PRIMARY CHARACTERIZATION OF THE ICHKEUL LAKE (TUNISIA) FOOD WEB: FAVORED PATHWAY OF ORGANIC MATTER TRANSFER AND TROPHIC LINKS COMPLEXITY

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Abstract
Fish trophic structure of the Ichkeul Lake (northern Tunisia, southern Mediterranean) was studied to determine principal preys and consumers as trophic links between them that allows characterization of the food web structure. To realize this purpose, two complementary approaches were performed; stable isotopes ratios of carbon and nitrogen were used as trophic tracers, while stomach content analysis was used to determine ingested preys by fishes. The first method was applied to fishes, invertebrates and primary producers were analyzed in both wet and dry seasons and in two marked areas of the site study, eastern area (with more marine tendency) and western area (with more lacustrine tendency). The second method was concerned only consumers namely fishes.

Keywords: Food webs, Fishes, Stable isotopes, Mediterranean Sea

Material and Methods:
Preys and predators were defined under trophic web using two tracer tools: isotopic stable and stomach content. Each one of this latest use different scale time integration, short time scalling (several hours to several tens of hours, which is the mean time of digestion for ostechtyens) for the first and long one (from two to three month which is mean time to muscle cells renewal in fishes) for the second. Filtered water i.e. Particulate Organic Mater (POM), sedimentary Organic Mater (SOM), Fish and invertebrates samples were analyzed to define isotopic signatures for $\delta^{13}C$ and $\delta^{15}N$ [1, 2]. Stomach content analysis was used to support isotopic results. This guts study was performed according to volumetric analysis approach with the method of points [3, 4, 5].

Results and discussion:
Among main predators which structured the food web, fishes were totalised of 491 individuals belonging to 16 species which were analyzed. The Hierarchical Cluster Analysis statistical test was performed to define diet similarities. This latest showed 9 trophic groups from them 8 were mono-specific: *B. belone*, *E. encrasicolus*, *P. microps*, *S. typhle*, *S. acus*, S. abaster, *A. anguilla* and *D. labrax*. The remaining species constituted a large multispecific cluster, which grouped the four Mugilidae species *Mugil cephalus*, *Liza aurata*, *Liza ramada* and *Liza saliens* as well as *Barbus callensis*, *Atherina boyeri*, *Aphanius fasciatus* and *Solea senegalensis* [5]. The main ingested preys by fishes were identified according to spatio-temporal variations for each species. Those various compartments of food web were analyzed by isotopic analysis using $\delta^{13}C$ and $\delta^{15}N$ to define its trophic position. Fish alimentary diagnosis (content stomach analysis) coupled with fish isotopic analysis and trophic links routing showed the importance organic matter from basal carbon since POM relative to the other one from SOM (benthic inland and continental trophic web versus pelagic lagooner marine trophic web). Zoobenthic invertebrates constitute the majority of preys ingested by higher levels consumers mainly by fishes (secondary and tertiary consumers); its have a major role to ensure organic matter (POM and SOM) transfer and energy flows from the bottom to the top food web and for several alimentary chain for the majority of fish species (Figure 1). $\delta^{13}C$ was ranged from -25.59‰ for POM to-18.46‰ for SOM both in wet season. $\delta^{15}N$ of organic matter, were varied from 7.77‰ in dry season to 9.35‰ in wet season, both recorded for SOM. Primary producers $\delta^{13}C$ was ranged between -24.04‰ for *Polysiphonia sp.* to -15.49‰ for *Potamogeton pectinatus* both in wet season. $\delta^{15}N$ was varied from 9.28‰ to 13.89‰ both in dry season. The invertebrates $\delta^{13}C$ was ranged from -24.24‰ for *Mytilus galloprovincialis* in dry season and -24.05‰ for *Potamon algeriense* in wet season. The maximum of $\delta^{13}C$ reached -12.45‰ for *Haminoea sp.* in dry season. The $\delta^{13}C$ range was varied from 9.12‰ for *Gammarus sp.* from a maximum of 21.37‰ for *Atyaephyra desmarestii*, both in wet season. $\delta^{13}C$ of fishes was varied from -28.86‰ for *Mugil cephalus* in wet season to -13.20‰ for *Liza saliens* in dry season. $\delta^{15}N$ was ranged from 9.80‰ for *Dicentrarchus labrax* (juvenile) to 19.41‰ for *Gambusia affinis*, both in wet season. Benthic carnivorous fishes (eel, sea bass and probably sole) as detritivores omnivorous fishes (Mugilidae and barb) have an important functional role as Key-species assuring trophic structure stability and functioning of lacustrine food web ecosystem. Trophic links characterization related mainly fishes (as top consumers) and their preys confirm hypothesis of the importance of benthic trophic web relative to the pelagic one (Figure 1). Comparatively to the others ecosystems, the functioning pattern of the Ichkeul Lake and generally of coastal shallow waters ecosystems were closely similar to most Mediterranean ecosystems.

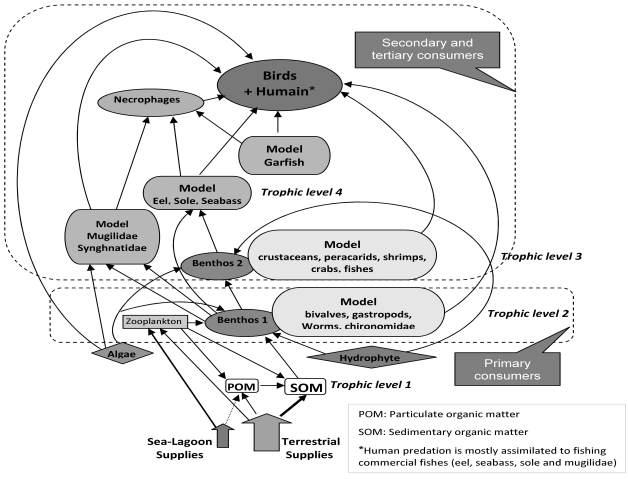

Fig. 1. Ichkeul food web lake characterization: Favored path of organic matter transfer (POM and SOM) under trophic web, functional role of groups and species and trophic links complexity.

References
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