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PACIFIC TUNA TAGGING PROJECT
Summary Report
Phase 2 (Central Pacific)
Cruise 1: 5 May – 3 June 2008

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ABSTRACT

The Pacific Tuna Tagging Programme (PTTP) is a WPCFC endorsed project being implemented through a variety of funding sources by the SPC-OFP to tag tropical tuna throughout the WCPO. The primary tag release platform will be chartered pole-and-line vessel(s) operating west of the Date Line to the Philippines and Indonesia. Tag releases in the Central Pacific will be accomplished through a combination of PTTP funded charters and externally funded PTTP affiliated national tagging programs. The first PTTP funded Central Pacific tagging effort consisted of a 30 day charter of the Hawaii-based ***FV Double D*** to the NOAA TAO oceanographic buoys south of Hawaii along the 155°W meridian and east of the Line Islands of Kiribati. The objective of this cruise and other sub-regional components of the PTTP is to target difficult to access areas of the Central Pacific (including French Polynesia) to improve overall spatial coverage of PTTP tag releases. The ***Double D*** is a Honolulu-based multi-purpose pelagic handline/longline vessel equipped with the full complement of Hawaiian-style tuna handline gears in addition to hydraulic trolling reels. The vessel is also equipped with two mini longline reels for conventional or targeted short-set longline fishing on tuna and pomphret aggregations. A total of 1909 tropical tunas were tagged and released during the cruise comprising 1736 bigeye (90.9%), 57 skipjack (3.0%) and 116 yellowfin tuna (6.1%). The majority of tag releases were made on the TAO buoy at 2°N, 155°W (69.3%) with 25.1% released on the TAO buoy at 5°N. Over 90% of total releases were bigeye tuna. Higher percentages of yellowfin were found on the higher latitude buoys where relatively few fish were tagged. The cruise also deployed 50 Wildlife Computers MK9 archival tags in 45 bigeye and 5 yellowfin tuna. Most of the tags were deployed on the TAO buoy at 2°N (37 bigeye, 2 yellowfin) with 6 bigeye and 1 yellowfin implanted with archival tags on the TAO buoy at 5N. Archival tags were also deployed at TAO 8°N, 155°W (1 yellowfin) and NOAA weather buoy 51002 (2 bigeye, 1 yellowfin). The cruise encountered a large purse seine vessel on TAO buoy 5°N 155°W with intentions of setting on the TAO buoy that were discouraged by the tagging vessel. This encounter emphasizes the importance of drifting aggregations away from the buoys after tagging and the need to equip PTTP tagging vessels with powerful submersible and surface lights to facilitate this process. PTTP tag recovery efforts and publicity also need to be increased in this region, especially with Kiribati Fisheries and port sampling personnel, the IATTC and the large purse seine vessels currently operating in the central Pacific. The cruise proved to be a successful test of the sub-regional tagging approach, releasing good numbers of bigeye tuna in this remote but ecologically important area of the WCPO.

INTRODUCTION

This report summarizes activities during a 30 day tuna tagging cruise of the ***FV Double D*** to the NOAA TAO oceanographic buoys south of Hawaii along the 155°W meridian and the waters of Kiribati, Line Islands[2]. This tagging cruise represented the first PTTP funded "sub-regional" approach of the second phase of the WCPFC endorsed Pacific Tuna Tagging Programme (PTTP) currently being implemented by the SPC-OFP, designated ***PTTP Phase 2 (Central Pacific)*** and given the tagging database Cruise designation CP-08-01. The proposed objective of sub-regional components of the PTTP is to target difficult to access areas of the Central Pacific (including French Polynesia) to improve overall spatial coverage of tag releases. The ***Double D*** is a multi-purpose pelagic handline/longline vessel equipped with

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[2] http://tao.noaa.gov/refreshed/index.php

the full complement of Hawaiian style tuna handline gears in addition to hydraulic trolling reels. The vessel is also equipped with two mini longline reels for conventional or targeted short-set longline fishing on tuna and pomphret aggregations. The vessel was used very successfully as a principal tagging platform during the PFRP funded Hawaii Tuna Tagging Project (HTTP). The vessel sailed from Honolulu with Joe Dettling as captain, his son Joe C Dettling Jr as crew/cook. David Itano was contracted by the SPC to conduct the tagging operations and to serve as charter Cruise Leader representing the SPC. Two additional crewmembers (Arvin Leal and Claver Servanes) were boarded at Christmas Island on 14 May who assisted on deck and bridge watch for the remainder of the cruise.

GENERAL DESCRIPTION OF VESSEL AND GEAR

The ***Double D*** is a 21 m multi-purpose commercial tuna fishing vessel designed and constructed by owner/operator Joseph Dettling for Hawaiian pelagic fisheries. The boat is unique to say the least, of catamaran style and constructed completely of welded plate aluminum (**Figure 1**). The vessel was constructed in Kailua-Kona, Hawaii in 1988 and originally known as the ***Fishing Island*** which was anchored off Kona as a self-aggregating fishing platform in the style of the fishing "barges" of southern California c 1950 – 1970s. In 1992, Dettling installed twin Mitsubishi main engines and fitted the vessel for commercial fishing. The boat has been a keystone of the Hawaiian offshore handline fishery that operates on the Cross Seamount and offshore NOAA weather buoys, targeting juvenile bigeye tuna. A large proportion of tag releases achieved during the Hawaii Tuna Tagging Project were made from this vessel using a combination of troll and handline gears.

In January 2001, Dettling started to experiment with short longline gear over the Cross Seamount summit to target larger, higher quality bigeye and seamount associated pomphrets, locally known as monchong (*Eumegistis illustris*). Within a few years, a new fishery had developed that sets less than one nautical mile of mainline on aggregated tuna and monchong schools. Since then, two of the Cross Seamount/weather buoy highliners have fully converted to the short longline gear and method. Basically, the system deploys a float, long section of bare mainline, weight, branchlines, intermediate sub-surface floats, a weight, a long bare mainline to surface, and a final float which places all hooks at depth, close to the seamount summit. In essence the configuration is a single, huge basket of gear with all the branchlines at the bottom of the catenary and is fully described by Beverly and Itano (2004). The system put all hooks at the target depth with no hooks in the mixed layer, increasing value of the target catch and greatly reducing mixed layer bycatch. The short length of mainline also circumvents the need for a federally permitted and monitored Hawaii Longline Permit since "longline gear" in Hawaii is defined as having a mainline longer than one nautical mile.

In recent years, the captain has chosen to utilize his Hawaii Longline Permit and sets approximately 7 miles of horizontal longline to sweep the entire Cross Seamount summit, setting as deep as possible over the summit. The large weights are no longer used but very large baskets of gear are set with long droplines and an effort is made to set extra mainline during the set. The ***Double D*** was chosen for this project due to the autonomy of the vessel and proven ability of the captain to innovate and produce high quality tag releases.

Vessel and gear details are itemized in **Appendix I**. The boat is equipped with a very efficient reverse osmosis watermaker, designed and built by Dettling at a fraction of the cost of commercially marketed units. A fresh ice maker, low fuel consumption main engines, redundant power generation systems and large fuel capacity make the ***Double D*** an ideal platform for extended tagging cruises. The CL used this vessel during the HTTP to tag tuna throughout the Northwest Hawaiian Island archipelago that stretch over 1250 nautical miles northwest of Honolulu to Kure Atoll. An "on demand" hot water shower was a very positive addition since the HTTP days but the lavatory still consists of a 5 gallon bucket with rope.

The vessel electronics are adequate for the job aside from the radar unit which is of limited range and use. The Furuno 5FCV 585 is an excellent depth sounder/fish finder with a bright, high resolution image and was very useful in assessing school size and species during the cruise. The IRIDIUM phone was linked to an HP laptop PC that was very efficient for email communications. The vessel was also equipped with two GPS radio buoys that report position through the Iridium email system.

Vessel accommodations are basic but adequate. The CL was housed in the main galley area on a couch. The only inconvenience experienced were two 12 volt lights that were constantly burning to allow crew to visit the galley at any hour or to locate tools and gear quickly. Airline style eyeshades solved that problem. The Captain and crew slept above on the bridge. The addition of two Philipino crewmen during the cruise made this a bit crowded but still workable. The contract requirement to air condition the galley area proved so desirable that the Captain also air conditioned the bridge prior to departing Honolulu. These proved to be life-savers as the low wind days were very hot and humid.

FISHING GEARS

The ***Double D*** is truly a multi-purpose tuna fishing vessel, equipped for trolling, handlining and longlining. The stern deck is equipped with three hydraulic trolling reels that can double as hydraulic down lines for *palu ahi* and *ika shibi* handlining or for diamond jigging at depth. The crew is also very familiar with using short lines to "chunk bait" fish at the surface on cut bait or use traditional basket gear for ika shibi fishing. **Figure 2** shows the back deck layout which is equipped with twin longline reels and 3 hydraulic trolling reels. One of the three tagging stations set up for the cruise is also shown. The two Custom Sea Gear, mini-longline reels can be used to set short horizontal or vertical longline gear. Their rated capacity is about 5 and 8 nm of mainline. However, the ***Double D*** is not limited mainline sets of one nautical mile as the Captain also holds a Federal Hawaii Longline Permit.

The vessel is also rigged to deploy tuna "dangler" gear which consists of metal davits that extend at right angles from the hull for 1.5 to 2 meters and deploy one or two very short surface trolling lines (**Figure 3**). Bigeye and yellowfin both respond to danglers but the gear is most effective on bigeye tuna. For the tagging work, longer leaders with smaller barbless single hooks were used to minimize hooking trauma.

A combination of 7" and 9" trolling lures, plastic squids and hand fashioned trolling lures were used on the hydraulic trolling reels, short troll lines and danglers. The skin of the leatherjacket or Hawaiian lai (*Scomberoides lysan*) were also used to skirt and dress the short troll gear. Lai skin makes very durable and attractive skirting material for trolling lures and was used to fashion bigeye lures during the cruise.

Handline jigging baskets were set up using 1/8" poly chord backing to 400 lb test monofilament crimped to chrome diamond jigs and an assortment of metal jigs. The CL also brought two standup style sport rods with 2-speed conventional reels loaded with 80 and 100 lb test spectra line. These rigs are very effective at jigging sub-surface tuna due to the low drag and non-stretch qualities of the spectra. In order to leader and land the fish, jigs were rigged with 4 m of 1.8 mm monofilament. **Figure 4** shows the prepared lai skin for lure making and a mix of lures and jigs used during the cruise.

The most important consideration in contracting this particular vessel is that the Captain and crew of the ***Double D*** are adept at quickly selecting and switching to any combination of gear types and lures that are appropriate to target a particular fish school situation. This versatility and experience in getting a tuna school to bite is highly desirable for a tagging charter and a characteristic of the vessels engaged in the Hawaii offshore handline fishery.

TAGGING and DATA RECORDING

The tagging and data recording gears used during CP-08-01 are detailed in **Appendix II**. The cruise was supplied with SPC yellow dart tags manufactured by Hallprint Ltd, Pty of Australia for the PTTP. Size Y-11 tags for fish less than 40 cm and size Y-13 tags were supplied but only Y-13 tags were deployed during the cruise. Fifty Wildlife Computers MK9 archival tags were also available during the cruise for use on bigeye and yellowfin tuna. These tags were of the newer generation MK9 with 64MB of memory and set to sample all parameters every 30 seconds. These tags were specifically requested and manufactured with shorter light stalks bent at 90° for streamlining and reduced drag. Archival tagged tuna were externally marked with a Y-13 conventional tag since red dart tags were not supplied.

Tag release data was recorded on Olympus Digital Voice Recorders (model VN-4100), transcribed to PTTP data sheets and entered into the TAGDAGER Access database. The voice recorder was made waterproof during fishing and tagging operations by protecting the unit with a West Marine waterproof pouch for small cel phones. TAGDAGER files were backed up daily to a 1 GB USB data stick. Total backups of TAGDAGER, report files and digital photos were made to a LaCie 80 GB external hard drive.

Four tagging stations were set up on the rear deck of the ***Double D***. The Cruise Leaders primary tagging station was a tagging cradle originally designed for the University of Hawaii ***RV Opah*** for sonic tagging tuna in Hawaiian waters. The cradle was installed on the port stern transom of the ***Double D*** and supplied with a saltwater hose for irrigating tuna during archival tagging procedures. **Figure 5** shows this tagging cradle with a bigeye tuna being irrigated with the seawater hose and conventional dart tags tied to the front of the cradle. One of the bent stalk MK9 archival tags has already been inserted and sewn into the peritoneal cavity. The cradle location on the transom make it ideal for loading fish from the port gate and releasing tuna right over the stern. Two other tagging cradles were manufactured by Dettling to house 110 cm closed cell foam tagging mattresses that were installed on the port and starboard near the hydraulic reels (**Figure 6**). An additional tagging mattress was placed on the starboard deck for larger fish or when the small tagging cradles filled.

A 1.8 m sling for lifting large tuna was fabricated in Honolulu specifically for this cruise. The sling was based on the design developed by Bruno Leroy (SPC-OFP) that has been used successfully on longline vessels and during the SPC/NFA sponsored PNG Tuna Tagging Project. The only significant change in materials was the use of stainless steel poles in place of the aluminum poles used by Leroy. A long handled dip net with knotless webbing and 90 cm ring was also used for lifting medium sized tuna from the water for tagging. **Figure 7** shows the lifting sling from side and front view.

Joe Dettling Jr. was trained in tagging and data entry during the cruise and participated in full tagging duties from May 16 onwards (**Figure 8**). He learned very quickly and proved essential to the success of the tagging cruise. Maximum benefit of two taggers was achieved by training the two Philipino crewmen to pull fish for the taggers. The tuna usually bit in quick bursts that kept two taggers fully occupied. Having Joe Jr tagging also allowed the CL to concentrate on archival tagging the larger, best condition tuna while JD2 kept up on conventional releases.

GENERAL DESCRIPTION OF CRUISE TRACK AND FISHING ACTIVITY

The track of Cruise CP-08-01 is found below as **Figure 9** and can be summarized by the following schematic:

Hawaii → 8N TAO → Christmas Island → 2N TAO → 5N TAO → 2N TAO → 5N TAO → 8N TAO → Hawaii

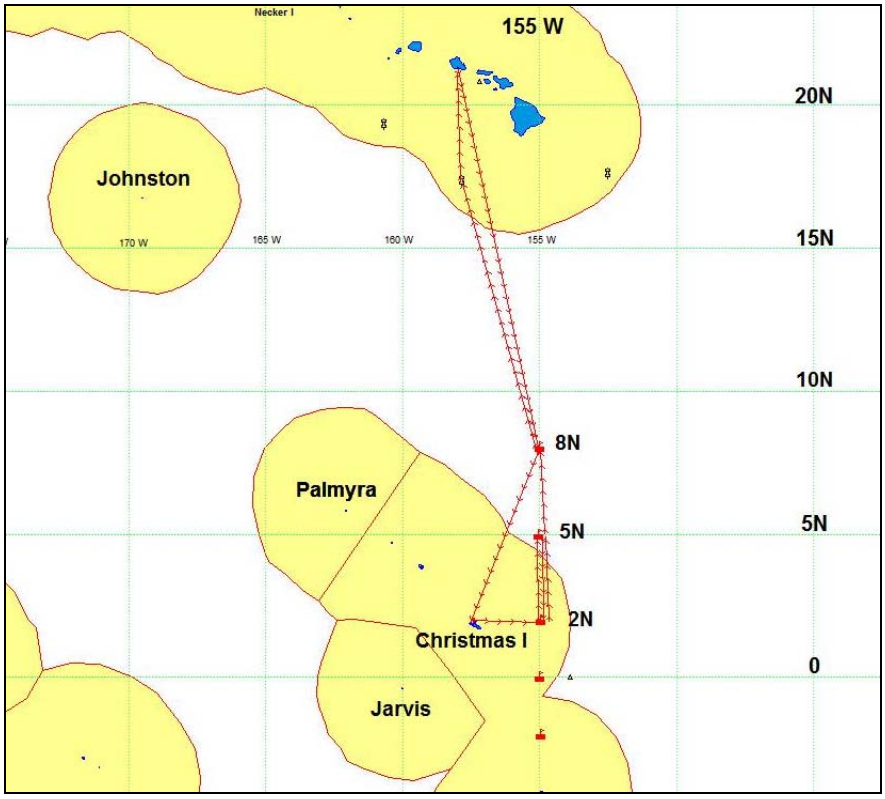


Figure 9. Cruise track during Cruise CP-08-01-08, May 5 – June 3, 2008

A summary of general movements during the cruise and daily tag releases by area/buoy is given in **Table 1**. Details of cruise activities with daily tag releases are included in **Appendix III.** A detailed account of the encounter with the purse seine vessel on TAO buoy 5N 155W are included in a separate section below.

Of the 30 days of charter during CP-08-01, 12 days were spent steaming, one day was spent at Christmas Island to clear customs formalities and board crew and part or all of 17 days were spent fishing and tagging.

The ***Double D*** left Honolulu Harbor on the morning of May 5, 2008 on a direct course for the TAO array that lies along the 155°W meridian. The plan was to try the TAO buoys at 8°N and 5°N before running in to Christmas Island to pick up the rest of our crew. After that we would evaluate the situation and either return to the 5°N or investigate the TAO buoys at 2°N and the Equator.

The vessel ran SSE for five days, arriving at the 8°N TAO buoy on May 10 by late morning. A large mixed species aggregation was present making it difficult to target the tuna, especially with the rough sea conditions encountered. Several mahi mahi, wahoo, silky sharks and a large marlin were hooked and released aside from some fish kept for immediate consumption. Ran south to the TAO buoy at 5°N and

were pleasantly surprised to find an actively biting bigeye school on the surface which was fished and tagged for 123 quick releases. We then proceeded toward Christmas Island all day and next, arriving late on May 13. Customs formalities were taken care of on May 14 and our two Philipino crewmen were taken aboard.

The vessel ran east to the TAO buoy at 2°N 155°W and fished it for four days with the first two days producing 1049 releases, almost all of which were bigeye. Fishing success quickly slowed after the first day or two: a pattern that continued throughout the cruise. Images on the high definition echo sounder indicated that a large school of bigeye was still present but not biting. Night time jigging was variable but produced some larger bigeye for archival tagging up to 115 cm. We moved north to the TAO buoy at 5°N on May 20 for four days of fishing that repeated this pattern with tag release numberss declining from 143, 64, 39 to one single skipjack over the four-day period. A large school remained on the buoy during this time that was visible on the echo sounder.

There seemed to be no choice but to return to the TAO buoy at 2°N where 178 tuna, mostly bigeye, were tagged over the next two days. On May 26 we returned once again to the TAO buoy at 5°N by mid day to find a large purse seine vessel nearby and a drifting FAD and strobe light tied to the TAO buoy. Only 11 releases were made on this day and mostly by jigging small tuna while tied up to the buoy. We drifted the school off in the early morning of May 27 in an effort to safeguard our tag releases if the purse seiner returned and headed north, arriving at the TAO buoy at 8°N on May 28. We found a mixed aggregation clustered tight on the buoy and tagged 89 tuna by trolling and jigging. The next morning only one yellowfin was trolled and tagged. The sounder indicated a good sized aggregation of tuna but they refused to bite. We headed north toward Hawaii on the morning of May 29, arriving at the NOAA weather buoy 51002 inside the Hawaii EEZ the afternoon of June 1. Eleven bigeye and yellowfin were tagged with the last 3 remaining archival tags and a 8 conventional tags. The vessel then steamed north to finish the cruise on June 3, 2008.

Table 1. Daily activities and tag release summery during CP-08-01-08

Date 2008	**General Area**	**Principal Activity**	**Conventional Tag Releases (archival releases in brackets)**			
			BET	**SKJ**	**YFT**	**Tot**
5/5/08	Depart Honolulu	Running	-	-	-	-
5/6/08	S Hawaii EEZ	Running	-	-	-	-
5/7/08	S of Hawaii	Running	-	-	-	-
5/8/08	S of Hawaii	Running	-	-	-	-
5/9/08	S of Hawaii	Running	-	-	-	-
5/10/08	TAO 8N 155W	Fishing	0	1	5 (1)	6
5/11/08	TAO 5N 155W	Fishing	97 (5)	0	1	98
5/12/08	TAO 5N 155W	Fishing running SW	121	0	2 (1)	123
5/13/08	NE of Christmas	Running SW, arrive Christmas	-	-	-	-

5/14/08	Christmas I	Clearance crew loading	-	-	-	-
5/15/08	E of Christmas I	Running E	-	-	-	-
5/16/08	TAO 2N 155W	Fishing	471 (19)	10	38	519
5/17/08	TAO 2N 155W	Fishing	526 (6)	2	2	530
5/18/08	TAO 2N 155W	Fishing	77 (6)	5	1	83
5/19/08	TAO 2N 155W, north to 5N	Fishing Running N	11	2	0	13
5/20/08	TAO 5N 155W	Running N Fishing	135	1	7	143
5/21/08	TAO 5N 155W	Fishing	62 (1)	0	2	64
5/22/08	TAO 5N 155W	Fishing	32	2	5	39
5/23/08	TAO 5N 155W	Fishing Running south	0	1	0	1
5/24/08	TAO 2N 155W	Fishing	101 (6)	24	8 (1)	133
5/25/08	TAO 2N 155W north to 5N	Fishing running N	43	0	2 (1)	45
5/26/08	TAO 5N 155W	Running N Fishing	8	1	2	11
5/27/08	between 5N and 8N on 155W	Running N	-	-	-	-
5/28/08	TAO 8N 155W	Fishing	45	8	36	89
5/29/08	TAO 8N 155W	Fishing running N	0	0	1	1
5/30/08	S of Hawaii	Running N	-	-	-	-
5/31/08	S of Hawaii	Running N				0
6/1/08	NOAA 51002	Running N Fishing	7 (2)	0	4 (1)	11
6/2/08	S of Hawaii	Running N	-	-	-	-
6/3/08	S of Oahu Honolulu Harbor	Running N end cruise	-	-	-	-
	TOTALS		**1736**	**57**	**116**	**1909**

Purse seine vessel encounter – May 26, 2008

The ***Double D*** sighted the TAO buoy at **5N, 155W** at 1130 on 5/26/08 while running north from the TAO buoy at 2N, 155W. Around 1145 the mast, boom and upper structure of a large purse seine vessel were sighted to the east of the buoy. On arrival at the TAO buoy it was discovered that a drifting FAD was tied to the buoy and a light strobe was attached to the buoy "A" frame that holds the instruments and satellite antennae (**Figure 10**). The drifting FAD was taken onboard the ***Double D*** using the starboard boom and electric winch. At this point, Captain Dettling succeeded in contacting the purse seine vessel via VHF radio and requested the vessel's identity. An English speaking representative on the purse seiner with heavy Latin accent identified the vessel as the purse seiner Ana or Anna, last out of Callao, Peru. Capt Dettling informed the vessel that we had removed the drifting FAD we had found on the TAO buoy, to not tie any FADs to any TAO moorings and that we would be patrolling all TAO buoys on the 155W line from 8N to 8S. The vessel replied that the fishing was not so good here anyway, he was going to "look around" and the vessel turned east and rapidly left the area. Video footage of the vessel was taken.

The drifting FAD taken onboard the ***Double D*** was typical of the type the CL had seen onboard purse seiners in the Indian Ocean which are thoroughly described in Itano et al. 2004. The main construction was a rectangular bamboo raft (170 x 260 cm) covered with ¾" fine mesh netting with four purse seine corks tied to each corner for additional buoyancy (**Figure 11**). A 20 meter section of purse seine webbing (# 48 twine in 4.25" stretched mesh) was tied to the center of the underside of the raft to serve as an aggregator. The bottom of this netting was weighted down with a short section of used chain.

The incident was reported to the IATTC, WCPFC and the National Data Buoy Center by email. No vessel of that name could be found on the IATTC or WCPFC vessel registries. It was assumed the vessel falsified its identity or was an unregistered IUU vessel operating without authorization. The distance to the vessel remained too far to read any name or identifying numbers but video footage was taken that may reveal her identity. By visual observations through binoculars, the Cruise Leader estimated the vessel to be close to 1200 GRT in size, was of the Campbell Shipyards style with main engine smokestack on the stern deck just forward of the net pile and relatively old in style, c 1975 – 1980. It is difficult to see in the video but it appears there were two speedboats on the starboard working deck and a helicopter on the deckhouse landing pad (see **Figure 12)**.

FISHING TECHNIQUES

The primary fishing gear used during CP-08-01 was troll or modified trolling/dangler surface gear or sub-surface jigging. All 1909 tag releases were made on one of the three TAO buoys visited. The longline gear was not used during the cruise. Our first attempts at trolling with the hydraulic trolling reels used conventional 7" skirted trolling lures with 9/0 single hooks. This gear proved unsuitable for the most part as it tended to attract bycatch species (mahi mahi, wahoo, sharks, billfish) and the hooks damaged many of the smaller target tuna species. The Captain quickly shifted gears to short troll lines (4 – 10 m) and dangler gear rigged with small lures and 7/0 – 8/0 single hooks. When the bite slowed, the hydraulic trolling lines were run with small lures and light drag. All barbs were completely bent down to ease release and minimize damage. Trolling in this manner was most effective from 0600 – 0830 and around 1400 – 1730.

Sub-surface jigging was carried out primarily at night (**Figure 13**). Unlike PTTP experience in the western Pacific, the best jigging hours for bigeye were from 1930 – 2200 hours. After that, schools of small yellowfin took over feeding on tiny flying fish attracted to the ships lights. These fish usually did not take jigs readily although they tended to bite just before dawn. All jigs were rigged with single hooks on a short section of spectra line (see Figure 4). The sport poles with spectra line out fished the heavy

handline gear most of the time but were abandoned in favor of handlines or hydraulic reels when the bite improved The most efficient system found was to jig with the 400 lb mono on the hydraulic reels with jigs attached with a 5 m section of 250 lb mono. Small fish were hauled by hand but larger fish could be pulled on the hydraulic reels. The hydraulic reels have an adjustable drag which allows a setting that minimizes damage.

Fish were often detected on the depth sounder but would not bite troll gear, jigs or dead bait. Palu ahi gear was deployed on two occasions with sanma or cut tuna for bait but did not produce any hookups. Live squid (*Sthenoteuthis oualaniensis*) were jigged on a few occasions. The live squid baited on circle hooks never failed to produce bigeye (see **Figure 14**).

TAG RELEASES

Conventional tags

A total of 1909 tropical tunas were tagged and released during the cruise comprising 1736 bigeye (90.9%), 57 skipjack (3.0%) and 116 yellowfin tuna (6.1%). Only the larger Y-13 tags were used as no releases were less than 40 cm FL. Conventional tag releases spanned the Y-13 tag numbers P61001 – P62950[3]. Fishing and tagging was conducted on 17 of the 30 cruise days for an average of 112 releases per fishing day. Daily tag releases ranged from 530 per day on May 17 to a single release on May 29. The relatively low proportion of fishing/tagging days had to do with the long run from Hawaii to the fishing grounds, distance between TAO buoys and lack of free schools or other floating objects encountered.

The majority of tag releases were made on the TAO buoy at 2N (69.3%) with 25.1% released on the TAO buoy at 5N. Over 90% of these releases were bigeye tuna. The high percentage of bigeye overall was a big surprise and bonus achieved by this cruise. This information is summarized in **Table 2**. The distribution of bigeye releases, by buoy is shown in **Figure 15**. Higher percentages of yellowfin were found on the higher latitude buoys where relatively few fish were tagged.

Table 2. Tag releases by buoy

Buoy	# days	BET	SKJ	YFT	Total	Percentage			Total %
						BET	SKJ	YFT	
51002	1	7	0	4	11	63.6	-	36.4	**0.6%**
8N	3	45	9	42	96	46.9	9.4	43.8	**5.0%**
5N	7	455	5	19	479	95.0	1.0	4.0	**25.1%**
2N	6	1229	43	51	1323	92.9	3.3	3.9	**69.3%**
Totals	**17**	**1736**	**57**	**116**	**1909**	**90.0**	**3.0**	**6.1**	

[3] Does not total 1909 as some tags were lost overboard while loading tags or during tagging operations

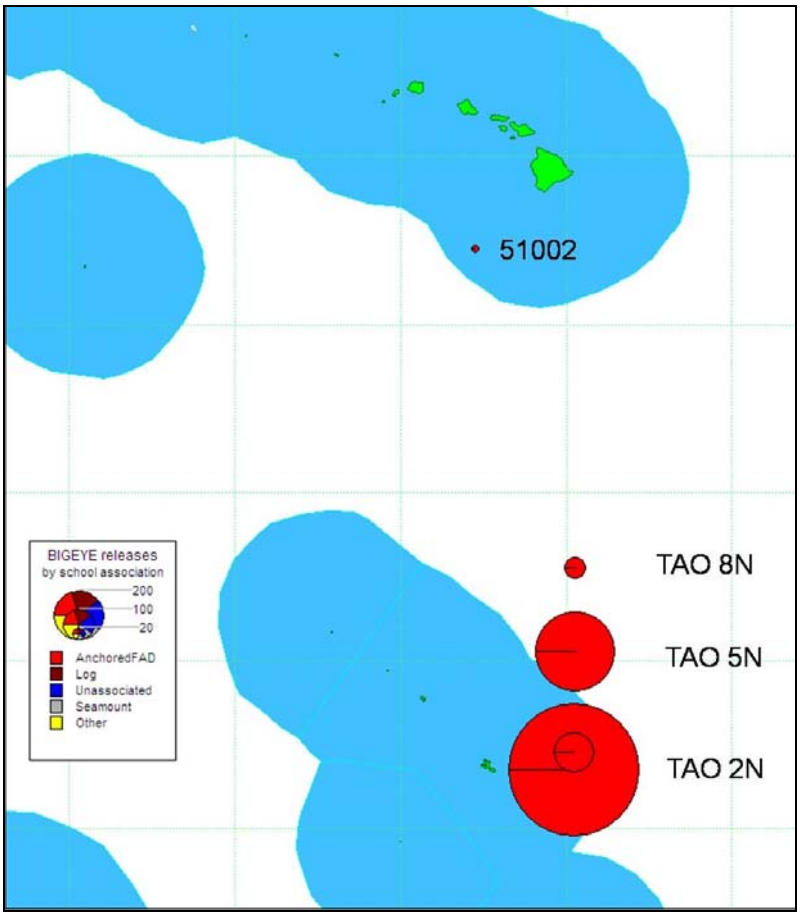


Figure 15. Distribution of Bigeye tag releases by buoy

Archival tagging summary

The cruise was equipped with 50 Wildlife Computers MK9 archival tags. All fifty were deployed during the cruise in 45 bigeye and 5 yellowfin tuna. Most of the tags were deployed on the TAO buoy at 2N (37 bigeye, 2 yellowfin) with 6 bigeye and 1 yellowfin implanted with archival tags on the TAO buoy at 5N. Archival tags were also deployed at TAO 8N (1 yellowfin) and NOAA weather buoy 51002 (2 bigeye, 1 yellowfin). All archival tags were implanted into the peritoneal cavity and secured with two sutures. Tuna receiving an archival tag were placed upside down on the central tagging cradle, irrigated with a seawater hose, eyes covered with synthetic chamois, measured and also tagged with a Y-13 Hallprint dart tag (**Figure 16**). All archival tagging was conducted by the cruise leader.

TAG RECOVERIES

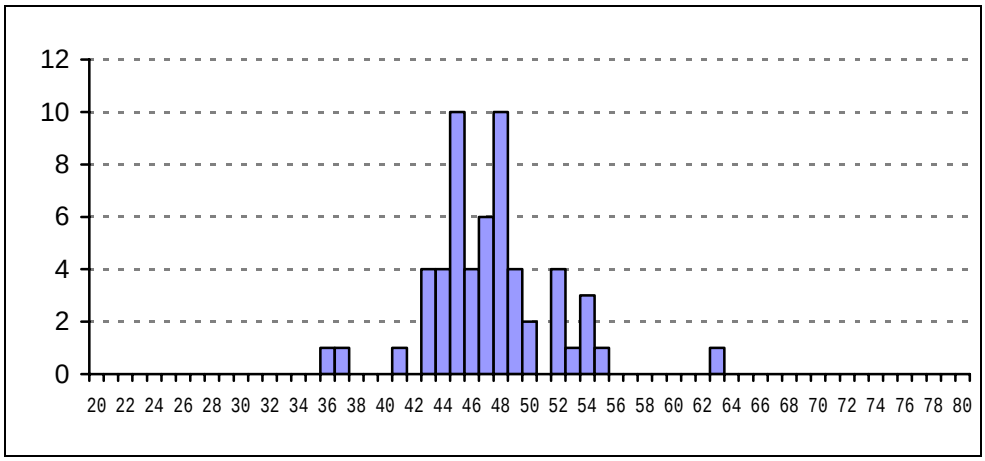
Three tuna tagged during the cruise were recaptured by the tagging vessel. All recaptures were made on the TAO buoy at 2N 155W. The recaptures consisted of one yellowfin tuna (9 DAL), and two bigeye (1 and 9 DAL). The recaptured bigeye appeared normal and the tag entry wounds were starting to heal nicely (see **Figure 17**). The recaptured yellowfin was hooked on a jig at night but acted very sluggish and "tired" looking when landed.

SIZE DISTRIBUTION OF TAGGED FISH

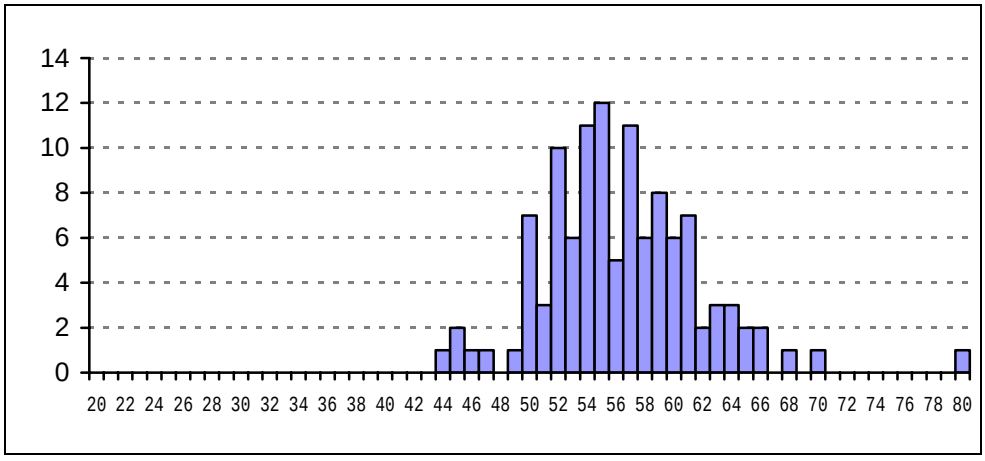
Figure 18 shows the size distribution of skipjack, yellowfin and bigeye tuna tagged during the cruise up to 80 cm FL. Some larger yellowfin and bigeye were tagged with archival tags and are represented separately. The small number of skipjack present were generally small in size, between 48 – 52 cm. There were large breezers of small skipjack present on the TAO buoys at 2N and 5N but were not targeted or well selected by the fishing gear used. Most of the yellowfin tagged during the cruise were year old fish around 50 – 62 cm in size. Bigeye tag releases centered around 60 cm with no distinct modes in the smaller sizes. **Figure 19** shows the size distribution of archival tag releases that ranged from 63 – 115 cm for bigeye and 68 – 106 cm for yellowfin. Most archival releases ranged from 67 – 80 cm. The largest archival releases were caught using jigs on handlines or sport poles. It should be noted that several bigeye greater than 75 cm that were suitable for archival tags were only marked with a conventional dart tag due to the time required for archival tagging and the fast biting nature of the schools.

Figure 18. Size distribution of tagged fish

Skipjack n = 57



Yellowfin n = 113



Bigeye n = 1692

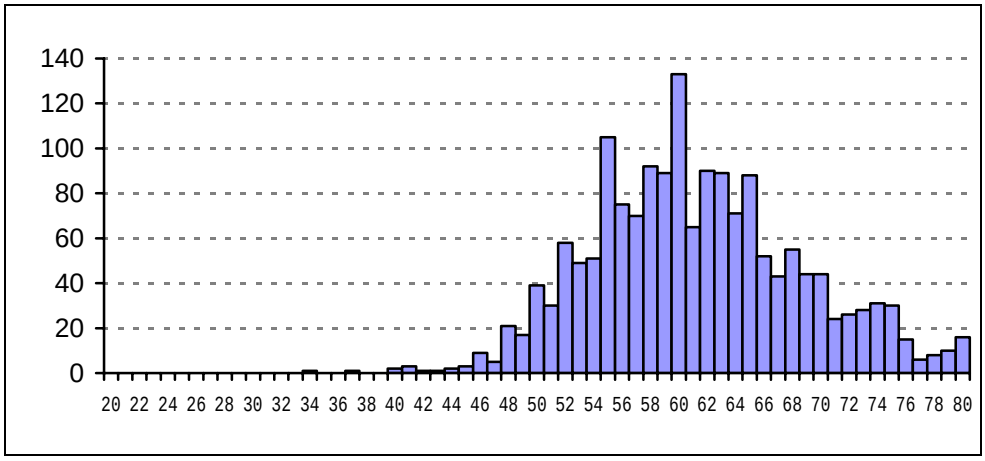
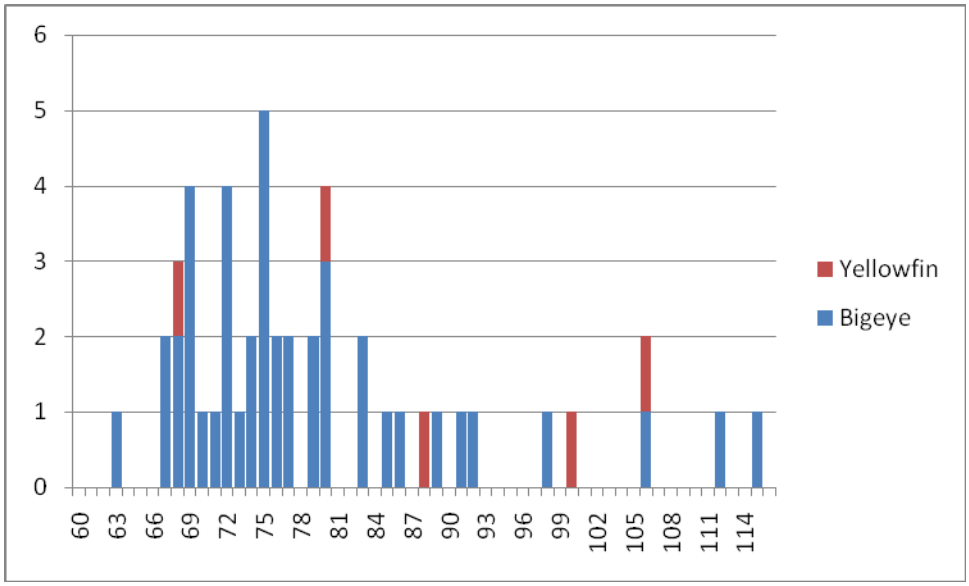


Figure 19. Size distribution of archival tag releases



BIOLOGICAL SAMPLING

Bigeye and yellowfin tuna judged to be unsuitable for tagging due to injury were retained for biological sampling in support of PFRP funded NOAA/JIMAR project #651106, examining nursery origin and degrees of movement of yellowfin and bigeye tuna in the central Pacific. Saggital otolith pairs were extracted and stored for later analysis (**Figure 20**). A total of 96 bigeye and 32 yellowfin were sampled in this manner.

UNDERWATER VIDEO AND CRUISE DOCUMENTATION

Cruise CP-08-01 was well documented with hundreds of digital still pictures (examples used to illustrate this report), digital video (JVC unit for fishing and tagging documentation) and with a submersible video system. The underwater video was taken with a Splashcam Marine Video system by Ocean Systems Inc[4] (Deep Blue Professional system). The unit consists of a color video camera head tethered to an LCD screen and DVD recording unit that remains on the vessel (**Figure 21**). A Wildlife Computers MK9 archvial tag was attached to the camera head during tests to log recording depth. Digital still images of the echo sounder display were also taken of the presumed tuna schools while recording underwater images (examples in **Figure 22**).

Clear images of tuna were easily captured at depths corresponding to the depths indicated by the depth sounder images (25 – 50m). Tuna species and general size were readily identifiable to the trained eye: bigeye, yellowfin and skipjack images were recorded. The tuna did not appear alarmed or necessarily aware of the camera and came very close to the recording head. Unfortunately, all frames recorded underwater were very over-exposed which created a "washed out" appearance to all underwater footage. This was not seen for video taken with the same gear in above water shots. Ocean Systems Inc. was contacted by email during the cruise but were not able to correct the issue. The system has been sent back to the manufacturer to try and solve the problem.

OUTCOMES and RECOMMENDATIONS

Tagging cruise CP-08-01 proved to be a highly successful first trial of the "sub-regional" approach to deploying tags in remote or difficult to access areas of the WCPO. Tag release numbers were very good considering all fish were taken with non pole-and-line gear. The greatest unanticipated bonus of the cruise was the discovery that these TAO buoys held shallow schooling bigeye that were vulnerable to simple surface trolling and handline gears.

The choice of vessel, captain and crew was strongly validated during the cruise. The ***Double D*** performed extremely well in fuel economy, autonomy, stability and ability to raise schools to the troll gear. The mix of gears at Captain Dettling's disposal also proved to be the key to the success of the cruise. Training Joe Jr in tagging and data recording procedures was also an important side-benefit resulting from the cruise. Having the two Philipino crewmen to pull fish to keep two taggers fully occupied was also a key factor to the success of the cruise.

The tagging stations set up for the cruise proved to be nearly ideal. If this vessel is chartered again it would be best to have one more tagging mattress on the deck and another archival tagging station set up on the starboard stern transom. The two tagging cradles constructed for CP-08-01 were 28" and 36" in height. The lower cradle was found to be easier to use and load with dangler caught fish and two at this height should be be constructed for subsequent cruises. The shorter light stalks for the MK9 archival tags

[4] http://www.splashcam.com/index.htm

used on the cruise appeared to be a good choice and were easy to implant and suture. The shorter stalk appeared to be long enough to obtain light data but less conspicuous to predators.

The timing of this cruise was tailored to personnel availability and anticipated poor market conditions in Hawaii (which held true), but was not well timed for the fishing. This cruise spanned the full moon period which is traditionally the worst time for surface bigeye and dangler fishing (according to Captain Dettling). If possible, future trips should be planned to incorporate the new moon to full moon periods.

A striking feature noted by the Captain and Cruise Leader during the cruise was the green color of the water below 10N which was also relatively cool. The water looked very different from Hawaii or the tropical western Pacific and appeared to be more similar to water in the productive EPO. An email query on the water color and SST with National Data Buoy Center personnel during the cruise resulted in the following note from an oceanographer at NOAA:

Subject: Re: [Fwd: [Fwd: Re: 155W TAO Buoy Positions 5/11/08]]
Date: Mon, 12 May 2008 14:04:16 -0500
From: Janice Boyd <Janice.Boyd@noaa.gov>
To: Dick Thayer <Richard.Thayer@noaa.gov>
References: <482854A0.1060103@noaa.gov>

> There is a persistent phenomenon called equatorial upwelling that causes deep waters (generally containing nutrients) to be pulled up to the near surface region, resulting in enhanced productivity along the equator.Further north, between around 2- 10 deg N, is the eastward flowing North Equatorial Counter Current. It tends to have high nutrients but productivity is often limited by the availability of micronutrients, esp. iron. Further north of 10 deg, the waters become typically low nutrient and low productivity (ie, blue).
>
> Sounds like they are sailing S into regions of water with enhance nutrient concentration where micronutrients for whatever reason (dust clouds from land) are not limiting so the phytoplankton are taking off. Not particularly unusual, but the occurrence is patchy and may not look the same a month from now.
>
> Janice

The fact that these TAO buoys report water temperatures to a depth of 500 m is a huge bonus for planning future trips. It is possible that the success of this cruise, particularly for bigeye was promoted by an episodic upwelling event of short temporal scale. Planning future cruises in this area should make full use of the TAO sensors and sources of remote sensing data of SST, currents, chlorophyll and other nutrient levels.

The vessel was well equipped for the cruise but could improve in a few areas. Future tagging charters should require a better radar unit and functional SST gauge. A longer range, higher definition radar would promote safety while running at night and easier target acquisition if logs or drifting FADs are marked with radar reflectors. A larger selection of trolling lures, jigs, hooks, handline and leader material should also be stocked to be prepared for any situation. A larger variety and stock of food would be appreciated by all.

Encountering the purse seiner ***Montelucia*** transshipping at Christmas Island was a sobering moment but a good reminder to increase tag return publicity with the EU fleets and any fleets likely to be operating in the cruise area (**Figure 23**). This vessel is among nine EPO seiners currently licensed to operate in the Kiribati EEZ. It is assumed that they will recapture a large proportion of recaptured tuna from this cruise. Ideally, publicity should be initiated well before the commencement of future cruises

The confrontation with a purse seiner on TAO buoy 5N 155W was a real "wake up call" to the PTTP and future cruises. It is unlikely that surveillance or enforcement will be able to prevent fishing operations on these buoys which stresses the importance of drifting aggregations away from the buoys after tagging. PTTP tagging vessels should be equipped with an underwater bait attraction light and powerful surface lights to facilitate this process. Cruise plans should also include the time needed to drift schools far away from the buoys which may require a full day of drifting per buoy or FAD.

Final note: NMFS enforcement is investigating the identity of the purse seine vessel in question and promoting increased monitoring of this area. The US Coast Guard has been informed of the situation and been asked to incorporate the TAO and other weather buoys into their surface and air patrols of the WCPO. Captain Dettling has supplied the NMFS with a copy of the video taken of the drifting FAD and vessel sighted by the Double D. The identity of the vessel remains unknown.

REFERENCES

Beverly, S., and D. Itano. 2004. **Technology related projects and proposals to mitigate bycatch levels in longline and purse seine fisheries.** a. Trial setting of deep longline techniques to reduce bycatch and increase targeting of deep-swimming tunas. 17th Standing Committee on Tuna and Billfish, Majuro, Republic of the Marshall Islands – 11-18 August 2004. FTWG WP-7.

Itano, D., S. Fukofuka, & D. Brogan. 2004. **The development, design and recent status of anchored and drifting FADs in the WCPO.** 17th Standing Committee on Tuna and Billfish, Majuro, Republic of the Marshall Islands – 11-18 August 2004. FTWG INF-3.

APPENDIX I. Vessel and gear details

Construction	Kailua-Kona, Honokohau Harbor
Date of launch	March 20, 1988
Call sign	WBQ7713
Hull style, material	Catamaran, all aluminium welded
Net tonnage	34
Length (overall)	70’ (21.3 m)
Breadth	24’ 4” (7.4 m)
Draft	3’ (0.9 m)
Fuel Capacity	3,400 gallons (12873 L)
Operating range	30 days fuel, water unlimited
Freshwater capacity	400 gallons (1515 L) storage onboard reverse osmosis watermaker
Speed (cruising)	7.2 kts @ 915 rpm
Main engines	Hyundai 6DZ (2)
Auxiliary engines	Kubota 20 kw
	John Deere 20 KW
Auxiliary generator	Cruise, belt driven off main, 20 KW
Fresh ice maker	Howe 3 st/day
Desalinator	Applied Membrane Rev Osmosis, 30 gal/hour
Fish hold capacity	15 t
ELECTRONIC GEARS	
Global Positioning System	Furuno GP 31, Furuno GP 50
Autopilot	COMNAV 1001
Radar	Furuno
Fish finder	Furuno 5FCV 585
Radios	Furuno FS 1503 SSB
	Motorola Triton II
	Standard Communications VHF
Satellite communications	IRIDIUM 9595A handset SkyFile email program on HP laptop
GPS radio buoys	ORBIMAGE GPS radio buoys (2)
Vessel Monitoring System	Faria Watch Dog

FISHING GEARS	
Hydraulic trolling reels	Custom Sea Gear (3)
Longline reels	Custom Sea Gear, 5 nm capacity (2)
Dangler poles	2 per side rigged during cruise
Misc handlines, short troll lines	
Misc jigs and trolling lures	

APPENDIX II. Tagging and data recording gear

Conventional tags – supplied by SPC	Hallprint plastic dart tags (yellow) Y-13 (5,000 pcs) P61001 – P66000 Y-11(1,000 pcs) Z40001 – Z41000
Conventional tags – used during cruise	Y-13 (P61001 – P62950)
Stainless steel applicators	Y-13 size, 170 mm length overall (300) Y-11 size, 140 mm length overall (150)
Archival tags	Wildlife Computers, MK9 Modified short light stalk, bent at 90°
Archival tagging cradle	110 cm, 42” high at highest point
Conventional tagging cradles (2)	110 cm, 28” and 36” high at highest poing
Tagging mattress	100 cm
Archival tagging sutures	Ethicon PDS II, CP-1 ½ circle, 70 cm violet absorbable suture, # Z467
Tuna lifting sling	1.8 m long x 1.5 m opening
Landing net	90 x 90 cm ring with 1.8 m handle
Laptop PC with TAGAGER software	Dell Latitude D620
Data recorders	Olympus Digital Voice Recorder VN-4100
Backup hardware	LaCie 80 GB external HD, PNY Attache 1 GB USB data stick

APPENDIX III. Summary of cruise activity, with number of tagged fish released per day

Date 2008	General Area	Principal Activity	Conventional Tags (includes archival releases)				Archival Release detail			Total Tagged
			BET	SKJ	YFT	Tot	BET	YFT	Tot	
5/5/08	Depart Honolulu	Running	-	-	-	-	-	-	-	-
5/6/08	S Hawaii EEZ	Running	-	-	-	-	-	-	-	-
5/7/08	S of Hawaii	Running	-	-	-	-	-	-	-	-
5/8/08	S of Hawaii	Running	-	-	-	-	-	-	-	-
5/9/08	S of Hawaii	Running	-	-	-	-	-	-	-	-
5/10/08	TAO 8N 155W	Fishing	0	1	5	6	0	1	1	**6**
5/11/08	TAO 5N 155W	Fishing	97	0	1	98	5	0	5	**98**
5/12/08	TAO 5N 155W	Fishing running SW	121	0	2	123	0	1	1	**123**
5/13/08	NE of Christmas	Running SW, arrive Christmas	-	-	-	-	-	-	-	-
5/14/08	Christmas I	Clearance crew loading	-	-	-	-	-	-	-	-
5/15/08	E of Christmas I	Running E	-	-	-	-	-	-	-	-
5/16/08	TAO 2N 155W	Fishing	471	10	38	519	19	0	19	**519**
5/17/08	TAO 2N 155W	Fishing	526	2	2	530	6	0	6	**530**
5/18/08	TAO 2N 155W	Fishing	77	5	1	83	6	0	6	**83**
5/19/08	TAO 2N 155W, north to 5N	Fishing Running N	11	2	0	13	0	0	0	**13**
5/20/08	TAO 5N 155W	Running N Fishing	135	1	7	143	0	0	0	**143**
5/21/08	TAO 5N 155W	Fishing	62	0	2	64	1	0	1	**64**
5/22/08	TAO 5N 155W	Fishing	32	2	5	39	0	0	0	**39**
5/23/08	TAO 5N 155W	Fishing Running south	0	1	0	1	0	0	0	**1**
5/24/08	TAO 2N 155W	Fishing	101	24	8	133	6	1	7	**133**
5/25/08	TAO 2N 155W north to 5N	Fishing running N	43	0	2	45	0	1	1	**45**
5/26/08	TAO 5N 155W	Running N Fishing	8	1	2	11	0	0	0	**11**

5/27/08	between 5N and 8N on 155W	Running N		-	-	-	-	-	-	-
5/28/08	TAO 8N 155W	Fishing	45	8	36	89	0	0	0	**89**
5/29/08	TAO 8N 155W	Fishing running N	0	0	1	1	0	0	0	**1**
5/30/08	S of Hawaii	Running N	-	-	-	-	-	-	-	-
5/31/08	S of Hawaii	Running N	-	-	-	-	-	-	-	-
6/1/08	NOAA 51002	Running N Fishing	7	0	4	11	2	1	3	**11**
6/2/08	S of Hawaii	Running N	-	-	-	-	-	-	-	-
6/3/08	S of Oahu Honolulu Harbor	Running N end cruise	-	-	-	-	-	-	-	-
	TOTALS		**1736**	**57**	**116**	**1909**	**45**	**5**	**50**	**1909**

FIGURES

Figure 1. *Double D* provisioning in Honolulu

Figure 2. Starboard stern working deck showing one mini-longine reel, one hydraulic trolling reel, a padded tagging mattress and tagging cradle.

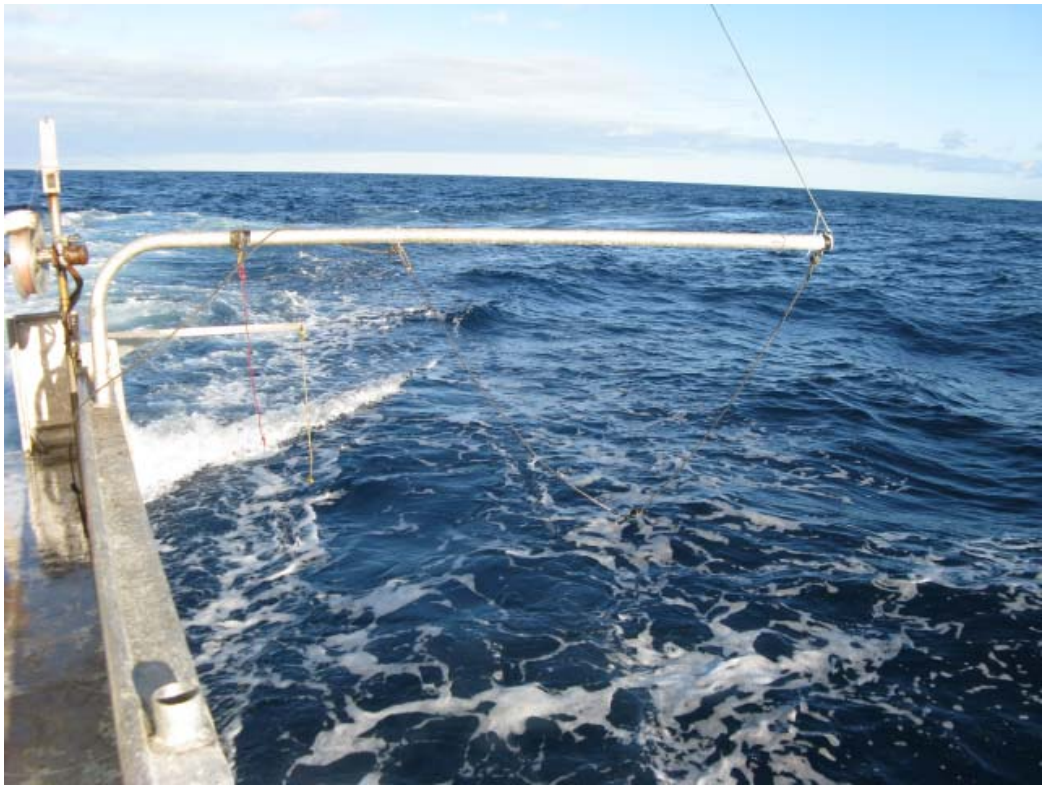


Figure 3. Two dangler poles rigged on the port stern.

Figure 4. Lai skin for lure making and a mix of troll and jigging lures.

Figure 5. Archival tagging cradle with a tagged bigeye

Figure 6. Conventional tagging cradle

Figure 7. Lifting sling for large tuna

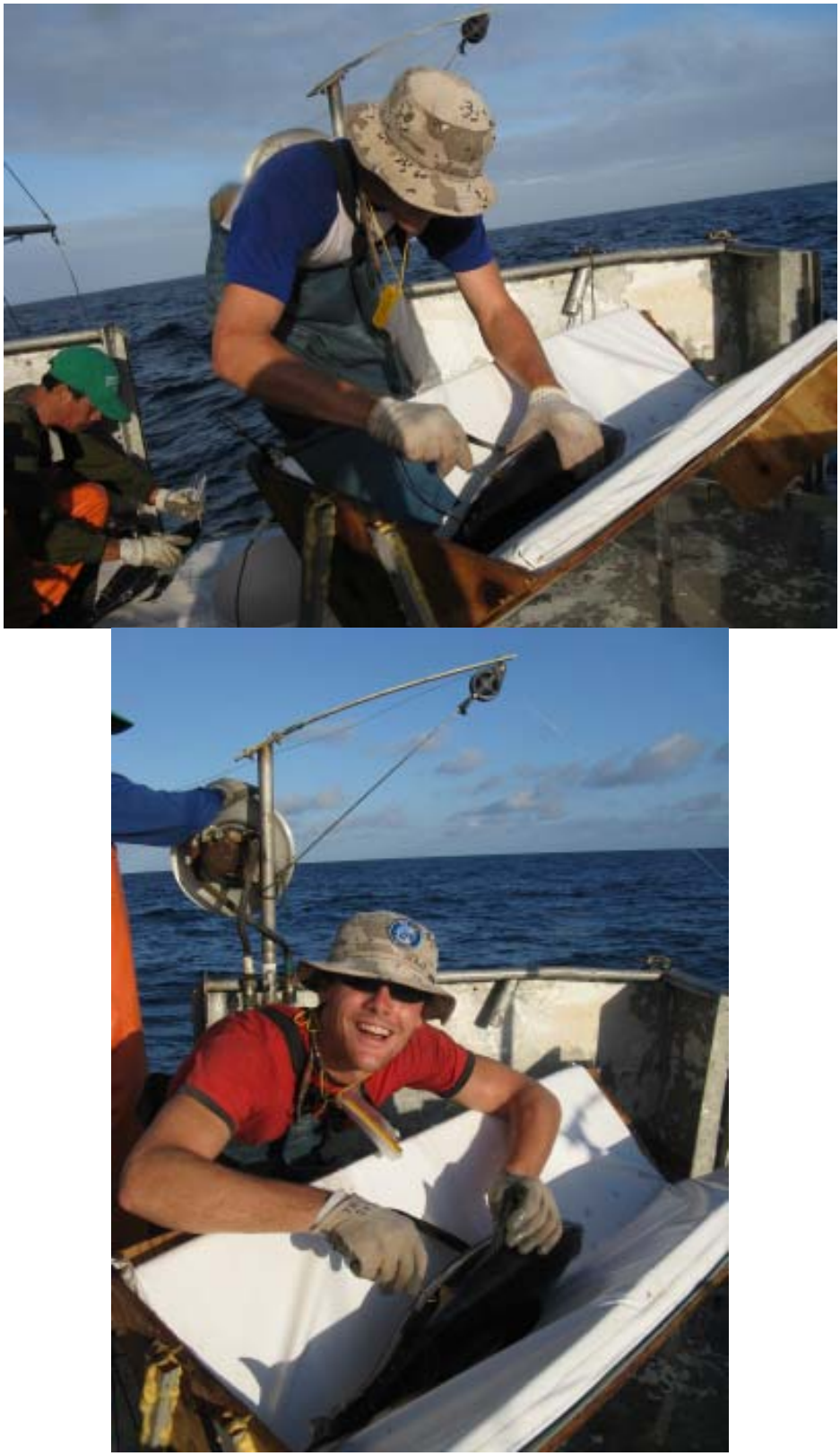


Figure 8. Happy tagger

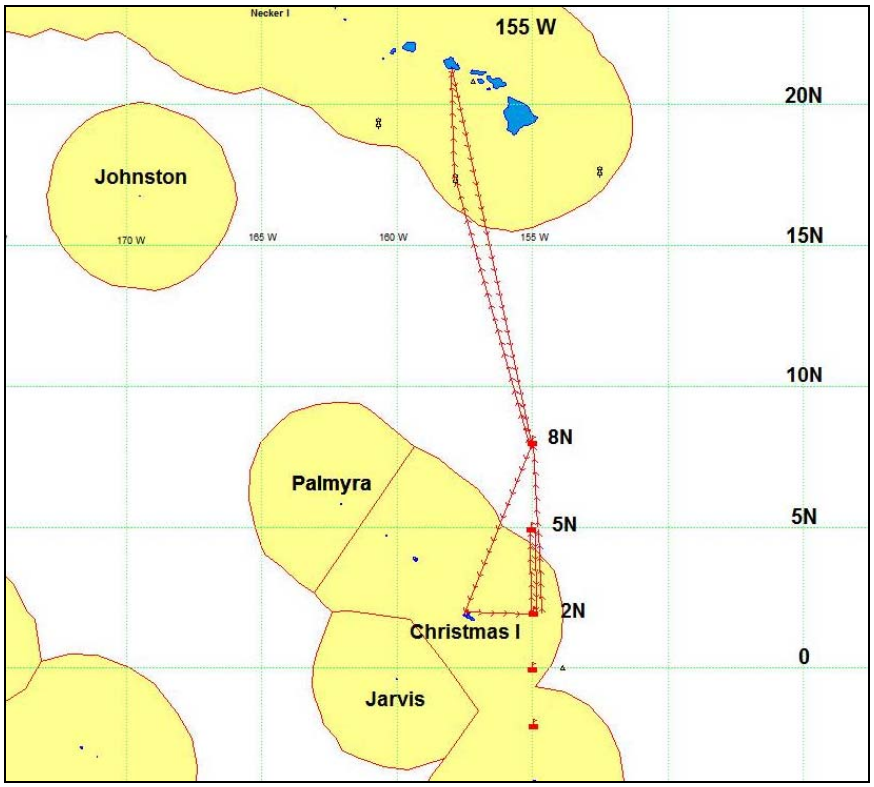


Figure 9. Cruise track during CP-01-08, May 5 - June 3, 2008

Figure 10. buoy at 5N, 155W with purse seine drifting FAD tied to it and a strobe light on the frame

Figure 11. Underside of drifting FAD showing attachment point for 20 m aggregator

Figure 12. Single frame image from digital video of purse seine vessel on TAO 5N 155W

Figure 13. Jiggy jiggy

Figure 14. Jigging squid for live bait

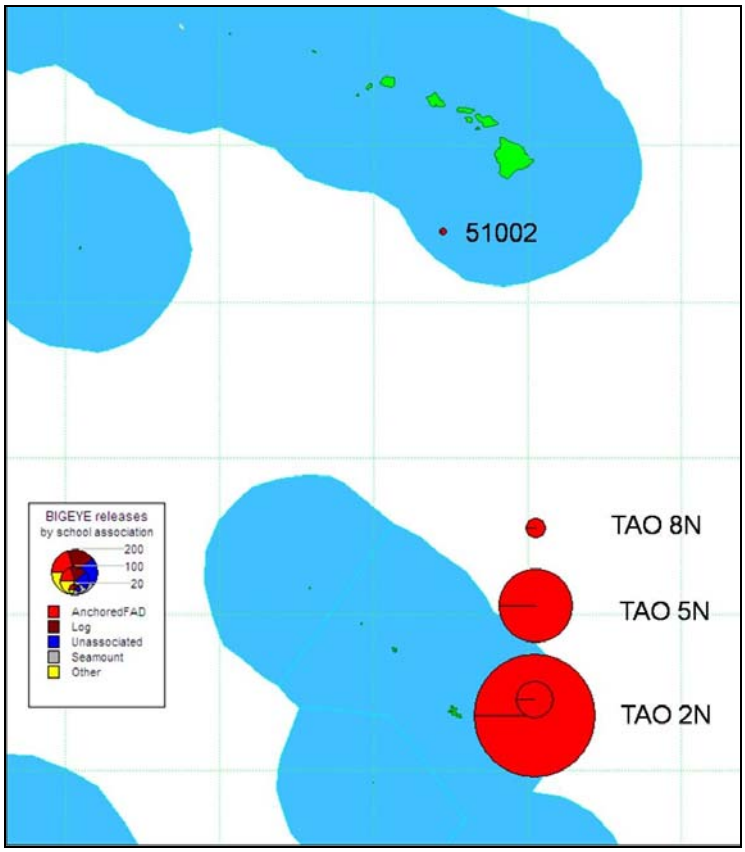
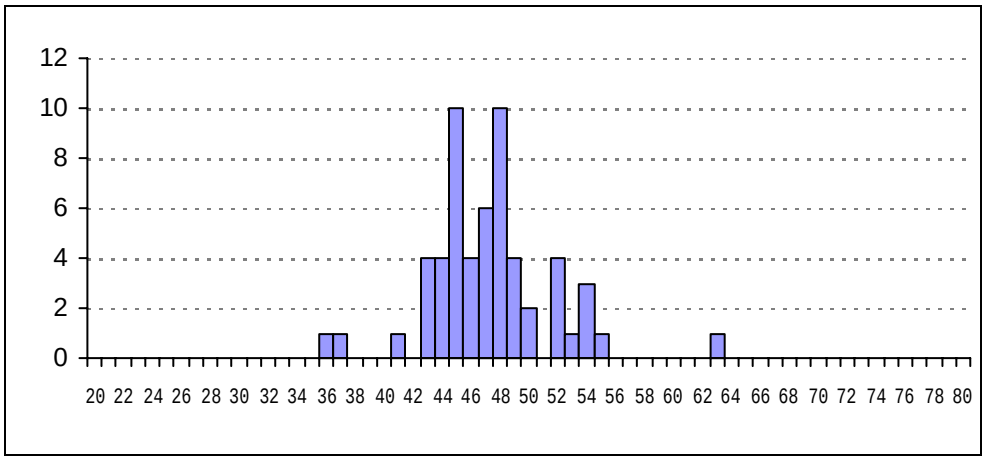


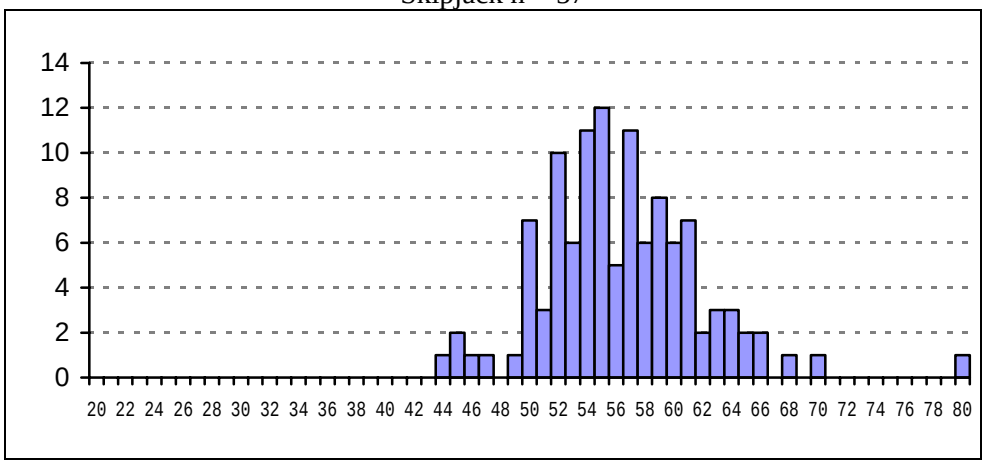
Figure 15. Distribution of Bigeye tag releases by buoy

Figure 16. Bigeye tuna tagged with MK9 archival tag

Figure 17. First recaptured bigeye for CP-01-08



Skipjack n = 57



Yellowfin n = 113

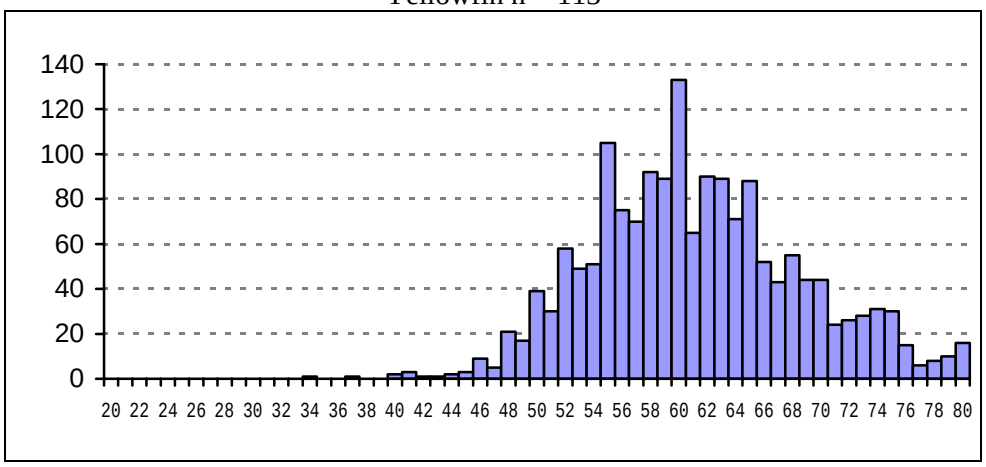


Figure 18. Size distribution of skipjack, yellowfin and bigeye tuna tagged during CP-01-08

Bigeye n = 1692

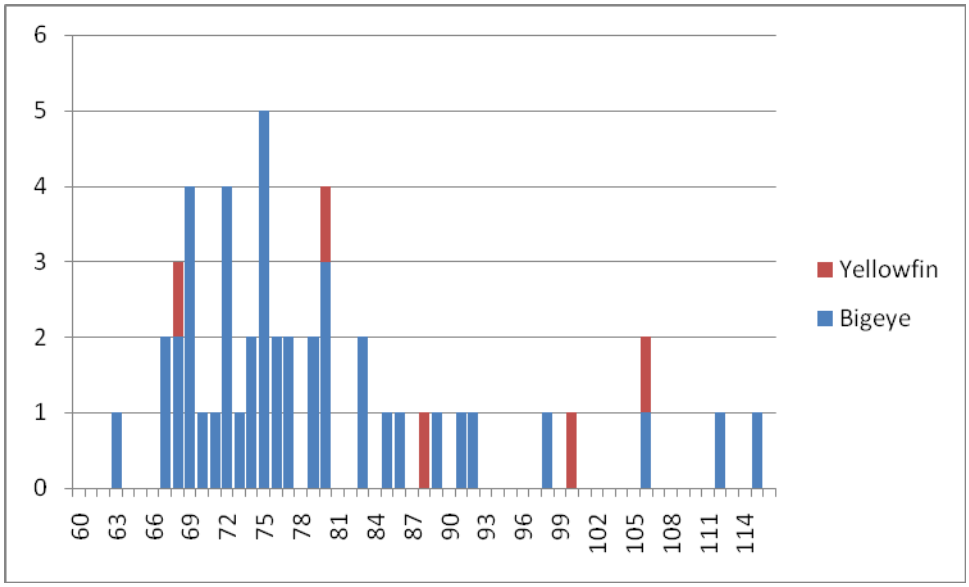


Figure 19. Size distribution of archival tag releases

Figure 20. Measuring tuna selected for otolith sampling

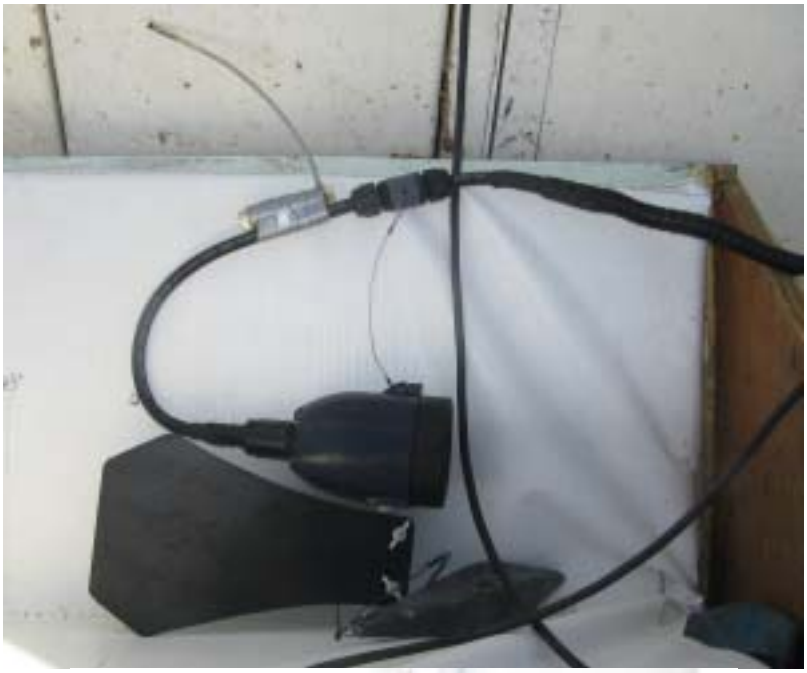


Figure 21. SPLASHCAM system showing video head, stabilizing fin and weight cabled to viewing and recording gear

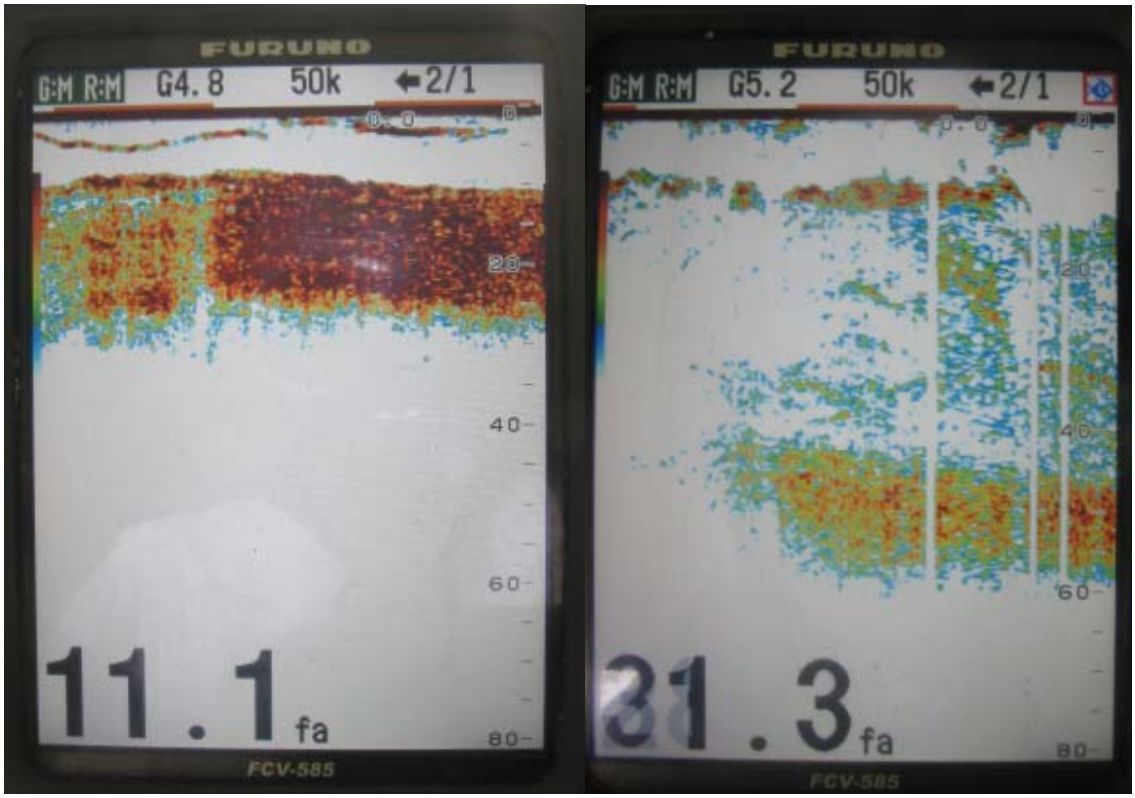


Figure 22. Echo sounder images of presumed tuna schools aggregated to TAO buoys (depths in fathoms)

Figure 23. Purse seine vessel Montelucia transhipping catch to the carrier Montesol off Christmas Island