BIOLOGICAL SAMPLING newsletter

SPC Secretariat of the Pacific Community

SPC-OFP Ecosystem Monitoring and Analysis Section*

Issue #20 November 2011

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Welcome to the 20th issue of *Biological Sampling Newsletter*, which provides news about the Ecosystem Monitoring and Analysis Section of the Secretariat of the Pacific Community's (SPC's) Oceanic Fisheries Programme (OFP).

In this issue we 1) look at Euphausiidae, the most abundant family of krill, 2) provide information on a technique to identify a member of the Euphausiidae family, 3) provide information on identification of sunfish and boxfish, 4) present the tagging website , 5) explain what to do if you find a tagged fish, 6) present Nectalis 1 scientific cruise.

We hope you enjoy this new issue !

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Euphausiidae, the most abundant family of krill

Krill is the common name of crustaceans belonging to the order Euphausiacea. This order contains two families, including that of Euphausiidae which is the most abundant. It includes ten genera and 85 species. Here are a few genera belonging to the family Euphausiidae.

Figure 1 : *Thysanopoda* sp.

Figure 2 : *Nyctiphanes* sp.

Figure 3 : *Stylocheiron* sp.

Figure 4 : *Euphausia* sp.

Euphausiid morphology

Krill are crustaceans with a chitinous carapace (cuticle) made up of the cephalothorax (head/thorax) and the abdomen, which consists of six articulated segments. The body ends with the 'tail', consisting of the telson, which often forms a triangle and houses the anus, and the uropod, which serves as a rudder for swimming in open water. At the cephalothorax we observe seven pairs of legs called pereiopods or thoracic legs (legs ambulatory) and on the abdomen there are five pairs of legs called pleopods. Euphausiids are bioluminescent animals, having organs called photophores that can emit light. Their distribution on the body is: one at the base of each eye, a pair on the basis of thoracic segments three and seven, and one mid-ventrally on abdominal segments one to four.

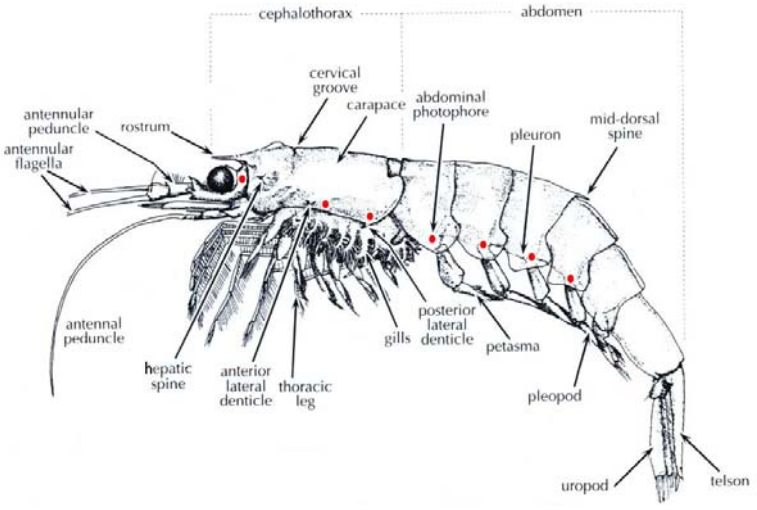


Figure 5 : Morphology of Euphausiidae
(Red dots represent position of photophores)

Size

Krill are moderate to small crustaceans; the total length (TL) of an adult is between 12 mm and 60 mm, depending on the species (but a few species grow to between 120 and 150 mm (TL)). We have observed krill larvae, juveniles and adults in tuna stomachs, ranging in size from 1.9 mm to 20 mm (TL).

Environment

Krill occur worldwide in all oceans, although many individual species have endemic (*i.e.* specific geographic area) or neritic (i.e. coastal) restricted distributions. They live between the surface of the sea and a depth of 6,000 metres. They are known from seamounts and knolls.

Predator

Stomach analyses reveal that those crustacean are a common prey for skipjack, albacore and bigeye tunas.

Economy

Well-known species of Euphausiidae for commercial krill fisheries include Antarctic krill *(Euphausia superba),* Pacific krill *(E. pacifica)* and Northern krill *(Meganyctiphanes norvegica).*
Krill tastes salty and somewhat stronger than shrimp. For mass-consumption and commercially prepared products they must be peeled, because their carapace contains fluorides, which are toxic in high concentrations. There is a small but growing market for krill oil as a dietary supplement ingredient.
Krill is one of the new ingredients recognised by the European Community. Compared to fish oils, krill oil has many advantages:

- it is better absorbed as it is rich in phospholipids;
- it contains one of the most powerful antioxidants;
- diverse studies have shown a beneficial effect on one's quality of life, relief for tender joints, and the regulation of cholesterol levels.

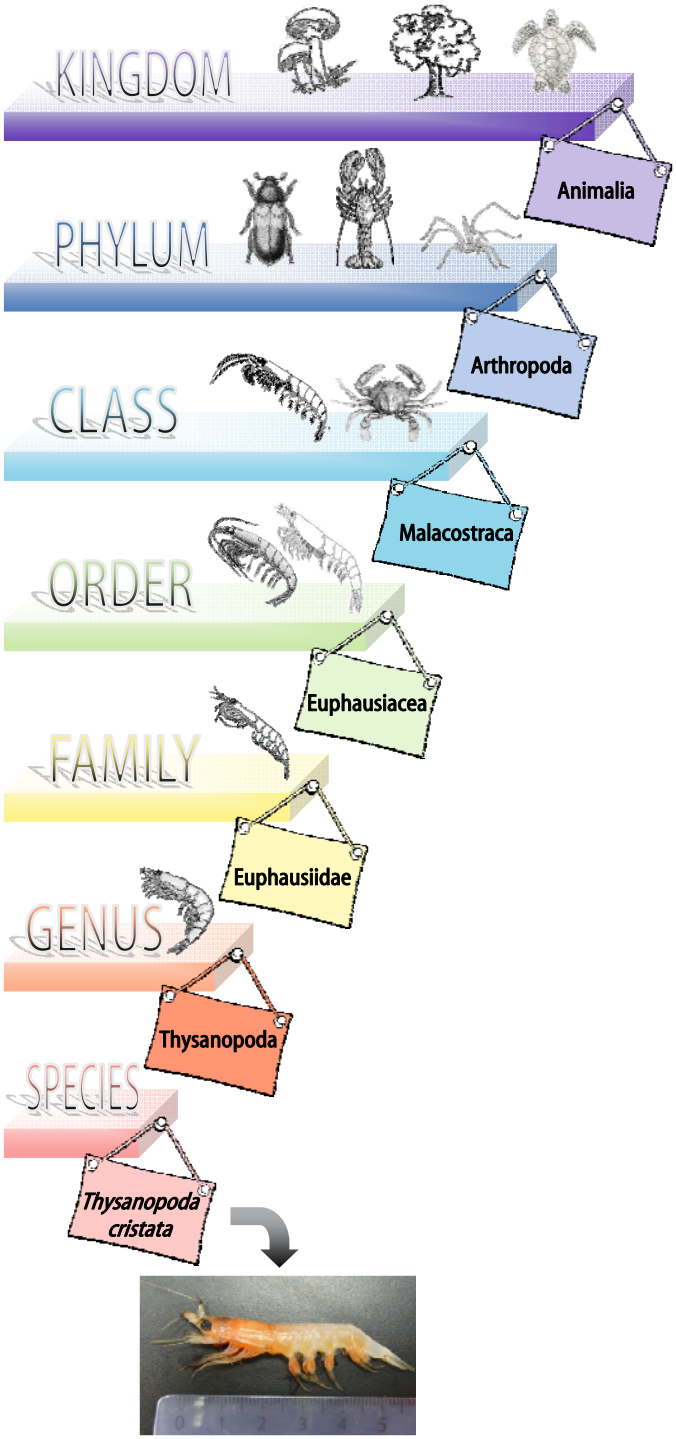
Figure 6 : Meganyctiphanes norvegica
(Source : http://www.seawater.no/fauna/arthropoda/norvegica.html)

Thysanopoda cristata, a species belonging to Euphausiidae family

First, some vocabulary…

Taxonomy is the science that seeks to describe living organisms and group them into entities called taxa (singular: taxon) in order to identify and name them, and then classify them. To do this we use the identification key.

An identification key is traditionally a series of proposals on the characteristics of a specimen that can be identified step by step and then the specimen is given a name. There are identification keys for zoological and botanical groups and for each taxonomic level: key orders, families, genera and species.



Identification with a key

In this article we will show you how we managed to identify our specimen to its species name.

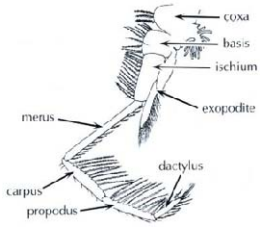
1 - The body is composed of cephalothorax and an abdomen.
- Seven thoracic legs

→ Order: Euphausiacea

2 - Gills easily visibles on thoracic segments seven to eight.
- Photophores present on pleuron one to four.

→ Family: Euphausiidae

3 - Eyes undivided into two lobes, thoracic legs of approximately equal length.
- Seventh pair of thoracic legs shorter than sixth, with five segments.
- Eighth thoracic leg extremely minute.

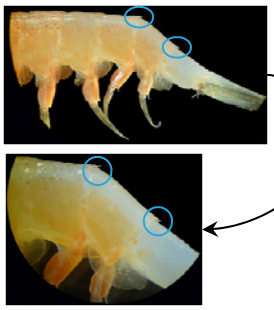


→ Genus: *Thysanopoda* sp.

4 - Carapace without distinct cervical groove.

Exemple of cervical groove

- One or more abdominal segments with dorsal spine
- Dorsal spines on fourth and fifth abdominal segments.

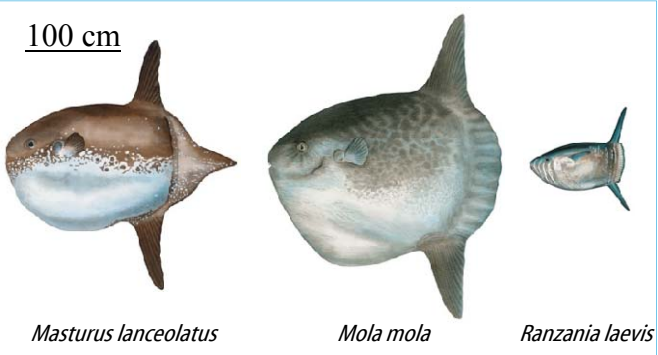


→ Species: *Thysanopoda cristata*

Tetraodontiformes: sunfish and boxfish identification

Sunfish

Molas or ocean sunfish belong to the Molidae family, unique fish whose bodies come to an end just behind the dorsal and anal fins, giving them a 'half-a-fish' appearance.



Comparison of the three adult sunfish species

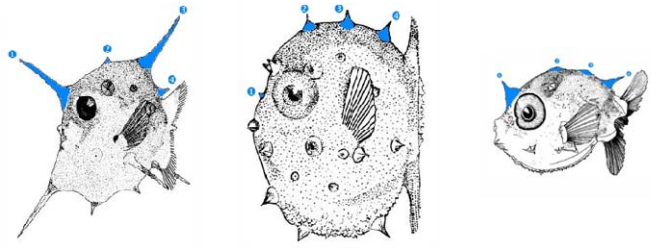
They feed mainly on soft-bodied animals, such as jellyfish, although they also eat small fish or crustaceans.
Three easily distinguishable species are known in the Atlantic, Indian and Pacific Oceans. A fourth one is known only in southern waters south40°S.

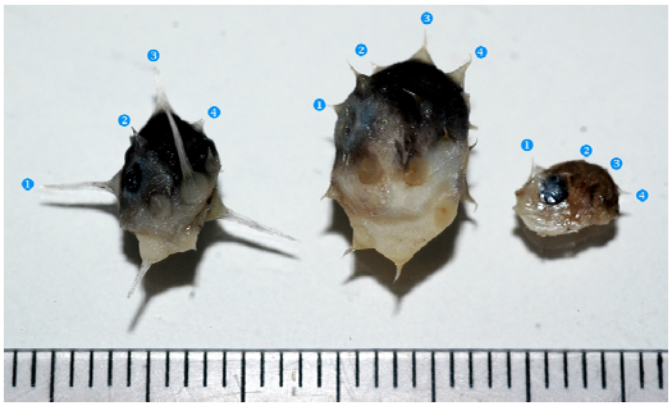
Because sunfish are the largest of the ray-finned bony fish (with the ocean sunfish *Mola mola* recorded up to 3.3 metres in length and 2.3 tonnes in weight) the adults do not have many natural predators, but as larvae and juveniles it is not uncommon to find some in the stomachs contents we analyse, with about one stomach in a hundred containing some. We therefore try to classify them at specific level.

Identification

Before developing to the juvenile stage, the larvae have up to 23 large body spines and are called 'spinose larvae'. The spines of each species are in a unique combination of size and shape that are specific to that species.

	Larvae spines	Total number of vertebrae
Masturus lanceolatus	❶ and ❸ longer	16
Mola mola	❶ minute and ❷, ❸, ❹ same size	17
Ranzania laevis	❶ and ❹ longer	18





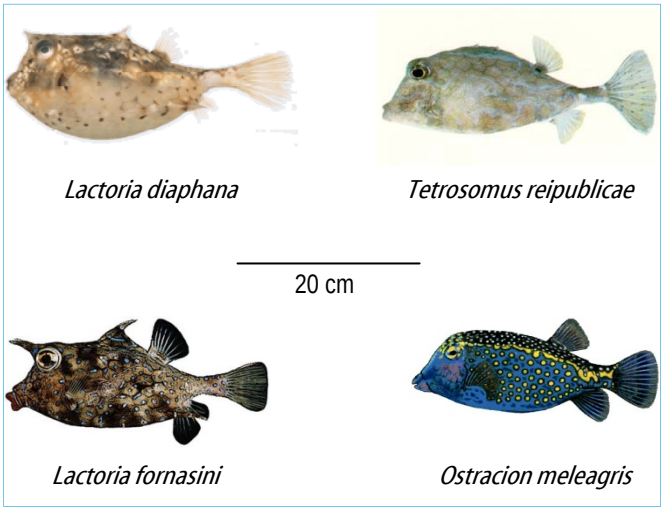
Comparison of the three sunfish species spinose larvae

If the fish are too identify digested or are already juveniles (so without any spines), we have one further opportunity to identify them because each species has a different number of vertebrae.

Fish found in stomach

Boxfish

Boxfish belong to the Ostraciidae family and are famous for being almost completely encased in a 'honeycomb' box-like carapace made of enlarged scale-plates. Species of the genus *Lactoria* are also called cowfish because of their 'horns'.
As adults, these heavy scales limit Ostraciidae to slow movements, but few other fish are able to eat them. Furthermore, many of the species secrete poisons from their skin into the surrounding water, which further protects them from predation.
Thanks to their unique shape and unusually bright colours, many of the 25 known species are famous aquarium fishes.

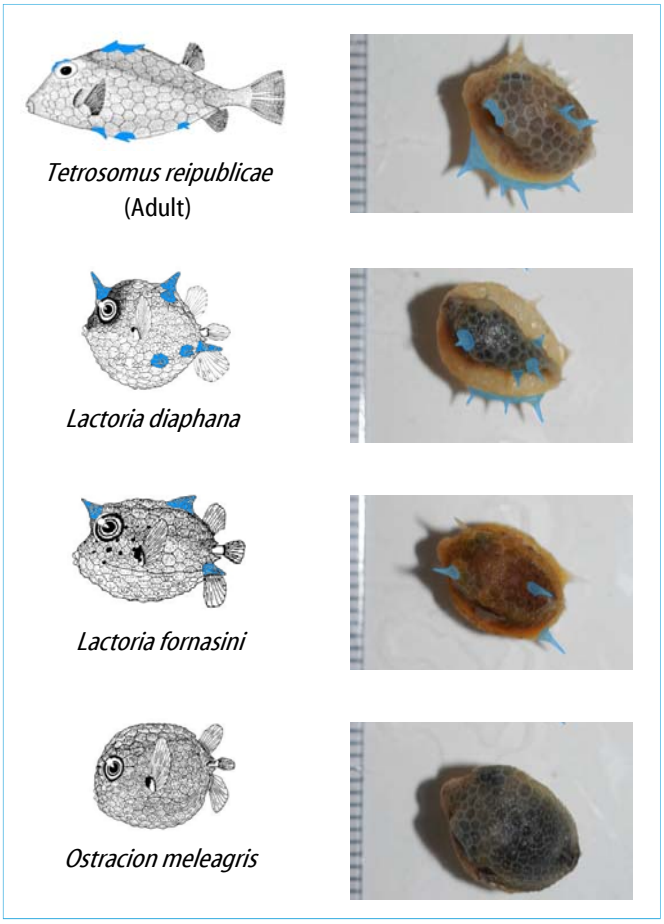


Adults of the most common boxfish species
found in the stomachs of open water predators

Adults occur at a depth of 100 metres and feed on benthic invertebrates, but juveniles are pelagic and so are preyed on by large open-water predators. Approximately five stomachs in a hundred contain larvae of Ostraciidae, and species of the genus *Lactoria* constitute at least half of these. That is why we now look at more criteria in order to be more precise in our identification, and identify at least to the genus level, sometimes to the species when enough information is available.

Identification

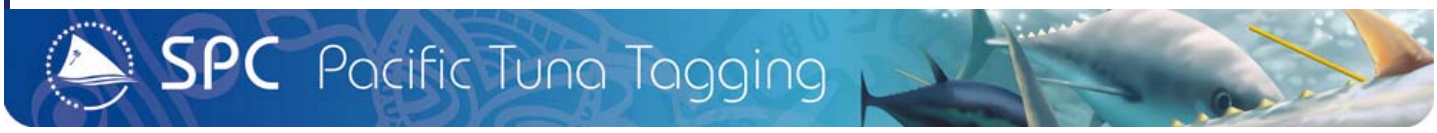
Like their closely related cousins sunfish, boxfish belong to the tetraodontiformes order (also like filefish, puffers and triggerfish).
Identification of the ingested larvae follows the same principle, looking for a unique combination of body shape, size and number of spine-like modified scales. These are illustrated below.



Comparison of most common ingested boxfish larvae species
(photos are view from the top)

	Larvae spines	Comments
Tetrosomus reipublicae	2 minute spines on eye 2 dorsal spines, well developed 4 lateral spines	very uncommon prey spines decrease in size when adult (until having only three lateral spines)
Lactoria diaphana	1 spine on eye 1 dorsal and 2 dorso-lateral spines	adults with same spines
Lactoria fornasini	1 spine on eye 1 dorsal spine 1 lateral caudal spine	adults with same spines
Ostracion sp.	no spines in genus *Ostracion*	quite uncommon prey difficult to identify at specific level when young

The tagging website



The tagging website http://www.spc.int/tagging/, which was launched at the beginning of 2011, is designed to be a reference website for tuna tagging in the Pacific. It improves visibility of the largest tagging programme in the region and reflects the important work already done by SPC and its partners.

Within this new portal, you can find information about the different tagging programmes, read publications about tagging, learn about the different types of tag, watch tagging videos and look at our gallery of photographs.

Live tagging data are accessible, using two- and three-dimensional maps that give you a better understanding of the data.

This website is used by tag finders as an interface to submit tag recaptures and get their rewards, and also by tag recovery officers to manage the collection and organisation of recovered tags in a secure web space.

Enjoy browsing this exciting new website !!

What to do if you find a tagged fish?

You find a tagged fish during fishing time

- Ask permission to put the fish aside.
- Verify that there is no archival tag in the belly. You should be able to see the antenna of the archival tag sticking out. Remove the archival tag by cutting the fish from the anus toward the gills (a small cut will be enough, do not pull the antenna).
- Measure the fish. If possible weigh the fish.
- Remove entirely the tag from the fish. Make sure that the dart doesn't remain inside the flesh of the fish.
- Fill in the tag recovery form and report the exact date and position of the catch.
- If you have access to a freezer, you can collect biological samples (otoliths, first dorsal spine, stomach, gonads, muscle, liver)

You find a tagged fish during well transfer

- Ask permission to put the fish aside.
- Verify that there is no archival tag in the belly. You should be able to see the antenna of the archival tag sticking out. Remove the archival tag by cutting the fish from the anus toward the gills (a small cut will be enough, do not pull the antenna).
- Record the well number.
- Measure the fish. If possible weigh the fish.
- Remove entirely the tag from the fish. Make sure that the dart doesn't remain inside the flesh of the fish.
- Fill in the tag recovery form and if there were several sets in the well, report the period and the position that include all the sets.
- If you have access to a freezer, you can collect biological samples (otoliths, first dorsal spine, stomach, gonads, muscle, liver)

What do you do if the crew give you a tag?

- Ask when they found the tagged fish and all possible questions to recover information relative to the recovery. If the date when the tag was found is not precise you can at least enter the month and the year of the catch.
- If the catch position cannot be retrieved, try to at least describe the region where the tagged fish was caught.
- If the crew gives you an approximate date, try to access the vessel's logbook to find out where the boat was around that date and use the estimate section of the form to report the position.

SPC Pacific Tuna Tagging

Rewards

In each main port you can find a **Tag Recovery Officer (TRO)**, they are able to distribute reward for recovered tags.

- If you find a tag, to claim your reward you need to give the tag to the TRO. You can remove the tag from the recovery form (do not remove the tag recovery form from your workbook). Inform the TRO that all information related to the tag has been provided in your observer workbook. If you can make a copy of the tag recovery form provide it to the TRO. If it is not possible to make a copy of the form, give him your trip ID number (so we can find your workbook and retrieve the tag recovery forms).

- If a crew member on the boat finds a tag, fill out the tag recovery form with him and give the tag back to the finder. Write a comment on the form "tag given back to the finder for reward purpose", and advise him where to collect his reward in the next major port.

Tag recoveries may also be reported to SPC by email (tagging@spc.int), or on a web-based form at www.spc.int/tagging. You can inform the captain and the crew that they can use the website if they recover tags in the future. Observers must always use the recovery forms in the workbook to report tag recoveries.

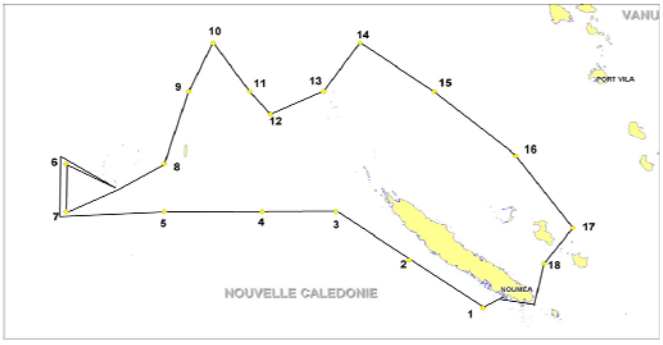
Nectalis 1 scientific cruise: collecting tuna preys

R/V Alis
(IRD-C.Maes)

In August 2011, SPC participated in a scientific expedition to collect tuna prey and acquire a better knowledge of the composition and behaviour of the prey. For more than ten years SPC, in collaboration with the observer programmes of Pacific Island countries and territories, has been collecting the stomach contents of tuna and other top predators. Analysis of these samples in SPC's Noumea laboratory tells us a lot about the type and amount of prey consumed by each species. This latest expedition looked at the same subject but from another point of view; to observe where and when tuna prey can be found and how this is related to environmental data such as temperature, currents, and the presence of phytoplankton and zooplankton. It is essential to include these observations in the ecosystem models to help validate these models and also to help refine the forecast of tuna location, as tuna will tend to follow their prey.

We designed this project in collaboration with our colleagues from IRD, the French Institute of Research for Development, located in Noumea next door to SPC headquarters. Six scientists — a physical oceanographer, an electronician, an acoustician, a chemist specialising in phytoplankton, a specialist in zooplankton and a specialist in micronekton (tuna prey) — boarded the IRD 28 metre-research vessel RV *Alis*.

We ambitiously planned to stop at 29 sampling stations around New Caledonia during a three-week cruise. Unfortunately, rough weather at the beginning of the cruise (we had to seek shelter for two days at an atoll) and longer stops than planned at each stationforced us to limit the number of stations to 18, as we wanted to complete the scheduled measurements at each station.



Nectalis 1 revised cruise plan

At each station, the procedure went as follows:

- Lowering to a depth of 500 meters the CTD probe (salinity, temperature and depth), the oxygen probe, the fluorimetry probe (which indicates phytoplankton quantities) and a light sensor, as well as eight bottles for water sampling. These were closed at depths of 180 m, 150 m, 130 m, 110 m, 90 m, 50 m, 30 m and 3 m. The water samples were analyzed for nutrients such as nitrates, and filtered so we could characterize and quantify the phytoplankton ;

Recovering the CTD probe and the sampling water bottles

- Lowering to a depth of 800 meters the L-ADCP, a piece of apparatus that gives information on sea currents but can also be used to estimate the location and quantity of zooplankton;

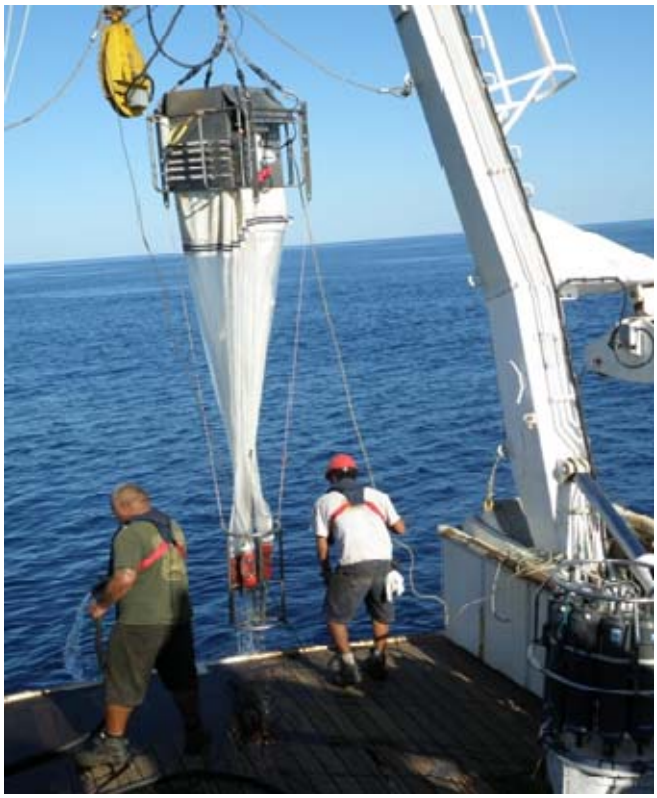
The L-ADCP (in yellow)

- Lowering to a depth of 200 meters the TAPS, an acoustic probe programmed to specifically detect zooplankton;

Preparing the TAPS

Nectalis 1 scientific cruise: collecting tuna preys

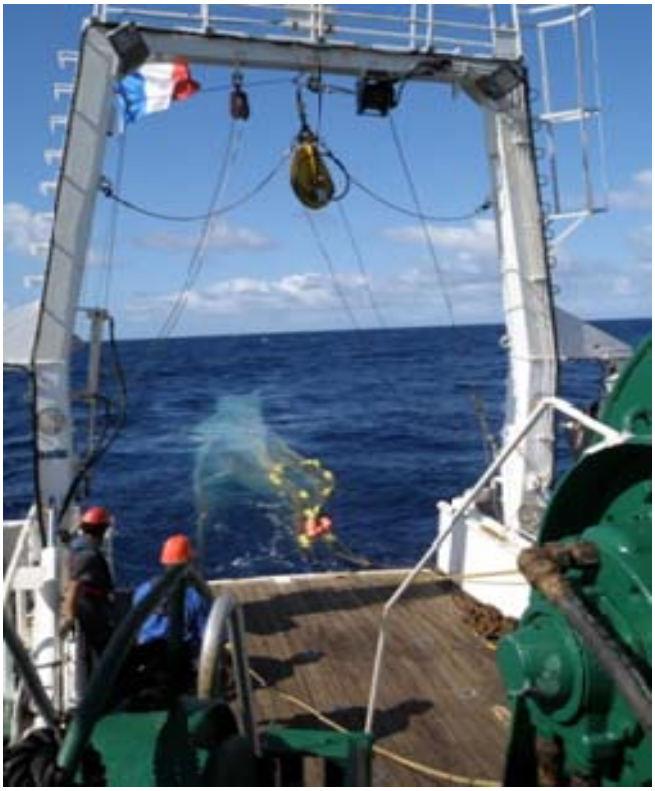
- Towing vertically from a depth of 600 meters to the surface a zooplankton net with five collectors opening and closing at different depths to collect samples in the depth ranges: 600–500 m, 500–400 m, 400–200 m, 200–100 m and 100 m to the surface



Recovering the zooplankton net

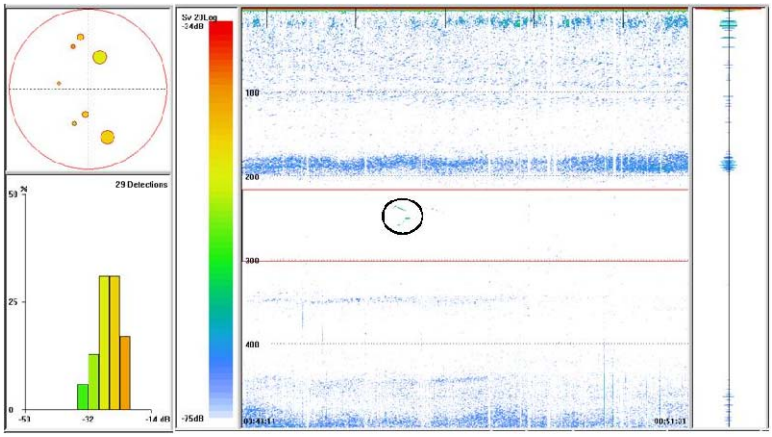
- Towing horizontally a micronekton net which catches the tuna prey. We were trawling once or twice at each station according to the acoustic signal visible on the sounder to target large patches of tuna prey. We trawled at different depths between 500 m and the surface

Some tuna preys collected with the micronekton net



Setting the micronekton net

En route we were also taking some automatic measurements of S-ADCP (current and zooplankton), surface temperature and salinity, and acoustic signals. The acoustic sounder was used to determine at which depth we should trawl for micronekton but, more importantly, it was used to localise and estimate the quantity of tuna prey on the trajectory of the boat, and we were also able to identify some tuna in the signal from time to time.



Echogram from the fishing echosounder, in the black circle are some signal of large predators, probably tuna, just above, around 180-200m depth is a thick layer of tuna preys

Photo credits :

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http://www.marinespecies.org/carms/photogallery.php?album=2000&pic=38358

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http://krill.rutgers.edu

Page 5 :
http://www.puffer.gr.jp/monograph/Library/puffers/ostraciidae/index.htm

We welcome your comments on the content of this newsletter – please send them to Valérie Allain (valeriea@spc.int), Elodie VOUREY (elodiev@spc.int).