

# Inter-individual variability in dietary estimates of trophic levels: a case study of carnivorous coral reef fishes in New Caledonia

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## Trophic levels as ecosystem indicators

- Trophic levels (TL) define the position of an organism within the food web
- They are generally represented by mean values estimated without taking account for the period and location of sampling
- The mean TL of landings (or catches) and the Fisheries In Balance (FIB) index have been proposed as ecosystem indicators highlighting situations of overexploitation

Investigating the variability of trophic levels could improve our vision of trophic transfers and help in better understanding fishing effects on trophic structure



## Stomach content data and TL estimation

- Sampling of 7619 stomachs: the relative stomachal volume of each prey was visually estimated
- Selection of 34 carnivorous coral reef fish species
  - Aggregate by classes the relative part of each prey in the stomach
  - Assign to each prey a TL according to the degree of taxonomic resolution known
  - Estimate the TL of the predator following:

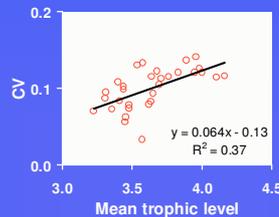
$$TL = 1 + \text{mean TL of food items}$$

where the mean is weighted by the contribution of each food item

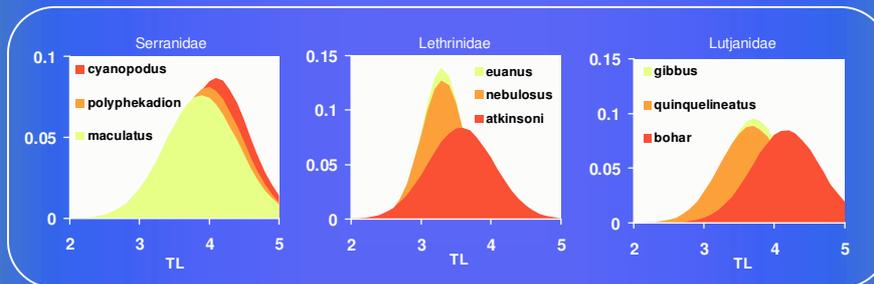
We use stomach content data to investigate the influence of taxonomy, body weight and sampling location on individual TL for 34 coral reef fish species in New Caledonia

## Trophic levels variability

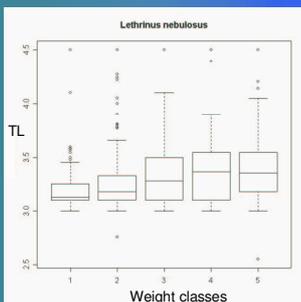
- For the selected species, the mean TL was plotted vs. the coefficient of variation (CV): variability around the mean TL of a species linearly increases with its trophic position
- Mean and standard deviations were estimated for some species of Serranidae, Lethrinidae and Lutjanidae, and conventionally plotted following normal distributions



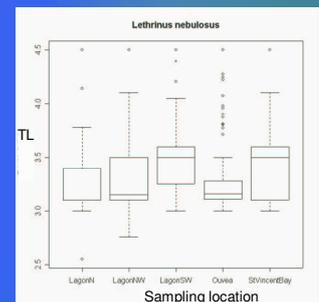
Variability of TL by species is linked to their trophic position. High TL appear more generalist feeders than low TL. Species show a high variability of their TL in all the sampled families.



## Identifying some factors of trophic levels variability



- No significant effect of location and weight (or size) is found for most of the selected species. Other factors should be investigated to explain the high variability observed.
- A significant effect of sampling location is detected for *L. nebulosus*, *L. atkinsoni*, *E. cyanopodus* and *P. heptacanthus*. This might be explained by the opportunistic behaviour of these species that adapt their diet to their environment.
- Analysis of variance shows a significant effect of weight on the trophic level of *L. nebulosus*. The TL increases with weight and hence with the age. The cross-effect weight/location detected suggests a different TL evolution between sites.



- Analysis of variance showed no significant relationship between trophic level and size for the majority of species selected. Thus, trophic level and size do not provide the same information despite strong correlations found in some ecosystems. The complexity of coral reefs food webs and the importance of herbivores in such ecosystems may explain this absence of relation.
- High intra-specific variability observed is poorly explained by sampling location or changes in diet with age except for very few species. Investigating changes in TL with size for the piscivore species was impossible because all fish preys were assigned a unique value of TL (3.5).
- There is an urgent need in theoretical and applied ecology to take into account and model the variability existing around the mean of fish species TL because it gives major information on trophic transfers within the food web and could help in detecting major changes occurring in an ecosystem.