Biological Sampling Newsletter

for Observers and Port Samplers

SPC-OFP Ecosystem Monitoring and Analysis Section*

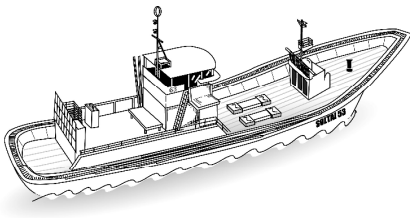
Issue #11 — 30 July 2009

Welcome

to the eleventh 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 present the training in otolith extraction in Vanuatu and New Caledonia, with a quick reminder of how to extract otoliths with forceps. There are updates on the tagging project with a report on the last cruise and more explanation on tag seeding, and finally the results of the striped marlin biology research undertaken by R. Keller Kopf.

Hope you enjoy this new issue!



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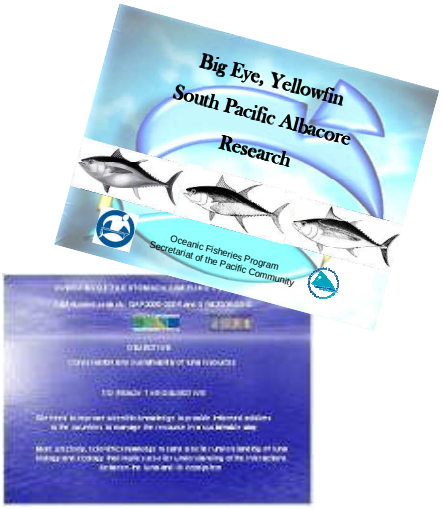
OTOLITH EXTRACTION TRAINING

Several biological sampling training sessions have been organised, one in Nouméa on drilling techniques for otolith extraction, and one in Vanuatu on collection of stomach/liver/muscle samples and otolith extraction techniques. In Nouméa our team had the chance to host Jessica Farley from the Commonwealth Scientific and Industrial Research Organisation (CSIRO); she demonstrated and trained us in otolith extraction by drilling and by removing the top of the head.

The New Caledonia Observer Coordinator, Hugues Gossuin and Observers Charles Cuewapuru and Jacques Enaff also had the opportunity to practice this technique.



In Santo, Vanuatu, Caroline Sanchez went to the maritime college to present the projects on bigeye, yellowfin and albacore biology and the stomach sampling programme.

She trained the cadet observers in sampling techniques such as the different otolith extraction techniques and the stomach sampling procedure.

Removing the top of the head

Caroline demonstrating the removal of the top the of head to extract otoliths

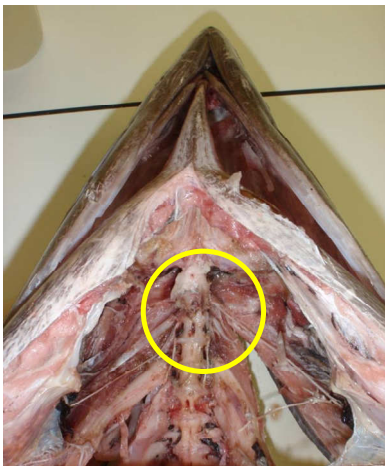
Stomach sampling

Albacore, forceps techniques to extract otoliths

Do not forget if you do have an albacore sampling kit and a stomach sampling kit, we need more stomach samples and we also need albacore otoliths! However, to avoid confusion if you are not completely familiar with the two procedures do not go onboard with both kits. Do one type of sampling — either stomachs or albacore — per trip.

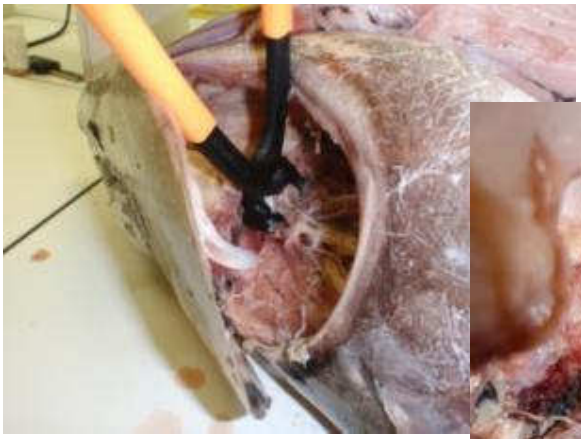
Albacore otolith extraction procedure

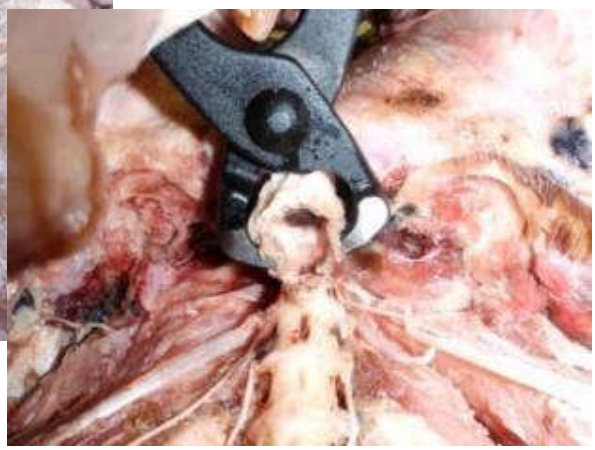
As a reminder, here is a step-by-step review of the albacore otolith extraction procedure. Do not forget that we also need the entire gonad.



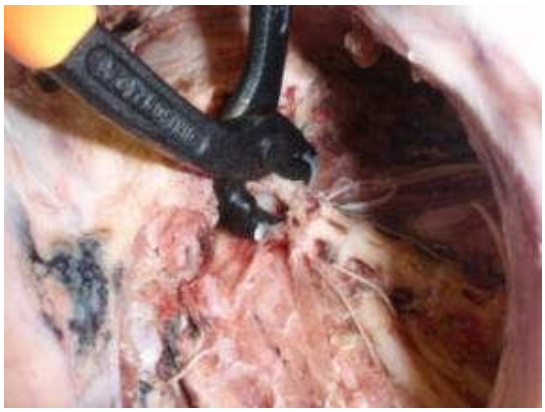
① After gills have been removed, locate the otic capsule where the backbone joins the head.

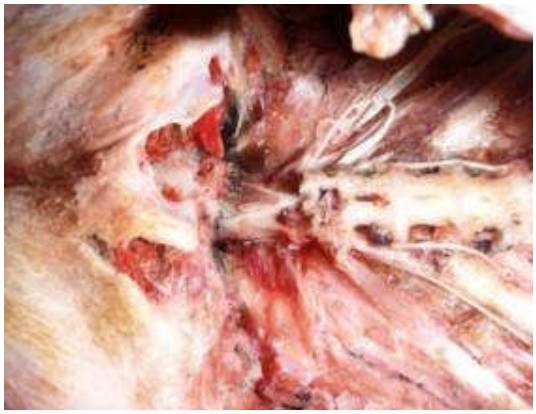
② Remove large ‘lump’ of bone with cutters.



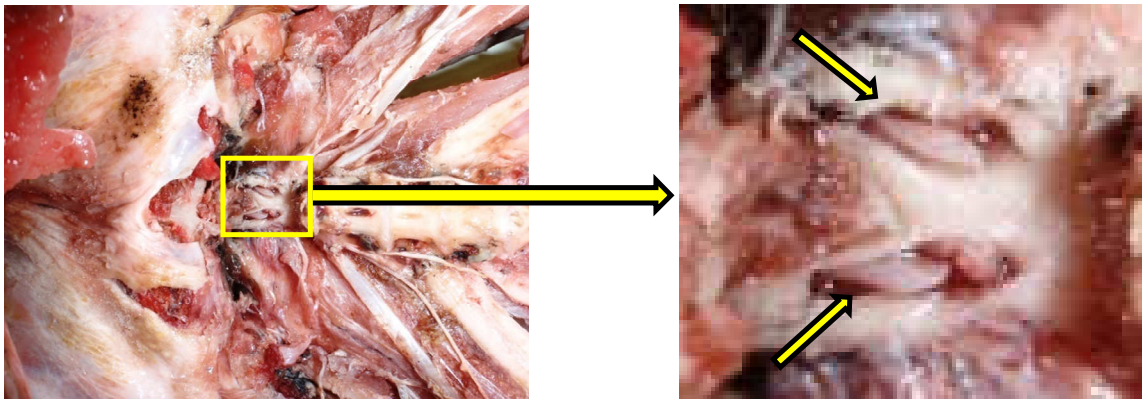


③ Make another, deeper cut under previous cut.

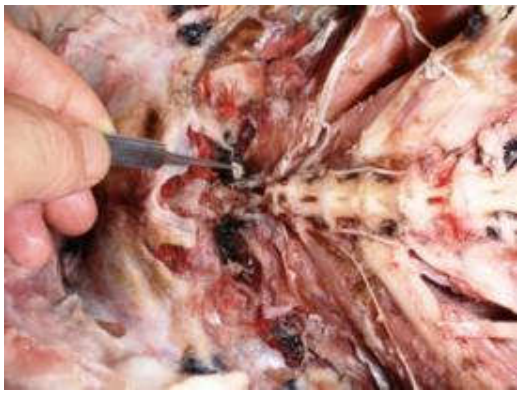




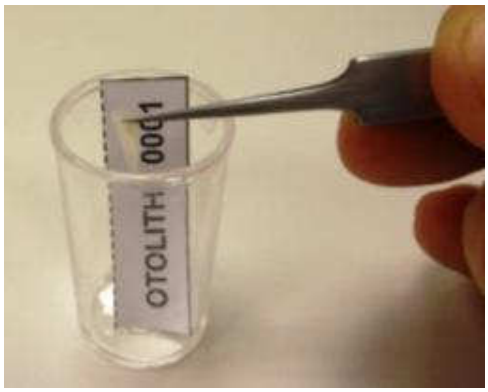
④ Clear remaining bone with cutters to expose otolith cavities.



⑤ Remove, clean and dry otoliths.



⑥ Place dried otoliths and tag in vial.



REWARDS $

Please do not forget that you are rewarded for doing biological sampling. Reward will only be paid when samples **and** data are provided.

For the albacore research:

- Reward will be a $2 per sample (otoliths + gonad + data).

Rewards will increase when more samples are collected ($3 for over 100 samples; $4 for over 300 samples).

For the stomach sampling:

- Reward will be a $1 per sample (stomach + liver + muscles + data).

The difference in the rewards is due to difficulties of extraction.

PACIFIC TUNA TAGGING PROGRAMME (PTTP): WP2 TAGGING CRUISE

Western Pacific Cruise 2 (WP2) was designed as a three-month cruise to undertake tagging operations in exclusive economic zones (EEZs) of Papua New Guinea (PNG), Federated States of Micronesia, Marshall Islands, Kiribati, Tuvalu and Solomon Islands (Fig. 1). It commenced on 15 March and was completed on 12 June 2009.

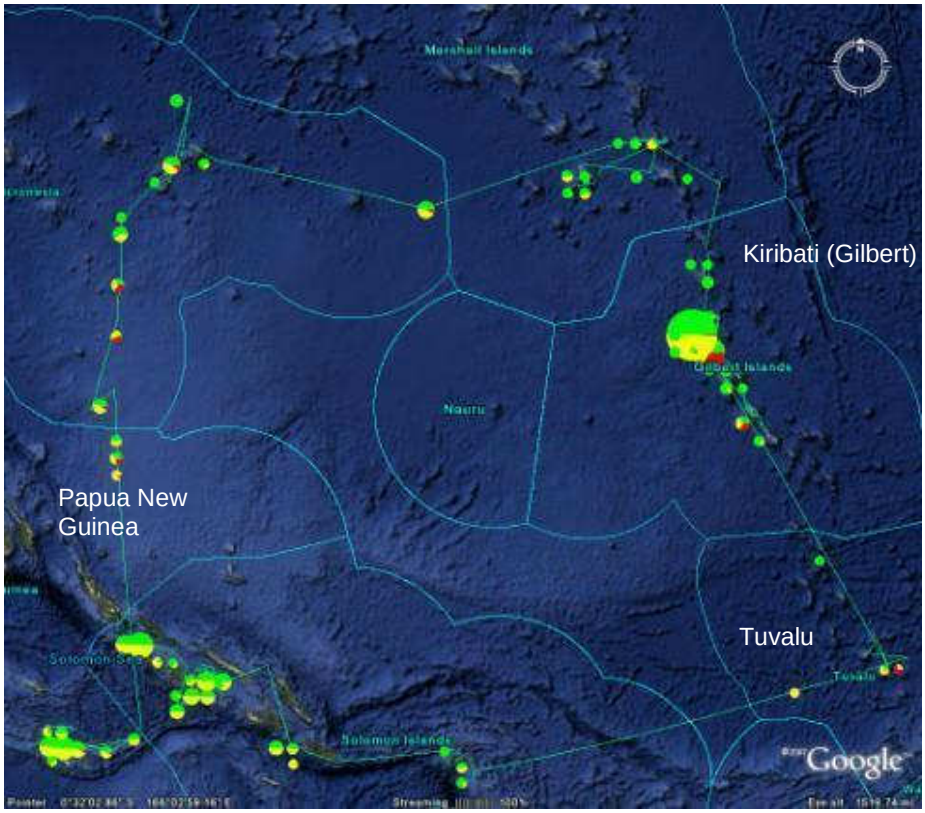


Figure 1. WP2 cruise track and tag released (green is skipjack, yellow is yellowfin and red is bigeye).

During WP2 tagging, a total of 51,078 tuna were tagged with conventional yellow tags and 176 with archival tags.

Of the 51,078 conventional tags, 67% were placed in skipjack, 27% in yellowfin and 6% in bigeye tuna. Most of the tagged fish were caught under anchored fish aggregating devices (FADs), close to islands or reefs, in free schools or under floating logs (Table 1).

A total of 56 yellowfin, 81 bigeye and 39 skipjack were tagged with archival tags.

Table 1. Number of tags (conventional and archival) released per species and school type during WP2.

School association	Releases			
	SKJ	YFT	BET	TOTAL
Other	22	1	0	**23**
Free school	7456	1196	434	**9086**
Log	2266	3072	9	**5347**
Anchored Fad	12862	5787	196	**18845**
Drifting Fad	1085	395	298	**1778**
Marine mammal or Whale shark	305	773	32	**1110**
Current line	23	1	0	**24**
Seamount	1024	1180	2172	**4376**
Island or reef	9159	1502	4	**10665**
TOTAL	**34202**	**13907**	**3145**	**51254**

A large yellowfin tuna ready to be released after an archival tag has been inserted in the body cavity.

Full stomach collected from a large tuna after the tagging operation.

Along with the tagging activities our team is taking the opportunity to collect biological samples to complement the samples gathered by the observers. We collected 566 stomach (Table 2), muscle and liver samples for the trophic structure study during WP2. We also used the fatmeter on 379 fish (179 skipjack, 149 yellowfin and 51 bigeye) to measure the fat content of these fish to estimate their trophic status.

Table 2. Number of stomachs collected per species and school type during WP2.

Species	Anchored FAD	Drifting FAD	Free School	Seamount	TAO Buoy	Whale Shark	Grand Total
Bigeye		16	15	35	7		**73**
Skipjack	38	30	176	3	3		**250**
Yellowfin	49	72	63	29	15	15	**243**
Grand Total	**87**	**118**	**254**	**67**	**25**	**15**	**566**

Highlights of WP2 tagging cruises:

- An outstanding number of bigeye was caught during WP2, representing 54% of those obtained in the previous 15.5 months of tagging cruises.
- Exceptional catch of large yellowfin and bigeye at Maiana Bank, south of Tarawa in Kiribati, allowed us to deploy many archival tags.
- During the WP2 cruise the total number of tags released under PTTP surpassed 200,000; at 21 July 2009 we had reached a total of 215,775 tags.

Large tuna caught on Maiana Bank (Kiribati) requiring three poles to get it out of the water

Another three-month tagging cruise (WP3) started on 13 July and will last until 13 October 2009. Still operating on the Solomon Islands pole-and-line fishing vessel Soltai 105, the cruise plan is to fish in Federated States of Micronesia, PNG, the high seas north of PNG, Palau and Indonesia.

PACIFIC TUNA TAGGING PROGRAMME (PTTP): TAG SEEDING

An essential component of any mark and recapture study that seeks to estimate fish population abundance, exploitation rates or migration rates from tagging data is the tag reporting rate. Tag seeding, the surreptitious tagging of tuna onboard fishing vessels, is being carried out as part of the tag recovery measures of PTTP, run by the Secretariat of the Pacific Community (SPC). Tag seeding is one of the main methods used to estimate tag reporting rates.

Tag seeding onboard purse-seine vessels

Tag seeding is being conducted by observers onboard purse-seine vessels as part of regional and national observer programmes. The purse-seine fleet is targeted for tag seeding experiments primarily because:

1. purse seiners account for most of the tuna catch in the western Pacific; the estimation of reporting rates for this gear type is therefore of critical importance;
2. the large modern purse seiners typical of the western Pacific fleet handle large quantities of tuna very rapidly with little opportunity for onboard inspection of individual fish for tags;
3. the very fact that most tagged tunas recaptured by purse seiners would be detected during or after unloading of the catch in port offers the opportunity for tagged tuna to be planted in the catches before these detection processes begin; and
4. the layout of purse-seine vessels and the method of handling the catch onboard facilitate the opportunity for planting tags surreptitiously, without detection by the ship's crew.

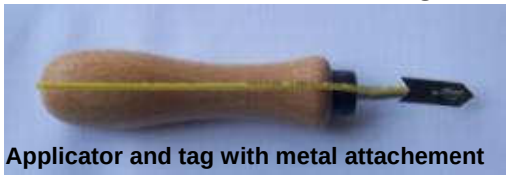
Such tag seeding operations would be more difficult to conduct on other types of vessels such as pole-and-line vessels and longline vessels operating in the fishery.

Tag seeding operation

In-country observer coordinators are being used as focal points for the distribution of tag seeding kits to trained observers. Trained observers on purse-seine vessels were asked to deploy up to 25 tags in the catch during a voyage. Optimally, observers were asked to tag 15 tunas with a single tag and to double tag 5 fish — thus placing the 25 tags on 20 fish.

Training observers for tag seeding

Fish are tagged discretely, usually on the wet deck, just below the work deck where the catch is landed before entering the well via a chute or in the well as part of an observer's routine sampling regime onboard. The tags and manner of tagging are identical to those used in the main tagging programme and for tag seeding carried out during PTTP phase 1. Seeded tags are implanted on dead fish; as a result the anchorage of the tag within the bones is not secured by the healing of the fish's flesh. In 2009, to avoid rapid shedding, tags with metal attachments (instead of plastic ones) were distributed in order to better secure the tags within the flesh of the fish.



Applicator and tag with metal attachement

Tag numbers, dates, species, fork lengths and well numbers are recorded on a specific tag seeding log form and the information sent to SPC at the completion of a voyage. Upon recovery, seeded tags are processed in the same fashion as genuine tag recoveries. Tag finders are paid the standard reward for tag recoveries and are not informed that the tags are part of a tag seeding experiment.

Tag reporting

Tag seeding was carried out on 26 observer cruises between February 2007 and March 2009. During these cruises 584 tags were deployed and placed in fish wells as shown in Table 3. Of these 584 tags, 209 have been recovered during unloading or processing of catches in canneries. The numbers of returns by species differ significantly from those expected from the return rate pooled across species. On this basis, reporting of tags can be assumed to be independent of species.

Table 3. Number of seeded tag releases and recoveries by species.

Species	Releases	Recoveries	% recovery
SKJ	**306**	**109**	**35.6**
YFT	**187**	**67**	**35.8**
BET	**91**	**33**	**36.3**
TOTAL	**584**	**209**	**35.8**

Most tag seeding cruises were undertaken on PNG flagged purse seiners, due to the extensive coverage of PNG waters during phase 1 of the tagging programme. Tag seeding was also undertaken on vessels from China, Japan, Korea, Marshall Islands, Philippines, Taiwan and United States of America. It is expected that tag reporting rates will vary by fleet due to the tendency of different fleets to unload their catches in different ports. As tag detection and reporting took place during unloading and at the later stages of processing, it is suspected that variation in the effectiveness of tag detection and reporting at unloading ports would result in large differences in tag reporting rates.

The majority of tags were seeded in tunas in the range of 40 to 64 cm as shown in Figure 2. It is expected that larger size class tunas may experience a higher reporting rate due to the size sorting that occurs at canneries and unloading ports.

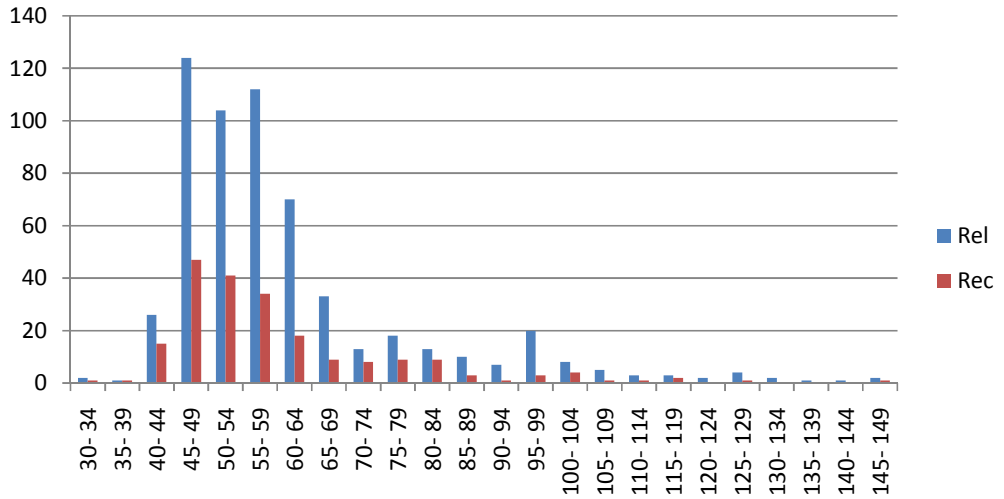


Figure 2. Number of seeded tag releases (Rel) and recoveries (Rec) by 5-cm size class.

Issues relating to tag seeding

By far the biggest constraint to tag seeding has been the availability of trained senior observers to carry out tag seeding onboard purse-seine vessels. One means to overcome this constraint is demonstrating the method to observer coordinators, allowing them to brief senior observers who have not done tag seeding previously and demonstrate the tag seeding method prior to the placement of a senior observer onboard a purse-seine vessel.

Started in 2006, the project studying the biology of the striped marlin led by Keller Kopf, from Australia, is finishing up in 2009. Keller will present the results of this study, in which observer programmes participated by collecting samples, during the 5th Western and Central Pacific Fisheries Commission (WCPFC) Scientific Committee meeting in Port Vila in August 2009.[1] Results are also reported in this newsletter.

Age, growth, and reproductive biology of striped marlin: project update

By R. Keller Kopf[2]

Striped marlin (*Kajikia audax*[3]) is the most commercially valuable species of marlin, sailfish, and spearfish and is an important recreational species throughout its distribution in the Indian and Pacific Oceans. To set sustainable levels of fishing, managers need reliable information about size-at-age, growth, when and where spawning occurs, and how old fish are when they start spawning. The answers to many of these questions have remained a mystery for striped marlin. The striped marlin biology project was designed to determine basic biological information so that population estimates could be made for this species.

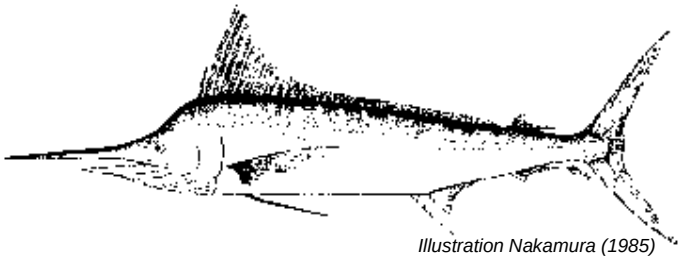


Illustration Nakamura (1985)

The project is finishing up in 2009 and has answered several important questions about age, growth and reproduction of striped marlin. Measurements were made on a sample of 489 striped marlin collected between 2006 and 2008. Regional observer programmes and scientists throughout the southwest Pacific Ocean (Fig. 3) collected samples of gonads (ovaries and testes), fin spines, and otoliths (ear bones). Samples were collected from the commercial longline fishery on the eastern coast of Australia, commercial longline fisheries from Pacific Island countries and territories including Fiji, New Caledonia, and French Polynesia, the recreational fishery in New South Wales, Australia and the recreational fishery in Northland New Zealand.

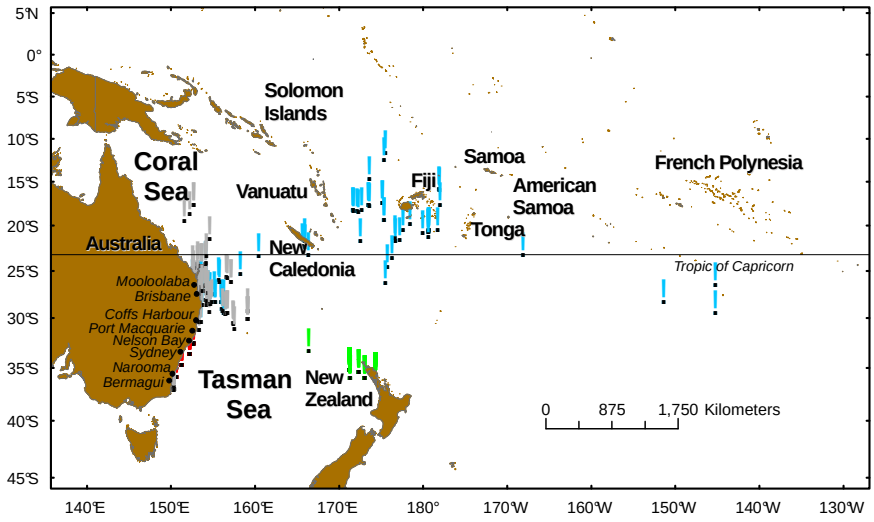


Figure 3. Location of samples collected from striped marlin in the southwest Pacific Ocean.

Blue = Pacific Island countries and territories including New Caledonia, Fiji, and French Polynesia, Green = New Zealand recreational, Red = Australian recreational, and Grey = Australian commercial longline.

[1] http://www.wcpfc.int/doc/bi-wp-01/r-keller-kopf-julian-pepperell-peter-s-davie-a-preliminary-report-age-growth-and-reprod

[2] Charles Sturt University, School of Environmental Sciences, PO Box 789, Albury NSW 2640 Australia. Office: +61 2 6051 9771, Fax: +61 2 6051 9897. Email: rkopf@csu.edu.au

[3] *Kajikia audax* is the new name of the striped marlin which used to be called *Tetrapturus audax*

Age of striped marlin was estimated by counting growth increments (annuli=rings) that formed in fin spines and otoliths (Fig. 4). Estimated ages ranged from 130 days in a 4 kg whole weight (112 cm, lower jaw — fork length, LF) male to eight years in a 168 kg (287 cm, LF) female. Pacific Island longline fisheries caught the majority of young (0–2 years) striped marlin while recreational and commercial fisheries in Australia caught intermediate ages (2–4 years), and New Zealand recreational fisheries caught the highest proportion of old (4–8 years) striped marlin. Males and females grew rapidly and attained 75–80% of their maximum body length during the first two years of life. The present study predicted that male and female striped marlin attained a length of 129 cm LF during the first six months of life and a length of 160 cm LF by age one. The growth rates reported here are amongst the fastest (in terms of body length) for any bony fish species.

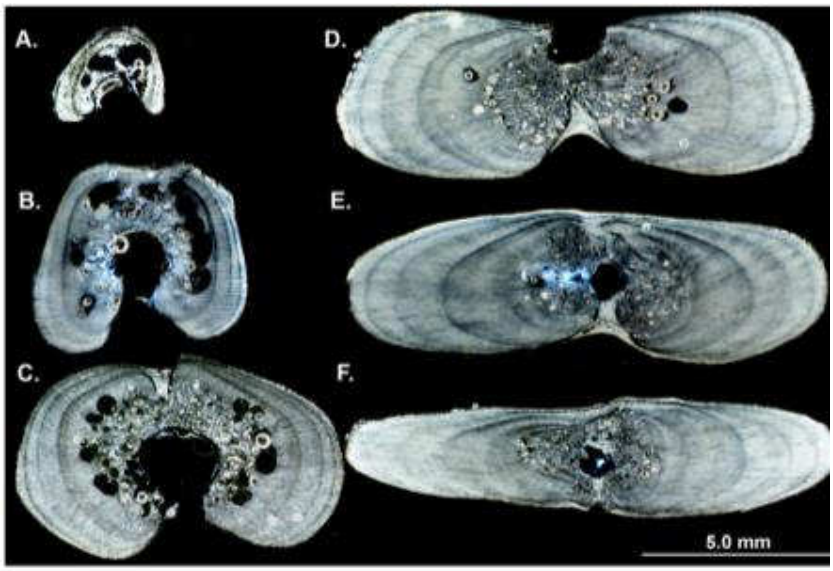


Figure 4. Images of sections used to determine the age of striped marlin from the first through the sixth dorsal fin spine (A–F).

Striped marlin started spawning in the Coral Sea between October and January at the ages of two to three years old. The majority of spawning took place off the east coast of Australia but reproductive activity was also observed in the EEZs of Fiji Islands, New Caledonia, and French Polynesia during the same period (Fig. 5). Egg counts showed that females can release about 3 million eggs each time they spawn which is thought to occur at least four times each year.

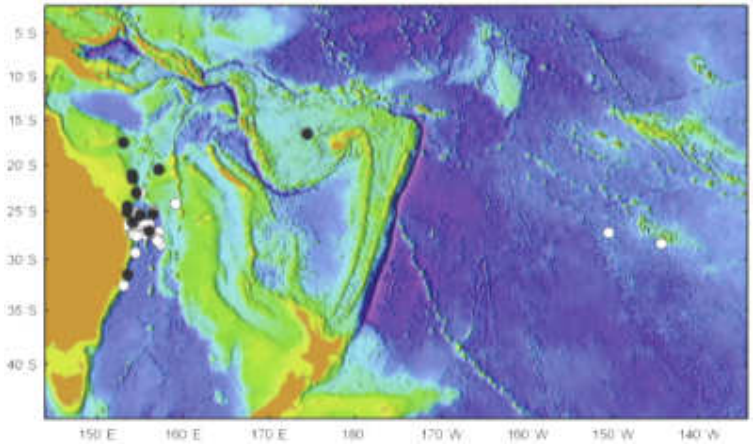


Figure 5. Locations of ripening (white circles) and actively spawning female (black circles) striped marlin.

The information collected by this project will be directly applicable to population assessment of striped marlin. It would not have been possible without the dedication of fisheries observers throughout the region and your help has been greatly appreciated. For further information please contact the author.

NEXT NEWSLETTER:
END OF SEPTEMBER/BEGINNING OF OCTOBER 2009

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