Operational profile of a highliner in the American Samoa small-scale (*alia*) longline albacore fishery

J. John Kaneko and Paul K. Bartram
PacMar, Inc.
3615 Harding Avenue, Suite 409
Honolulu, Hawaii 96816

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ABSTRACT

The operations of a highliner in the American Samoa small-scale *alia* longline albacore fishery were evaluated by monitoring its fishing activity between October 2003 and September 2004. The fishing gear configuration, fishing practices, catch per unit effort, catch species composition, length and weight frequencies of the catch, and the percentage of live and dead fish at the time of retrieval were monitored during 159 commercial *alia* longline sets (trips) made during the study period. The length of the mainline and the number of hooks per set were greater during the study period than in earlier years. Our study found albacore catch rate to be low, but that is consistent with a decline in catch rates for the *alia* fishery (and for Samoa and the South Pacific albacore fisheries generally) in recent years. A greater percentage of albacore was retrieved alive in sets made during full moon periods than in sets made during new and half moon periods of the month. Recommendations are presented for increasing the percentage of live albacore viable for tagging studies.

Line hauling by hand on a small-scale alia albacore long-liner off American Samoa.

Data collectors from Pago Pago Village meet the alia longliner late at night to debrief the captain and collect data on the catch and the fishing operation.

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1. PROBLEM STATEMENT

The American Samoa small-scale *alia* longline albacore fishery is a relatively new fishery that experienced rapid growth since its beginning in 1995 through 2002. The horizontal longline fishing method was introduced to American Samoa fishermen by Eo Mokoma, who adapted techniques from fishermen in independent Samoa. *Alia* are twin-hulled boats originally built in Samoa and American Samoa for trolling and bottomfishing and now adapted to small-scale pelagic longlining. The majority of these small boats are approximately 28 to 34 ft in length and powered by outboard engines. Albacore tuna is targeted for sale to canneries in American Samoa.

Monitoring the fishery currently relies on federal logbooks for self-reporting of fishing activity and an offshore creel survey data collection system by the American Samoa Department of Marine and Wildlife Resources (DMWR). The small *alia* boats cannot accommodate fishery observers because of severe space limitations and safety considerations. The reliability of the logbook data has been questioned (WPRFMC, 2004) and there have been problems with delinquent filing of logbooks. The creel survey system also has difficulties in covering fishing boats as they often land at the docks late at night.

Operational characteristics of the *alia* are known from interviews with *alia* fishermen conducted in the early years of the fishery. Severance et al. (1999) interviewed *alia* fishermen in American Samoa and most descriptions of the *alia* longline fishery rely on this report. The *alia* longline fishery continues to evolve and research is needed to provide an updated profile of the *alia* sector. During the 2003-2004 research period, only highliners continued to operate because of low albacore catch rates. Therefore, unless there is reasonable similarity in fishing operations, the findings of the study should not be extrapolated to other *alia*.

The *alia* albacore longline fishery continues to be important to the development of local fishing capacity in American Samoa. It is conducted almost entirely by native fishermen and has provided opportunities for the development of a local fishing fleet that can participate in the tuna industry by supplying fish to the canneries in Pago Pago. Prior to the advent of the *alia* longline fishery, there was little opportunity for local fishermen and business people to exploit the local canneries as a basis for developing fishing businesses and creating jobs. Management efforts by the Western Pacific Regional Fisheries Management Council (WPRFMC) and the National Marine Fisheries Service (NOAA) have recognized the value of local participation in the fishery. A 50 nautical mile area around the islands was closed to vessels greater than 50 ft in length to protect and nurture the development of the *alia* longline fishery. The present research was conducted because the *alia* fishery is important to American Samoa, is not well documented, continues to evolve, and faces an uncertain future as catch rates have declined sharply in recent years.

2. OBJECTIVES

The project profiles the longline fishing practices and monitors the performance of a highliner (high producing *alia* with experienced captain and crew) in the American Samoa *alia* longline albacore fishery. The project does not supplant other on-going monitoring efforts, nor does it generate data that could be used for extrapolations to the rest of the fleet. Detailed information was collected on fishing gear configuration, fishing practices, details of the catch, discards and landings, and interactions with protected species.

Tagging studies are important for determining the distribution of fish stocks or sub-populations. Fish must be landed alive and viable to be tagged and released with a good chance of survival. Adult albacore are known to be fragile and the percentage of live fish retrieved on longline gear is low. One possible cause of the high mortality rate is the rupture of the swim bladder when albacore are hauled to the surface. The project applied local fishermen's knowledge of albacore behavior to evaluate the effect of the moon phase on the percentage of live albacore retrieved. Increasing the percentage of live viable albacore could increase the efficiency of tagging studies used to further evaluate South Pacific albacore and manage the fishery.

This study has three primary objectives.

1. Objective 1. To monitor the fishing activity of a highliner *alia* boat and develop a detailed profile of *alia* longline fishing operations.
   - Document the *alia* longline gear (gear configuration, number and type of hooks used, the type of bait, number of light sticks, etc.).
   - Document the *alia* longline fishing practices (location of sets, time of line setting, hook soak time, line retrieval, etc.).

2. Objective 2. To monitor and evaluate the catch of a highliner *alia* boat.
   - Document the *alia* longline catch (species composition, weight and length frequencies, and initial live/dead status of the catch).
   - Document bycatch and interactions (if any) with protected species (marine mammals, seabirds and sea turtles).

3. Objective 3. To explore ways to increase the catch of live albacore, that might be viable for future tagging studies.
   - Evaluate the albacore catch rate and percentage of albacore retrieved alive from sets made during full moon and new/half moon periods.
   - Make recommendations for a fishing protocol to increase the percentage of live albacore retrieved that might remain viable for tagging studies.

3. METHODS

3.1 Project Preparation and Organization

The project began with designing and organizing the data collection system. This included a user-friendly waterproof fish tally sheet for captains to use at sea and a trip data sheet for completion by data collectors while debriefing captains and evaluating the landings. Local coordination of the data collection system was facilitated through a data manager (Daiana Aitaoto, experienced with managing fishery data) who coordinated with an *alia* owner/manager (Eo Mokoma who pioneered the American Samoa *alia* longline fishery), and local village community leaders (Henry Sesepasara, former head of

American Samoa DMWR and others) who also helped oversee the data collectors recruited from the *aumaga* (untitled young men) of Pago Pago village. Each played an important role in helping the principal investigators (PIs) to ensure the performance of the *alia* captains and crew, and data collectors to collect quality data.

3.2 Training

The data collectors were trained to identify fish and protected species, measure fish fork length, and weigh fish using a hanging spring scale (Accu-weight, 300 lb capacity hanging scale). The crew of the contracted *alia* was trained on the global positioning system (waterproof handheld Garmin GPS 76) to determine where and when the line setting started and ended, and where and when the line hauling started and ended. The data collectors were trained to complete the trip data sheet using the GPS waypoints, the captain's fish tally sheet, and information derived by debriefing the captain and measuring the landed fish.

The *alia* owner/manager, captains and crew were trained to perform data collection at sea and reporting responsibilities on shore. They received training in identifying fish, marine mammals, sea turtles and seabirds. The captain was instructed to retain all fish caught, with the exception of sharks (too dangerous, not marketed or consumed) and any protected species. The catch remained the property of the boat owner.

The captains and crew were also trained on how to determine if fish were alive when hauled. Fish that were swimming or demonstrated movement on deck were considered alive, while those that did not were considered dead. For fish that may be released alive, it is also important to make a judgment of whether the animal is uninjured and may survive, or has experienced injuries that make survival unlikely after release. "Dead" as defined by the NOAA Fisheries Observer manual (NOAA, 2001), indicates that there is no visible muscular activity and the animal may be stiff or limp (pre-rigor). Fish hauled alive were identified by clipping the tip of the dorsal section of the caudal fin, and recorded on the fish tally sheet by the captain and the trip data sheet by the data collectors.

The *alia* owner/manager agreed to have his captain(s) participate in the project by 1) retaining the entire catch (with the exception of sharks and protected species), 2) maintaining a tally of the catch indicating the status of the fish when hauled (alive or dead), 3) being debriefed by the data collectors to provide detailed information on the day's fishing, 4) using a GPS to record information on the location of the set and, 5) allowing the data collectors to evaluate the retained catch by identifying the fish species and collecting weight and length data. The *alia* owner/manager gave permission to the PIs to report on the fishing activities and location of sets made by the contracted *alia*.

3.3 Data Collection Sequence

A schedule of *alia* fishing trips to be monitored was prepared each week and coordinated with the PIs in Honolulu, the *alia* owner/manager, and the project data manager in

American Samoa. The *alia* owner/manager notified the data manager of the weekly fishing schedule, when the *alia* was going to depart, and approximately when it would return from the fishing trip. The two data collectors were alerted to be prepared to meet the boat at the end of the trip. The *alia* fishing trips consisted of a single longline set. The vessel left the dock early in the morning and returned to port late at night.

The data collectors debriefed the captain while the fish were unloaded, transferred data from the fish tally sheet kept by the captain, and retrieved GPS waypoints for the day's fishing activity. The fish were then identified to species and round weights (lb) and fork lengths (cm) were recorded. The initial status (live or dead) of the fish was also recorded. Completed trip data sheets were then delivered to the data manager in Pago Pago the following day for review and entry into an Excel spreadsheet before being sent to the PIs in Honolulu.

3.4 Data Collection Instruments

The fish tally sheet (Appendix 1) was designed for the captains to take on the *alia* to record the details of the trip. The tally sheet was laminated to make it waterproof and enable captains to write with a grease pencil. The sheet was wiped clean before the next trip. The fish tally sheet contains photographs and the common and Samoan names of the pelagic fish, marine mammals, and sea turtles that might be encountered.

The trip data sheet (Appendix 2) included information on the set, length of mainline, number of hooks set, number of hooks between floats, the type of hooks used, the number of hooks lost, the type of bait and whether lightsticks were used. GPS readings were used to determine the timing and location of the set. The number and species of fish caught, the live/dead status of the fish, and any fish releases or interactions with protected species were determined using the fish tally sheet and by debriefing the captain.

3.5 Data Quality Control

After the data collection began, the PIs monitored activities during the initial fishing trips and periodically during the study period. One of the PIs went on two fishing trips to give the captain and crew additional hands-on training and four other trips during the study to observe and verify fishing operations. The data collection system was further monitored by following the sequence of activities from the notification of the data manager about an *alia* trip; data collectors meeting the boat, debriefing the captain and collecting data; and delivery to the data manager. As an additional quality control measure, one of the village community leaders assisting the project team went on a fishing trip to observe the *alia* crew and captain during the fishing operations and verify their performance of data collection and reporting responsibilities.

The data manager checked the trip data sheets for incomplete records before data entry. She contacted the data collectors for clarification or alerted the PIs to potentially questionable data issues for them to resolve. After the original trip data sheets were sent to Honolulu, the PI's checked the accuracy of the data entered against the trip data sheets once again. Any questions about the data sets were sent to the data manager who followed up with the data collectors, *alia* owner/manager, and captain and crew for clarification.

3.6 Evaluating Factors that Might Increase the Percentage of Live Albacore

Eo Mokoma, an *alia* owner/manager and expert fisherman, was asked to make observations and suggestions on factors affecting whether albacore are hauled alive or dead or dying on the line. He and his captains worked with the PIs to develop recommendations for fishing strategies to retrieve a greater percentage of live albacore, viable for tagging studies.

It was theorized that albacore may be found in more shallow water depths during the full moon and that fish are more likely to die on the line when soak times are extended. It was also theorized that fish are more likely to be mortally injured by rupture of the swim bladder when line hauling is rapid. The relationship between the moon phase and percentage of live albacore caught during monitored longline sets was evaluated. The full moon phase was defined as the 10-day period beginning four days before the full moon and ending five days after the full moon. Each monitored longline set was designated as either a "full moon" or "new/half moon" set. A comparison was made of albacore catch per unit effort (CPUE) and percentage of live albacore during sets made within and outside of the full moon period.

4. RESULTS

4.1 *Alia* Trips and Sets Made During the Study Period

The contracted *alia* set a total of 65,436 hooks in 159 longline sets during the monitoring period between October 2003 and September 2004 (Table 1). During the same period, a total of 170,065 hooks were set and 623 longline sets were made by the *alia* fleet and reported to DMWR. A total of 539 trips were reported by the *alia* fleet indicating that some of the boats made more than one set per trip. The contracted *alia* made single-day, single-set trips during the study which typify its normal operations and that of other *alia* of its size.

Table 1. The American Samoa small-scale (*alia*) longline albacore fishery activity between October 2003 and September 2004 (source: DMWR).

	***Alia* fleet activity**	**Contracted *alia***
Number of trips	539	159
Number of sets	623	159
Number of hooks set	170,065	65,436

4.2 *Alia* Fishery Activity by Month During the Study Period

The number of *alia* reporting fishing trips to DMWR by month during the study period ranged from 3-10 trips (Figure 1). The total number of sets by the month reported by the *alia* fleet ranged from 26-101 sets (Figure 2). During this period, the contracted *alia* conducted from 9-19 trips (and sets) per month. The number of hooks set per month by the *alia* fleet and reported to DMWR ranged from a low of 6,000 in January 2004 to a high of 26,450 in October 2003 (Figure 3). The contracted *alia* set from 4,356 to 7,384 hooks per month during this period.

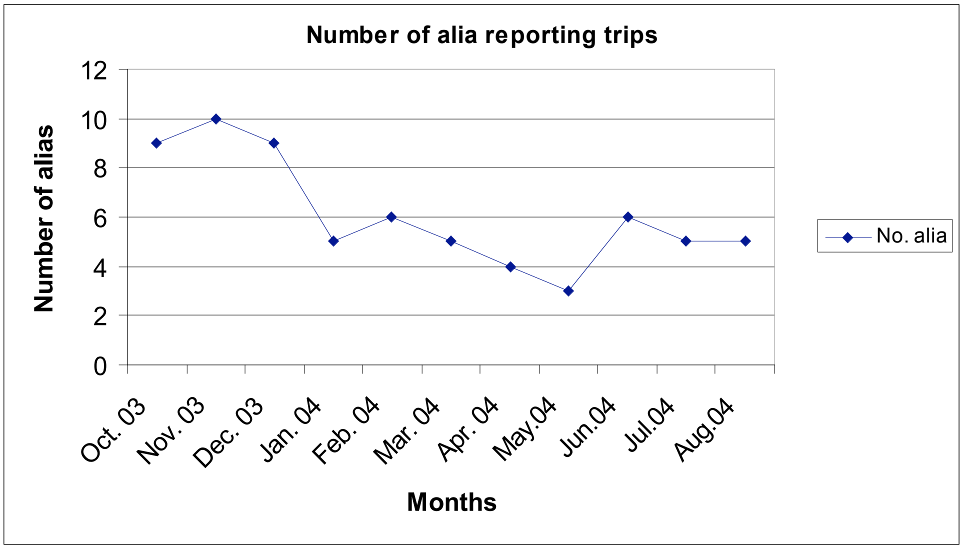


Figure 1. Number of *alia* reporting trips in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (source: DMWR).

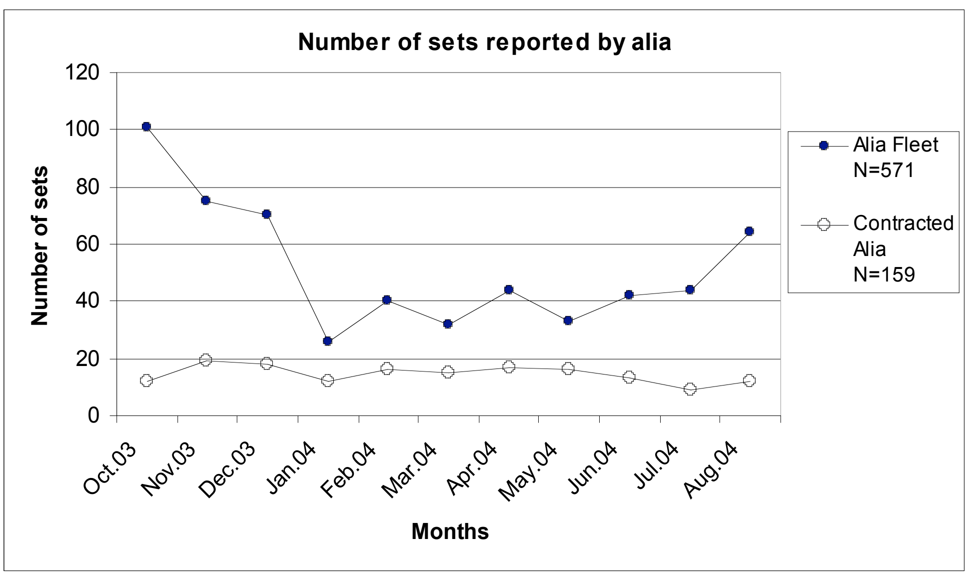


Figure 2. Number of sets reported in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (source: DMWR *alia* fleet data include the sets made by the contracted *alia*).

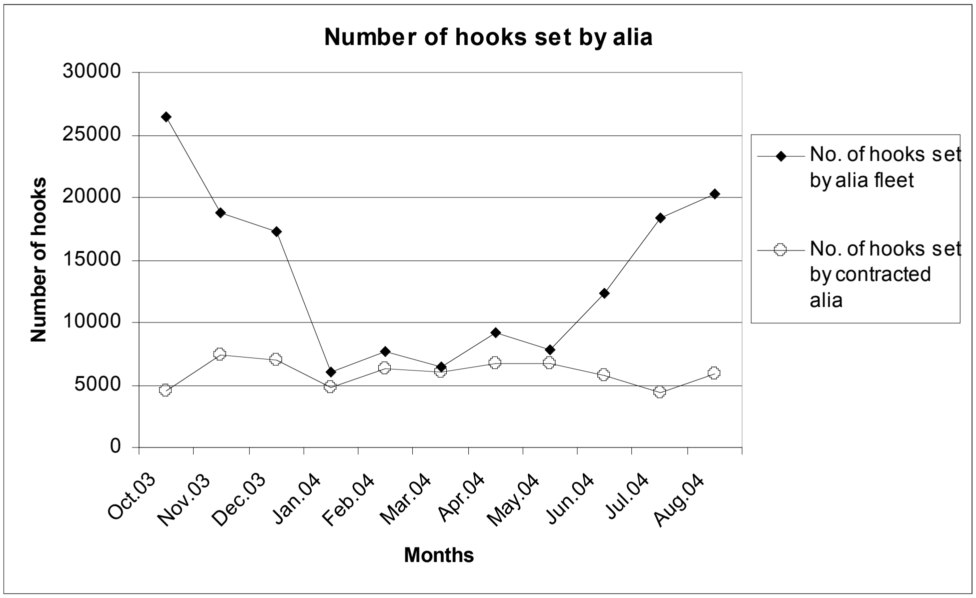


Figure 3. Number of hooks set in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (source: DMWR alia fleet data include the hooks set by the contracted alia).

4.3 Gear Configuration of the Contracted *Alia*

Details of the gear configuration of the contracted *alia* are given in Table 2. The mean length of mainline was 10 miles, the mean number of hooks per set was 412 (range 315 to 500 hooks per set), and the mean number of hooks between floats was 31. The contracted *alia* used 14/0 and 15/0 circle hooks with pilchards for bait but did not use any lightsticks. The gear configuration used by the contracted *alia* has changed slightly since 2001 when the owner/manager of this and other *alia* was interviewed (Aitaoto, 2001). In 2001, these *alia* (28 to 31 ft length) set 3 to 5 miles of mainline with 200 to 400 hooks. The number of hooks between floats was 30 and 15/0 circle hooks were used.

Table 2. Gear configuration of a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

Mean length of mainline(miles)	10
Mean number of hooks per set	412
Mean number of hooks between floats	31
Mean number of lightsticks	0
Number of sets	159
Type of hooks	14/0, 15/0 circle
Type of bait	pilchards

4.4 Fishing Practices of the Contracted *Alia*

The sequence of setting and hauling longline gear by the contracted *alia* during the 159 monitored sets is summarized in Table 3. Line setting began on average at 6:13 a.m. and was completed by 7:29 a.m. The mean line soak time was 9 hr 20 min after which hauling began on average at 4:49 p.m. Hauling was completed by 8:54 p.m. after approximately 4 hr 5 min. During the 159 sets, the mean number of hooks lost was 8.8 per set. During two of the sets, the majority of the mainline was lost during line hauling and only a small fraction of the hooks were retrieved. The lost longline gear was recovered the following day using the GPS settings. The hooks lost during these sets contributed substantially to the mean number of hooks lost per set (4.3 hooks lost per set) so that the adjusted mean (without these two sets) is closer to 4.5 hooks lost per set.

Table 3. Fishing practices of a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

Mean Time Setting Started	06:13
Mean time Setting Completed	07:29
Mean Soak Time (from end of setting to start of hauling)	9hr 20min
Mean Time Hauling Started	16:49
Mean Time Hauling Completed	20:54
Mean Number of Hooks Lost per Set	8.8
Number of Sets (by contracted alia)	159

4.5 Location of the Sets Made by the Contracted *Alia*

The GPS waypoints for all 159 sets made by the contracted *alia* confirmed that all sets were made within 32.4 nm (60 km) of Pago Pago harbor, concentrated off the southwest coast of the Island of Tutuila. All sets occurred within the 50 nm zone around the islands that is closed to vessels >50 ft hull length.

4.6 Catch Composition of the Contracted *Alia*

The total catch of 1,220 fish made by the contracted *alia* during the 159 sets is described in Table 4 by species, numbers of fish caught, the round weight (lb) of fish caught, and the numbers and weights of fish retained. The top five species caught were in descending order, albacore tuna (595), yellowfin tuna (359), skipjack tuna (74), mahimahi (57) and wahoo (50). Only 27 bigeye tuna were caught during the project period. Kawakawa, black marlin, sailfish, spearfish, oceanic whitetip shark, thresher shark, dogtooth tuna, lancetfish, snake mackerel, and pelagic stingray were not caught during this study. Catch composition by weight was 52.4% albacore tuna, 31.4% yellowfin, 3.7% bigeye tuna, 3.2% mahimahi, 2.8% wahoo and 2.4% skipjack tuna with the balance of the catch (4.1%) made up of mixed pelagic species. The mean round weights of both albacore and yellowfin were close to 40 lb. The mean weight of skipjack tuna was approximately 14 lb. The mean weights of mahimahi and wahoo were approximately 26 lb. The bigeye tuna caught during the study had an average weight of about 63 lb. Mahimahi and wahoo had average weights of slightly under 26 lb. Blue marlins averaged 75 lb in weight and the striped marlins were larger at 99 lb. Shark weights were not measured because these fish were not retained.

Table 4. Catch composition of a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (based on 159 sets).

Species	No. Fish	Weight (lb)	Mean Weight (lb)	No. Kept	Weight Kept (lb)
Albacore tuna[1]	595	23,791	39.9	595	23,791
Yellowfin tuna	359	14,268	39.7	359	14,268
Bigeye tuna	27	1,707	63.2	27	1,707
Skipjack tuna	74	1,058	14.3	74	1,058
Kawakawa	0	0	0	0	0
Tunas Subtotal	**1,055**	**40,824**		**1,055**	**40,824**
Mahimahi	57	1470	25.8	57	1470
Wahoo	50	1284	25.7	50	1284
Swordfish	1	105	105	1	105
Blue marlin	10	753	75.3	10	753
Black marlin	0	0	0	0	0
Striped marlin	2	198	99	2	198
Sailfish	0	0	0	0	0
Spearfish	0	0	0	0	0
Ocean white tip shark	0	0	0	0	0
Blue shark	3	NW[2]	NW	0	
Shortfin mako shark	10	NW	NW	0	
Longfin mako shark	5	NW	NW	0	
Thresher shark	0	0	0	0	0
Dogtooth tuna	0	0	0	0	0
Other PPMUS Subtotal	**138**	**3,810**		**120**	**3,810**
Great barracuda	15	271	18.1	15	271
Rainbow runner	1	5	5	1	5
Moonfish	3	314	104.7	3	314
Oilfish	0	0	0	0	0
Pomfret	8	161	20.2	8	161
Lancetfish	0	0	0	0	0
Snake mackerel	0	0	0	0	0
Pelagic stingray	0	0	0	0	0
Misc. Subtotal	**27**	**751**		**27**	**751**
TOTAL PELAGICS	**1,220**	**45,385**		**1,202**	**45,385**

[1] Includes one albacore that was mostly eaten by sharks, for which the mean albacore weight based on 594 whole albacore retrieved was assigned.
[2] NW = not weighed or measured.

The contracted *alia* retained all fish caught, with the exception of the 18 sharks. All other fish were retained, as is the standard practice of the *alia* owner, captain, and crew. Bycatch, defined as fishery waste after Hall (1996) was minimal in this fishing operation.

4.7 Catch Per Unit Effort (CPUE) for the Contracted *Alia*

The combined catch per unit effort for the 159 sets made by the contracted *alia* was 18.81 fish per 1,000 hooks and 700.9 lb of mixed pelagic fish per 1,000 hooks (Table 5). CPUE values were calculated based on the number of hooks retrieved. This is a substantial decrease in overall CPUE in the *alia* fishery compared to 2002 and 2003, when mixed species CPUE was estimated as 37.3 to 45.4 fish per 1,000 hooks

(WPRFMC, 2004). This decline may be a result of the above average sea surface water temperatures and weaker current and eddy features in the vicinity of Samoa and American Samoa which prevailed during the study period (Langley, 2004).

Table 5. Catch per unit effort (per 1,000 hooks) of a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (based on 64,748 hooks retrieved n 159 sets).

Species	No. fish per 1,000 hooks	Wt. fish per 1,000 hooks
Albacore tuna	9.18	367.4
Yellowfin tuna	5.54	220.4
Bigeye tuna	0.42	26.4
Skipjack tuna	1.14	16.3
TUNAS SUBTOTAL	**16.28**	**630.5**
Mahimahi	0.88	22.7
Wahoo	0.77	19.8
Swordfish	0.02	1.6
Blue marlin	0.15	11.6
Striped marlin	0.03	3.1
Blue shark	0.05	NW[1]
Shortfin mako shark	0.15	NW
Longfin mako shark	0.06	NW
Other PPMUS SUBTOTAL	**2.11**	**58.8**
Great barracuda	0.23	4.2
Rainbow runner	0.02	0.1
Moonfish	0.05	4.8
Pomfret	0.12	2.5
MISC. SUBTOTAL	**0.42**	**11.6**
TOTAL PELAGICS	**18.81**	**700.9**

[1] NW = not weighed, CPUE by weight does not include sharks.

The mean albacore CPUE was 9.18 fish per 1,000 hooks (Table 5). This represents a sharp decline from 2003 when CPUE is reported to have ranged from 18.9 to 20.6 fish per 1,000 hooks based on logbook and creel survey data collection systems (WPRFMC, 2004). The monthly CPUE for albacore in the present study ranged from 4.7 to 16.1 albacore per 1,000 hooks (Figure 4). The low catch rate of the target species is likely the main reason for the drop in the number of boats, the number of sets and the number of hooks deployed by the *alia* fleet during the project period.

The mean yellowfin tuna CPUE was 5.54 fish per 1,000 hooks during the study period (Table 5). This is a decline from estimates in 2002 and 2003 that ranged from 7.0 to 10.7 yellowfin per 1,000 hooks based on logbook and creel survey data collection systems (WPRFMC, 2004). The monthly CPUE for yellowfin varied widely from none caught in February 2004 to 22.3 yellowfin per 1,000 hooks in July 2004 (Figure 5).

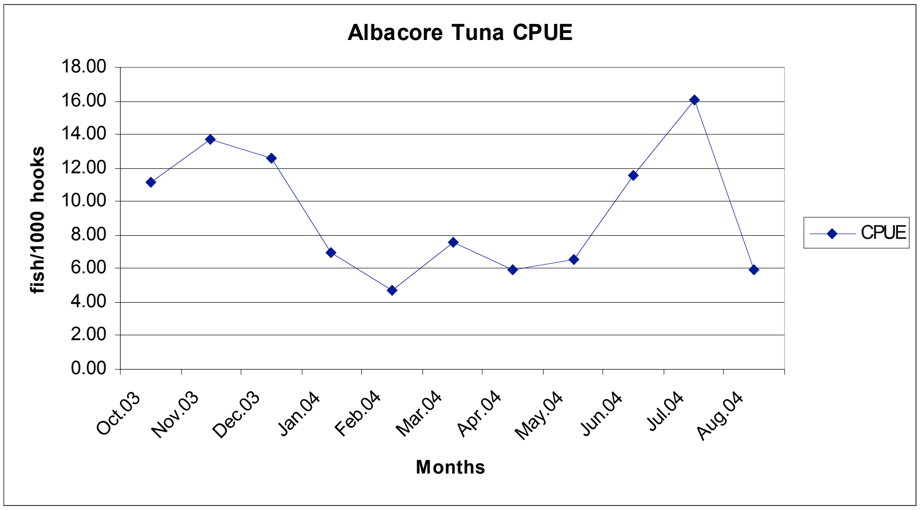


Figure 4. Albacore tuna catch per unit effort (fish/1,000 hooks) by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 by month (based on 64,748 hooks retrieved in 159 sets).

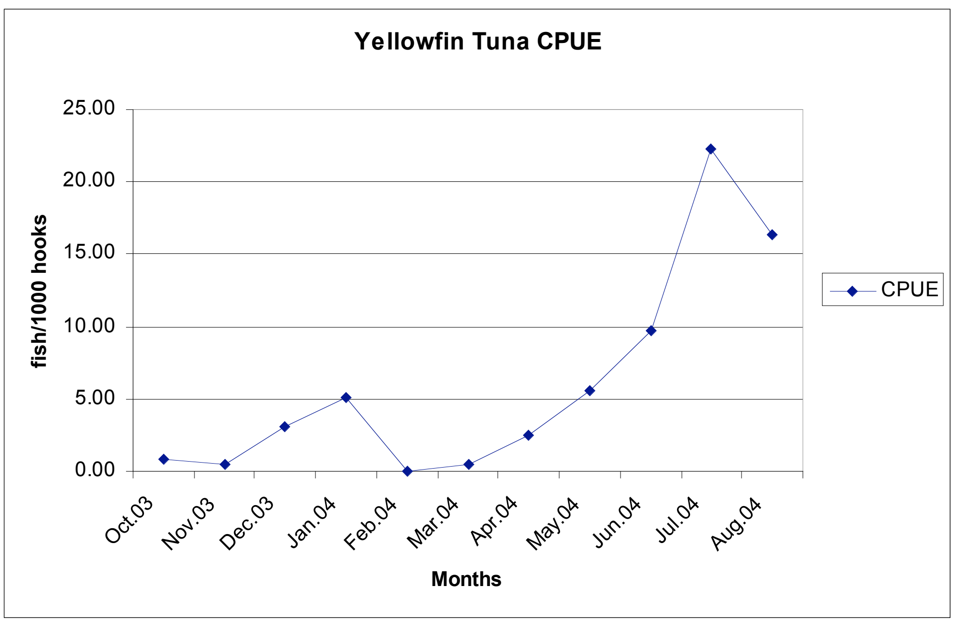


Figure 5. Yellowfin tuna catch per unit effort (fish/1,000 hooks) by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 by month (based on 64,748 hooks retrieved in 159 sets).

The mean bigeye tuna CPUE was 0.42 fish per 1,000 hooks during the study (Table 5), slightly below the reported range of CPUE of 0.46 to 1.17 fish per 1,000 hooks derived from logbook and creel survey data collection systems during 2002 and 2003 (WPRFMC, 2004). The monthly bigeye tuna catch ranged from 0 to 0.92 fish per 1,000 hooks (Figure 6).

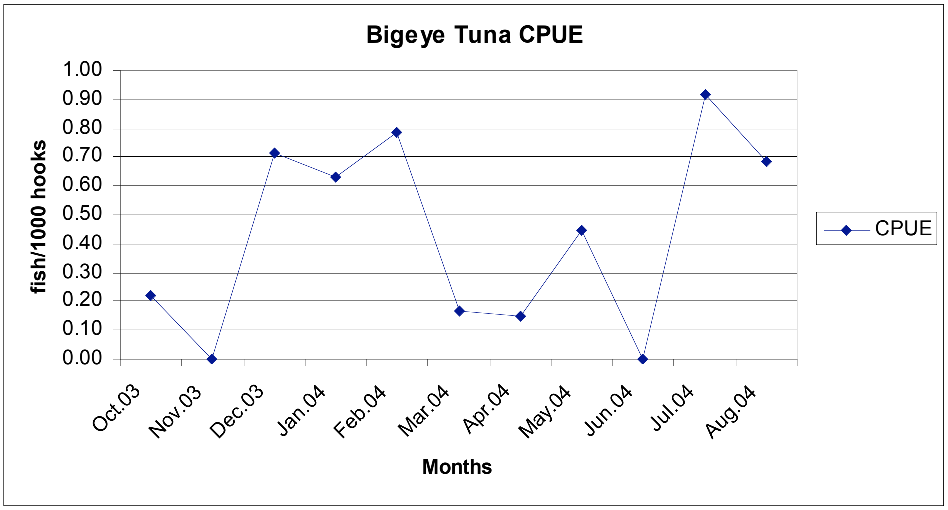


Figure 6. Bigeye tuna catch per unit effort (fish/1,000 hooks) by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 by month (based on 64,748 hooks retrieved in 159 sets).

The mean skipjack CPUE was 1.14 fish per 1,000 hooks during the study (Table 5). This is considerably lower than catch rates reported for the *alia* fleet in 2002 and 2003 when skipjack CPUE ranged from 3.92 to 7.31 skipjack per 1,000 hooks according to estimates made using logbook and creel survey data systems (WPRFMC, 2004). The monthly skipjack catch rate ranged from 0 to 4.82 fish per 1,000 hooks during the study (Figure 7).

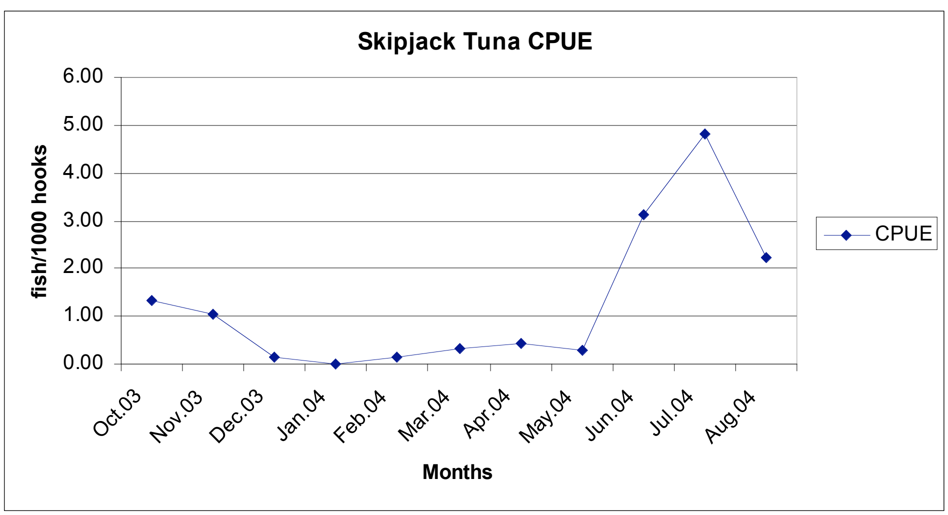


Figure 7. Skipjack tuna catch per unit effort (fish/1000 hooks) by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 by month (based on 64,748 hooks retrieved in 159 sets).

The mean mahimahi CPUE was 0.88 fish per 1,000 hooks during the study period (Table 5). This is a substantial decline from estimates in 2002 and 2003 that ranged from 2.97 to 4.47 mahimahi per 1,000 hooks based on logbook and creel survey data collection systems (WPRFMC, 2004). The monthly CPUE for mahimahi varied widely from a low of 0.17 to 2.42 per 1,000 hooks (Figure 8).

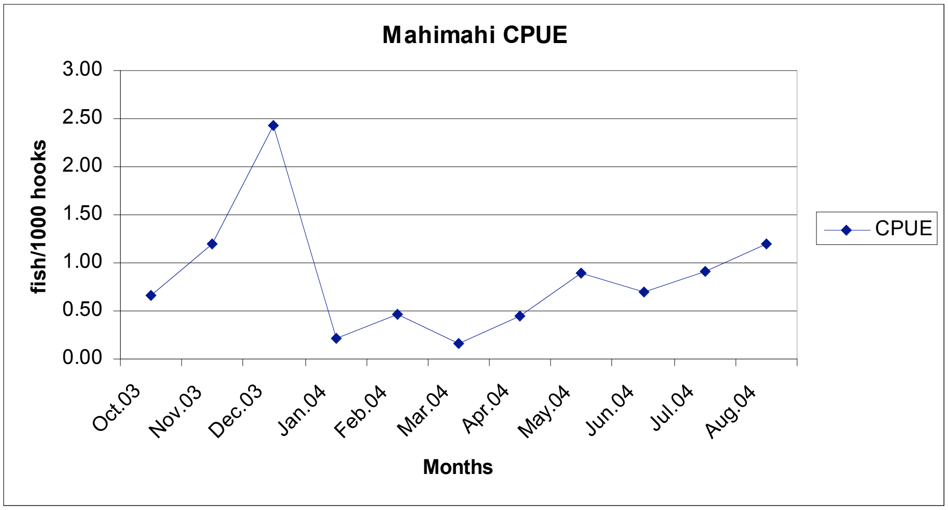


Figure 8. Mahimahi catch per unit effort (fish/1000 hooks) by a highliner in the American Samoa small-scale longline (*alia*) albacore fishery between October 2003 and September 2004 by month (based on 64,748 hooks retrieved in 159 sets).

The mean wahoo CPUE was 0.77 fish per 1,000 hooks during the study period (Table 5). This is a large decrease from *alia* fleet estimates in 2002 and 2003 that ranged from 2.37 to 2.99 wahoo per 1,000 hooks based on logbook and creel survey data collection systems (WPRFMC, 2004). The monthly CPUE for wahoo ranged from 0 to 2.39 fish per 1,000 hooks (Figure 9).

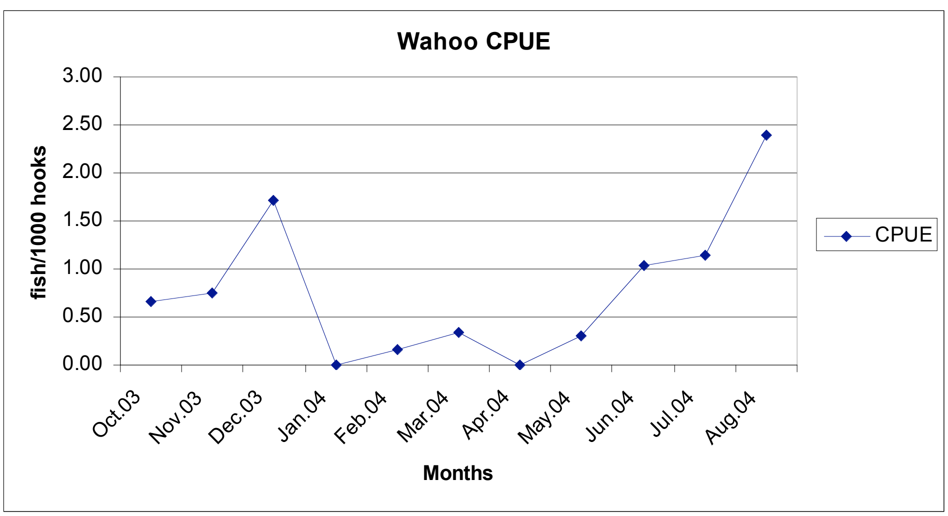


Figure 9. Wahoo catch per unit effort (fish/1000 hooks) by a highliner in the American Samoa small-scale longline (*alia*) albacore fishery between October 2003 and September 2004 by month (based on 64,748 hooks retrieved in 159 sets).

The mean blue marlin CPUE was 0.15 fish per 1,000 hooks during the study period (Table 5). Blue marlin CPUE estimates in 2002 and 2003 for the *alia* fleet ranged from 0.13 to 0.35 fish per 1,000 hooks based on logbook and creel survey data collection systems (WPRFMC, 2004). The monthly CPUE for blue marlin varied from 0 to 0.42 fish per 1,000 hooks (Figure 10).

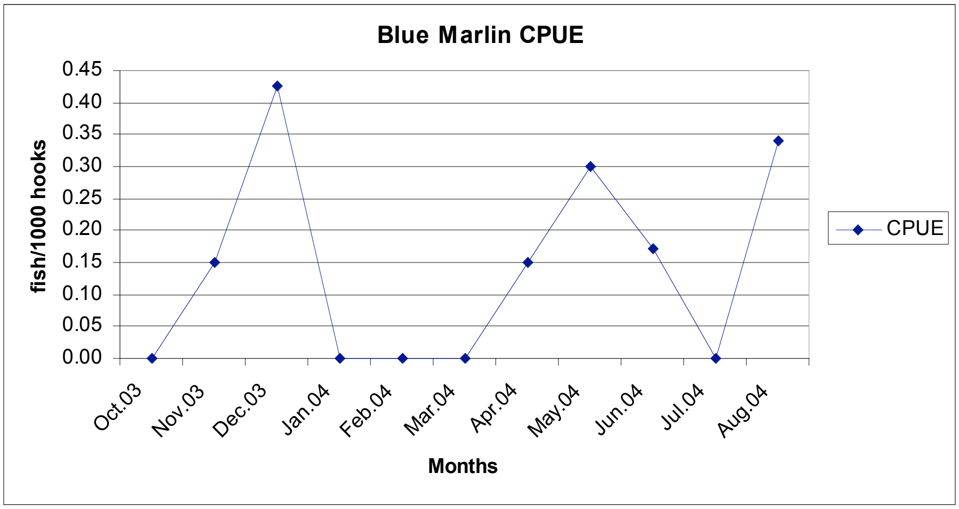


Figure 10. Blue marlin catch per unit effort (fish/1,000 hooks) by a highliner in the American Samoa small-scale longline (*alia*) albacore fishery between October 2003 and September 2004 by month (based on 64,748 hooks retrieved in 159 sets).

4.8 Fish Size Frequencies

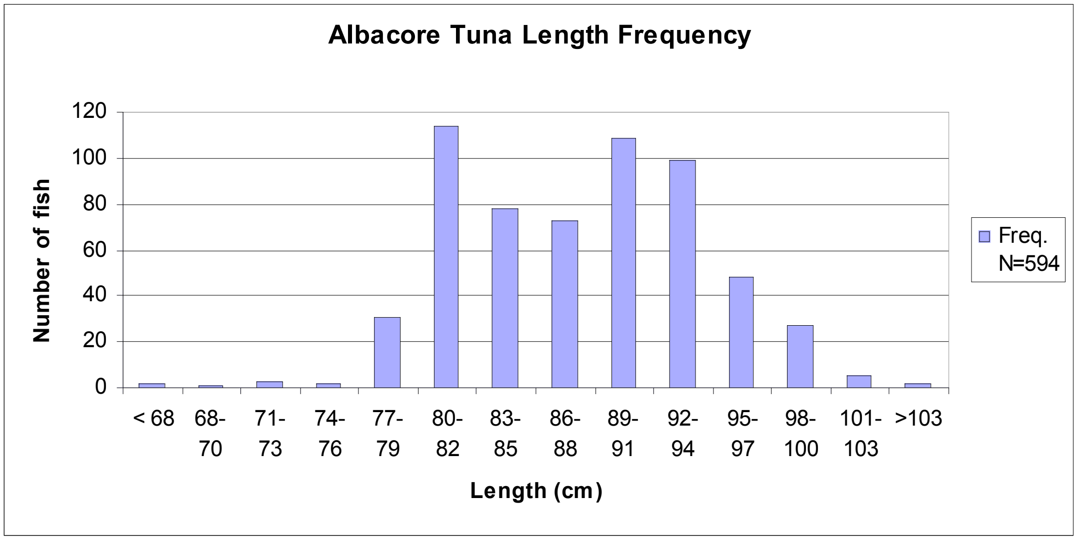
The mean round weights (lb) and fork lengths (cm) of the catch are presented in Table 6 for each of the species caught during this study.

The mean weight of the 594 whole albacore retrieved during this study was 39.9 lb (18.14 kg) (Table 6). This represents a decline in mean fish weight from 2000 to 2002 when the mean albacore weights ranged from 44.8 to 45.5 lb (WPRFMC, 2004). In 2003, the reported mean weight of albacore dropped to 38.6 lb. The weight and length frequencies for albacore caught in this study are given in Figure 11.

Table 6. Length and weight of the catch produced by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (based on 64,748 hooks retrieved in 159 sets).

Species	N	Mean length (cm)	Mean Weight (lb)
Albacore tuna[1]	594	87.8	39.9
Yellowfin tuna	359	94.6	39.7
Bigeye tuna	27	102.3	63.2
Skipjack tuna	74	61.3	14.3
TUNAS SUBTOTAL	**1054**		
Mahimahi	57	106.8	25.8
Wahoo	50	112.5	25.7
Swordfish	1	150	105
Blue marlin	10	142	75.3
Striped marlin	2	170	99
Blue shark	3	NW[2]	NW
Shortfin mako shark	10	NW	NW
Longfin mako shark	5	NW	NW
OTHER PPMUS SUBTOTAL	**138**		
Great barracuda	15	81.7	18.1
Rainbow runner	1	62	5
Moonfish	3	112.7	104.7
Pomfret	8	63	20.1
MISC SUBTOTAL	**27**		
TOTAL PELAGICS	**1219**		

[1] One albacore was retrieved that had been mostly eaten by sharks and was not used in the determination of mean weight and length, but was used in the CPUE calculations.
[2] NW = not weighed or retained.



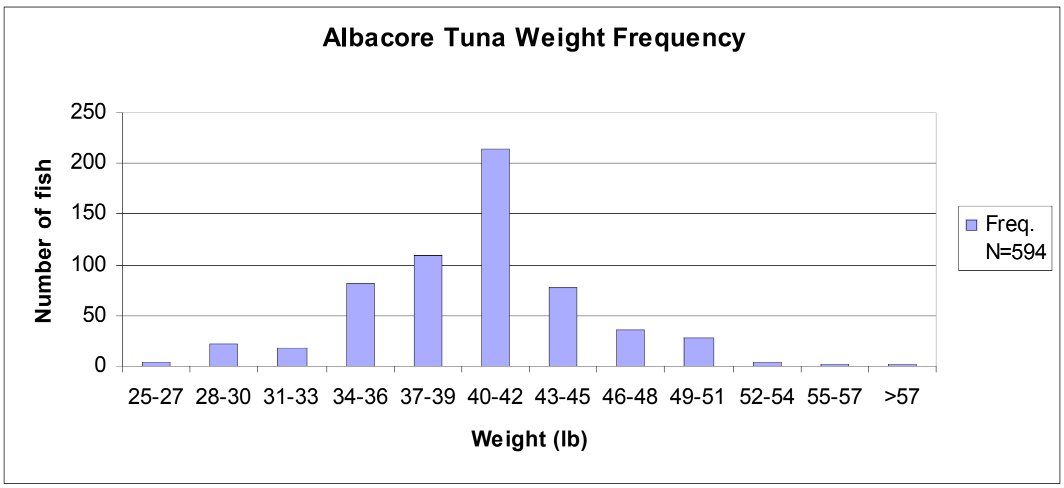
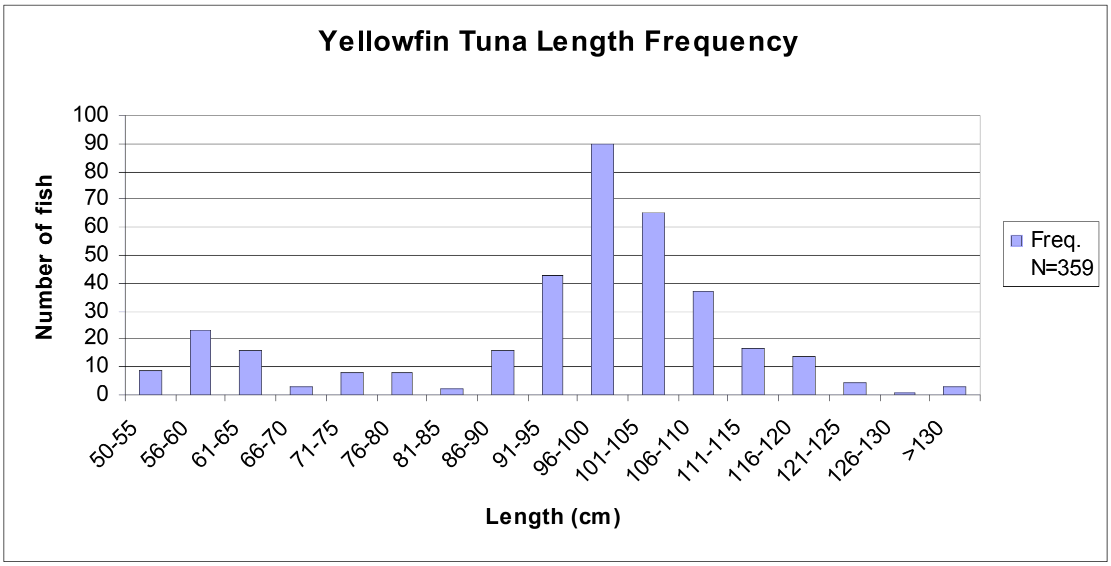


Figure 11. Size frequency of albacore tuna caught by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

The mean weight of the 359 yellowfin tuna retrieved during this study was 39.7 lb (18.05 kg) (Table 6). This represents a slight increase in mean fish weight in comparison with the period from 2000 to 2003 when the mean yellowfin tuna weights ranged from 17.8 to 38.1 lb (WPRFMC, 2004). The weight and length frequencies for yellowfin tuna caught in this study are given in Figure 12.



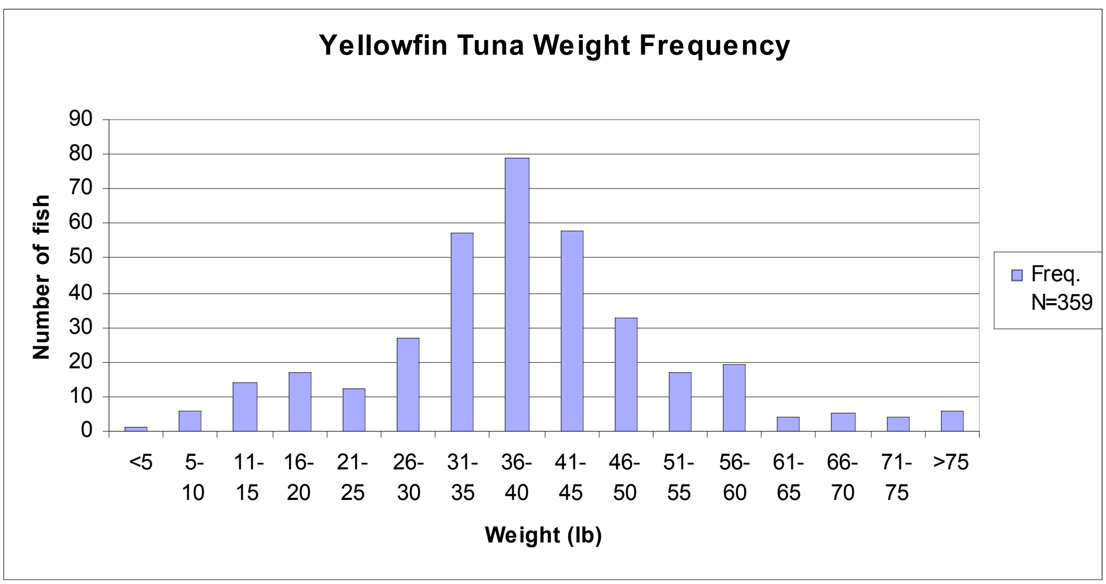


Figure 12. Size frequency of yellowfin tuna caught by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

The mean weight of the 27 bigeye tuna caught during this study was 63.2 lb (28.73 kg) (Table 6). The mean weight of bigeye tuna ranged from 61.1 to 69.2 lb during the period from 2000 to 2002 (WPRFMC, 2004), however the mean weight dropped to 37.2 lb in 2003. The weight and length frequencies for bigeye tuna caught in this study are given in Figure 13.

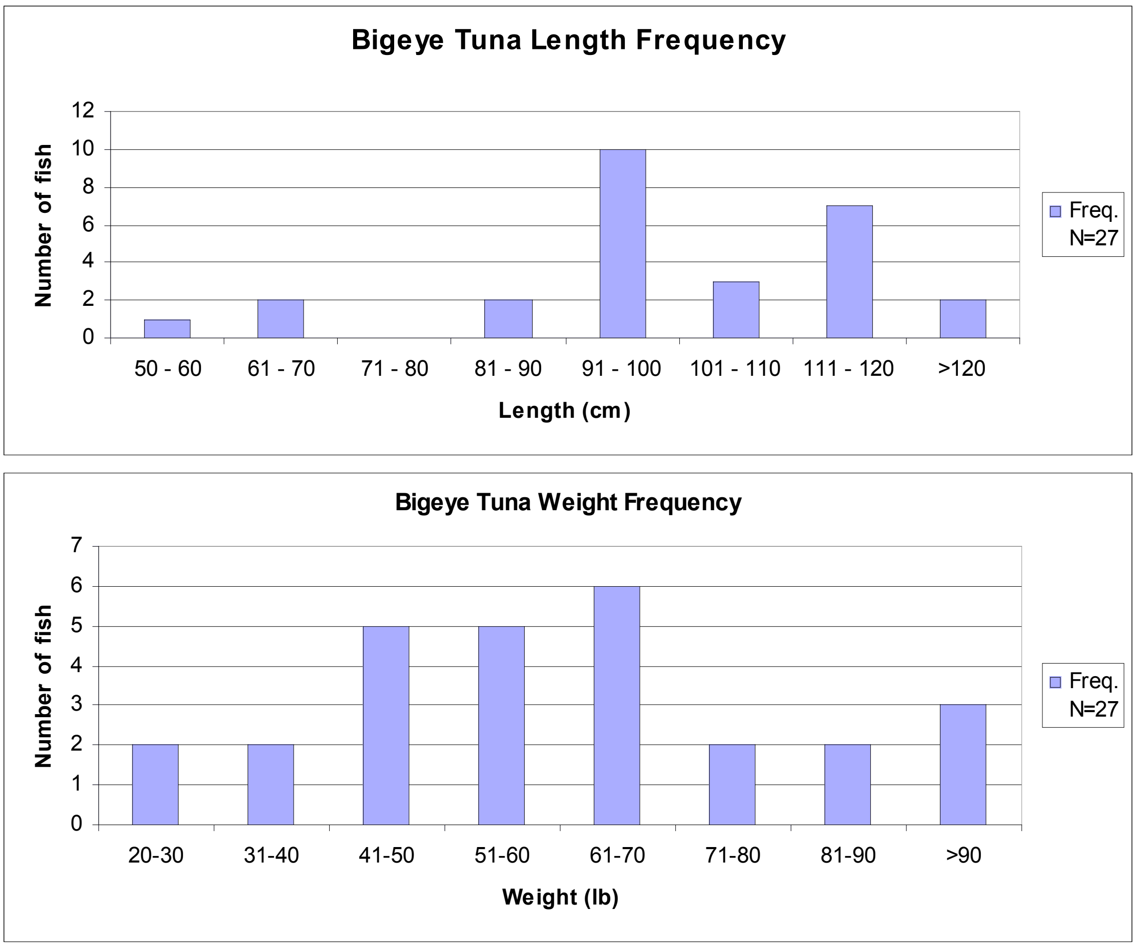
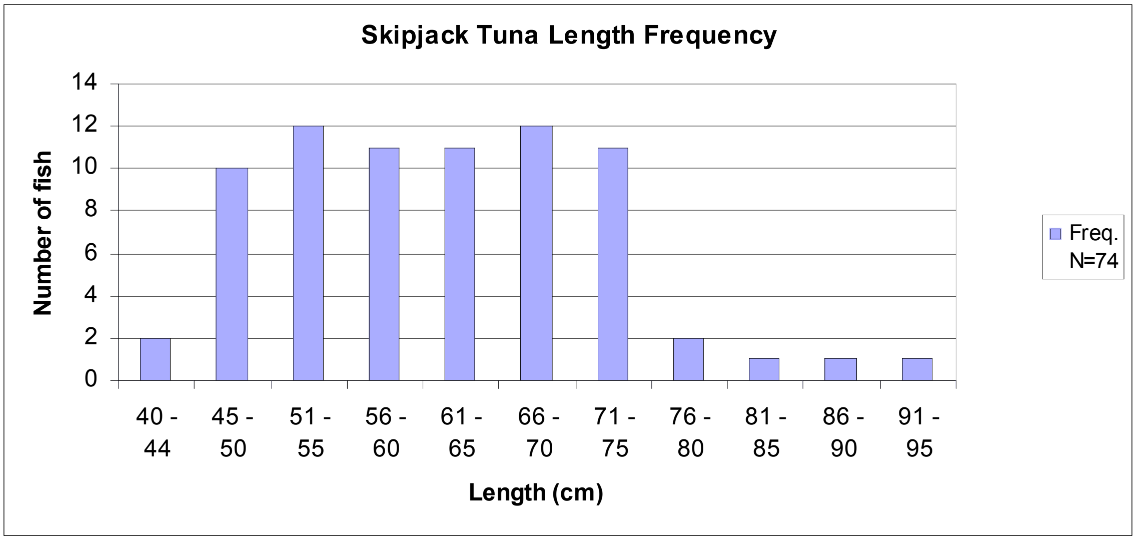


Figure 13. Size frequency of bigeye tuna caught by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

The mean weight of the 74 skipjack caught during this study was 14.3 lb (6.50 kg) (Table 6). The mean skipjack weight ranged from 14.8 lb in 2001 to 8.6 lb in 2003 (WPRFMC, 2004). The weight and length frequencies for skipjack caught in this study are given in Figure 14.



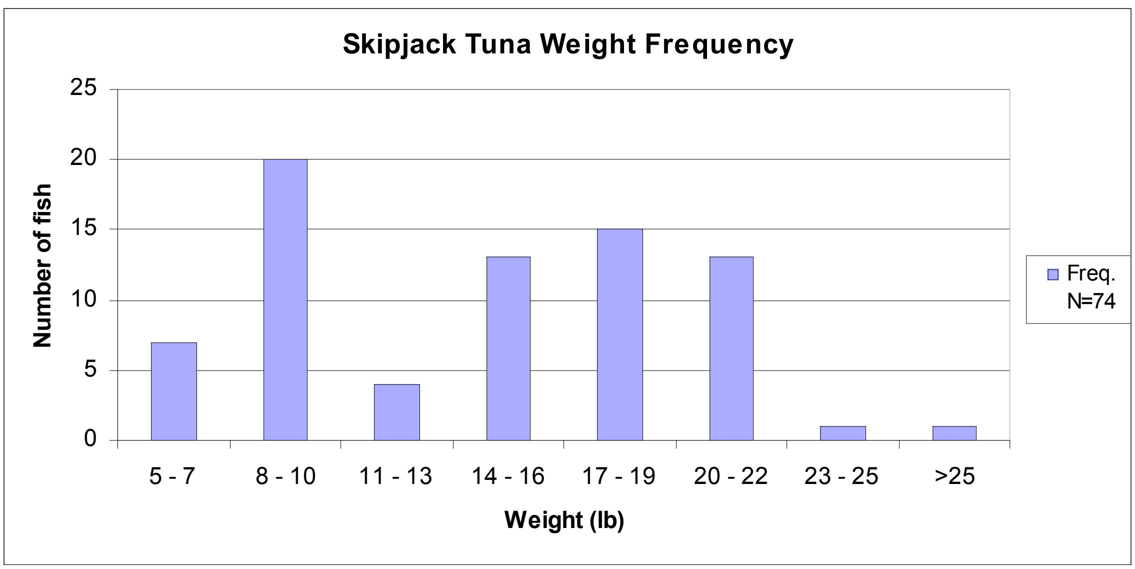
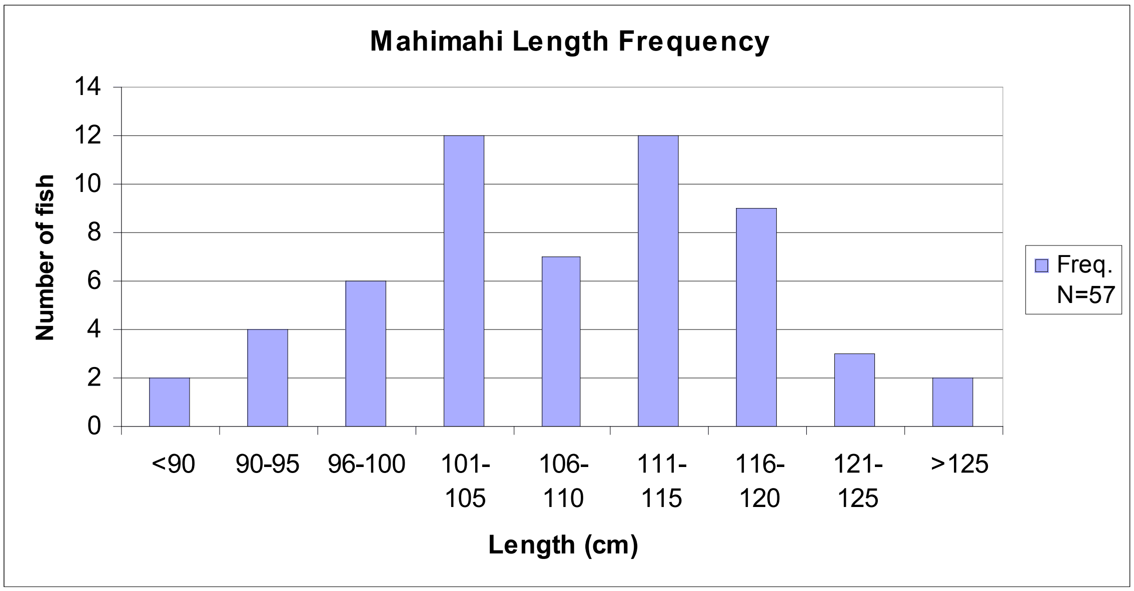


Figure 14. Size frequency of skipjack caught by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

The mean weight of the 57 mahimahi caught during this study was 25.8 lb (11.73 kg) (Table 6). This represents a slight increase in mean fish weight in comparison with the period from 2000 to 2003 when the mean mahimahi weights ranged from 19.3 to 24.8 lb (WPRFMC, 2004). The weight and length frequencies for mahimahi caught in this study are given in Figure 15.



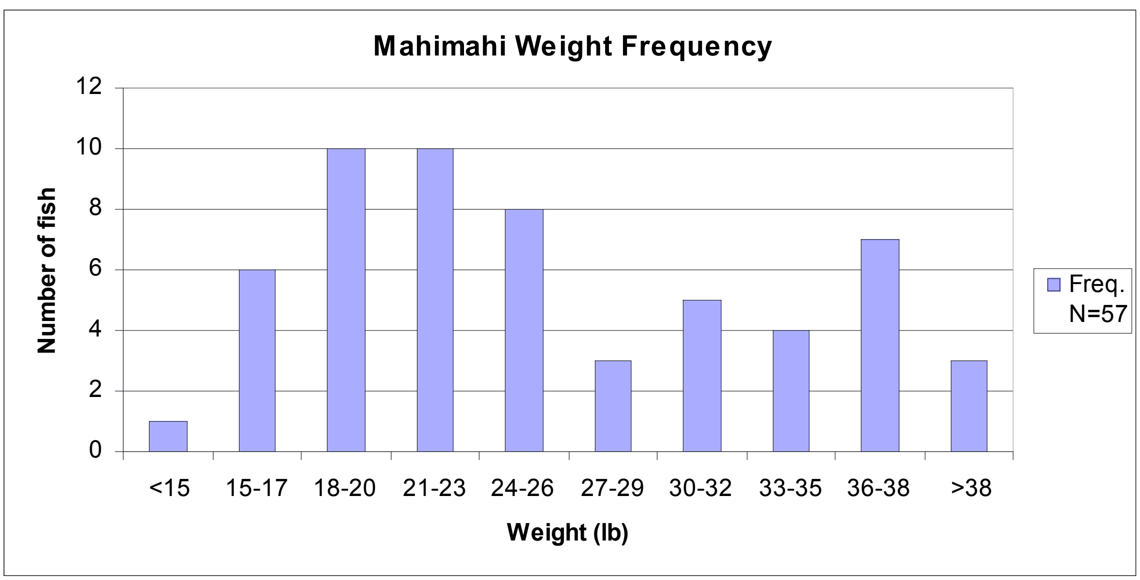


Figure 15. Size frequency of mahimahi caught by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

The mean weight of the 50 wahoo caught during this study was 25.7 lb (11.68 kg) (Table 6). This represents a slight decrease in mean fish weight in comparison with the period from 2000 to 2003 when the mean wahoo weights ranged from 28.2 to 31.9 lb (WPRFMC, 2004). The weight and length frequencies for wahoo caught in this study are given in Figure 16.

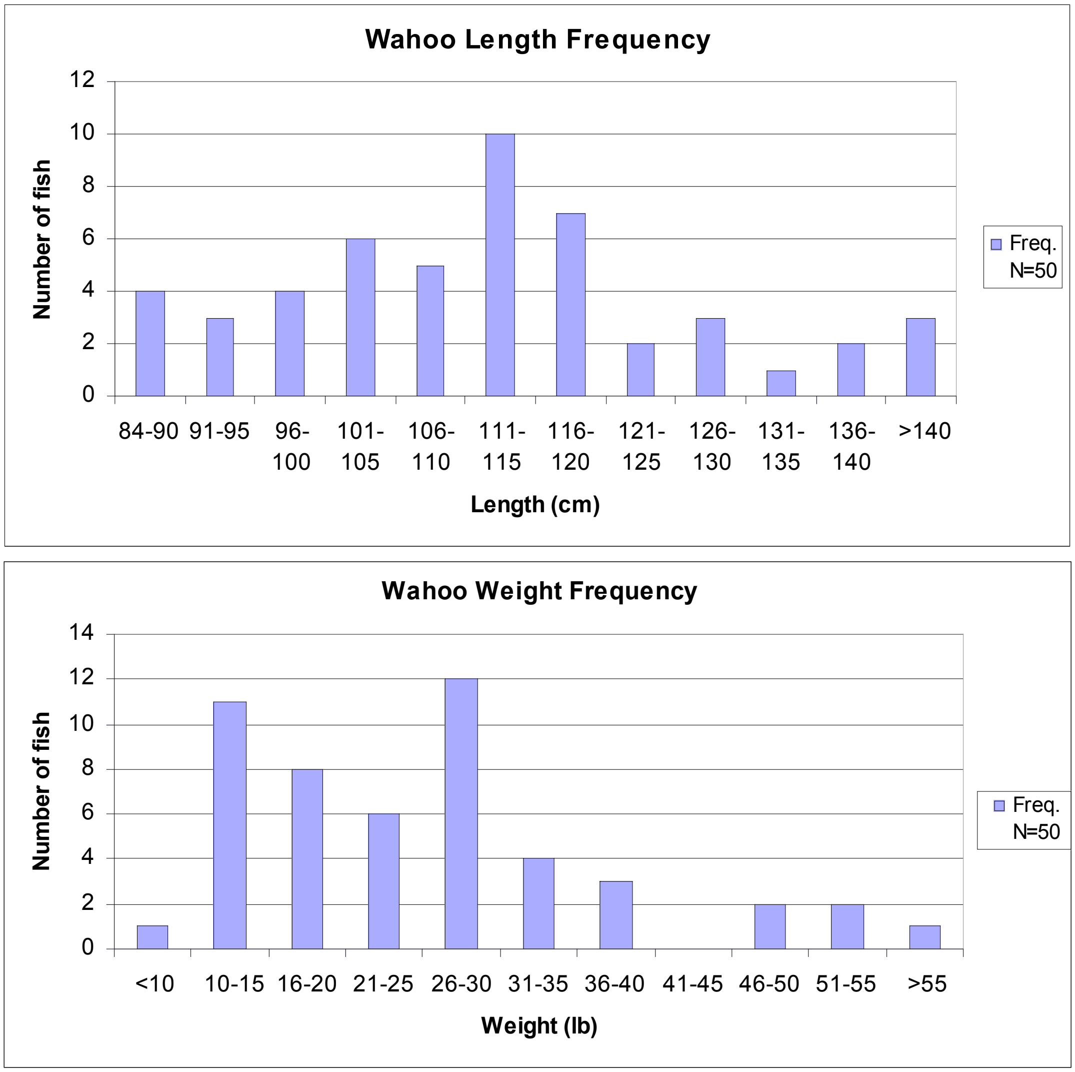


Figure 16. Size frequency of wahoo caught by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004.

4.9 Live/Dead Status of the Catch

The majority of the mixed species catch (91%) was dead or injured when retrieved and only 9% of the fish were alive and uninjured (Table 7). This is a considerable distinction from the Hawaii bigeye tuna longline fishery where it was observed that 46% of the mixed species catch was alive when retrieved (Kaneko, 2000; Kaneko et al, 2004). This may be the result of the longer period that the gear is soaked in the *alia* fishery (9 hr 20 min) (Table 3) compared with the Hawaii bigeye tuna longline fishery (mean 6 hrs 16 min) (Kaneko, 2000; Kaneko et al, 2004). American Samoa *alia* fishermen believe that an 8 hour soak period is the minimum for good albacore catch but this may in part account for the higher mortality rate.

Only 12% of the albacore, 4.7% of the yellowfin tuna and 11.1% of the bigeye tuna were alive when hauled on board. None of the skipjack, billfish, longfin mako sharks, rainbow runners, moonfish or pomfrets were alive when hauled. All three of the blue sharks caught during the study were alive, and only 3 of the 10 shortfin mako sharks were alive when retrieved.

Table 7. Catch status (live/dead) at retrieval for a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (based on 64,748 hooks retrieved from 159 sets).

Species	N	% Alive	% Injured	% Dead
Albacore tuna	595	12.1	0	87.9
Yellowfin tuna	359	4.7	0	95.3
Bigeye tuna	27	11.1	0	88.9
Skipjack tuna	74	0.0	0	100.0
TUNAS SUBTOTAL	**1,055**	**8.6**	**0**	**91.4**
Mahimahi	57	8.8	0	91.2
Wahoo	50	4.0	0	96.0
Swordfish	1	0.0	0	100.0
Blue marlin	10	0.0	0	100.0
Striped marlin	2	0.0	0	100.0
Blue shark	3	100.0	0	0.0
Shortfin mako shark	10	30.0	50	20.0
Longfin mako shark	5	0.0	60	40.0
OTHER PPMUS SUBTOTAL	**138**	**9.4**	**5.8**	**84.8**
Great barracuda	15	20.0	0	80.0
Rainbow runner	1	0.0	0	100.0
Moonfish	3	0.0	0	100.0
Pomfret	8	12.5	0	87.5
MISC SUBTOTAL	**27**	**14.8**	**0**	**85.2**
TOTAL PELAGICS	**1,220**	**8.9**	**0.7**	**90.4**

Knowing the initial live/dead status of the catch in all fisheries is a starting point for evaluation of bycatch impacts and the potential for bycatch reduction. The definition of bycatch used in this report is fishery waste—animals that are caught in fishing gear and discarded dead or released mortally injured (after Hall, 1996). This definition of bycatch does not include the release of live animals that survive the interaction with fishing gear. In recreational fisheries, this is known as “catch and release,” an action generally regarded as a conservation measure.

The percentage of live and dead fish at the time of hauling is likely to be determined by many factors including the fish species, hooking time, time on the line, line soak time, depth of hooks and possibly the line hauling rate.

4.10 Effect of Moon Phase on the Percentage of Live Albacore

It is common for albacore tuna to be dead or mortally injured when retrieved on longline gear. Bard and Josse (1996) proposed that one possible reason could be damage to the swim bladder. It has been noted that the swim bladders of albacore retrieved after dying on longline gear are inflated and intact, while the swim bladder of mortally injured albacore are frequently found to be deflated and ruptured during necropsy. It is possible that live adult albacore hauled to the surface are not able to decompress the swim bladder quickly enough to prevent rupture of the bladder. A better understanding of this phenomenon can guide fishing strategies to retrieve a greater percentage of live adult albacore viable for tagging with an increased likelihood of post-release survival.

The number and percentage of live and dead albacore was determined during the present study. Local experience-based knowledge is that albacore caught by *alia* during the full moon sequence (four days prior to the full moon and five days after the full moon) behave differently than during the remainder of month outside of the full moon sequence. It is theorized that because of the full moon's effect on tides, mixing, or moonlight the albacore and their prey are found at more shallow depths than during the periods outside of the full moon sequence. It has also been proposed that the percentage of live albacore retrieved on longline sets during the full moon sequence could be increased because of the more shallow distribution of the fish with a less severe differential in pressure between the hooking depth and the surface.

The effect of moon phase on the initial live/dead status of albacore and the CPUE for albacore is presented in Table 8. Of the 159 sets made by the contracted *alia* during this study, 52 sets were made during the 10-day full moon period. One hundred ninety one (191) of the total 595 albacore caught during the study were caught during full moon sets. The CPUE for albacore was similar between full moon (9.14 fish/1,000 hooks) and new moon sets (9.21 fish/1,000 hooks). The percentage of live albacore caught during full moon sets was 15.18%, whereas during new/half moon sets, the percentage of live albacore was 10.64%. This may be the result of the effect of the full moon on where and when the albacore are hooked.

Table 8. Comparison of the live/dead status of albacore caught during the full moon and new moon periods by a highliner in the American Samoa small-scale (*alia*) longline albacore fishery between October 2003 and September 2004 (based on 64,748 hooks retrieved in 159 sets).

	Full Moon[1]	**New/Half Moon**
No. of sets	52	107
No. of albacore	191	404
CPUE albacore	9.14	9.21
No. of live albacore	29	43
No. of dead albacore	162	361
Total No. of albacore	191	404
% live albacore	15.18%	10.64%

[1] Full moon period was defined as the 10 day period beginning four days prior to and five days after the full moon.

Recommendations for increasing the percentage of live albacore include the following.

- Make sets around the full moon (especially in June and July) when it is believed that fish are at shallower depths and the percentage of fish retrieved alive is greater.
- Patrol the mainline after setting to retrieve live fish.
- Start line hauling from the end of the mainline that was deployed first. This will shorten the soak time for the first hooks set and ensure ample soak time for the hooks that were set last.
- Slow down the retrieval rate to 80 to 100 hooks per hour (similar to *alia* retrieval rates).

If line hauling is slowed down to rates that typify *alia* (<100 hooks per hour compared with 250 hooks per hour for mechanized line hauling), albacore may be better able to "decompress" and compensate for the pressure change experienced when hauled to the surface. Further evaluation of these recommendations may help to increase the likelihood of retrieving a greater percentage of live albacore viable for tagging.

4.11 Incidental Catch of Protected Species

Although over 65,000 hooks were set during the study, no sea turtles, seabirds, or marine mammal interactions were reported.

Previously recorded sea turtle interactions with longline fishing gear in the American Samoa fishery were associated with exploratory fishing trips made by larger (>50 ft) longliners using J-hooks, squid bait, and during sets made in proximity of Swain's Island (Eo Mokoma and Vince Halleck, pers. comm.). None have ever been reported in association with the *alia* fishery. One possible explanation for the lack of sea turtle interactions in the *alia* fishery is that the circle hooks adopted in the beginning of the fishery and later by larger-scale monohull vessels may have had a beneficial impact in reducing the likelihood of incidental sea turtle capture. A combination of circle hooks and mackerel-like bait has been shown to greatly reduce the sea turtle interaction rates in the North Atlantic swordfish fishery (Watson et al., 2004). The American Samoa *alia* longline fishery uses circle hooks and pilchards. The lack of sea turtle interactions with the high density of longline hooks in the American Samoa EEZ agrees with the research findings in the North Atlantic Ocean.

5. DISCUSSION

5.1 Community Impacts

Employment opportunities for the youth in American Samoa are limited. Tuna fishing and canning industries dominate the private sector. Jobs on tuna purse seiners and larger longliners are dominated by non-Samoan crew. Many of the cannery jobs tend to be held by people from Samoa and upper level jobs are held by expatriates. The community leaders share concern for the youth of their villages and welcome opportunities to train and employ young people in jobs such as fishery data collection that might help prepare them for meaningful, steady employment as data collectors for either the DMWR or NOAA fisheries and marine resources programs. The project data collectors were trained and successfully completed their data collection roles for the current project. They now have practical work experience and have demonstrated reliability by faithfully meeting the contracted *alia* late at night to collect fishing data; interacting with the fishing boat owner, captain and crew; and providing data to the data manager. It is hoped that the project data collectors might find long-term employment as port samplers in the near future.

5.2 Updated Operational Profile of a Highliner in the *Alia* Fishery

The project documented the operational profile of a highliner in the American Samoa *alia* albacore longline fishery. Information on gear configuration and fishing practices has been summarized. *Alia* operational characteristics have evolved with increasing length of mainline and number of hooks being deployed per set, compared to four years ago (Aitaoto, 2001). The documented time sequence of an *alia* longline set has identified a prolonged hook soak time compared to the Hawaii tuna longline fishery.

5.3 Potential Value of Local Fishermen's Knowledge and Cooperative Research

The project demonstrated the potential value of working with experienced fishermen in cooperative research that can be enhanced by local knowledge to formulate research questions. Cooperative efforts can benefit the fishermen in that they are able to help evaluate their own theories or beliefs about fish behavior and catchability. Research involving fishermen also helps build relationships with researchers that strengthen fisheries management and more fully involve all members of the management system.

5.4 Catch Composition and CPUE Data

Information collected from the contracted *alia* has validated a sharp reduction in albacore CPUE reported in the South Pacific region that may be associated with unusually high sea surface water temperatures and lower than normal current and eddy feature strength. The CPUE data can also be compared with fleet-wide data generated by logbooks and creel survey data collection systems.

5.5 Weight and Length Data

The project generated information on the length and weight of fish caught in the small-scale *alia* longline albacore fishery in American Samoa. For some species, the additional data could be used to improve existing length-weight relationships.

5.6 Live/Dead Status of the Catch and Fish Bycatch

Determining the live/dead status of the catch at retrieval is an important step in evaluating the potential for reducing bycatch. Only live and uninjured fish have the potential to be released with a good chance of survival. Fish bycatch as defined by Hall (1996) represents fishery waste in the form of unwanted dead or dying target and non-targeted fish species discarded at sea. Release of live, viable, but unwanted fish should not be considered bycatch or fishery waste but viewed in the same positive light as the identical act in catch and release sport fisheries.

The bycatch rate in the American Samoa *alia* fishery is negligible because the fishermen are able to sell albacore, yellowfin and skipjack to the canneries, and can sell or distribute the incidental catch locally among communities, extended families, and churches. Larger longline vessels in the albacore fishery report higher bycatch rates presumably because they are more narrowly focused on sales to canneries (WPRFMC, 2004).

5.7 Protected Sea Turtle Species

The research results may validate the benefits of using circle hooks and mackerel-like bait to reduce the sea turtle hooking rates as demonstrated in the experimental swordfish fishing in the North Atlantic. The *alia* fishery has used circle style hooks and mackerel-like bait (pilchards) since its inception and this may account in part for the lack of reported sea turtle interactions.

6. REFERENCES

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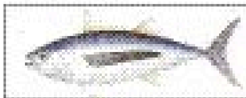
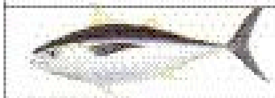
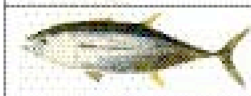
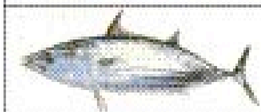
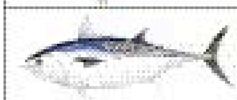
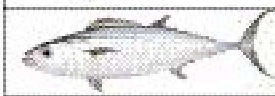
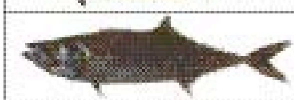
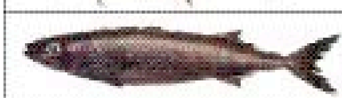
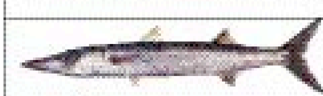
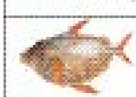
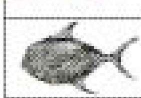
APPENDIX 1. *ALIA* FISH TALLY SHEET

TUNA

	Albacore ***(Thunnus alalunga)***	**A**
		D
	Bigeye ***(Thunnus obesus)***	**A**
		D
	ASIASI Yellowfin ***(Thunnus albacares)***	**A**
		D
	ATU Skipjack ***(Katsuwonas pelamis)***	**A**
		D
	Kawakawa ***(Euthynnus affinis)***	**A**
		D
	Dogtooth ***(Gymnosarda unicolor)***	**A**
		D

OTHER PELAGICS

ILLUSTRATION	**NAME**	**COUNT** (A=Alive; D=Dead)
	MASIMASI Mahimahi ***(Coryphaena hippurus)***	**A**
		D
	Wahoo ***(Acanthocybium solandri)***	**A**
		D
	Escolar (smooth) ***(Lepidocybium flavobrunneum)***	**A**
		D
	PALU TALATALA Oilfish ***(Ruvettus pretiosus)***	**A**
		D
	Great Barracuda ***(Sphyraena barracuda)***	**A**
		D
	Kawalea ***(Sphyraena helleri)***	**A**
		D
	Opah ***(Lampris regius)***	**A**
		D
	Sickle Pomfret (***Taractichthys steindachneri)***	**A**
		D

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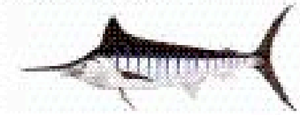
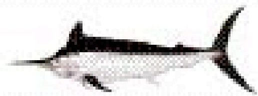
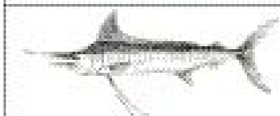
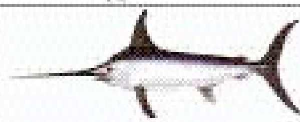
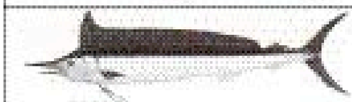
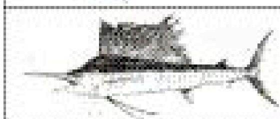
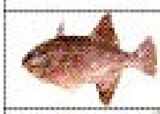
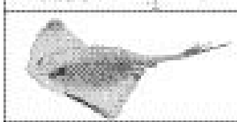
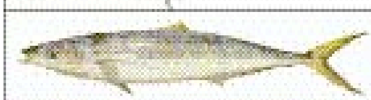
BILLFISH

ILLUSTRATION	NAME	COUNT (A=Alive; D=Dead)
	Blue Marlin *(Makaira mazara)*	A
		D
	Black Marlin *(Makaira indica)*	A
		D
	Striped Marlin *(Tetrapturus audax)*	A
		D
	Swordfish *(Xiphias gladius)*	A
		D
	Short-billed spearfish *(Tetrapturus angustirostris)*	A
		D
	Sailfish *(Istiophorus platypterus)*	A
		D

CRITTERS

ILLUSTRATION	NAME	COUNT (A=Alive; D=Dead)
	Long Snout lancetfish *(Alepisaurus ferox)*	A
		D
	Snake Mackerel *(Gempylus serpens Cuvier)*	A
		D
	Spotted Trigger Fish *(Canthidermis maculatus)*	A
		D
	Pelagic Puffer *(Lagocephalus lagocephalus)*	A
		D
	Pelagic Stingray *(Dasyatis violacea)*	A
		D
	Common sunfish *(Mola mola)*	A
		D
	Smooth sunfish *(Ranzania laevis)*	A
		D
	SAMANI Rainbow Runner *(Elagatis bipinnulatus)*	A
		D

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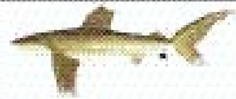
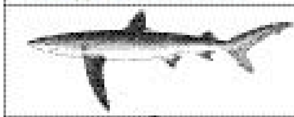
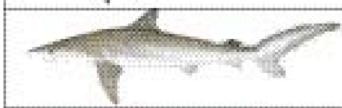
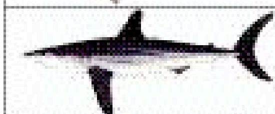
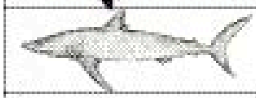
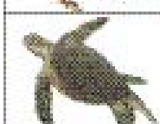
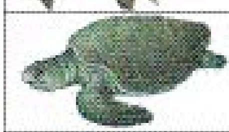
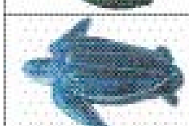
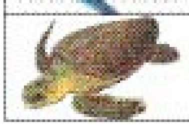
SHARKS

ILLUSTRATION	NAME	UNINJURED	INJURED	DEAD
	Oceanic white tip *(Carcharhinus longimanus)*			
	Blue shark (*Prionace glauca)*			
	Silky shark *(Carcharhinus falciformis)*			
	Short-finned Mako *(Isurus oxyrinchus)*			
	Long finned Mako *(Isurus paucus)*			
	Threaher shark *(Alopias vulpinus)*			
	Other sharks			

SEA TURTLES

ILLUSTRATION	NAME	UNINJURED	INJURED	DEAD
	Hawksbill (*Eretmochelys imbricata)*			
	Green (*Chelonia mydas)*			
	Olive Ridley (*Lepidochelys olivacae)*			
	Leatherback (*Dermochelys coriacea)*			
	Loggerhead (*Caretta caretta)*			

MARINE MAMMALS

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APPENDIX 2. ALIA TRIP DATA SHEET

*ECS Use Only
Set No. _________

AMERICAN SAMOA ALIA LONGLINE FISHING SET DATA FORM*

Vessel: _________________ Date of departure: _________ Date of return: _________

Data Collector(s): ______________________________;____________________________

SET INFORMATION

Date of Set: ____________ Length of Mainline Set _______miles Bait type _______________

Number of hooks set: ______hooks Hooks per float _______ Number of Lightsticks _______

Begin Set Time: ____:_____ Position: ______°______' N/S Latitude; ______°______' E/W Longitude

End Set Time: ____:_____ Position: ______°______' N/S Latitude; ______°______' E/W Longitude

HAUL INFORMATION

Date of Haul: __________ Number of Hooks Lost: ____________ hooks

Begin Haul Time: ____:_____ Position: ______°______' N/S Latitude; ______°______' E/W Longitude

End Haul Time: ____:_____ Position: ______°______' N/S Latitude; ______°______' E/W Longitude

TUNAS:	****Kept** *(length in cm/weight in lbs)*										**Released**
Albacore											
Bigeye											
Yellowfin											
Skipjack											
Dogtooth											
Kawakawa											
OTHER PELAGICS:	****Kept** *(length in cm/weight in lbs)*										**Released**
Mahimahi											
Wahoo											

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**Fish with clipped tails were alive when hauled aboard. Circle all fish (length + weight) for fish hauled while still alive.

OTHER PELAGICS:	**Kept** *Length(cm)/weight(lbs)*					**Released**
Moonfish (Opah)						
Escolar (smooth)						
Oilfish (rough)						
Great Barracuda						
Kawalea						
Rainbow Runner						
Pomfret						

CRITTERS:	**Kept** *(Lt./Wt.)*				**Released**
Longsnout Lancetfish					
Snake Mackerel					
Spotted Trigger Fish					
Pelagic Puffer					
Pelagic Stingray					
Common Mola					
Smooth Mola					

BILLFISH:	**Kept** *Length(cm)/weight(lbs)*					**Released**
Blue Marlin						
Striped Marlin						
Sailfish						
Spearfish						

SHARKS:	**Not Injured**	**Injured**	**Dead**
Ocean Whitetip			
Blue			
Silky			
Short-fin Mako			
Long-fin Mako			
Thresher			

ADDITIONAL: (species/mammals)	**Kept** *(length/weight)*					**Released**

TURTLE INSTRUCTIONS:

[1] Loggerhead, Green, Leatherback, Hawksbill, Olive Ridley, Unidentified
[2] Hooked or Entangled or Both
[3] 01) Ingested; 02) Head/Beak; 03) Front Flipper; 04) Body; 05) Unknown; 06) Tail; 07) Rear Flipper
[4] 00) Unknown; 01) Fell from gear, point unknown; 02) Fell from gear, in water; 03) Fell from gear, out of water; 04) Fell from gear, at roller; 05) Removal req. cutting gear/animal; 06) Removal w/ no cutting; 07) Other
[5] X) None; H) Hook; L) Line
[6] 01) Previously Dead; 02) Released Unharmed; 03) Released, Injured; 04) Died; 05) Escaped; 06) Treated as catch; 07) Other

Type of Turtle[1]	**Hooked/Entangled[2]**	**Location[3]**	**Gear Removed?[4]**	**Gear Remaining?[5]**	**Released[6]**

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