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SOUTH PACIFIC ALBACORE TAGGING PROJECT: 2010 SUMMARY REPORT

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South Pacific Albacore Tagging Project: 2010 Summary Report

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Executive Summary

A tagging programme for south Pacific albacore commenced in 2009 as part of the EU-funded SCIFISH project. The main objective was to obtain information on exploitation rates and movement of albacore. The first albacore tagging cruise was completed in 2009 with 2766 albacore tagged and released in the troll fishery off the west coast of New Zealand. To date, only 1 recapture has been reported from these tagged fish.

The second phase of albacore tagging for the SCIFISH project commenced in March 2010 with several tagging cruises completed in New Caledonia, New Zealand and Tonga. The primary objectives were to tag larger albacore than were tagged in 2009 in an attempt to increase tag recapture rates and also to release 30 satellite archival tags (miniPATs) to obtain detailed information on movement patterns.

Longlining was the principal fishing method used to catch albacore for tag and release. Catch rates and the condition of albacore landed varied significantly between locations, but generally a large proportion of albacore landed were unsuitable for tag and release. As a result, only 92 albacore were tagged with conventional tags and 19 with miniPATs. All conventional tag releases were in New Zealand where the proportion of albacore landed in good condition was substantially higher than in other locations.

Future tagging programs for albacore should consider the implications of different fishing gears and locations for tagging. Tagging at tropical latitudes is unlikely to yield large numbers of albacore suitable for tag and release, and longlining and trolling both cause injuries to a significant proportion of albacore thus reducing the proportion of tagged fish. Alternative methods for obtaining information on exploitation rates and movement for albacore should be explored due to the difficulties in the application of traditional tagging programs and the very low recapture rates of tagged albacore.

1. Introduction

A significant fishery for south Pacific albacore has operated since the 1950's, with the majority of the historic catch taken by foreign longline fishing fleets such and Chinese Taipei, Japan and Korea. Since the early 1990's, albacore have become an increasingly important species for the domestic longline fleets of Pacific Island Countries and Territories (PICT), which now account for nearly half the annual harvest (Langley 2006). The overall annual harvest of albacore has increased steadily from around 30,000 t in the 1990's to between 60,000 and 70,000 t in recent years (Hoyle et al. 2008). The majority of this harvest is caught by longlining, with a small proportion taken by troll fishing.

The most recent assessment of the south Pacific albacore stock (Hoyle et al. 2008) indicates that the stock size of albacore and the Maximum Sustainable Yield (MSY) is lower than predicted in previous assessments (Langley and Hampton 2005, 2006), but that the albacore stock is most likely not over-fished at present and that current levels of catch are sustainable. However, the assessment also highlighted that there was still evidence of bias within the assessment, and considerable uncertainty about current levels of fishing mortality. Given the uncertainty in the results of the assessment and the less optimistic implications of the results than in previous assessments, Hoyle et al. (2008) strongly suggested that efforts to improve the model should be considered a high priority. In particular, independent estimates of fishing mortality (F) obtained from tagging studies were considered to be important for refining future assessments. In addition, further information on movement patterns and independent estimates of growth from tagging studies would also assist in refining future assessments (Hoyle et al. 2008).

Given the importance of albacore to the longline fisheries of PICTs, and the uncertainty in stock assessments, there have been increasing demands for more research to be directed at the species. In response, the Secretariat of the Pacific Community (SPC) Oceanic Fisheries Program (OFP) developed a project for south Pacific albacore in consultation with the Forum Fisheries Agency (FFA) Secretariat and member countries, which was funded by the 9th European Development Fund (Overseas Countries and Territories component). The project has a three year time frame and is designed around the need to reduce uncertainty in stock assessments and to provide better management advice both at the regional and national levels.

As part of this project, the OFP designed a tagging study with the overall objective to provide contemporary data for refining our knowledge of albacore movements, exploitation rates and population biology. The first albacore tagging cruise was completed in 2009 along the west coast of New Zealand (Williams et al. 2009). A total of 2766 albacore were tagged and released with 1457 of these fish also receiving an injection of oxytetracycline (OTC) for an age validation experiment. To date, only 1 recapture has been reported from these tagged fish. This fish was recaptured in New Zealand waters, relatively close to the release site, approximately 11 months after release. It is unclear whether the low number of reported recaptures is due to low reporting rates, low recapture rates, low survival of tagged fish, or a combination of these factors.

The objective for 2010 tagging activities was to focus on tagging larger albacore than were tagged in 2009 (~50-70 cm FL) in an attempt to increase tag recapture rates. Larger albacore (>70 cm FL) will become available to longline fisheries much sooner than smaller fish.

Consequently, a greater proportion of the tagged population will be available to longline fisheries if larger, rather than smaller, albacore are tagged because smaller fish would be subject to a number of years of mortality prior to becoming vulnerable to longlining. The capture of larger albacore also permits the deployment of the new miniaturised satellite pop-up tags (miniPATs), which are now small enough to deploy on fish as small as 20kg. These tags can provide detailed information on the vertical and horizontal movement of fish, and are particularly suited for albacore which typically suffer from low recapture rates, such that standard archival tags are not a viable option. The governments of New Caledonia have provided further assistance for the application of miniPAT through their ZONECO project.

The specific aims of the second year of tagging for the Albacore Tagging Project (ATP) were to:

1. Tag a total of 30 albacore with Wildlife Computers miniPATs with releases spread across New Caledonia, New Zealand and Tonga

2. Tag all other albacore landed in good condition with conventional dart tags, and inject all of these tagged albacore with oxytetracycline as part of an age validation experiment, and

3. Collect biological samples (otoliths, gonads and stomachs) from a subsample of retained albacore to support associated research on age, growth, reproductive biology and trophic ecology of albacore.

This report provides a summary of activities completed to date for the second year (2010) of albacore tagging activities.

2 Methods

2.1. Tagging Cruises

Tagging of south Pacific albacore in 2010 took place in New Caledonia, New Zealand and Tonga. A different commercial longline vessel was chartered in each location for varying durations.

2.1.1. New Caledonia

The main objective of tagging albacore in New Caledonia was to deploy 10 minPATs as part of a ZONECO project implemented by SPC and the Institut de Recherche pour le Développement (IRD). The aim of this project is to examine the horizontal and vertical movements of albacore tuna. No conventional tagging and only limited biological sampling occurred in New Caledonia. The *F.V Yellowfin* was chartered in New Caledonia for two separate cruises (Table 1). Both cruises departed from Noumea and fishing effort was focussed to the northwest of New Caledonia near the Lansdowne Bank (Fig. 1).

2.1.2. New Zealand

The *F.V. Genesis* was chartered for 3 short cruises between in April and May (Table 1). Each cruise departed from Napier on the east coast of the north Island of New Zealand, and fishing effort was focussed on 3 seamounts to the east of Napier (Fig. 1). Albacore were tagged with

conventional tags and miniPATs and biological samples were taken from those fish not suitable for tagging.

2.1.3. Tonga

The *F. V. Pacific Sunrise* was chartered in Tonga for two cruises between June and July (Table 1). Initial plans were for a longer charter in Tonga, but the charter was terminated early due to low catch rates of albacore and the very low percentage of albacore landed in good condition. Both cruises departed from the port of Nuku'alofa and fishing effort was focussed mainly within the Tongan EEZ, but some experimental dropline fishing was done around the FADs in Niue (Fig. 1).

Table 1. Summary of 2010 albacore tagging cruises

Location	Cruise	Dates	Vessel	Cruise Leader	Tagging technician
New Caledonia	1	23-Mar – 28-Mar	Yellowfin	Bruno Leroy (SPC)	Ashley Williams (SPC)
	2	23-May – 5-Jun	Yellowfin	Bruno Leroy (SPC)	-
New Zealand	1	26-Apr – 30-Apr	Genesis	Ashley Williams (SPC)	Sylvain Caillot (SPC)
	2	3-May – 10-May	Genesis	Ashley Williams (SPC)	-
	3	14-May – 18-May	Genesis	Ashley Williams (SPC)	-
Tonga	1	28-Jun – 8-Jul	Pacific Sunrise	Ashley Williams (SPC)	Jessica Farley (CSIRO)
	2	10-Jul – 21-Jul	Pacific Sunrise	Malo Hosken (SPC)	Hearty Matamaru (NFD)

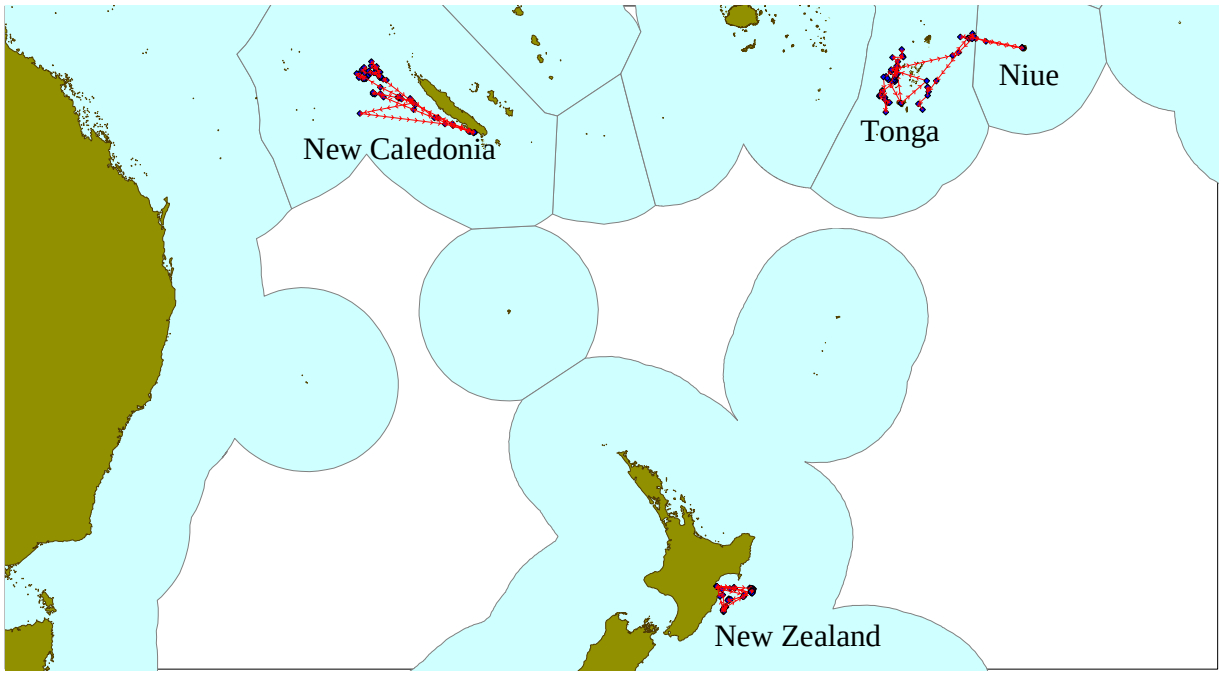

Fig. 1. Cruise tracks of FV Yellowfin (New Caledonia), FV Genesis (New Zealand), and FV Pacific Sunrise (Tonga) during Phase 2 the Albacore Tagging Project (ATP) in 2010. Blue diamonds indicate position of tagged albacore and 6-hourly positions.

2.2. Fishing and Tagging Methods

Longlining was the principal method used to capture albacore for the 2010 albacore tagging cruises because larger albacore are selected by longlines than by trolling (Griggs 2004) and the objective of tagging activities in 2010 was to tag larger albacore that will be immediately available to the longlines fisheries. A small amount of trolling and drift fishing was also done when conditions were not suitable for longlining. To maximise the likelihood of capturing albacore alive and in good condition, standard commercial longlining techniques were modified where possible. This varied among locations and cruises but generally included reducing the total number of hooks per set, reducing the number of hooks between floats and reducing the soaking time (time between finishing the set and starting to haul). The speed at which the mainline was hauled was also reduced when possible to reduce the effects of barotrauma.

Albacore are rarely seen at the surface, so the general fishing area was chosen using a combination of historic fishing effort data for the vessel, current information communicated from other fishing vessels, bathymetry charts and sea surface temperature (SST) charts. For each longline set, the date, time and location of the start and end of set and the start and end of haul was recorded. The species, time landed and condition of each fish was recorded during each haul. For trolling and drift fishing, the date, start and end fishing time, SST, troll speed, and location (latitude, longitude) was recorded for each school of albacore encountered.

All albacore brought to the side of the vessel that appeared to be in good condition were lifted on board with a purpose-built sling to reduce additional injuries to the fish. The fork length of all albacore considered suitable for tagging was measured to the nearest cm (rounded down) on a purpose-built tagging cradle for fish tagged with conventional tags and with aluminium callipers for fish tagged with miniPATs.

The fishing gear used to catch albacore inevitably causes some damage to the fish, which may range from very minor mouth damage from the hooks to significant damage likely to be fatal. Consequently, every albacore that was landed was inspected to determine whether it was suitable for tagging or not. Albacore with injuries suspected to be fatal such as bleeding from the gills or eyes, significant mouth damage or very lethargic fish, were not tagged, but were retained by the vessel for later sale.

2.2.1. New Caledonia

Longlines were the only fishing method used in New Caledonia. For the first cruise, a full charter contract was arranged with the *F.V. Yellowfin*. This permitted some experimentation with the longline method including using fewer hooks in total and shorter soak times than typically used when commercial fishing (Table 2). The *F.V. Yellowfin* conducted a normal commercial fishing trip for most of the second cruise (first 7 sets), with one day at the end of the cruise allocated to modifying the longlining technique for the specific purpose of tagging (Table 2). The number of hooks placed between floats was 30 for all sets in New Caledonia. A line shooter was also used for all sets, but the speed was reduced for all non-commercial sets to reduce the depth of the main line.

2.2.2. New Zealand

Longlines were the principal fishing method used in New Zealand but trolling and drift fishing were used occasionally when the weather was too rough to set a longline or there was time during the day. Setting longlines during the day in New Zealand waters during daylight hours is prohibited unless tori lines and weighted branchlines are used. Therefore, all longline sets were completed during the dark hours. Generally, less than 500 hooks were used for each set with no more than 20 hooks used between floats (Table 2). On some sets a smaller 'money-maker' float was placed between floats to raise the main line into shallower water. No line shooter was used for any sets in New Zealand, resulting in very shallow sets (<40 m).

The troll gear used was similar to that described by Williams et al (2009) except that fewer (<10) lines were used at any one time. The drift fishing gear consisted of three short (~30m) lengths of cord with 3m nylon leaders and single barbless hook. Each line was weighted slightly to reach a depth of approximately 20 m and each hook was baited with sardines. The lines were attached by a rubber 'bungee' to the starboard side of the vessel and the vessel drifted across the seamount.

2.2.3. Tonga

Longlines were the principle fishing method used in Tonga. The total number of hooks, number of hooks between floats and soak times varied widely in Tonga (Table 2), in an attempt to maximise the number of albacore landed alive. A line shooter was used on all longline sets.

During the second cruise in Tonga, some experimental vertical droplining was done around 2 FADs in the Niue EEZ. Hydraulic winches were rigged with 12 hooks and a large steel weight at the bottom. The hooks were spaced approximately 1 m apart and baited with squid and sardines. The lines were dropped to the bottom (approximately 800 m) when the vessel was approximately 100 m from the FAD. The vessel then drifted slowly past the FAD while the lines were raised and lowered through the water colomn. This process was repeated numerous times on both FADs.

2.2.4. PSAT tagging

A major objective of the 2010 albacore tagging activities was to deploy satellite archival tags on 30 albacore to obtain data on horizontal and vertical movement patterns. The relatively new Wildlife Computers miniPAT tags were chosen as the most suitable tags for albacore, given that they were approximately 30% smaller than the previous satellite tags produced by any manufacturer and the miniPATs had been subject to some preliminary testing.

Each miniPAT was programmed to release after 352 days. A shorter time period would have allowed finer temporal scale data to be recorded and transmitted, but the primary objective was to obtain long-term horizontal movement data. A longer time period (maximum allowable 360 days) would have increased the time interval between measurements. An in-built premature release mechanism ensured that each tag would release if the fish exceeded 1800 m or remained at constant depth (+/- 3 m) for more than 2 consecutive days. Each tag recorded the depth (pressure) and water temperature every 75 seconds.

Table 2. Longline configuration and setting details for each longline set in each of the three locations. Soak time refers to the time between finishing the set and starting the haul.

Location	Cruise	Set	No. Hooks	Hooks per basket	Soak time (h)
New Caledonia	1	1	1050	30	1.6
		2	750	30	0.9
		3	750	30	0.9
		4	750	30	0.8
		5	1050	30	2.2
	2	1	1750	30	4.3
		2	1750	30	4.3
		3	1750	30	4
		4	1750	30	3.6
		5	1750	30	4.3
		6	1750	30	3.9
		7	1750	30	4.1
		8	750	30	0.8
		9	750	30	1
New Zealand	1	1	560	20	6
		2	500	20	11.3
		3	360	20	2.2
	2	1	500	20	11.5
		2	480	12	4.5
		3	396	12	3.6
		4	391	11	4.2
		5	391	11	4.3
	3	1	308	11	4.1
		2	336	12	2.6
		3	276	12	2.9
		4	360	12	3.7
Tonga	1	1	600	12	3.4
		2	800	12	3.6
		3	700	10	2.8
		4	1500	10	3.5
		5	1500	10	3.4
		6	600	10	3
		7	600	10	2
		8	600	15	1.5
		9	600	10	0.8
		10	1600	20	5.3
		11	1200	20	6.9
		12	900	20	3.3
	2	1	700	10	3
		2	700	10	3
		3	700	10	2.4
		4	616	10	2.6
		5	600	10	3.3
		6	1600	10	6.8
		7	1652	10	9.8

The attachment mechanism for each miniPAT consisted of a short 8 cm plastic-coated wire with a 38 x 9 mm stainless steel dart head. A second attachment was also used to reduce excessive movement of the miniPAT once deployed. For the second attachment, a loop was made with the tail of a conventional 140 mm PDAT Hallprint™ tag and secured with a crimp or small piece of shrink wrap. The conventional tag was also fitted with the same stainless steel dart head as the main attachment. The loop in the conventional tag was placed over the narrow part of the main body of the miniPAT.

Albacore that were in good condition (lively, minimal or no injuries) and > 100 cm FL were initially considered candidates for deployment of miniPSATs. As the tagging cruises progressed, and few large albacore in good condition were landed, the minimum size of an albacore for deployment of a miniPAT was reduced to 90 cm FL for the New Zealand and Tonga cruises.

When landed, each albacore to be tagged with a miniPAT remained in the sling and was placed on the deck to be measured. A deck hose with a light flow of seawater was placed in the mouth to oxygenate the gills and a moist chamois was placed of the eye to calm the fish. Two small incisions were made with a small knife immediately below the first dorsal fin to assist with the insertion of the main and second miniPAT attachments. Both attachments were bathed in a solution of iodine and inserted between the pterygiophores with a small tag applicator at an oblique angle. The fish was then picked up with the sling and released. The condition of the fish, time on deck and the time, latitude and longitude of release was recorded for each tagged fish.

2.2.5. Conventional tagging

All albacore to be tagged with conventional tags were brought on board using the sling to minimise damage to the fish. Albacore were tagged using conventional plastic tip 140 mm PDAT Hallprint™ dart tags. The tag was inserted using a stainless steel applicator just below the second dorsal fin at an oblique angle to anchor the barb between the pterygiophores. Each tag was inscribed with a unique five-digit number, contact details and reward amount for returning tags. Albacore were returned to the water head first as soon as possible after tagging. The tag number, fork length, condition of fish, and tagging quality was recorded.

2.3. Oxytetracycline Experiment

The most reliable method for estimating the age of fish is by counting the number of increments in hard parts (otoliths, spines or vertebrae). However, this method is only reliable when the periodicity (e.g. daily, annual) in which the increments are deposited is known. For south Pacific albacore, this periodicity has not been validated, but is critically important to ensure accurate age estimates for parameter estimation and stock assessments. The most effective method to validate the periodicity of increment formation in hard parts is by an experiment involving the mark-recapture of chemically-tagged (e.g. oxytetracycline) fish (Campana 2001).

All albacore tagged with conventional tags also received an injection of oxytetracycline (OTC). These albacore received an approximate dosage of 25-50 mg/kg body weight of Oxytetra LA (200 mg/ml). The dosages varied due to the difficulties in administering precise doses to different sized albacore within a short time period. The OTC was administered using a 40 mm 18-gauge needle in an automatic syringe connected via UV-resistant tubing to a 100ml bottle of

Oxytetra which was kept in an insulated holder. OTC was injected deeply within the muscle tissue under the first dorsal fin. Fish injected with OTC received a white conventional tag with "keep whole fish" inscribed.

2.4. Biological Sampling

A suite of biological samples, including otoliths, gonads, stomachs, livers, muscle, and blood plasma, were collected during most cruises from albacore that were significantly injured and not tagged and released. These samples were collected to support associated research projects that are examining the age, growth, reproductive biology and the trophic structure of albacore. Priority was given to the size of fish from which samples were collected to fill existing gaps from previous sampling and to cover a large size range.

The lipid content of most albacore caught during the first New Caledonia cruise and both Tongan cruises was measured using an electronic Fatmeter. The lipid content of fish is related to the water content of the sample, so by measuring the water content using a micro strip sensor on the Fatmeter, the amount of lipids can be inferred by conversion with the appropriate calibration. Calibration for albacore was built in to the device but muscle samples were collected for refining the calibration in the lab.

3 Results

3.1. Tag Releases

3.1.1. Conventional tags

More than half of the albacore landed across all tagging cruises were caught in New Caledonia, with the remaining catches approximately equal between New Zealand and Tonga (Table 3). All albacore tagged were caught with longlines except for 2 fish that were caught by trolling in New Zealand. No albacore were tagged from drift fishing in New Zealand or Tonga.

The condition of albacore landed during the cruises in New Caledonia and Tonga was generally very poor with less than 3% of the catch considered suitable for tagging (Table 3). However, in New Zealand, between 9 and 62% of albacore landed were considered to be in good condition and suitable for tagging, most likely due to shallower sets and cooler water in New Zealand. The lower percentage for the first New Zealand cruise was a result of using very large hooks that often punctured the eye of the fish. Smaller hooks were used for cruises 2 and 3 in New Zealand and were rarely observed to puncture the eye of any albacore. Albacore were tagged with conventional tags only in New Zealand due to the very high percentage of albacore in poor condition landed in New Caledonia and Tonga. However, as catch rates were relatively low in New Zealand, only 92 albacore were tagged with conventional tags. All of these tagged fish also received an injection of OTC.

The smallest and largest albacore that was tagged with conventional tags across all New Zealand cruises was 52 cm and 97 cm FL, respectively (Fig. 2). There were two broad modes in the length frequency distribution at around 60 and 80 cm FL which may correspond to the 2 and 4 yo cohorts.

Table 3. Number of albacore landed and tagged with conventional or miniPAT tags in each location. Tagging rate refers to the percentage of landed albacore that were tagged and released.

Location	Cruise	No. albacore landed	Conventional tag releases	miniPAT releases	Tagging rate
New Caledonia	1	14	0	0	0.0%
	2	585	0	10	1.7%
	Total	**599**	**0**	**10**	**1.7%**
New Zealand	1	32	3	0	9.4%
	2	128	71	5	59.4%
	3	29	18	0	62.1%
	Total	**189**	**92**	**5**	**51.3%**
Tonga	1	139	0	4	2.9%
	2	35	0	0	0.0%
	Total	**174**	**0**	**4**	**2.3%**
Total		**962**	**92**	**19**	**11.5%**

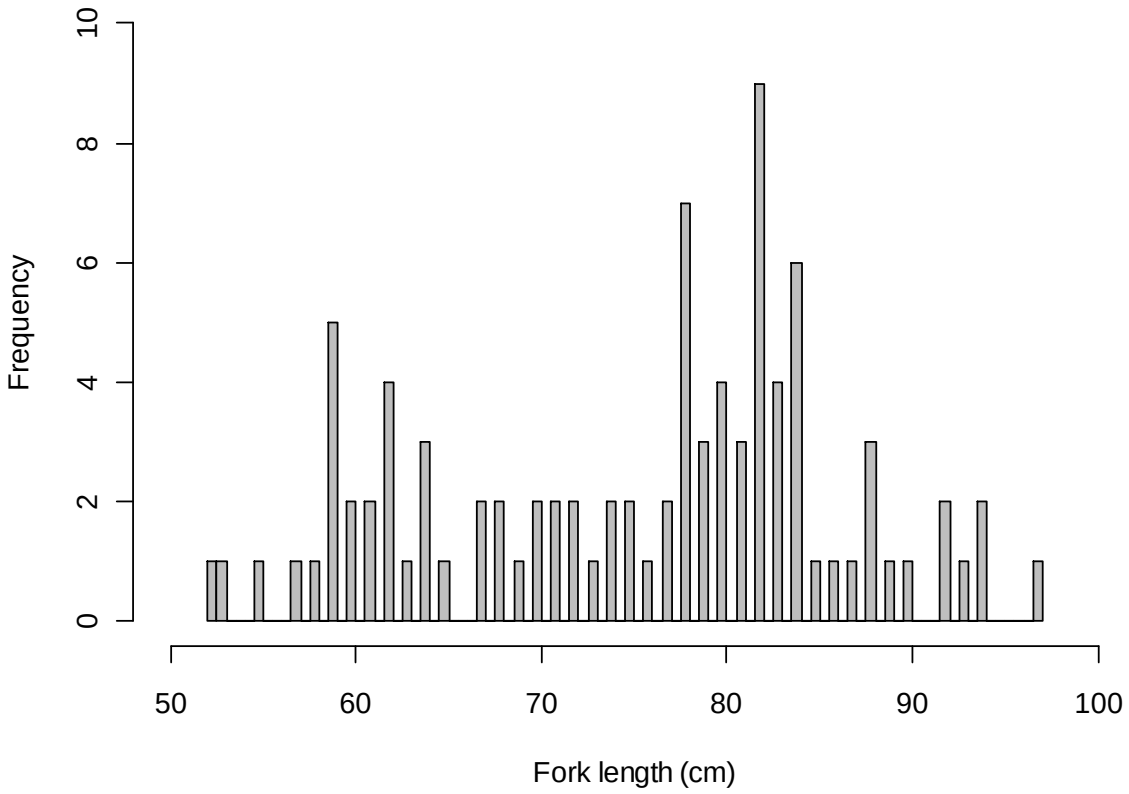

Fig. 2. Length frequency distribution of albacore tagged and released with conventional tags across all tagging cruises in New Zealand 2010.

3.1.2. miniPAT tags

A total of 19 albacore were tagged with miniPATs across all three areas (Table 3&4). The target of 10 minPAT releases was achieved in New Caledonia, but only 5 and 4 miniPATs were released in New Zealand and Tonga, respectively (Table 4). A combination of low catch rates and poor condition of albacore were the main reasons for not releasing all miniPATs.

The length of albacore tagged with miniPATs ranged from 89 to 107 cm. Most of these fish were in good condition when released, although some appeared fatigued or had some minor injuries. One fish floated briefly when released then slowly sank and appeared not to recover.

Table 4. Release information for albacore tagged with minPATs in each location.

Location	Cruise	FL (cm)	Release Date	Release Lat.	Release Long.	Condition at release
New Caledonia	2	98	25/06/2010	20°11.000S	161°43.000E	Fatigued
		102	27/06/2010	19°54.000S	161°41.000E	Good
		97	27/06/2010	19°56.000S	161°43.000E	Stressed
		100	27/06/2010	20°01.000S	161°48.000E	Fatigued
		102	28/06/2010	19°49.000S	161°44.000E	Good
		100	1/07/2010	19°37.000S	162°03.000E	Good
		107	2/07/2010	20°08.000S	162°25.000E	Fatigued
		101	3/07/2010	20°07.000S	162°26.000E	Fatigued
		101	3/07/2010	20°13.000S	162°34.000E	Good
		101	3/07/2010	20°14.000S	162°35.000E	Good
New Zealand	2	93	7/05/2010	39°35.700S	178°23.700E	Good
		98	7/05/2010	39°35.700S	178°23.700E	Good
		98	7/05/2010	39°35.400S	178°24.500E	Mouth damage
		98	7/05/2010	39°36.000S	178°26.600E	Good
		102	8/05/2010	39°38.000S	178°26.300E	Good
Tonga	1	95	1/07/2010	20°08.700S	175°45.465W	Good
		89	5/07/2010	19°54.050S	175°22.990W	Good
		105	5/07/2010	20°04.150S	175°24.830W	Floated on release
		91	6/07/2010	19°43.490S	175°22.040W	Mouth Bleeding

3.2. Tag Recoveries

There has been a single report of a recaptured albacore tagged during the 2009 cruises. This fish was recaptured in the New Zealand troll fishery, relatively close (within 200 km) to the release site, approximately 11 months after release. This fish also received an injection of OTC when tagged, so the whole fish was recovered and the otoliths and spine removed to be analysed as part of an age validation experiment.

3.3. Biological Sampling

A large number of biological samples were collected from albacore that were not tagged (Table 5). These samples were collected to support related projects that are examining the biology and ecology of albacore and related tunas. No biological samples were collected during cruise 2 in New Caledonia. Biological samples were collected from albacore across a wide length range from 60 cm FL to 105 cm FL (Fig. 3).

Table 5. Number of biological samples and fatmeter readings taken from albacore during all cruises in each location. No samples were collected from cruise 2 in New Caledonia.

Location	Cruise	Otoliths	Spines	Gonads	Stomachs	Muscle	Livers	Blood	Fatmeter
New Zealand	1	19	12	20	20	20	20	20	
	2	37	37	37	37	37	37	37	
	3	9	9	9	9	9	9	9	
New Caledonia	1				13	15	15		13
Tonga	1	110	110	111	83	111	109	37	111
	2	22	22	22	19	21	21		16
Total		**197**	**190**	**199**	**181**	**213**	**211**	**103**	**140**

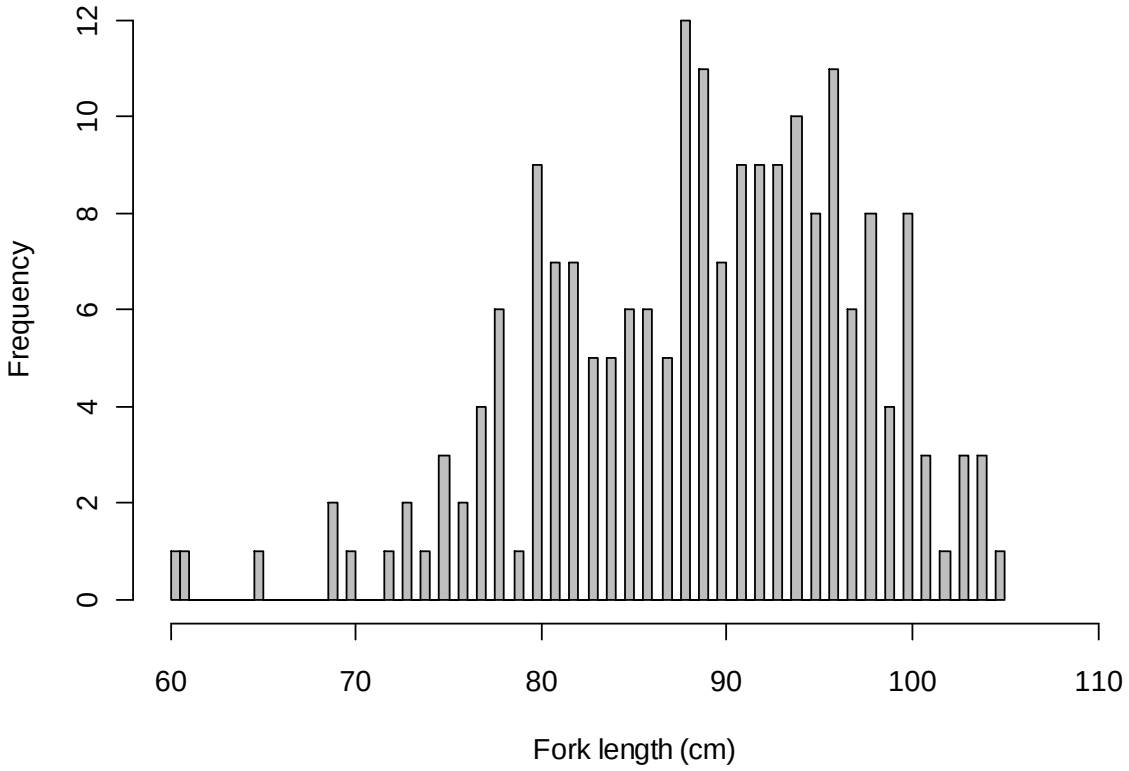

Fig. 3. Length frequency distribution of albacore from which biological samples were taken during all cruises in each location.

4 Conclusions

Overall, the 2010 albacore tagging cruises were partially successful in achieving the intended objectives. A number of miniPAT tags were released in each of the planned locations, although only 19 of the intended 30 miniPATs were released. Fewer albacore were tagged with conventional tags than expected due principally to the difficulty in capturing albacore in good condition with longlines. However, the size of albacore tagged with conventional tags in 2010 (median = 78 cm FL) was substantially larger than those tagged in 2009 (median = 59 cm FL), which was one of the objectives in 2010. A range of biological samples were collected from a large number of albacore providing important data for associated research.

Conventional tags were only used in New Zealand as the proportion of albacore landed in good condition was substantially higher in New Zealand (>50%) than in other locations (~2%). Differences in longline setting and oceanography are the most likely reasons for this observation. A line shooter was used when setting in New Caledonia and Tonga, but not in New Zealand. A line shooter strips line of the reel at faster speed than the vessel is travelling such that more line is deployed between floats using a line shooter than without. Therefore, the depth of the longline was set much shallower in New Zealand than in other locations. The sets were shorter (fewer hooks) in New Zealand which reduced the setting and hauling times and, subsequently, the total amount of time the hooks were in the water. The sea surface temperature was much cooler in New Zealand (14-19°C) than in New Caledonia (24-25°C) and Tonga (25-27°C) and albacore are likely to be closer to the surface in cooler water. Therefore, the difference in pressure realised by captured albacore, and subsequent incidence of barotraumas, was likely to be much lower in New Zealand than in New Caledonia and Tonga.

Despite the high proportion of albacore landed in poor condition, the high catch rates of albacore during the second cruise in New Caledonia enabled the deployment of all 10 miniPATs that were allocated for this location. The condition of albacore landed in New Zealand was often good, but low catch rates, particularly for large albacore, reduced opportunities to deploy miniPATs such that only 5 of the 10 miniPATs were released. In Tonga, the catch rates were low and the condition of albacore landed was generally poor. As a result, only 4 of the 10 miniPATs were released in Tonga. The value of the data received from these tags once they begin to transmit will depend on the duration for which they remain attached to the fish. It is common for satellite archival tags, such as the miniPAT, to release prematurely. A short deployment may result in limited horizontal movement data, but may still provide useful vertical movement data.

The low number of recaptured tagged albacore to date is not unexpected. Based on previous albacore tagging projects, the likelihood of any recaptures within the first year after tagging is relatively low (Labelle 1993). Most tagged albacore would be expected to be recaptured between one and four years after being released (Labelle 1993, Bertignac et al. 1996, Langley and Hampton 2005) and potentially some recaptures after 10 or more years (Langley and Hampton 2005).

A number of important lessons can be learnt from the albacore tagging program that can inform any future plans to tag albacore:

- A significant proportion of albacore captured by trolling or longlining are unsuitable for tag and release. The proportion that is unsuitable to tag depends on the location and the fishing method.

- In New Zealand, a greater proportion of albacore were landed in good condition by using longlines (>50%) than by trolling (~34%)

- The use of longlines at tropical latitudes to catch albacore for tag and release is likely to be unsuccessful due to the very high proportion of dead or injured albacore that are landed.

- Albacore caught at temperate latitudes are generally smaller than those caught at tropical latitudes, but the use of longlines can significantly increase the size of fish caught.

- Tag recapture rates of albacore are likely to be very low irrespective of capture method. Consequently, a large number (10's of thousands) of albacore may need to be tagged to gain useful information from tagging.

- The use of pop-up satellite archival tags (PSATs) offers the opportunity to obtain movement data without the need to recapture the fish. This is particularly useful for species such as albacore that suffer from low recapture rates.

- Alternative methods for obtaining information on exploitation rates and movement for albacore should be explored due to the difficulties in the application of traditional tagging programs.

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