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# Diets of Albacore, *Thunnus alalunga*, and Dolphins, *Delphinus delphis* and *Stenella coerulaeoalba*, Caught in the Northeast Atlantic Albacore Drift-net Fishery: A Progress Report

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## Abstract

A comparative dietary study of a community of large oceanic predators has been made possible by the availability of data on gut contents from tunas and other by-catch species sampled during the Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) fishery department study of the ecological impact of the French tuna drift-net fishery in the Northeast Atlantic. The stomach contents of common (*Delphinus delphis)* and striped dolphins, (*Stenella coerulaeoalba),* albacore *(Thunnus alalunga),* swordfish *(Xiphias gladius),* wreckfish *(Polyprion americanum),* blue shark (*Prionace glauca*), Ray's bream (*Brama brama*), and other minor species were collected in the summer 1993. This pilot study examined a small number of these samples, paying particular attention to comparisons between the diets of dolphins and tunas, associated *versus* non-associated in the catches. Besides the problem of by-catch, this set of samples represented a unique opportunity to investigate dietary relationships between co-existing oceanic predators and the ecological position of the dolphins in this community.

*Key words*: by-catch, dolphins, feeding/food, Northeast Atlantic, predation, tuna

## Introduction

Apart from seabird communities, very little is known of trophic relationships within communities of oceanic apex predators. Unlike seabirds whose recent meals can be sampled on land where they breed, other types of oceanic predators can not be collected with sufficient spatial and temporal unity to allow detailed comparison of dietary data within the context of competition/segregation theories. Therefore, any opportunity allowing a simultaneous appraisal of a community of predators should be carefully exploited to fill this gap in our knowledge of oceanic trophic webs. A recent study of incidental catches in the French tuna drift-net fishery of the Northeast Atlantic provided such an opportunity.

Drift-nets were introduced to the French albacore (*Thunnus alalunga*) fishery of the Northeast Atlantic in 1987 and soon became the main gear used by the French, English and Irish fleets operating in the area. The drift-net fishery rapidly became criticized for the potential environmental risks it could pose through the incidental catches of non-target species, especially dolphins. With the aim of estimating dolphin mortality, surveys of both the dolphin catches in the fishery and dolphin populations in the area were carried out in 1992–93 by Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) and described (Goujon *et al*.,1993). Although it was beyond the initial scope of the project, it was decided to collect biological samples and data from the dolphins caught by fishing vessels with observers on-board.

Stomach samples of every predatory species caught in the fishery were collected during the survey, thus yielding gut contents of dolphins, tunas, sharks and various other minor (in number of samples) species caught concurrently in the same area and water layer. The stomach contents of common (*Delphinus delphis)* and striped dolphins, (*Stenella coerulaeoalba),* albacore *(Thunnus alalunga),* swordfish *(Xiphias gladius),* wreckfish *(Polyprion americanum),* blue shark (*Prionace glauca*), Ray's bream (*Brama brama*), and other minor species were collected in the summer 1993. While the complete quantitative analysis of this material is still underway, this paper describes some preliminary results obtained from a subset of tuna and dolphin samples.

## Material and Methods

Eight major predatory species were collected from June to September 1993 in the area of the fishery (Fig. 1) including two dolphins, one shark, two thonid, one swordfish and two other teleost species (Table 1). In all cases, stomach contents were collected from individuals caught in the gillnets either as the target species or as by-catches. Whole stomachs were removed and kept frozen until processing in the laboratory. When dolphins were collected in a given net set, a sample of the associated fish fauna was taken from the same set. As a comparison, albacores were also collected from sets without dolphins.

The analytical procedure chosen was designed to provide quantitative data on number, mass and body length distribution of every prey taxon occurring in any individual gut. Particular attention was paid to discriminating fresh food material *versus* accumulated items since important biases can arise when both categories are lumped together (e.g. Ridoux, 1994). Numbers of individuals were counted in each prey category from diagnostic parts. For every identified taxon, up to 30 lengths were determined per gut sample using either standard body lengths or diagnostic organ lengths (e.g. fish otoliths, squid beaks, parts of crustacean exoskeleton).

As this analysis is still underway, the following results only deal with a sub-set of tuna and dolphin samples collected in a restricted area, (Fig.1), and display frequency of occurrence and relative abundance of broad prey categories (fish, cephalopods and crustaceans).

## Results

In a preliminary attempt to investigate the trophic relationships of the albacore and the two dolphins, a limited number of samples were selected from a restricted area of the fishery (12 to 15° west, 47 to 50° north, Fig.1). Ten samples each of the five following categories were analysed: 1) albacores from "clean" sets (with no dolphin), 2) albacores from sets with common dolphins, and 3) albacores from sets with striped dolphins, 4) commons dolphins and 5) striped dolphins.

### Stomach repletion

Repletion indices (defined as mass of gut content/cubic power of predator's body length) were lower in the albacores caught with striped dolphins than when albacore samples were from clean sets ($U = 17$, $p < 0.01$). No such difference was seen for albacores caught with common dolphin compared to albacore "clean" sets ($U = 29$ $p > 0.1$). Additionally, stomach repletion in albacores was generally lower than in dolphins.

### General food composition

The food of the albacore was mainly fish and, to a lesser extent, crustaceans. This composition was evident in samples collected from "clean" sets (Fig 2a) and also from sets with common dolphins (Fig. 2b). In contrast, when striped dolphins were caught (Fig. 2c), it appeared that the food of the albacore was mostly squids.

In the two dolphin species, squid represented the most important prey group both in frequency of occurrence and in relative abundance. Interspecific difference arose only when one considered prey groups of secondary importance. Fish ranked second in the food of the common dolphins (Fig. 3a) and only third in the striped dolphins (Fig. 3b) (in which crustaceans were more important in relative abundance).

### Some important prey species

At the species level (Table 2), the most striking difference between albacore and dolphins was the absence of lantern fishes, *Myctophidae,* and other meso-pelagic fish and shrimp from the diet of the tuna. There was less overlap in fish species between albacore and striped dolphin than between albacore and common dolphin. The overlap in fish species was very high between the two dolphins. However, the common dolphin samples included all the fish species found in the diet of the albacore,

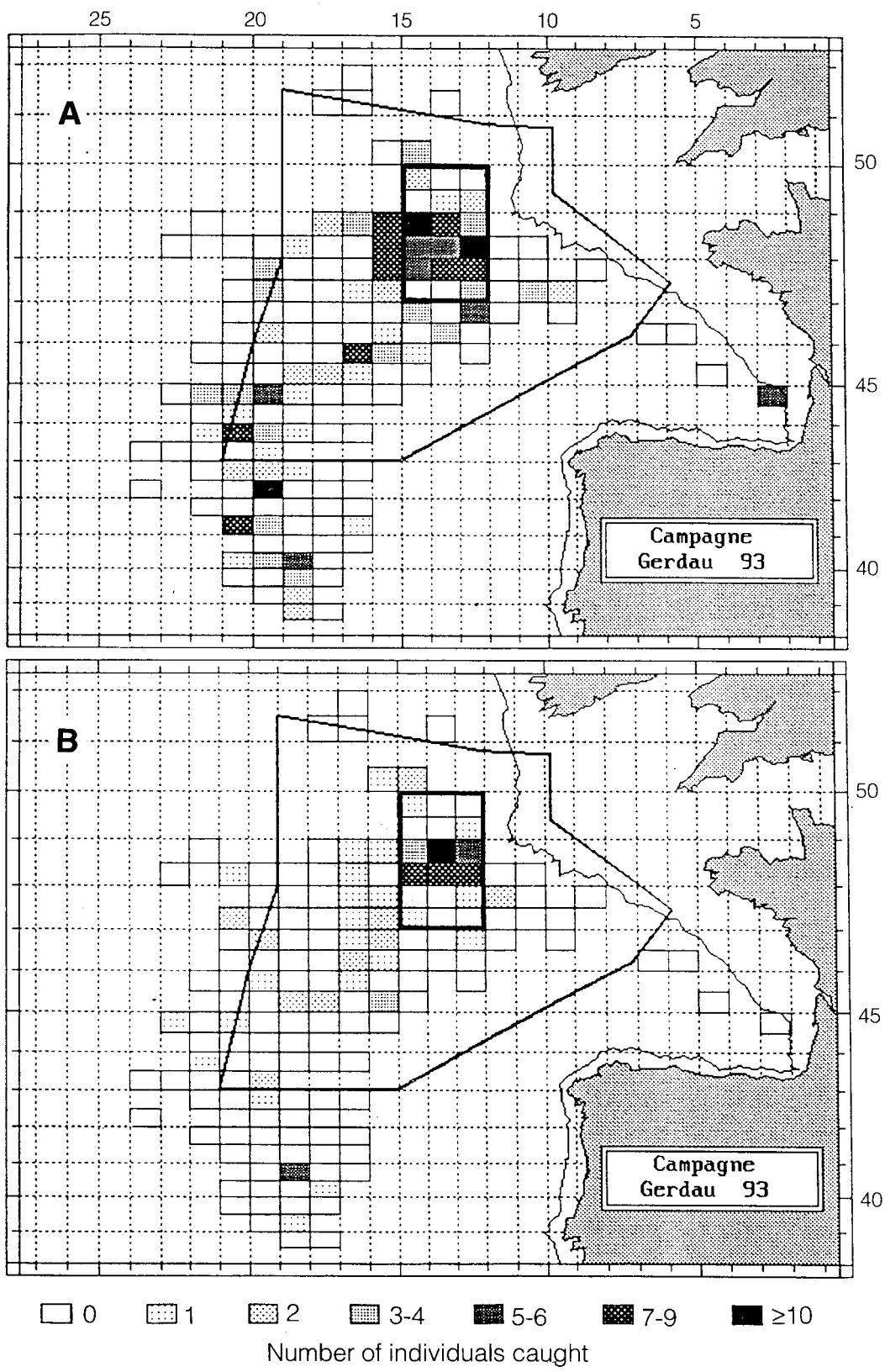


Fig. 1. Locations of capture of (**A**) striped and (**B**) common dolphins in the Northeast Atlantic tuna drift-net fishery, 1993. (The area corresponding to the subject of stomach sample analysed in this report is shown by the box 12° to 15°W, 47° to 50°N).

TABLE 1. List of stomach samples collected in summer, 1993.

| Species | Number of Samples |
|---|---|
| *Delphinus delphis* | 42 * |
| *Stenella coeruleoalba* | 97 * |
| *Thunnus alalunga* | 84 |
| *Xiphias gladius* | 104 |
| *Prionace glauca* | 39 |
| *Brama brama* | 41 |
| *Polyprion americanum* | 19 |
| *Thunnus thynnus* | 13 |
| Other minor species | 11 |

* additional samples were also collected in summer 1992, but the associated fish fauna were not sampled.

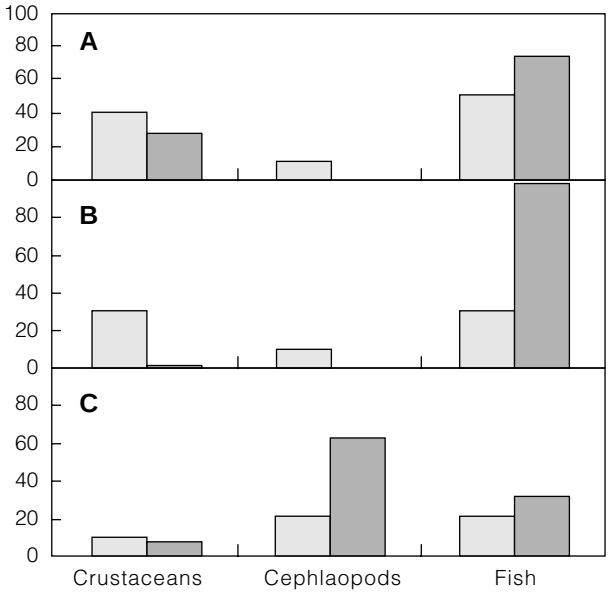


Fig. 2. Diets of albacore in relation to the presence of dolphins from (**A**) sets without dolpins, (**B**) sets with common dolphins, and (**C**) sets with striped dolphins. Light grey histograms indicate % occurrence. Dark grey histograms indicate % number.

whereas only one of these was present in the diet of the striped dolphin.

## Discussion

The present work is still in progress and, consequently, any conclusion drawn from the samples analysed to-date would be premature. However, several salient points appeared which suggest interesting perspectives when the whole collection of stomach contents should eventually be analysed.

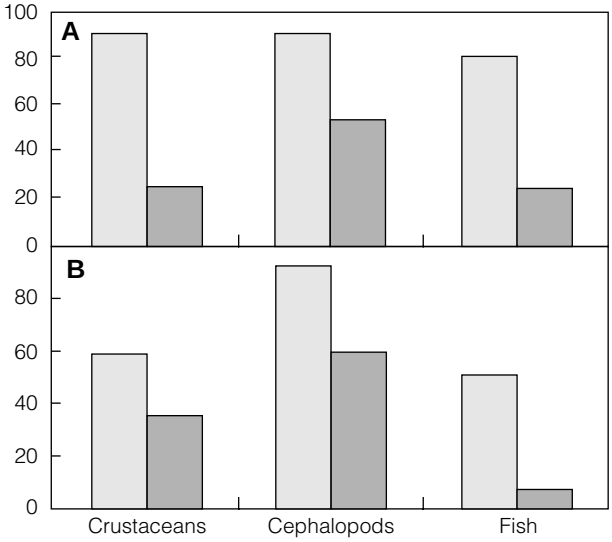


Fig. 3. Diets of dolphins by caught in tuna driftnets: (**A**) common dolphin and (**B**) striped dolphin. Light grey histograms indicate % occurrence. Dark grey histograms indicate % number.

Although they have been collected simultaneously and sympatrically in a restricted subarea of the fishery (Fig. 1), albacore and dolphins differ in their food preferences, with fish being predominant in the diet of the former and squid in the diets of the latter. However, evidence suggests that feeding behaviour of the albacore may differ when striped dolphins, and not common dolphins, co-occur with the albacore. Nonetheless, before any causal relationship is discussed, these results must be confirmed using the entire sample set. On the other hand, it appears, at this stage of the study, that the two dolphins differ little in their diets.

In a similar study in the east pacific tuna purse seine fishery, Perrin *et al*. (1973) compared the diets of spotted and spinner dolphins, *Stenalla attenuata* and *S. longirostris*, and the yellowfin tuna, *Thunnus albacares*, caught simultaneously. In contrast with our study, they showed that the two dolphin species differed in their diets; *S. attenuata* feeding largely on epi-pelagic prey, much in the same way as the yelllowfin tuna, and *S. longirostris* concentrating on deeper occurring prey species eaten at different times of the day.

TABLE 2. Occurrence of prey species in the diets of albacore, common dolphin and striped dolphin.

| Prey Groups | Species<br>Albacore | Common dolphin | Striped dolphin |
|---|---|---|---|
| **Crustaceans** | *Themisto* sp. | | |
| | | *Pasiphaea* sp. | |
| | | *Acantephyra* sp. | *Acantephyra* sp. |
| | | *" Sergestes* sp.*"* | *"Sergestes* sp.*"* |
| | *Meganyctiphanes norvegica* | *M. norvegica* | *M. norvegica* |
| **Fish** | *Maurolicus muelleri* | *M. muelleri* | |
| | | *Notoscopelus kroyeri* | *N. kroyeri* |
| | | *Ceratoscopelus maderensis* | *C. maderensis* |
| | | *Diaphus* sp. | *Diaphus* sp. |
| | *Pasiphaea* sp. | *Paralepis* spp. | *Paralepis* spp. |
| | *Scomberesox saurus* | *S. saurus* | *S. saurus* |
| | | *Stomias boa* | *S. boa* |
| | | *Chauliodus sloani* | *C. sloani* |
| | | | *Xenodermichthys copei* |
| | | *Micromesistius poutassou* | |
| **Cephalopods** | unidentified | unidentified | unidentified |

Future analysis should first emphasize the ponderal composition of the samples studied here by using length measurements already performed and standard relationships. Many of the length and weight relationships are not available in the literature and must therefore be established from well-preserved specimens present in the gut contents. Then, the analysis should be extended to the whole species assemblage found in the drift-net fishery in order to give an image of the trophic relationships in the community. Combined with fishery statistics, detailing relative population sizes and distribution, the dietary data could give an insight into the role of each predator in the oceanic food web on the Northeast Atlantic.

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