Biological Sampling Newsletter

for Observers and Port Samplers

SPC-OFP Ecosystem Monitoring and Analysis Section*

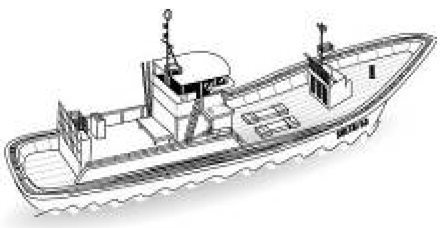
Issue #17 — 15 January 2011

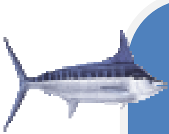
Welcome

to the 17th issue of the *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 a prey commonly found in predators' stomachs, 2) bring you insight into stomach analyses examining presence of reef prey in the tuna diet, 3) inform you on our lab technician training, 4) present the new observer training video, 5) report on the training of observers in Federated States of Micronesia (FSM), and finally 6) provide an update on the last tagging mission in the central Pacific.

We hope you enjoy this new issue!





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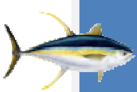

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STOMACH ANALYSIS: PREY COMMONLY FOUND

As in the previous issue, we introduce you to some common prey species found in tuna stomachs and techniques our laboratory technicians use to identify them.

***Onychoteuthis sp.*, commonly named hooked squid.**

This squid belongs to the family Onychoteuthidae. This family comprises about 18 species grouped in 5 genera including the genus *Onychoteuthis*.

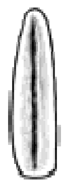
This type of squid is found mostly in tropical and subtropical waters throughout the world's oceans, although it is also common in high latitudes of the north Pacific. It occupies depths from 0 m to over 1000 m.

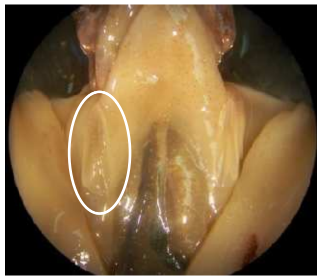
In tuna stomachs, we mainly come across juveniles and adults that range in size from 1 cm to 14 cm (mantle length).

The figures below show the morphologic characteristics that we look for to identify *Onychoteuthis sp*.

- <u>FUNNEL LOCKING APPARATUS</u>

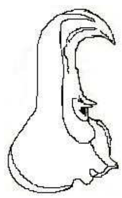
In *Onychoteuthis* the funnel parts (generally cartilagenous) of the locking mechanism between the funnel and mantle are straight, which means the groove in the cartilage is more or less straight.





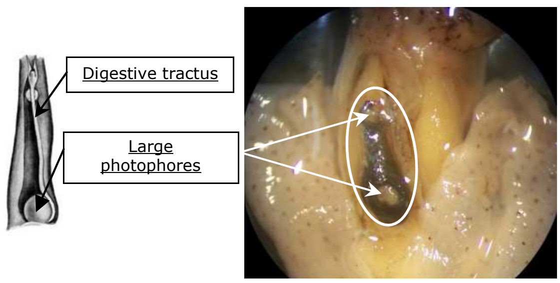
- <u>HOOKS IN THE TENTACLE</u>

Hooks are horny structures that look like a single claw and are derived from the inner sucker ring in some squids. In *Onychoteuthis*, the hooks are on the tentacles, while in other species they may be found on the arms and/or tentacular clubs.



- <u>PHOTOPHORE</u>

Photophores are organs that produce bioluminescence or 'living light'. In this squid, there are two large photophore ovals on the digestive tractus.



These morphological characteristics are used to quickly identify *Onychoteuthis* in tuna stomachs. Even if the digestive process is advanced, these structures still remain. Stomach analyses reveal that these fish are common prey for tuna – primarily for bigeye but also for yellowfin and skipjack.

STOMACH ANALYSIS: IMPORTANCE OF REEF PREY IN TUNA DIET

A recently completed study of tuna diet showed that although tuna are not selective regarding their diet, and its content depends on the availability of prey in the media, we can distinguish food preferences depending on the tuna species, fishing area and the school type.

Among the many preys eaten by top predators, the study focused on those originating from the reefs and lagoons. Fish larvae go to the open ocean for their development before coming back to settle in the reefs for the rest of their life. Tuna can encounter and consume larvae while they are in the open ocean. Previous studies showed presence of reef prey in tuna diet. However, these observations were sparse and not representative enough to be able to provide an overview of the importance of reef prey in the diets of tunas and top predators.

Our study is unique due to its large spatial scale and its detailed qualitative (determining the species eaten) and quantitative (determining how much is eaten) data.

Emilie (see *Biological Sampling Newsletter* 15 – July, Staff news) worked on this topic at OFP-EMA for about 6 months to finalise the study for her master's degree. She conducted data analyses on the contents of 4357 stomachs, looking specifically at the importance of reef prey in tuna diet. Samples came all over from the Pacific, collected by observers from the region.

This study showed that reef prey made up approximately 16.3 per cent of the diets of tunas and other top predators associated with oceanic fisheries.

This value varied according to many factors. Smaller quantities of reef preys were eaten in June–July and December–January. During the rest of the year the values were more important. This variability is mainly explained by the seasonality of reef prey presence in the ocean, life expectancy, larval survival – especially in the open ocean, and currents.

The percentage of reef prey in the stomachs is also highest in top predators fished by surface gear (purse seine, trolling, pole-and-line) near fish aggregating devices (FADs) and land. FADs could be described as a type of artificial reef and considered a source of production of prey (Figure 1).

Figure 1: Reef fish juveniles around anchored FAD in Papua New Guinea.

Predators caught in Papua New Guinea showed particularly high amounts of reef prey in their stomach content (Figure 2).

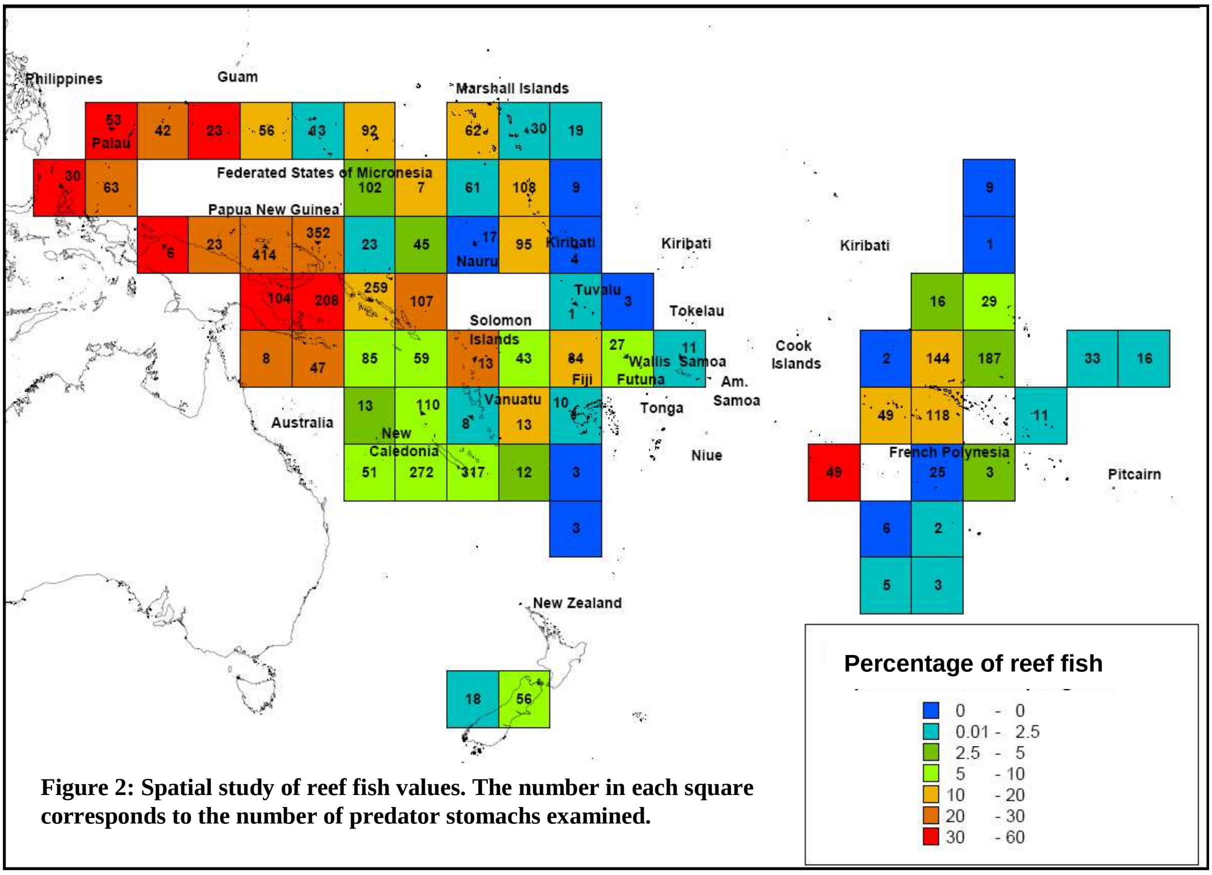


Figure 2: Spatial study of reef fish values. The number in each square corresponds to the number of predator stomachs examined.

Looking at the characteristics of the predators, we realised that small surface predators, particularly yellowfin and skipjack, have the highest amount of reef prey in their diet.

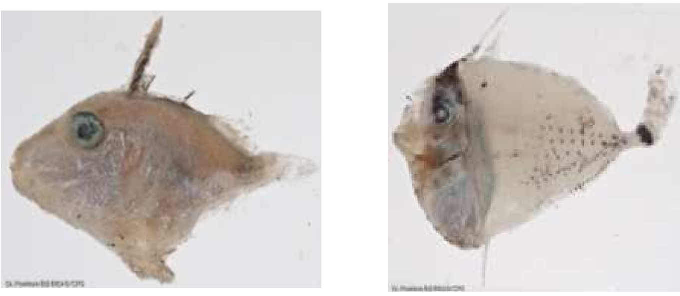


Figure 3: Trigger fish and surgeon fish larvae found respectively in stomachs of yellowfin, skipjack, wahoo fished in FSM and Solomon Islands.
(Pictures: Dominique Ponton, IRD.)

In the stomach content we identified 109 different species of reef prey, mainly fish (60%) and crustaceans (40%). Mollusks made up less than one percent. The main species of reef fish were larvae of trigger fish (*Balistidae*, see *Biological Sampling Newsletter* 13 – Prey commonly found) and surgeonfish (*Acanthuridae*, see *Biological Sampling Newsletter* 14 – Prey commonly found) (Figure 3).

The crustaceans found were mainly juvenile mantis shrimps (Figure 4).

Figure 4: Larvae and adult of mantis shrimps found in stomach of tuna fished in Solomon islands. (Picture: Australian Museum.)

This large-scale study conducted in the western and central Pacific Ocean made it possible to highlight general trends and showed that under certain conditions, reef prey make up a significant part of the diets of tunas and other predators. However, further analysis at finer scales could explain more specifically the distribution of reef prey and diet preferences of top predators. Moreover, better knowledge of oceanographic parameters such as currents could help explain more accurately the dispersion of larvae in the environment and their presence in tuna diet.

TUNA PREY IDENTIFICATION TRAINING AT THE MELBOURNE MUSEUM

From 10 to 27 October, SPC Laboratory Assistant Cyndie Dupoux travelled to the Melbourne Museum in Australia to undertake training in marine animal identification (taxonomy). Due to the diversity of preys found in the stomachs of tunas and other large fish collected by the observers, strong skills in identification of fish, crustaceans and squid are required. Cyndie was warmly welcomed at the Melbourne Museum, where she had the opportunity to meet several well-known specialists in taxonomy.

Meetings with cephalopod (cuttlefish, squid and octopus) experts

Cyndie worked mainly with Prof. Chung-Cheng Lu, Curator Emeritus, who visited us at SPC in New Caledonia earlier this year. They checked around 100 specimens of squid and octopus from stomach content and Professor Lu taught her new methods of identification that would be easy to implement in the SPC laboratory.

She also met Dr. Mark Norman, who is Head of Sciences at the Melbourne Museum. He is one of the world's leading octopus experts. He explained the main characteristics used in octopus identification (Octopodidae family) – one of the more complex families, containing 44 genera and roughly 200 different species.

Figure 5: Dr. Finn and Dr. Norman working on a giant squid stored at the Melbourne Museum

OFP-EMA is also working in collaboration with Dr. Julian Finn, Senior Curator at the Melbourne Museum, on genetic studies of argonauts (octopus-like animals with an external shell). He has 15 years of experience in marine invertebrate research, studying cephalopods in general (octopus, squid, cuttlefish and nautilus) and primarily argonauts.

Both Dr. Norman and Dr. Finn participated in the making of the documentary movie 'Oceans', released in January 2010.

Meetings with crustacean (shrimp, lobster, crab etc.) experts

Cyndie also had the opportunity to meet Dr. Gary Poore, Curator Emeritus, who investigates the diversity of marine crustaceans and has a wide and thorough knowledge of these animals. He checked around 35 specimens of shrimps, prawns, lobsters, amphipods, hermit crabs etc.

Figure 6: Dr. Poore sorting several crustacean samples

Dr. Caroline Farrelly also assisted Cyndie's work by drawing the different parts of shrimps and prawns used for identification and checking some krill, squat lobster, shrimp and prawn specimens.

VIDEO SHOOTING

Hirtzel Patel, a professional cameraman from Fiji, visited SPC headquarters in Noumea to shoot video as part of a project led by Sifa Fukofuka, well-known Observer Trainer, to produce a training video for observers. You will see this video during your next training session.

Figure 7: Hirtzel Patel interviewing Dr. Valerie Allain

In Noumea video interviews were recorded with John Hampton (Oceanic Fisheries Programme Manager), Simon Nicol (Principal fisheries Scientist) and Valerie Allain (Fisheries Scientist) from EMA, Peter Williams (Principal Fisheries Scientist) from the Data Management Section and Peter Sharples (Observer and Port Sampler Coordinator) from the Fisheries Monitoring Section. These scientists explained how SPC uses data and samples collected by observers during their trips.

Figure 8: Prey found in tuna stomachs sorted by the laboratory assistant

Hirtzel spent a fair amount of time in the SPC laboratory shooting video of lab technicians opening tuna stomachs, sorting preys and examining samples under the microscope.

During your next observer training session you will have the opportunity to see the work SPC staff is conducting with the data and samples you are collecting during your observer trips.

OBSERVER TRAINING – POHNPEI

From 25 to 29 October, SPC Research Assistant Malo Hosken travelled to Pohnpei, FSM to train 15 Fisheries Observers in biological sampling techniques.

The course content included:

- general knowledge in biological sampling, the details of each sample that observers may be asked to collect and a description of otolith extraction techniques;
- an explanation of the role biological samples have in improving understanding of the biology of tuna species;
- albacore biological sampling research and specific techniques for sampling otoliths and gonads;
- stomach sampling with explanation of the trophic dynamic study project;
- information about the bigeye and yellowfin project;
- general information on the Pacific Tuna Tagging Programme and detailed explanations about how to fill out tag recovery forms;
- tag seeding, tag recovery and biological sampling manuals;
- a practical session on otolith extraction: use of cutter, drill and saw; extraction of stomach, muscle, liver, spine and gonads; and how to deploy steel head tags for tag seeding; and
- general assessments.

Other trip objectives included liaising with coordinators and senior observers, collecting tagging data and bringing back biological samples, and obtaining video footage of training and interviews.

Trainee measuring skipjack as would happen onboard a purse seiner

Frozen tuna ready to be measured

***Seeded tags recovered by crew onboard* FV Eastern Marine**

CENTRAL PACIFIC TAGGING: CRUISE # 5

The central Pacific (CP) tagging cruises are part of the Pacific Tuna Tagging Programme (PTTP) that started in August 2006 with the objective of tagging and releasing tropical tunas throughout the western and central Pacific Ocean (WCPO). These cruises were designed to catch and tag tunas in areas where pole-and-line fishing gear is not efficient due to bait ground absence. Using specific trolling gear developed in Hawaii and targeting the US National Oceanic and Atmospheric Administration (NOAA) Tropical Atmosphere Ocean (TAO) oceanographic buoys anchored east of the international date line, the CP tagging cruises improved the overall spatial coverage of the PTTP tag releases and increased the number of tagged bigeye tunas, which are rarely caught by pole-and-line gear in the western part of WCPO.

Figure 8: Crew hauling two bigeye tunas from the first starboard dangler station. Note spray system in the background.

The CP5 cruise lasted 25 days onboard the Tonga-based *FV Pacific Sunrise*. The vessel was equipped with four ‘dangler’ stations (see Figure 8), each bearing two troll lines skimming the surface of the water. Three tagging cradles were mounted on the aft deck (two for conventional tagging and one for archival tagging). Four crew members hauled fish, the captain drove the vessel and two scientists tagged tunas. A spray system was rigged on the side of the vessel to mimic the commotion and noise of bait fish on which tuna normally prey.

The CP5 cruise, which covered 3600 nautical miles, was a great success. Fishing occurred at eight buoys and a total of 6359 tunas were tagged and released, 97 per cent of them being bigeye (Figure 9). Fifty-eight archival tags were also deployed (these measure the internal temperature of the fish, water temperature and pressure and light intensity).

Figure 9: Juvenile bigeye marked with conventional 13 cm yellow tag

Fish that were unsuitable for tagging were kept aside for biological sampling. Eighty-seven fish across seven species were sampled during the cruise, including 66 bigeye, two yellowfin and two skipjack tunas, as well as 11 mahi-mahi, three wahoo, two rainbow runner and one amberjack. Overall, sizes of fish ranged from 35 cm to 126 cm. For bigeye tuna, sizes ranged from 47 cm to 105 cm.

Two crew members assisted in the collection of biological samples. Their efforts were of a high standard, and thus in agreement with the vessel's captain they were trained in sampling techniques (including the use of cutters and saw to collect otoliths), the purposes and the specifics of biological sampling and how to record data correctly. They will be sampling tunas and bycatch species during longline fishing operations in Tonga's exclusive economic zone.

For more detailed information, you can read the cruise report on SPC's tagging website:
http://www.spc.int/tagging/en/publications.

Picture 3: End of cruise group photo. Left to right: Bruno, Hopo, Mani, Nuku, Malo, Lulu and Eti.

If you find a tagged fish, please record as much information as possible and ask to speak to a Tag Recovery Officer or Fisheries Officer when in port.

For further information about tuna tagging and reward collection please visit the SPC OFP website at http://www.spc.int/oceanfish and the tagging website at http://www.spc.int/tagging.

Next newsletter in April 2011

We welcome your comments on the content of this newsletter – please send them to Valérie Allain (valeriea@spc.int), Malo Hosken (maloh@spc.int) or Caroline Sanchez (carolines@spc.int).