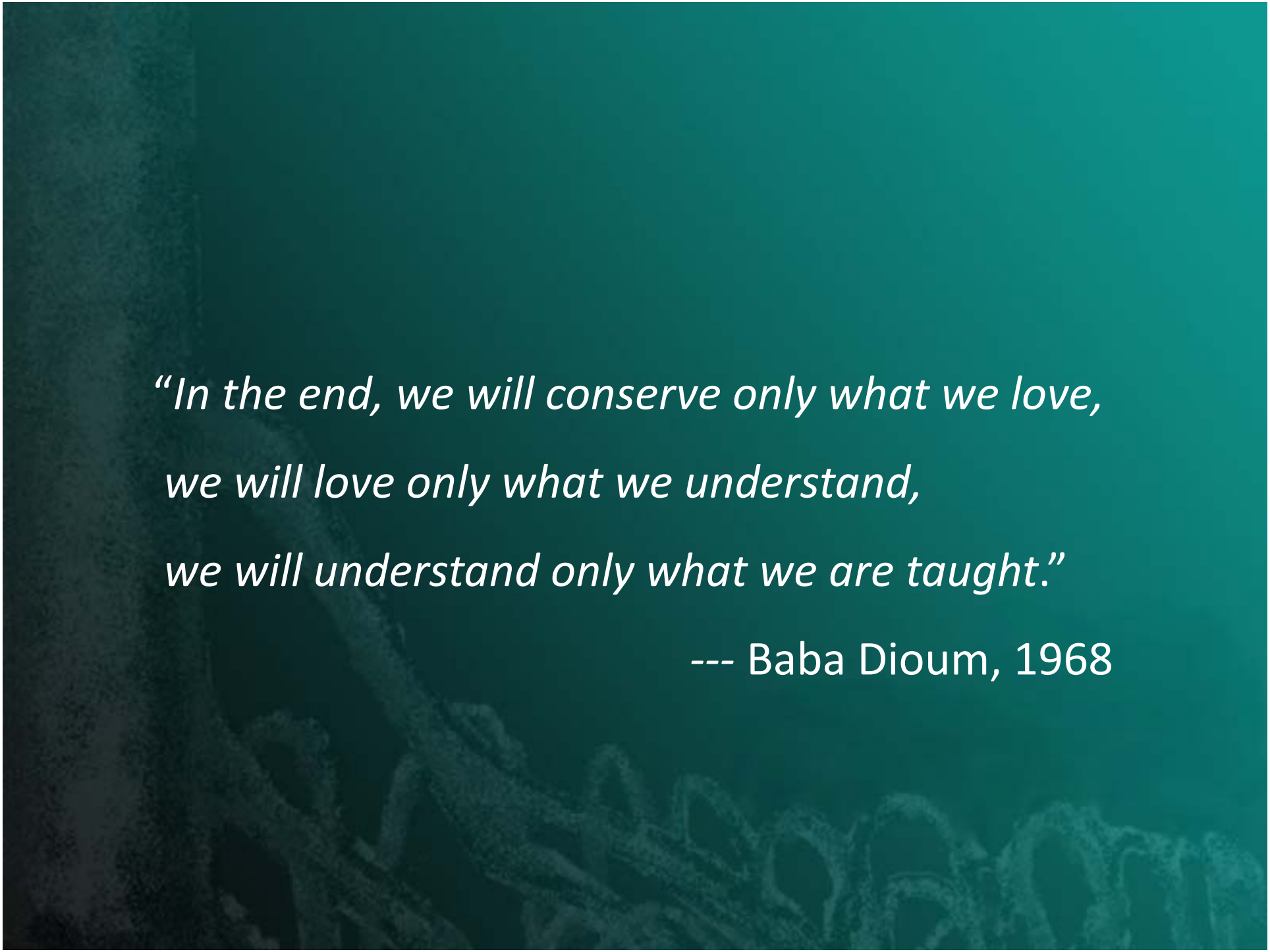
Myristica swamps – A treasure trove of biodiversity

Joyce Jose[1] ,Roby T.J.[2] , Ramachandran K. K.[3] and Nair P.V.[2]

[1] Department of Zoology, Mar Thoma College, Tiruvalla.

[2] GIS/FIMS, Kerala Forest Research Institute Peechi, Thrissur

[3] Wildlife Biology/FE & BC Kerala Forest Research Institute Peechi, Thrissur


“In the end, we will conserve only what we love,
we will love only what we understand,
we will understand only what we are taught.”
--- Baba Dioum, 1968

Myristica swamps

- are fresh water swamp forests with Myristicacea trees (*Myristica magnifica* and *Gymnacranthera farquhariana*) as dominant vegetation
- are characterized by the presence of aerial roots (knee roots and stilt roots)
- require special abiotic conditions for development and to sustain itself.
- Are naturally fragmented and restricted in distribution



Studies on *Myristica* swamps- flora, conservation value

- Krishnamoorthy (1960)
- Champion and Seth (1968)
- Pascal (1988)
- Rodgers and Panwar (1988a and b)

  highlighted the systematic destruction of these swamps,

  called for implementation of conservation measures on Priority I basis

  and the formation of Chirikala WLS for the exclusive protection of *Myristica* swamps
- Varghese (1992)
- Chandran and Mesta (2001, 2005) and Chandran *et al*. (1999)
- Gadgil *et al.* (1995)
- Ramesh and Pascal (1997)
- Varghese and Krishna Murthy, (2006)

Studies on the fauna of *Myristica* swamps

- Arvind *et al.* (2004)
- Ali *et al.* (2006)
- Subramanian (2005)

Studies by our team on the *Myristica* swamps

- Nair *et al.* (2007) is the first comprehensive study on the mapping and biodiversity of these swamp forests
- Roby and Nair (2006, 2007) did mapping and flora diversity studies
- Studies on the fauna of *Myristica* swamps in in Southern Kerala have been Nair *et al*. (2007) and by this scholar Joyce *et al.,* 2005; 2007a ; 2007b; 2007c; 2007d; Roby and Joyce, 2008)

Myristica swamps

have been reported from

Uttara Kannada district of Karnataka (Chandran *et al*., 1999)

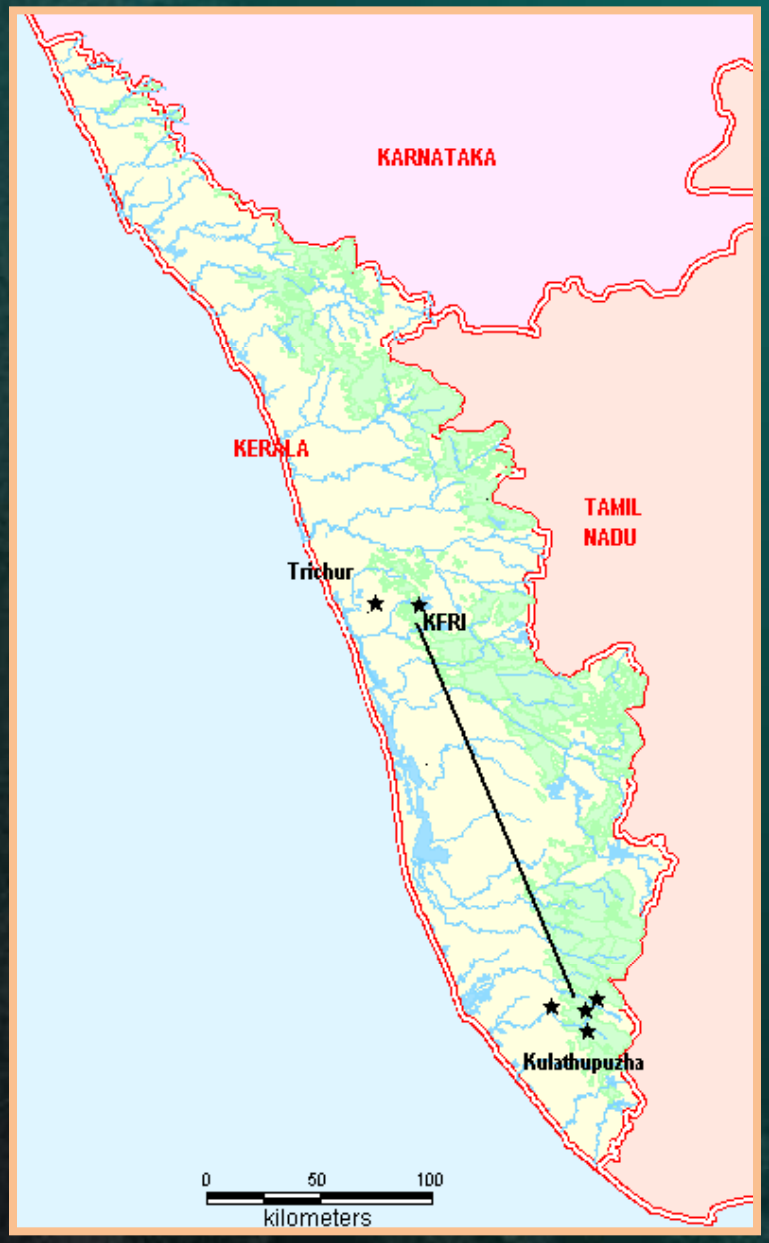
Satari in Goa (Santhakumaran *et al.,* 1995) *

Sacred grooves in Northern Kerala (Jayarajan, 2004) *

Peppara WLS (Varghese and Krishna Murthy, 2006) *

from Kulathupuzha and Anchal Forest Ranges and Shendurney Wildlife Sanctuary in Kerala (Krishnamoorthy, 1960; Varghese 1992) *

(* efforts do not specify exactly mapped area)



***Myristica* swamps** in Southern Kerala

The swamps have a cumulative area of just 149.75 ha which is .0039% of Kerala land area

Sixty individual swamp patches

Work done and methods followed (Nov 2004-March 2007)

Mapping	Boundary, stream, paths, GPS, Compass and tape, SOI. DEM. Contour.
Soil, hydrology	Soil samples- chemical and physical analysis, profile, Rainfall, water level, water table
Flora	Inventory, Taxonomic status, Conservation status and endemicity Quantitative analysis in 32 (17) plots. Trees 0.1 ha (100x0m). Shrubs 4x4x10m, herbs 1x1x10m. Phenology, Germination and Regeneration tests etc.
Fauna	Inventory, Taxonomic status, Conservation status and endemicity Quantitative analysis in 15 transects (100x4x2m) Night sampling in 2 swamps
Data Analysis	IVI, Diversity indices, Life tables, Relative dominance, Species proportion, composition and abundance Comparison of diurnal and nocturnal abundance and richness Comparison of values inside and outside the swamps Distribution models Completeness of Sampling Response to environmental gradients

We present here

Data on plant and animal diversity

Some results of general analysis

We wish

To highlight the conservation value of the *Myristica* swamps in the Kulathupuzha region

To garner support in the scientific community for immediate initiation of conservation measures

To spread awareness among the general public

To share the lessons we learnt during the study

Biodiversity of *Myristica* swamps

Flora - 92 herb -shrub species,

49 climbers

79 trees

49 plants endemic to Western Ghats

2 critically endangered species (*Vateria indica* and *Syzygium travancoricum)*

4 species are endangered (*Myristica fatua var. magnifica* is almost completely confined to swamps)

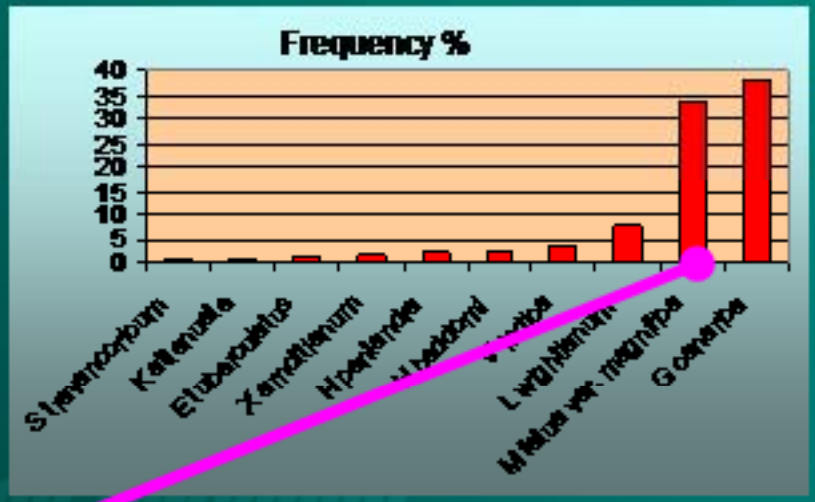
3 rare species

3 near threatened species

1 vulnerable species

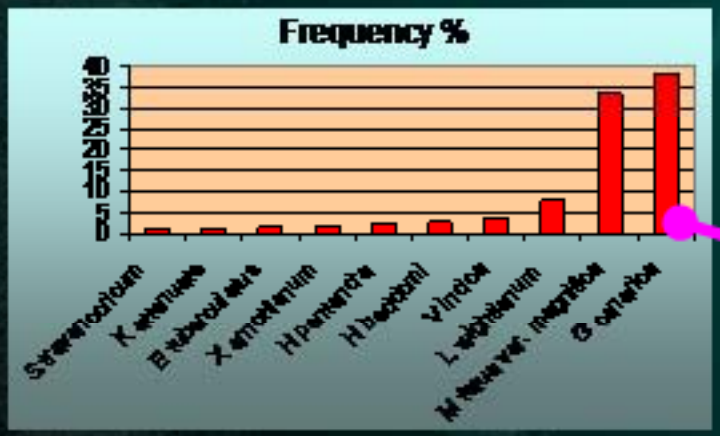
Myristica fatua var. magnifica

Major tree found in the swamp.
Adapted to swampy condition.
Produces stilt root for survival.
Narrow range of tolerance to fluctuations in inundation level.
Endangered tree restricted to swamps.
Aril is MFP



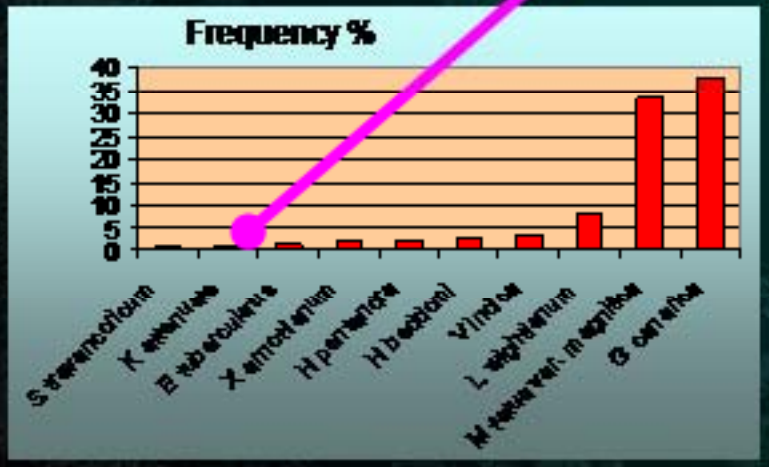
Gymnacranthera canarica

Tree species abundantly seen inside the Swamp.
Produces knee roots for survival.
Wide range of tolerance to fluctuations in inundation level.
Endemic to Western Ghats.



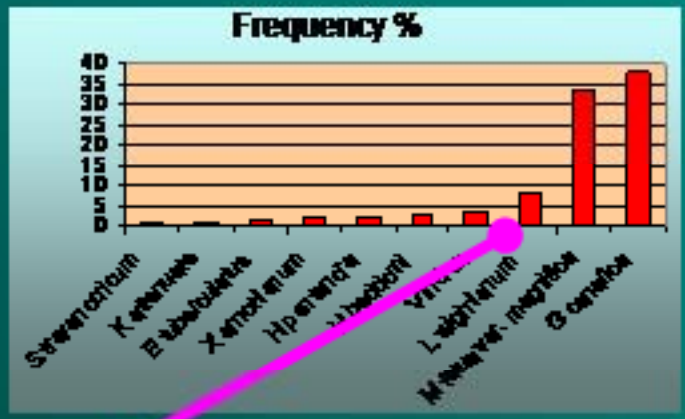
Knema attenuata

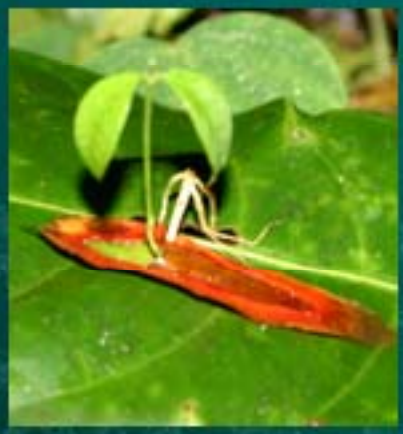
Myrsticaceae **member seen at the edges of swamp, less frequently seen inside the swamp, endemic to Western Ghats.**

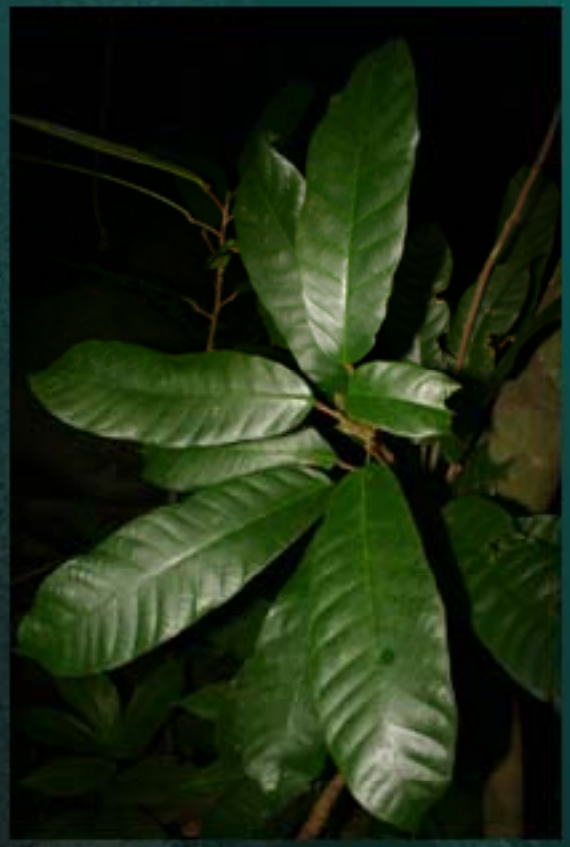


Lophopetalum wightianum

Non-*Myristica* tree species frequently found in the *Myristica* swamps, adapted to flooding condition.

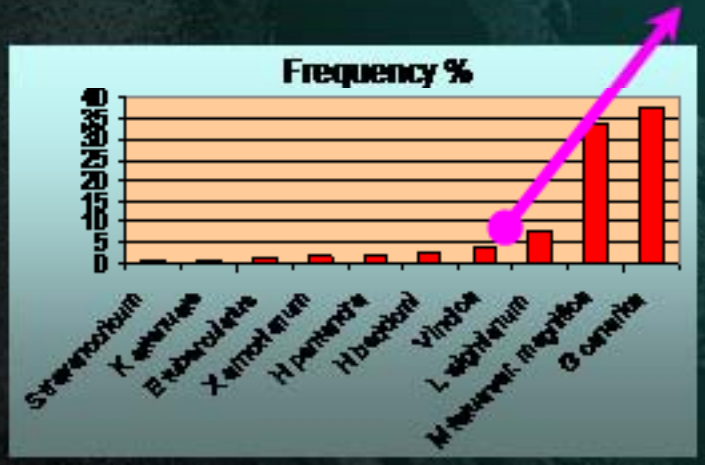






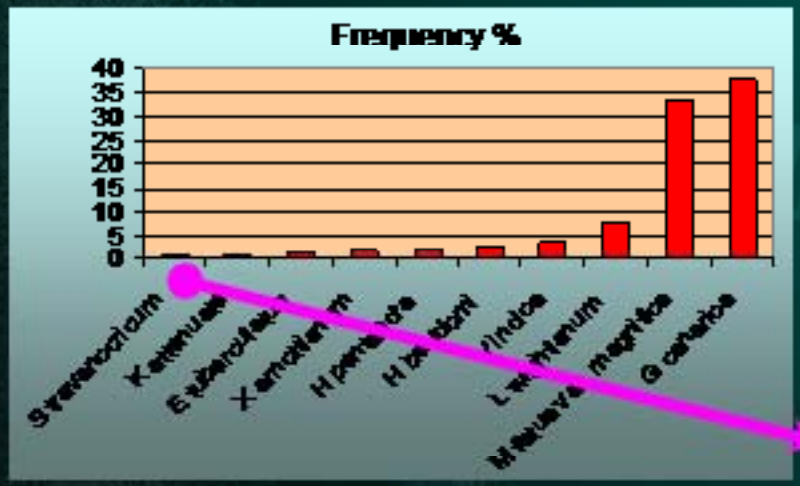
Vateria indica

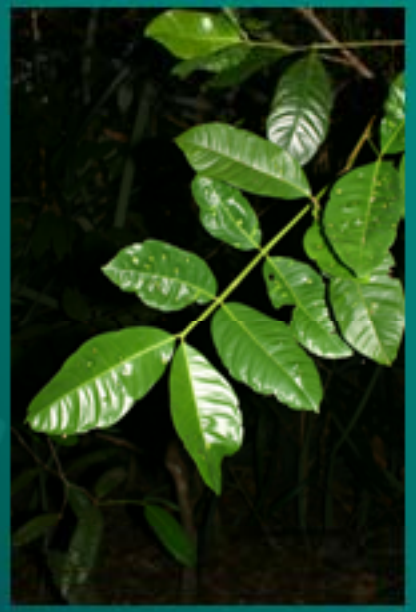
Tree speceis frequent in drier parts of *Myristica* swamps.



Syzygium travancoricum

A critically endangered tree found inside the swamp, this tree is restricted only to the swampy regions.
Only few hundreds of these endemic trees exist.





Other *Myristica* trees

Tree species found along the edges of the swamps. The aril of the fruit is a highly valued non wood forest product.

Myristica malabarica

Myristica dactyloids

Reeds, canes and palms

Pinanga dicksonii

Calamus hookerianus

Calamus thwaitesii

Pandanus thwaitesii

Ochlandra travancorica

Dominant woody climbers

Chilocarpus denudatus

Entada rheedei

Dominant climbers

Pothos scandens

Macrosolen capitellatus

Smilax zeylanica

Piper sp

Myxopyrum smilacifolium

Vanilla wightiana

Abrus pulchellus

Coscinium fenestratum

Bauhinia phoenicea

Ground vegetation

Lagenandra ovata

Schumannianthus virgatus

Alpinia malaccensis

Cyprus sp

Zingiber zerumbet

Pellionia heyneana

Barleria courtallica

Gomphandra tetrandra

Biodiversity of *Myristica* swamps

Fauna- *Myristica* swamps in Kerala have a total of 362 invertebrates and 281 vertebrates.

Invertebrate Diversity

General group/ Phylum	Class	Order	Family	Species
Protozoa	Not recorded			
Cnidaria	Not recorded			
Platyhelminthes	Turbellaria			2
	Cestoda			1
Nemathelminthes				1
Annelida	Oligochaeta			2
	Hirudinea			2
Mollusca	Gastropoda			10
Arthropoda	Crustacea	1		3
	Insecta	14	83	281
	Myriapoda	2		6
	Arachnida	5	19	54
Minor Phyla	Not recorded			
Total				362

Vertebrate Diversity

Class	Order	Family	Genus	Species
Picses	5	7	11	14
Amphibia	2	5	15	56
Reptilia	2	13	38	55
Aves	14	37	94	129
Mammalia	6	16	24	27
Total				281

Endemism in *Myristica* Swamps of Kerala

16.32 % of the animals recorded from the *Myristica* swamp are endemic to Western Ghats.

- 16.67% (3/18) of Odonates
- 4.94% (4/81) of Butterflies
- 42.86% (6/14) of Fishes
- 44.64% (25/56) of Amphibians
- 29.09% (16/55) of Reptiles
- 3.86% (5/129) of Birds
- 11.11% (3/27) of Mammals

recorded from the *Myristica* swamps are species, endemic to the Western Ghats. No animal exclusively confined to *Myristica* swamps.

Redlisted Animals in the *Myristica* swamps

Group	Species	% En	%Vu	%DD	%LRnt	% Total Redlisted
Pisces	14	14.29	7.14	0	0	21.48
Amphibia	56	12.5	8.93	5.36	5.36	32.14
Reptilia	55	9.09	14.55	0	43.64	67.27
Aves	129	0	0	0	1.55	1.55
Mammalia	27	11.11	14.81	0	3.70	29.63
Total	281	6.05	6.41	1.07	10.68	24.20

Odonates of *Myristica* swamps

Brachythemis contaminata

Cratilla lineata

Diplocodes trivialis

Rhinocypha bisignata

Libellago lineata

Neurothemis fulvia

Neurothemis tullia

Euphaea fraseri

Orthetrum pruinosum

Trithemis aurora

Esme longistyla

Phylloneura westermanni

Lestes elatus

Protosticta gravelyi

Vestalis apicalis

Vestalis gracilis

Butterflies of *Myristica* swamps

Actolepis puspa

Ampitta discorides

Appias albiina

Tholymis tillarga

Ariadne merione

Athyma ranga

Caleta caleta

Butterflies of *Myristica* swamps

Castalius rosimon

Curetis thetis

Cupha erymanthis

Euremia hecabe

Catopsilia pomona

Catopsilia pyranrhe

Cyrestis thyodamas

Euploea core

Danaus genutia

Delias eucharis

Discolampa ethion

Elyminas hypermnestra

Butterflies of *Myristica* swamps

Graphium agamemnon

Graphium antiphates

Graphium doson

Lambrix salsala

Graphium sarpedon

Hebomoia glaucippe

Hypolimnas bolina

Kaniska canace

Jamides celeno

Jamides sps

Junonia atlites

Junonia iphita

Butterflies of *Myristica* swamps

Leptosia nina

Melanitis leda

Mycalesis perseus

Parantica aglea

Neptis jumbah

Pachliopta aristolochiae

Pachliopta hector

Papilio polytes

Pantoporia hordonia

Papilio helenus

Papilio paris

Papilio polymnestor

Butterflies of *Myristica* swamps

Parthenos sylvia

Polyura athamus

Tanaecia lepidea

Ypthima huebneri

Psolos fuligo

Telicota ancilla

Thaduka multicaudata

Zeltus amasa

Tirumala septentrionis

Tirumula limniace

Ypthima baldus

Zizula hylax

Spiders of *Myristica* swamps

Argiope anasuja

Bavia kairali

Chalcotropis

Haploclastus sps nest

Carhottus sps

Clubiona sps

Ctenus

Hasarius

Epeus indicus female

Eriovixia

Gasteracantha dalyi

Hersilia savignyi

Spiders of *Myristica* swamps

Hersilia sp1

Heteropoda venatoria male

Heurodes

Neoscona

Leucauge

Lycosa sps1

Lycosa sps2

Nephila pilipes

Monaeses

Neoscona 2

Neoscona 3

Nephila kuhlii

Spiders of *Myristica* swamps

Nephylengis malabarensis

Opadometa fastigata

Ptocasius

Poecilotheria rufilata

Oxyopes sp1

Oxyopes hindostanicus

Oxyopes sp3

Theridula angula

Pardosa sps1

Pardosa sps2

Poecilotheria

Fishes of *Myristica* swamps

Barilius gatensis

Lepidocephalus thermalis

Aplocheilus lineatus

Barilius bakeri

Garra mullya

Danio aequipinnatus

Channa orientalis

Puntius fasciatus

Amphibians of *Myristica* swamps

Ichthyophis cf *tricolor*

Bufo melanostictus

Kaloula taprobanica

Ramanella triangularis

Limnonectes limnocharis

Limnonectes nilagirica

Limnonectes keralensis

Haplobatrachus tigerinus

Euphlyctis cyanophlyctis

Euphlyctis hexadactylus

Indirana brachytarsus

Indirana leithii

Amphibians of *Myristica* swamps

Indirana beddomii

Indirana semipalmatus

Indirana leptodactylus

Micrixalus fuscus

Nyctibatrachus minor

Nyctibatrachus aliciae

Nyctibatrachus major

Tomopterna rufescens

Rana temporalis

Rana aurantiaca

Rana malabarica

Rhacophorus malabaricus

Amphibians of *Myristica* swamps

Polypedates leucomystax

Polypedates maculatus

Polypedates pseudocruciger

Philautus leucorhinus

Philautus variabilis

Philautus flaviventris

Philautus sps1

Philautus sps 3

Philautus pulcherrimus

Philautus tinniens

Philautus cf *charius*

Philautus.temporalis

Amphibians of *Myristica* swamps

Philautus sps 4

Philautus sps 5

Philautus sps 6

452A3

Philautus sps 7

Philautus sps 8

Philautus sps 9

452A2 *Philautus*

Philautus sps 11

Philautus sps 12

Philautus sps 13

452 A1 *Philautus*

Amphibians of *Myristica* swamps

452A6

Philautus cf *pulcherrimus*

Rhacophorus cf *lateralis* juvenile

Rhacophorus juvenile

Reptiles of *Myristica* swamps

Geoemyda silvatica

Indotestudo travancorica

Melanochelys trijuga

Calotes calotes

Calotes versicolor

Calotes ellioti

Draco dussumieri

Otocryptis beddomeii

Reptiles of *Myristica* swamps

Psamophilus sps

Cnemaspis 3 cf *wynadensis*

Cnemaspis 1

Cnemaspis 2

Hemidactylus 1

Hemidactylus 2

Hemidactylus frenatus

Skink 3

Sphenomorphus dussumieri

Ristella beddomii

Mabuya macularius

Mabuya carinata

Reptiles of *Myristica* swamps

Amphiesma beddomei

Amphiesma stolatum

Chrysopelea ornata

Ahaetulla nasuta

Dendrelaphis pictus

Dendrelaphis tristis

Lycodon aulicus

Xylophis stenorhynchus

Oligodon affinis

Piyas mucosa

Xenochrophis piscator

Ramphotyphlops braminus

Reptiles of *Myristica* swamps

Uropeltis macrolepis

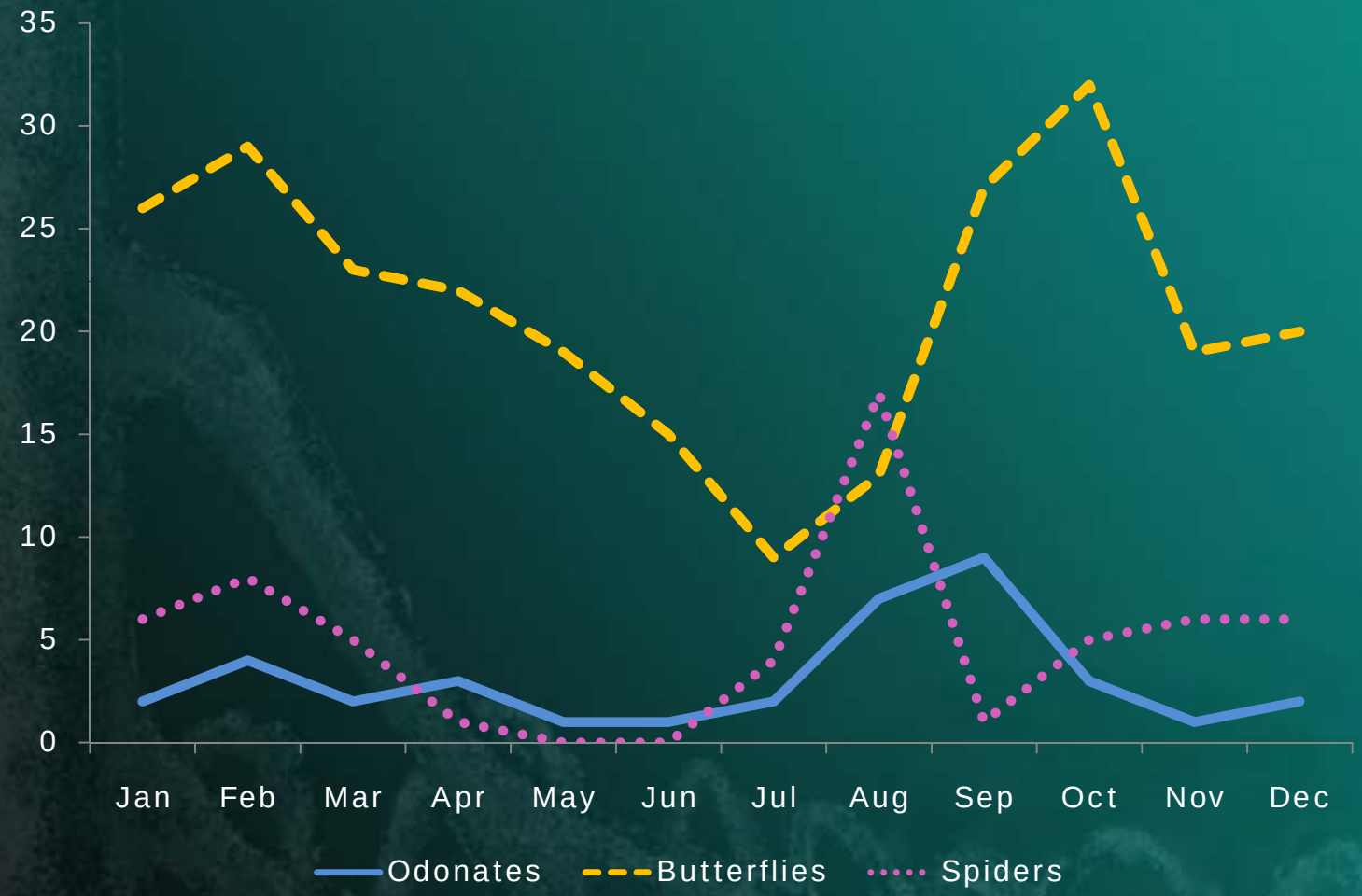
Hypnale hypnale

Trimeresurus malabaricus

Melanophidium cf *punctatum*

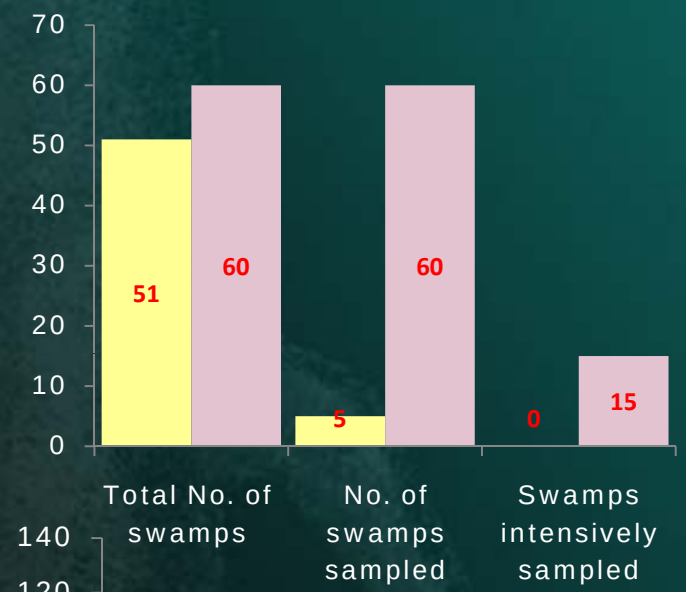
Trimeresurus malabaricus

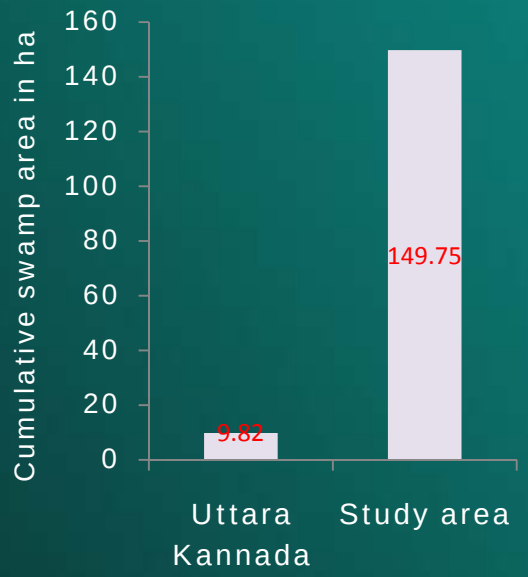
Distribution of species richness across months - invertebrates

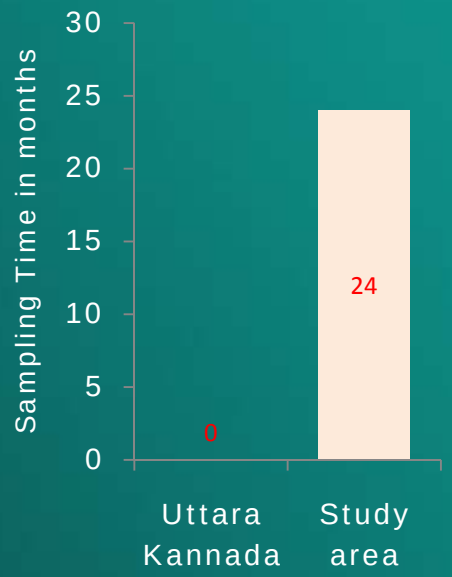


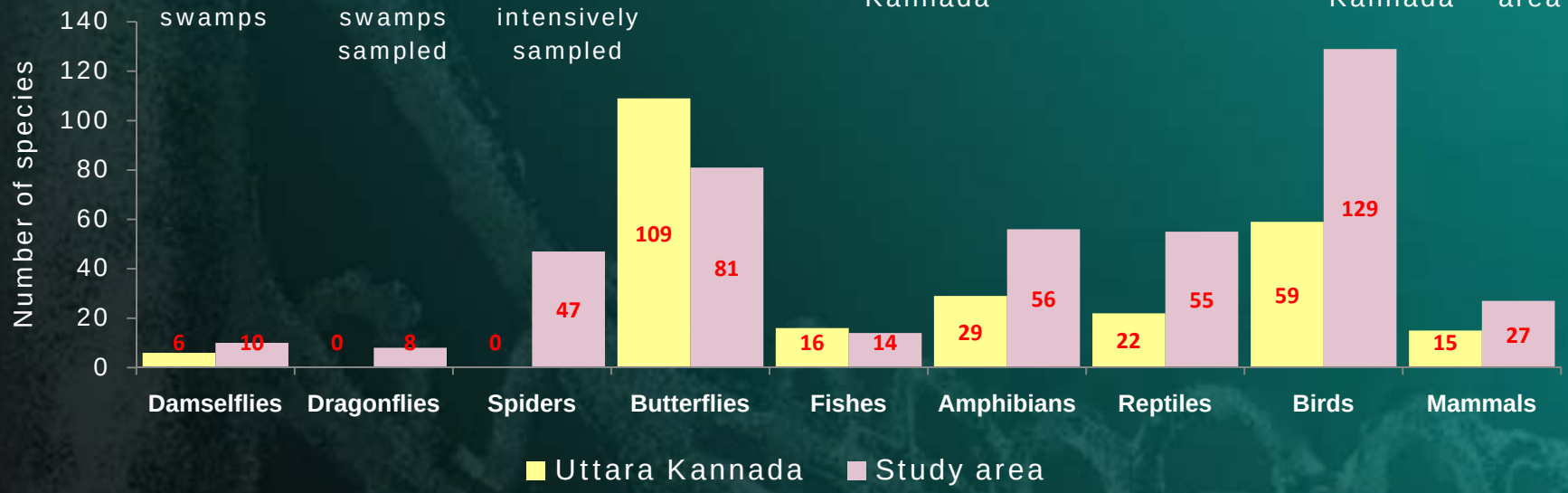
Distribution of species richness across months - vertebrates

Comparison with *Myristica* swamp forests in Karnataka





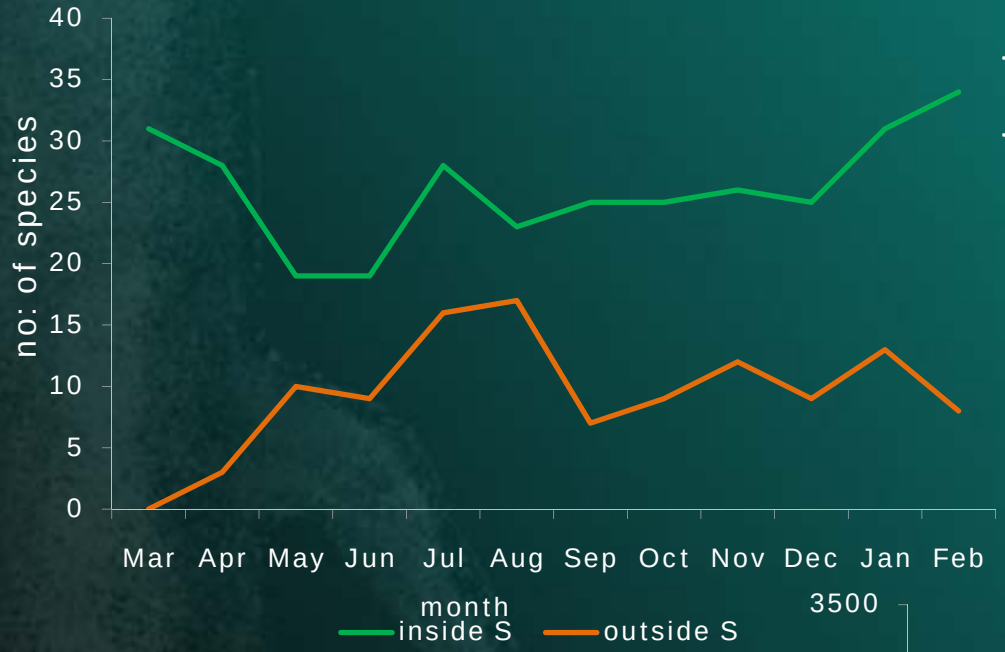




.The cumulative land area of *Myristica* swamps in the Kulathupuzha region is 15.25 times the cumulative land area of *Myristica* swamps in the Uttara Kannada region.

Swamps as a preferred habitat for herpetofauna

N and S across months inside and outside the swamps- Amphibians



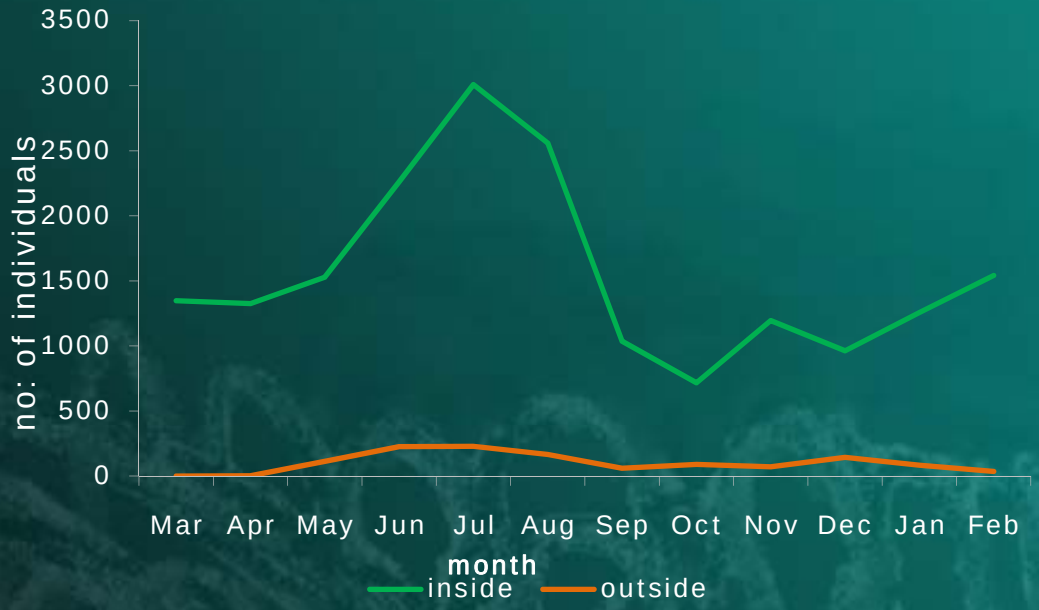
Total species sighted inside swamp = 43

Total species sighted outside swamp = 28

(T = 0 and p < 0.05 species richness)

Total individuals sighted inside swamp = 18748

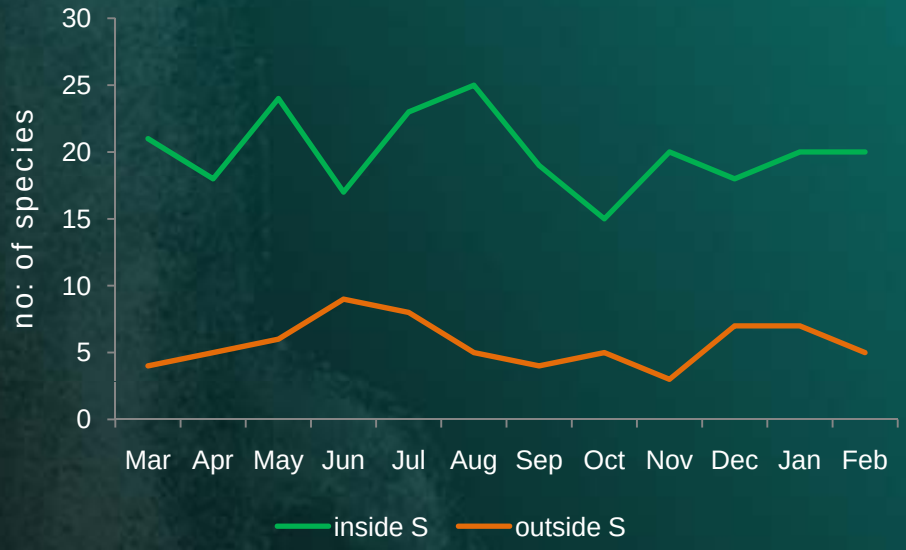
Total individuals sighted outside swamp =1218



Significant difference
(T = 0 and p < 0.05 abundances)

Swamps as a preferred habitat for herpetofauna

N and S across months inside and outside the swamps- Reptiles



Total species sighted inside swamp = 40

Total species sighted outside swamp = 26

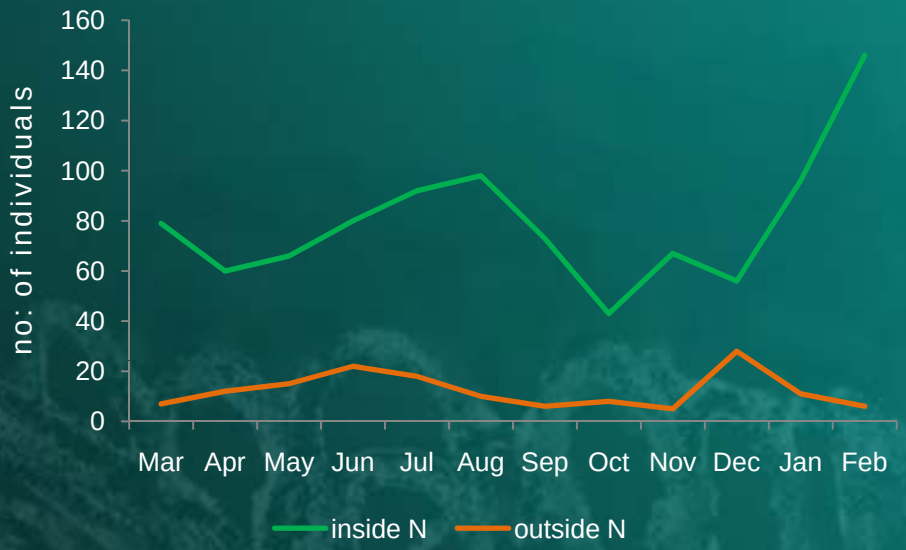
(T = 0 and p < 0.05 species richness)*

Total individuals sighted inside swamp = 956

Total individuals sighted outside swamp = 148

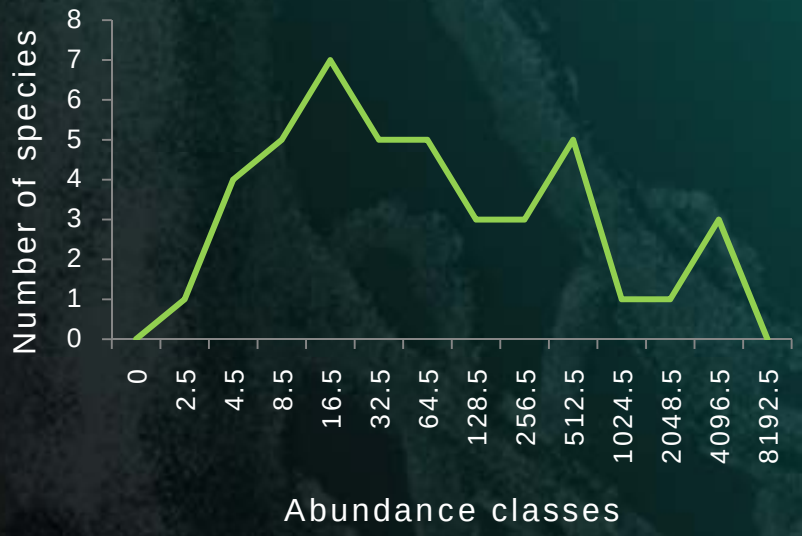
(T = 0 and p < 0.05 abundances) *

* Significant difference



Indications of disturbance

Species Abundance Distribution- Amphibians



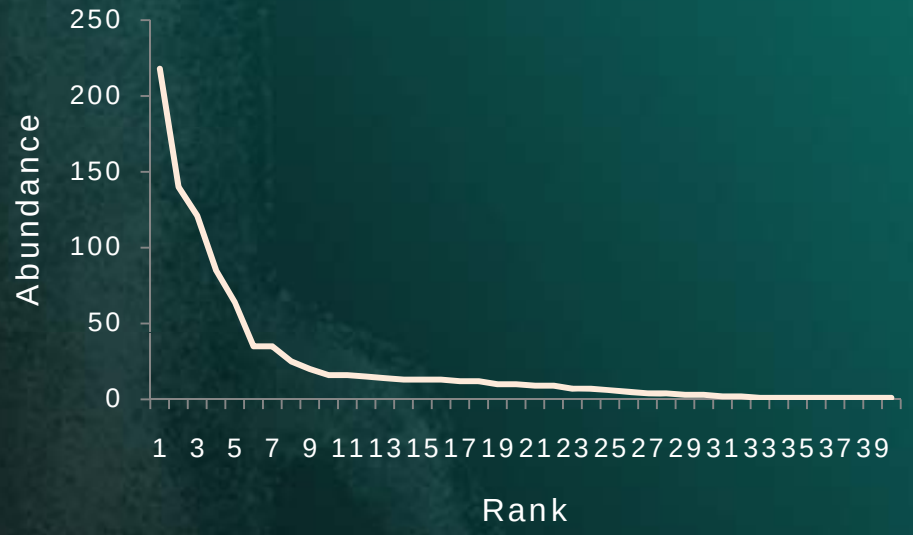
Conventional models could not be fitted into the data set of this study.

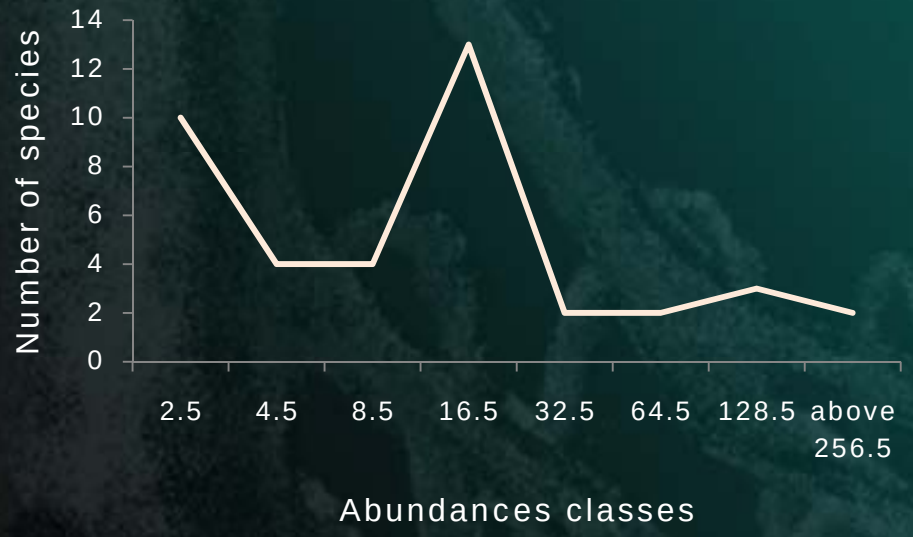
The data is multimodal in the log scale but does not reject the universal hollow curve law on the arithmetic scale.

The peaks are large and therefore cannot be attributed to sampling noise.

Indications of disturbance

Species Abundance Distribution- Reptiles





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General results

Plants

- Few specialist trees were dominant
- Lesser diversity inside the swamps
- More evenness outside the swamps
- are also supported by the lower alpha diversity figures and S
- Low similarities

Animals

- Higher diversity the swamps
- More specialist during rainy season
- Lesser diversity in rainy season when compared to dry season
- High diversity confined to edges
- More evenness outside the swamps
- High similarities

Environmental characters- inundation the most defining criteria

Life tables of trees- indicates disturbances in the past

Lessons learnt

- Intensive study in a small region is fruitful
- Long term support- in terms of infrastructure and funding required
- More biodiversity is not always good
- Animals as bio-indicators indicate even minute changes
- Immediate measures for conservation
- Awareness of our own backyards imperative

Recommendations

Conservation plan for the *Myristica* swamps in general

•Upgrading the area to protected area status (integrating the swamps in Anchal and Kulathupuzha areas to Shendurney Wildlife sanctuary or demarcating the swamp areas as an individual protected area in its own right.)

•Restoring surrounding forests to natural evergreen forests

•Avoiding constructions altering the hydrology of the area

•Identifying potential *Myristica* swamp areas and initiate replanting with *Myristicacea* and allied swamp species

•Integrate the interests of local population with the interests of conservation in lines of community reserves

•Long-term monitoring of all conservation and management activities to ensure maximum utilization of effort and infrastructure and minimizing anthropogenic disturbances.

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