

# Males are different: Sexual dimorphism of Upper Teeth in two Species of Lantern Sharks (Etmopteridae)

Nico Straube, Jürgen Kriwet, Ulrich Schliewen & Sho Tanaka

Museum für Naturkunde der Humboldt-Universität zu Berlin  
Invalidenstr. 43, 10115 Berlin, Germany



Zoologische Staatssammlung München, Sektion Ichthyologie  
Münchhausenstraße 21, 81247 Munich, Germany

Department of Marine Science and Technology, Tokai University  
3-20-1 Orido, Shimizu, Shizuoka, 424-8610 Japan



## Biological Aspects:

- Etmopteridae, or Lantern Sharks, are the most diverse family among the Squaliformes (42 species in 5 genera)
- Etmopteridae are cosmopolitically distributed in deeper waters from 100 to more than 2000 m at continental shelves, insular slopes and seamounts
- ovoviviparous females give birth from 6 to 16 puppies per litter
- common bycatch in deep sea fisheries
- generally, the dentition of *Etmopterus* is dognathic heterodont
- upper jaws display 2 to 3 functional rows of multicuspited teeth (Fig. 1 & 4)
- lower jaw teeth are single-cusped, arranged staggered with cusps bent towards the rears (Fig. 4)
- specimens presented here were caught in Suruga Bay off Japan in depths of 400 m



2 cm *Etmopterus brachyurus*



2 cm *Etmopterus molleri*

## Analyses and Results:

- jaws of *E. brachyurus* and *E. molleri* were analyzed focussing on the number of cusplets of upper jaw teeth
- the cusplet numbers of teeth in the 2nd and 3rd functional tooth series as well as the 3rd replacement tooth series were counted (N = 563)
- the teeth were analysed with regards to species, and sexual dimorphism as well as inner jaw variation
- additionally, preserved adult female specimens housed in the MNHN, and DMB (Tokai University) were inspected as closely as possible with special regards to subadult individuals
- adult males show significantly more lateral cusplets than adult females do; only adult males show in certain jaw areas a first pair of cusplets which is smaller than the following ones (Fig. 1)
- male and female specimens cluster together, not species, if analysed with regards to cusplet numbers (Fig. 2)
- within jaws of male specimens, upper teeth can be grouped by number and structure of lateral cusplets (Fig. 3)

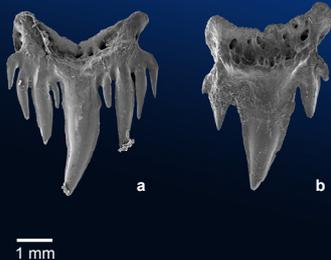


Fig. 1: SEM images of upper teeth of *E. brachyurus* (a = male; b = female); the same sexual dimorphic characters appear in upper teeth of *E. molleri*.

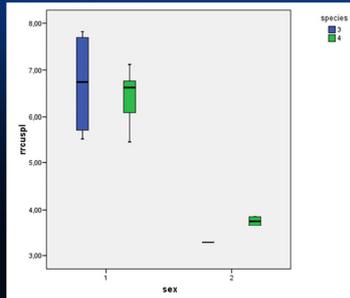


Fig. 2: Boxplot showing separation of male and female specimens of *E. brachyurus* (3) and *E. molleri* (4) by cusplet numbers. Species are not separable by upper tooth structure.

## Conclusions:

- results indicate that the often used character "number of cusplets of upper teeth" of *Etmopterus* is not supportive for species identification, but bares information about sex
- additionally to the number of lateral cusplets, adult male specimens of *E. molleri* and *E. brachyurus* show a first pair of lateral cusplets which is smaller than the following pair of cusplets
- as to cusplet numbers of upper teeth, the situation is similar in *E. pusillus*, *E. bigelowi* (Tachikawa et al. 1999), and *E. baxteri* (Straube et al. 2007)
- subadult specimens of the mentioned species of *Etmopterus* display upper tooth structures, which are similar to adult female upper teeth
- probably several species of *Etmopterus* show sexual dimorphism in upper tooth morphologies
- as to the fossil record, consisting almost solely of single teeth, upper teeth of fossil taxa of *Etmopterus* may give information to genus level, sex and in part to its former position in jaws
- generally, more data are desirable to verify results presented here
- one can only speculate about the reason for increasing cusplet numbers in males when reaching sexual maturity: is it a consequence of a shift in the diet, as seen in *Etmopterus spinax* (Coelho et al. 2006), or should the phenomenon be placed in the context of (seasonal?) courtship behaviour?

## References:

- Neiva J, Coelho R, Erzini K (2006) Feeding habits of the velvet belly lanternshark *Etmopterus spinax* (Chondrichthyes: Etmopteridae) of the Algarve, southern Portugal. J. Mar. Biol. Ass. U.K., 86, 835-841.
- Straube N, Schliewen U, Kriwet J (2007) Dental structure of the giant lantern shark *Etmopterus baxteri* (Chondrichthyes: Squaliformes) and its taxonomic implications. Environ. Biol. Fish. Online first prepublished.
- Shirai S, Tachikawa H (1993) Taxonomic resolution of the *Etmopterus pusillus* species group (Elasmobranchii, Etmopteridae) with description of *E. bigelowi*, n. sp. Copeia, 2, 483-495.

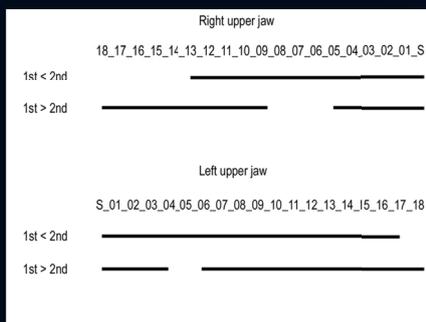


Fig. 3: Analysed groupings of upper teeth within jaws of adult male specimens of *E. brachyurus*. Anterior teeth (positions S to 05) show a gradual decrease of cusplet size; lateral teeth (positions S to 13) show a first pair of cusplets, which is smaller than the following pairs of cusplets; posterior teeth (positions 9 to 18) show again gradual decrease of cusplet size. S = symphysis, numbers 01 to 18 refer to position of tooth in jaw counting from the symphysis to the rears.

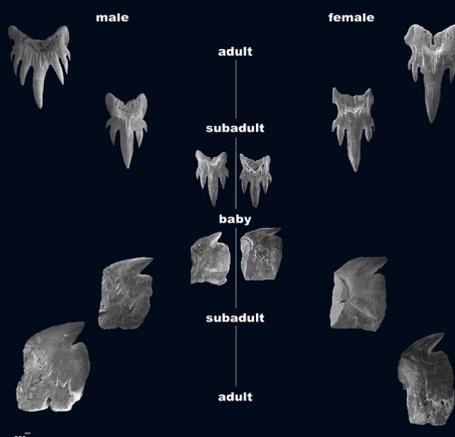


Fig. 4: Dentition development in *E. baxteri*. Note the morphological changes of upper tooth shape with growth: number of lateral cusplets in males increases with reaching sexual maturity. Males of *E. baxteri* do not show a first pair of cusplets, which is smaller than the following ones. Generally, lower teeth increase in size, but do not show such significant sexual dimorphism as upper teeth do.

Sincere thanks to Horie Taku, Keiichi Sato, Peter Bartsch, Dirk Neumann, Mathias Geiger, Stefanie Klug, Friedrich Pfeil, Roland Melzer, Stephanie Socher.