

# The taxonomy and phylogeny of the superfamily Trichiuroidea (Teleostei: Scombriformes)

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## Introduction



Gempylidae



Trichiuridae

**Trichiuroidea** is a superfamily of a recently erected acanthomorph order Scombriformes (= clade Pelagia *sensu* Miya et al., 2013) and comprises two families: **Gempylidae** (with 26 currently recognized species in 16 genera) and **Trichiuridae** (with 46 currently recognized species in ten genera).

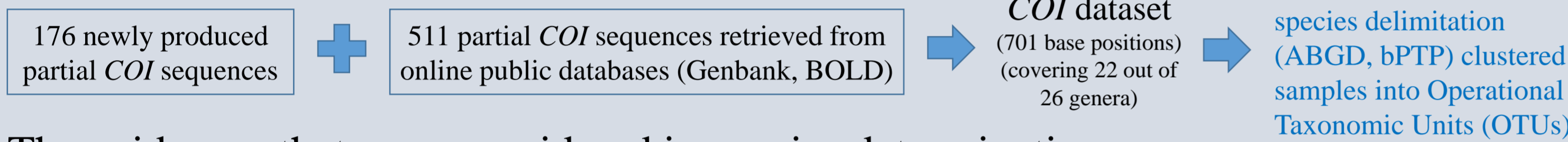
- The trichiuroids exhibit a spectrum of body shape from fusiform to elongated form. They are pelagic and demersal carnivores mostly occur in tropical and temperate seas, within which several species are important in fisheries (Nakamura and Parin, 1993).
- Controversies still remain for **phylogenetic hypothesis, taxonomic status, species-level diversity and morphological diagnosis** of trichiuroids.

## Species-level taxonomy of Trichiuroidea with special focus on *Trichiurus* spp.

### I aimed to:

- Test the species validity and explored the species diversity in 22 trichiuroid genera using an integrated approach in taxonomy
- Examine the morphology of *Trichiurus* spp. to establish an adequate species diagnostic system for species occurring in the tropical Indo-West Pacific and Northwest Pacific

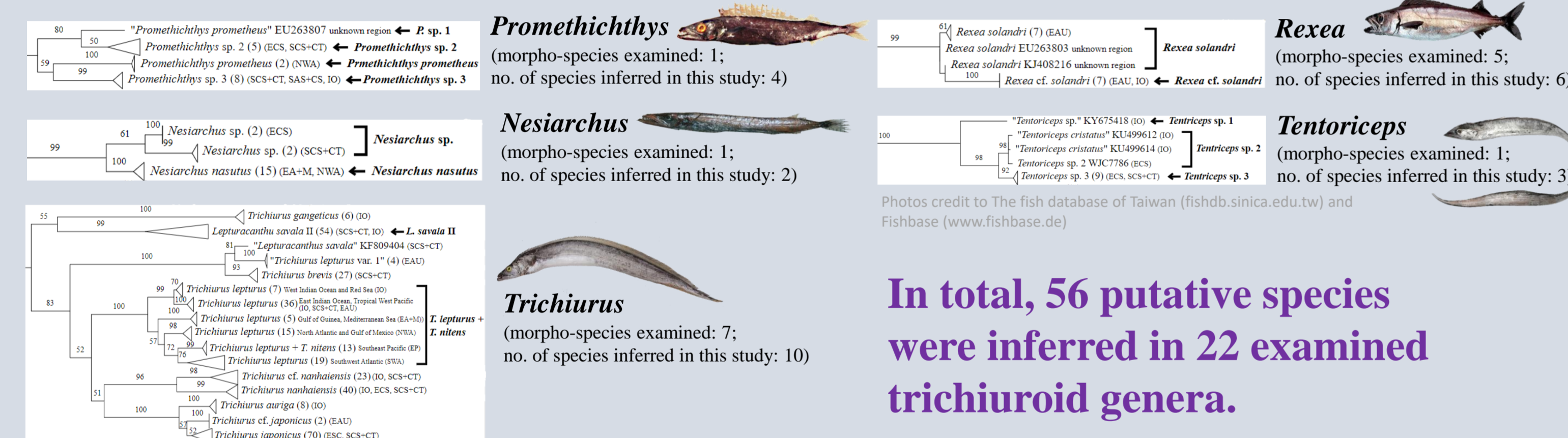
### Materials and Methods:



The evidences that were considered in species determination:

- Results of ABGD and bPTP analyses
- Morphological differences
- Reciprocal monophyly in *COI* tree and in multi-nuclear gene tree
- Geographical distribution

### Hidden diversity was unveiled in following genera:

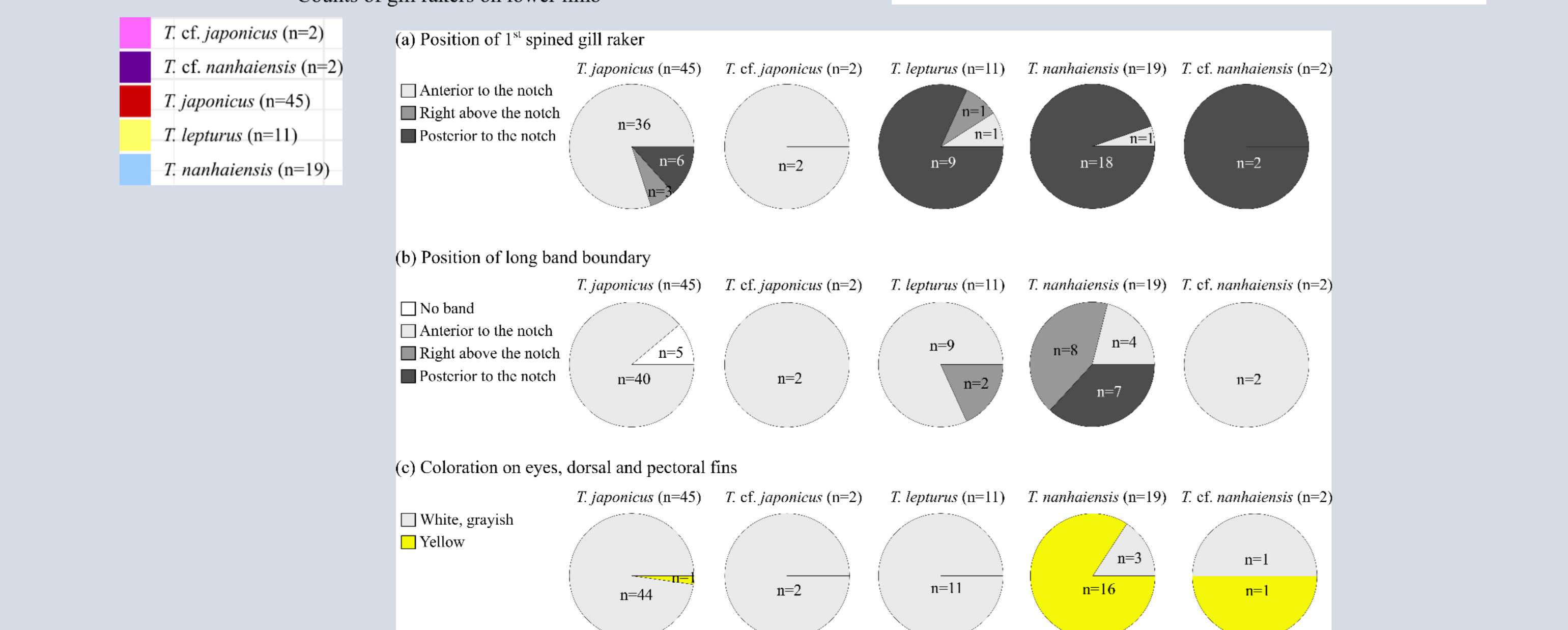
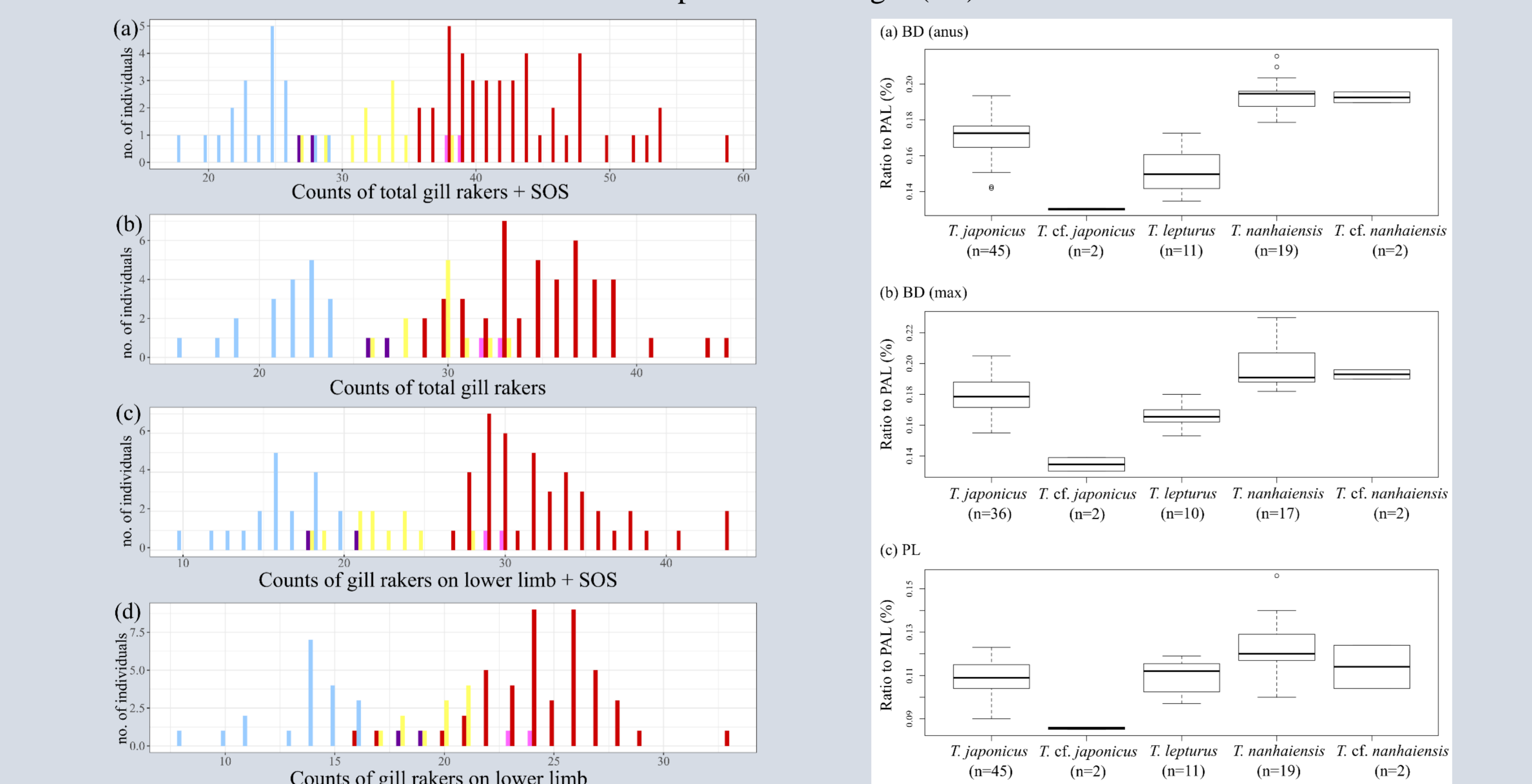
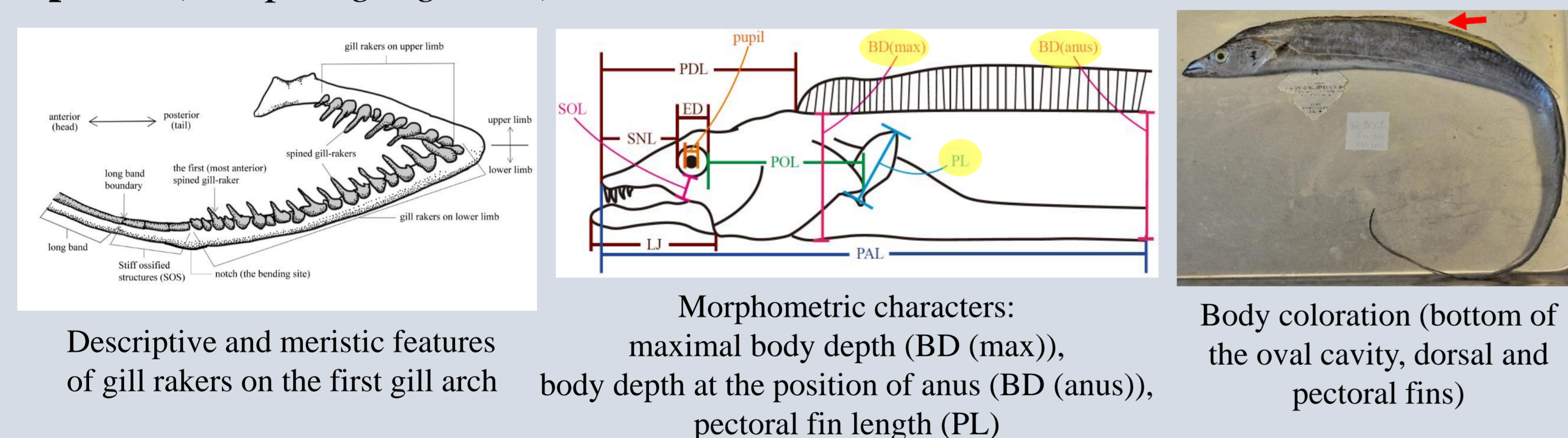


In total, 56 putative species were inferred in 22 examined trichiuroid genera.

### Morphological assessment of *Trichiurus* species

Examined specimens: A total of 85 specimens from *T. gangeticus*, *T. lepturus*, *T. nanhaiensis*, *T. japonicus*, *T. cf. nanhaiensis*, and *T. cf. japonicus* collected in the West Pacific and East Indian Ocean

Newly introduced diagnostic characters that, when considered concurrently, are likely to **enhance the accuracy of species identification of the examined *Trichiurus* species** (except *T. gangeticus*):

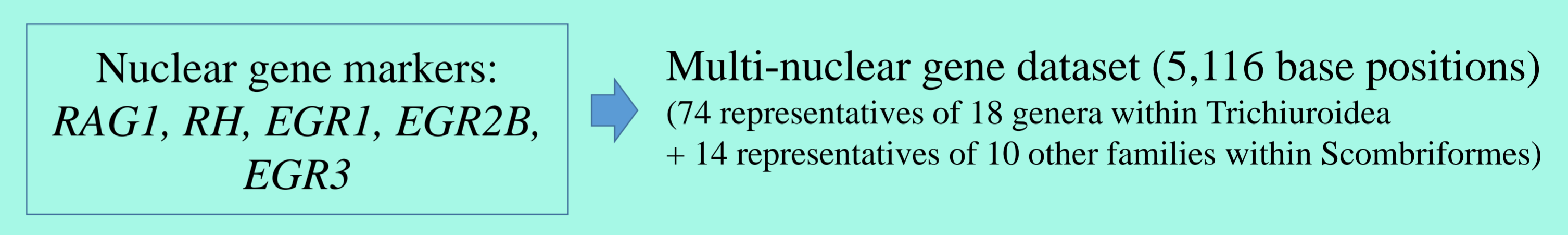


## Phylogeny and classification of Trichiuroidea

### I aimed to investigate:

- Phylogenetic placement of Trichiuroidea within the Scombriformes
- Relationships within the superfamily
- Monophyly of the currently recognized genera
- Divergence times of the major trichiuroid lineages

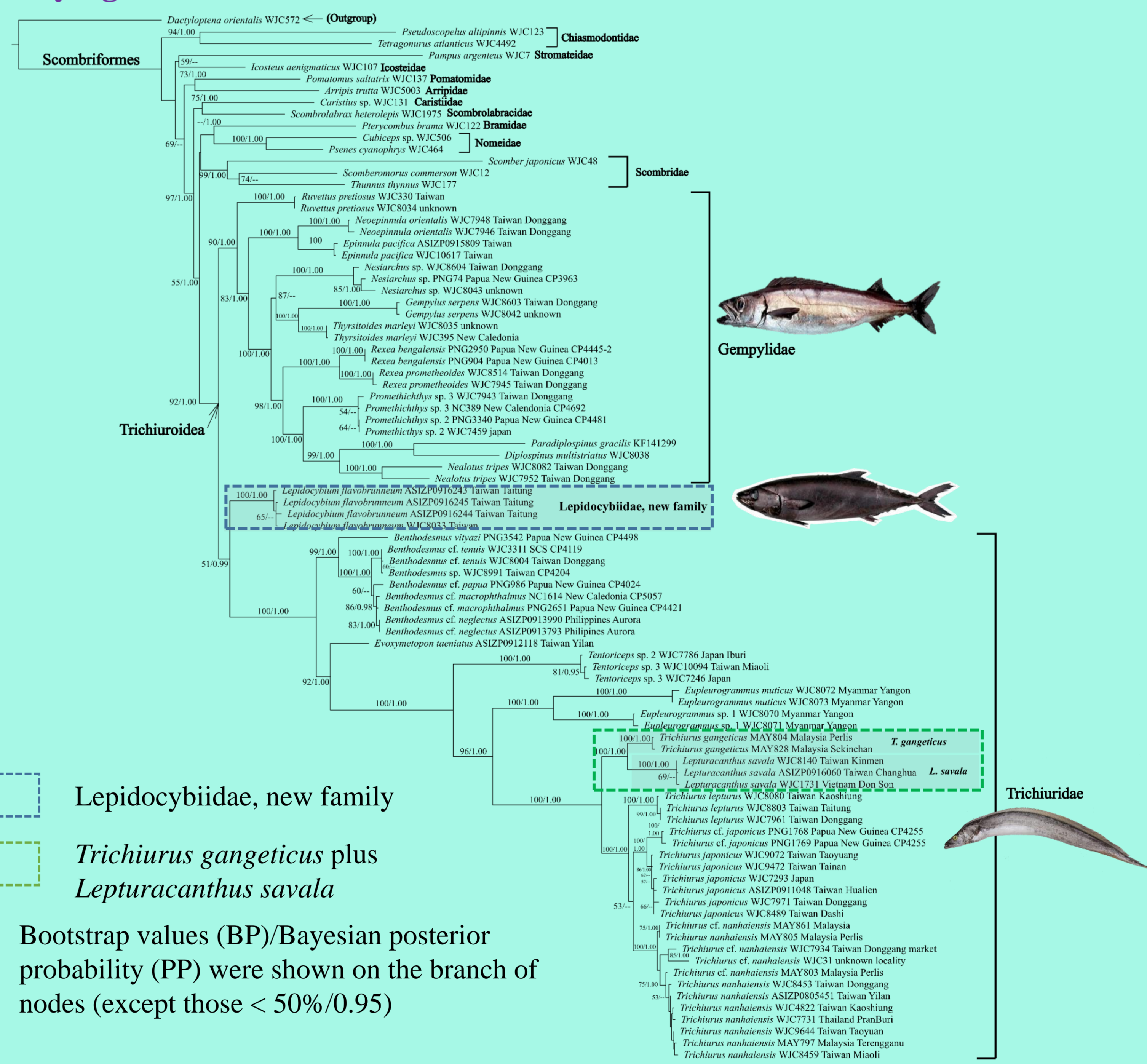
### Materials and Methods:



**Phylogeny inference:** Maximum likelihood method (ML) and Bayesian Inference (BI), using substitution model GTR+ Γ, with partitions set by gene

**Divergence time estimation:** under Bayesian method, using substitution model GTR+ Γ, with partitions set by gene. Data of three fossils was used for time calibration.

### Phylogenetic tree of Trichiuroidea and its scombriform allies:



Lepidocybiidae, new family

*Trichiurus gangeticus* plus *Lepturacanthus savala*

Bootstrap values (BP)/Bayesian posterior probability (PP) were shown on the branch of nodes (except those < 50%/0.95)

### Highlights

- The monophyletic Trichiuroidea formed a well-supported lineage with family Caristiidae, Scombrilabracidae, Bramidae, Nomeidae and Scombridae.
- The genus *Lepidocybium* should be regarded as a separate family of the Trichiuroidea. The new family name Lepidocybiidae is proposed.
- The intergeneric relationships in each family were well resolved (BP ≥ 85; PP ≥ 0.95).
- The genus *Trichiurus* is paraphyletic with respect to *Lepturacanthus savala*.
- The estimated divergence time of Trichiuroidea (median age: 65.1 Mya; 95% HPD: 50.1–84.8 Mya) coincided with the past estimations (30–75 Mya) (Miya et al., 2013; Friedman et al., 2019; Ghezelayagh et al., 2021, Preprint) and the time of the K-Pg mass-extinction event at c.a. 66 Mya.

### References

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