and amphibians, but also on other reptiles and crustaceans. The fish biomass is considered to be a main factor in determining the abundance of water snakes.

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Linked indicators and reasons for selection: Aquatic turtle

Linked indicator	Reason
Erosion	Erosion will cause habitat loss and displace nesting site of turtles along the riverbanks.
Exposed sandy habitat in the dry season	Aquatic turtles need sandy habitat for thermoregulation and nesting.
Dry maximum channel depth	High water level depth can inundate nests of turtles on riverbank.
Wet season duration	Short duration of wet season may have minor direct impact on aquatic turtles living in the mainstream. On the contrary, long wet seasons may cause unsuccessful reproduction since eggs of aquatic turtles need about 60-90 days of dry season for hatching.

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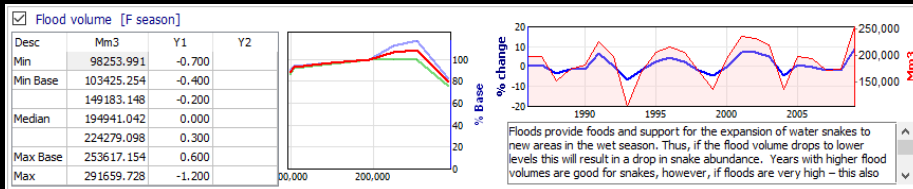
Linked indicators and reasons for selection: Aquatic turtle

Linked indicator	Reason
Riparian and aquatic cover	Riparian and aquatic cover provide shelter and feeding ground for some turtles.
Fish biomass	The fish biomass is considered be a main factor in determine the abundance of water turtles.
Snail abundance	Aquatic turtle, especially <i>Malayemys subtrijuga</i> in floodplains, feed mainly on snails.
Extent flooded forest cover	In the floodplain area, flooded forest provides shelter and feeding ground for some turtles.
Extent herbaceous marsh veg.	In the floodplain area, herbaceous marsh veg. provides shelter and feeding ground for some aquatic turtles.
Average floodplain depth	High level of average floodplain depth will inundate nests of turtles in the dry season

Response curve

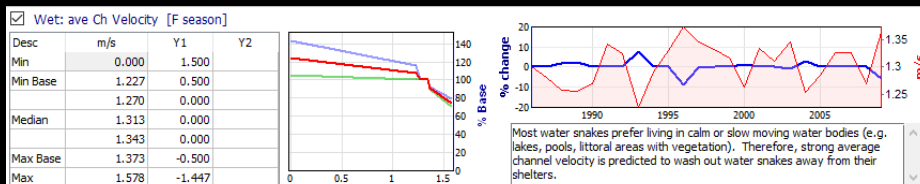
- 1 Response Curve (RC) for each linked indicator
 - E.g. Aquatic serpent has 7 linked indicators = 7 RCs
 - Number of response curve varies according to FA
- Response curves capture how indicator will change as the linked indicator changes:
 - As average channel velocity increases, abundance of aquatic serpent will decrease
 - As fish biomass increases, abundance of aquatic serpent will increase
- Directions of changes are generally well established
- Magnitude of changes can be more difficult to quantify

Response curve: Aquatic serpent at FA3



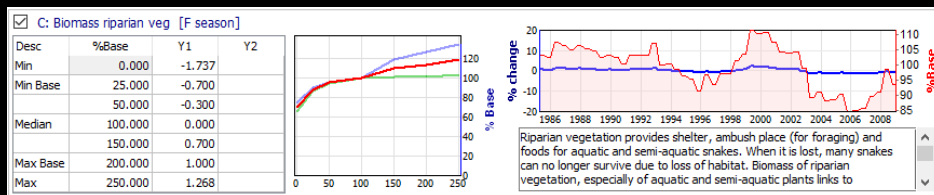
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Response curve: Aquatic serpent at FA3



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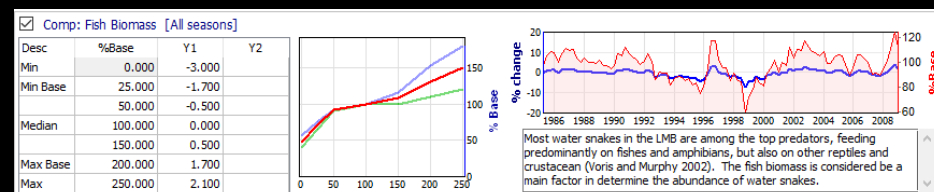
Response curve: Aquatic serpent at FA3



Riparian vegetation provides shelter, ambush place (for foraging) and foods for aquatic and semi-aquatic snakes. When it is lost, many snakes can no longer survive due to loss of habitat. Biomass of riparian vegetation, especially of aquatic and semi-aquatic plants links to abundance of aquatic snakes. It is estimated that there would be a c. 30% decline if the biomass of riparian vegetation dropped to zero and an increase of c. 20% if the biomass was c. 250% of 2015 levels.

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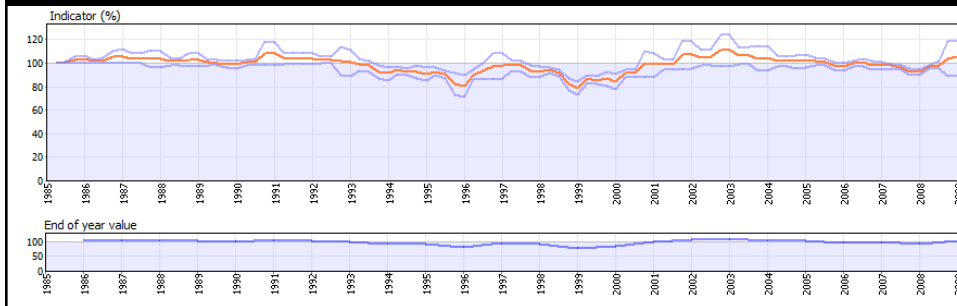
Response curve: Aquatic serpent at FA3



Most water snakes in the LMB are among the top predators, feeding predominantly on fishes and amphibians, but also on other reptiles and crustacean (Voris and Murphy 2002, Catterall *et al.* 2007). The fish biomass is considered be a main factor in determine the abundance of water snakes.

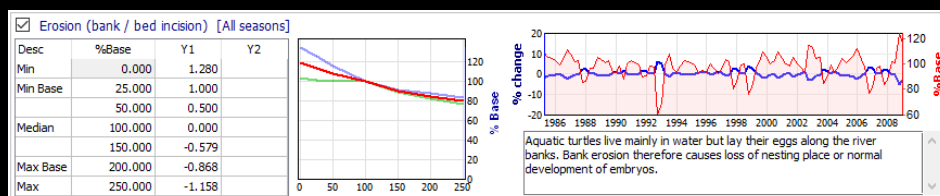
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Response curve: Aquatic serpent at FA3



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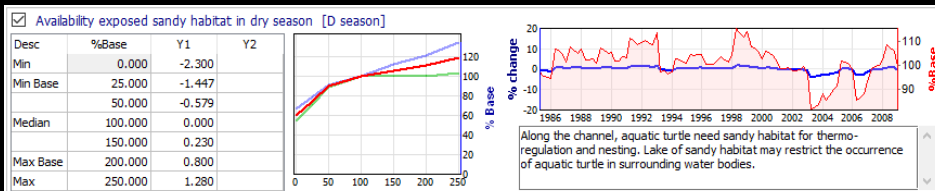
Response curve: Aquatic turtle at FA3



Aquatic turtles live mainly in water but lay their eggs along the riverbanks. Both Asian Softshell Turtle and Asian Giant Softshell Turtle were reported to lay eggs in some sections of the Mekong River (Timmins 2008). There is no information on whether nesting sites of aquatic turtles in Mekong River and its floodplain are located in areas with high potential of bank erosion. Bank erosion could cause total loss of nesting area or partly affect normal development of embryos.

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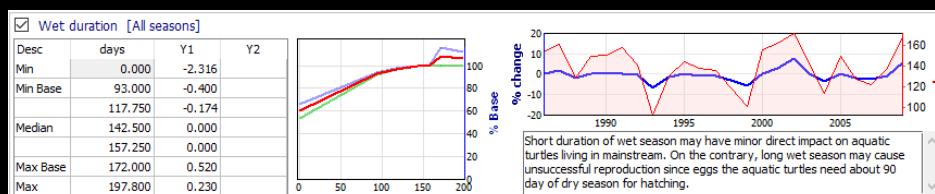
Response curve: Aquatic turtle at FA3



Along the channel, aquatic turtle needs sandy habitat for thermo-regulation and nesting as reported for Asian Giant Softshell Turtle (Emmett, 2009) and Asiatic Softshell Turtle (Timmins 2006) in LMB or for other riverine turtles, (including those in eastern Minnesota, USA (Lenhart *et al.* 2013)) . Lack of sandy habitat may restrict the occurrence of aquatic turtles in surrounding water bodies.

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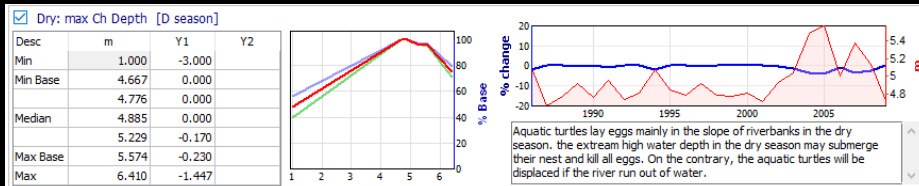
Response curve: Aquatic turtle at FA3



Short duration of wet season may have minor direct impact on aquatic turtles living in mainstream. On the contrary, long wet season may cause unsuccessful reproduction since eggs the aquatic turtles need about 60-90 days of dry season for hatching (Emmett 2009).

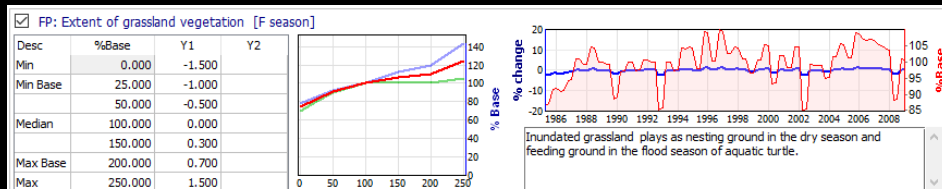
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Response curve: Aquatic turtle at FA3



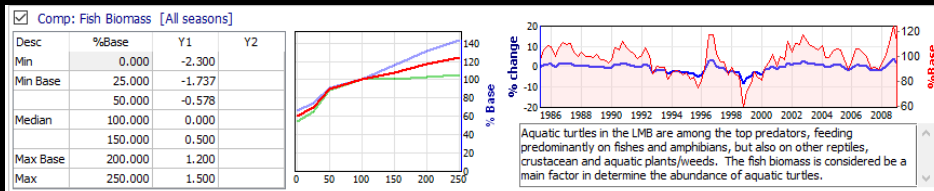
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Response curve: Aquatic turtle at FA3



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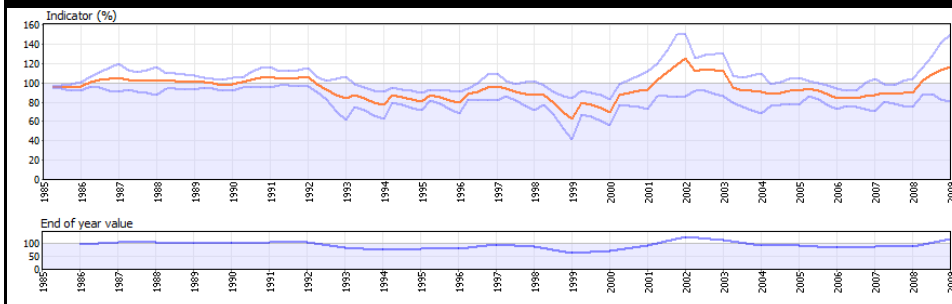
Response curve: Aquatic turtle at FA3



Aquatic turtles in the LMB are among the top predators, feeding predominantly on fishes and amphibians, but also on other reptiles and crustaceans (Voris and Murphy 2002). Fishes are important prey of reptiles, especially aquatic turtles and aquatic snakes (Asian Turtle Trade Working Group 2000, Murphy 2007). The fish biomass is considered to be a main factor in determining the abundance of water snakes.

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Response curve: Aquatic turtle at FA3



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Thank you & Questions?

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