

**JOB PROGRESS REPORT  
RESEARCH PROJECT SEGMENT**

**STATE:** Territory of Guam

**PROJECT NO.:** F-1R-5

**SUB-PROJECT NO.:** F-1

**STUDY NO.:** 1

**JOB NO.:** 2

**STUDY 1:** Fisheries Participation, Effort, and Harvest Surveys (2430)

**JOB TITLE:** Inshore Fisheries Survey

**PERIOD COVERED:** October 1, 1996 to September 30, 1997

**SUMMARY**

Monthly inshore fisheries surveys were conducted along Guam's shoreline from October, 1996 to September, 1997. The total estimated inshore fisheries catch for this time period was 45.6 mt (metric tonnes), 69% of which were finfish (excluding the juvenile rabbitfish or maññhak and juvenile fusilier or achemsom). Hook and line was the most practiced method accounting for 66% of the total participation (excluding seasonal fisheries data) or 44,774 participants. In terms of catch rate, other methods were the most successful of all the daytime methods, yielding approximately 2.12 kg/gear-hour (gh) with a daytime harvest of 4.6 mt, and drag net was the most successful nighttime fishing method, yielding approximately 1.67 kg/gh with a nighttime harvest of 0.10 mt. Hook and line was the most successful method in terms of the overall harvest, yielding approximately 0.15 kg/gh with a total harvest of 15.0 mt. The seasonal maññhak and achemsom catch was estimated at 7.1 mt in FY97.

**Aerial Survey**

The aerial survey report is included in Appendix 1.

**Kid's Fishing Derbies**

The kid's fishing derby report is included in Appendix 2.

**BACKGROUND**

Effective management of Guam's inshore fishery resources requires accumulating data on the types of fishing methods used, fishing pressure, and annual catch. In order to identify trends in fishing participation, effort, and catch, the Division of Aquatics and Wildlife Resources (DAWR) has been monitoring marine fishing activities since the early 1960's. Over this period of time, survey and analysis methodologies have changed in response to fluctuations in budget

and staff. In the last several years, however, field survey techniques have been expanded and refined, while estimates of Guam's recreational / subsistence fishing activities have come to be based on more reliable data analysis techniques.

## **Data Analysis**

The establishment of the Fourth Dimension program (4D) has greatly reduced the time needed to compile and analyze Guam's inshore survey data. This has allowed more time to upgrade data collection procedures and to ensure statistical reliability.

## **OBJECTIVES**

1. To establish baseline catch and effort data for reef fish species necessary to develop a fisheries management plan for Guam.
2. To gather limited biological data on Guam's fisheries for management purposes.

## **PROCEDURES**

During FY97, four "inshore-catch" survey days were selected per month. Fishermen-intercept interviews were conducted to determine amount of effort, fishing method, location, reef zone, species composition, and amount caught for both day and night fishing. The day survey covered a six-hour interval (beginning at 0630h) and the night survey covered a five-hour interval (beginning at dusk or 1900h). On any given survey day, one survey area (Figure 1), is randomly selected from either Gun Beach to Adelupe (region I: locations 1-11), Adelupe to Agat (region II: locations 12-34), or Pago to Merizo (region III: locations 71-41) and inshore data collection is restricted within the selected region. However, because of infrequently interviewed methods, e.g., drag netting, and low participation, representative samples can be difficult to obtain. Therefore, if this situation occurred, one or both of the other two adjacent areas could be surveyed.

During FY97, day and night "inshore-participation" surveys were conducted on four randomly selected days per month, which did not occur on the same days as the "inshore-catch" surveys. These surveys entailed making visual observations of fishing participation within readily accessible portions of Guam's coastline (Fig. 1, locations: 1-17, 19-21, 23-26, 29-34, 40-43, 51-53, 56, 57, 60-69, 71, 72). Fishing effort data is collected by instantaneous counts (while driving in a continuous route) around the island. The route is alternated each survey between "clockwise" and "counterclockwise" and the starting locations are randomly selected (Fig. 1). Since the participation survey includes both day and night fishing, start times begin at 0630h and 1900h and end once the entire island circuit has been completed.

Seasonal data on the scad mackerel (atulai), goatfish (ti'ao), jacks (i'e'), and juvenile rabbitfish (maññak) were acquired through actual participation and catch surveys. Species of fish that seasonally recruit *en masse* on Guam's reefs, i.e., juveniles of rabbitfish (maññak), and

fusiliers (achemsom) were not entered into the database due to the sporadic nature of these fisheries.

Maññhak *en masse* recruitment events are predicted to occur up to three times a year for approximately 1 week, depending on the overall size of the run. Recruitment events are expected to occur the day of or days following the fourth, fifth, and tenth last quarter moon phase. Achemsom recruitments are irregular, but have been significant in terms of island-wide total harvest in certain years and usually recruit with maññhak when they occur.

Atulai migrate into inshore areas throughout the year, which may cover a period lasting up to

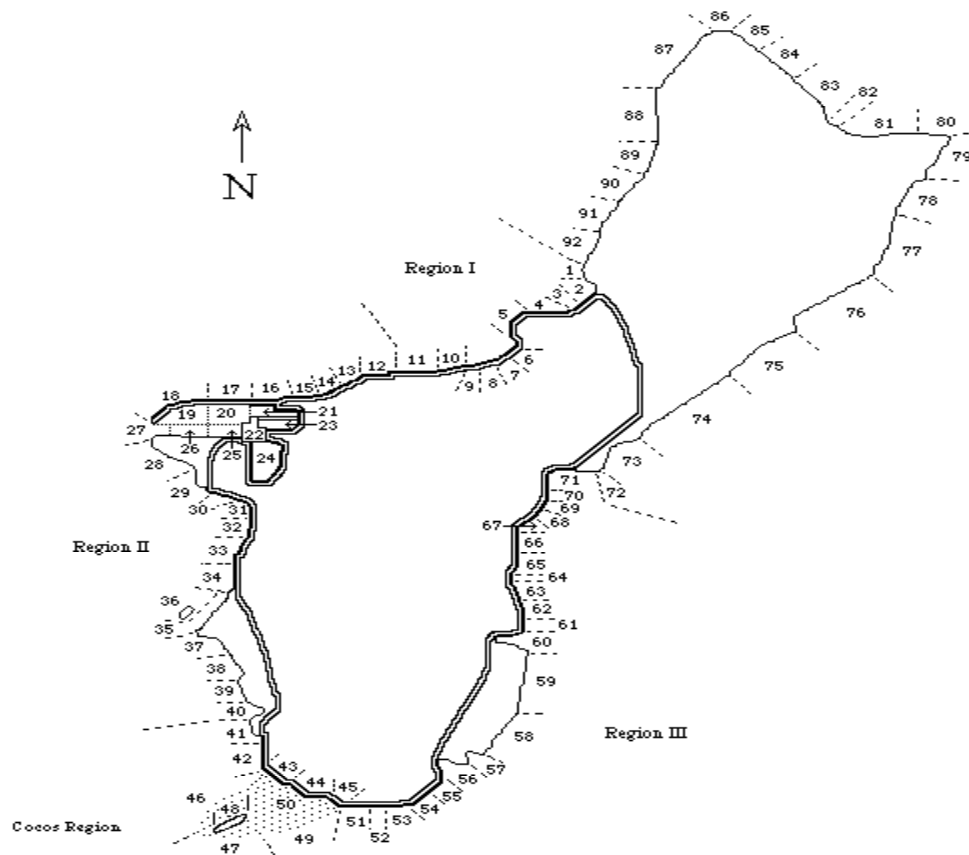


Figure 1. Inshore Fisheries “Participation Survey” Route and Location Codes.

nine months. They usually enter protected locations, e.g., bays and channels, at daybreak and swim into deeper water before evening. A significant portion of the annual catch is not reported from this fishery because the larger net catches are sporadic and seldom appear on regular surveys.

Ti'ao and i'e' recruit annually on reef flats and make up a large portion of the annual catch and effort. Ti'ao generally recruit within a few days of the May full moon and during strong recruitment years, pulses of new recruitment will also follow the June and July full moons. I'e' runs also follow the full moon starting in May and can continue after each full moon through November. It is speculated that continued recruitment may be linked to rainfall. Past recruitment events of these species have shown to be highly significant in terms of total catch, especially *Caranx ignobilis*, *C. melampygous*, *C. papuensis*, and *C. sexfasciatus* with hook and line, and *Mulloides flavolineatus* and *M. vanicolensis* with cast net, when they occur.

The FY97 inshore harvest estimates were statistically expanded by a computer software package for Macintosh known as the Fourth Dimension database program (4D). The 4D program utilizes formulae described in the FY83 report (Project FW-2R-20, Sub-Project F, Study F-1, Job 2) to compile and expand inshore survey data for the fiscal year.

## **RESULTS**

During FY97, the estimated inshore harvest for day, night, and seasonal fishing around Guam was 45.6 mt. Finfish accounted for 69% of total harvest or 31.6 mt (excluding maññak surveyed in May). The seasonal maññak and achemsom catch accounted for an estimated 7.1 mt in FY97. The total inshore catch (finfish and invertebrates, including the 29 June and 13 July maññak data) resulted from a total effort of 217,789 person-hours (ph) and 197,525 gear-hours (gh). Overall, approximately 0.19 kg/gh of fish were harvested in FY97 (Table 1).

## **CATCH**

Hook and line fishing yielded the largest overall catch with 15.0 mt or 48% of the total finfish harvest. Cast netting was second with 7.8 mt or 25%, while gill netting was third with 6.3 mt or 20%, and other methods were fourth with 5.6 mt or 18% of the total harvest (Table 1).

The top three daytime methods accounted for approximately 93% of the daytime total and 75% of the combined total harvest (Table 2). Hook and line fishing accounted for the most fish with 11.8 mt or 46% of the day harvest. Cast netting was second with 7.6 mt or 30%, while gill netting was third with 4.5 mt or 18%, and snorkel spearfishing was fourth with 1.0 mt or 4% of the total day finfish harvest.

The top three nighttime methods accounted for approximately 98% of the night total and 20% of the combined total harvest (Table 3). Hook and line fishing accounted for the most fish caught with 3.2 mt or 50% of the total night harvest and snorkel spearfishing was second with 1.7 mt or 27%. Gill netting was third with 1.4 mt or 21% and drag netting was fourth with 0.9 mt or 1% of the total night finfish harvest.

## EFFORT

Hook and line fishing was the most practiced fishing method based on the total participation (Table 1), accounting for 44,744 persons or approximately 65% of the total participation. Cast netting was the second most practiced method overall accounting for 10,055 participants or 15% of the total participation, while gill netting followed in third with 7,637 participants or 11% of the total participation.

The rank order for day fishing participation placed hook and line first with 30,180 or 61% participants. Cast netting and gill netting placed second and third respectively with 9,989 or 20% and 5,628 or 11% of the participants (Table 2). Hook and line fishing remained the most practiced night fishing method with 14,593 participants or 77% of night participation. The second most practiced method was gill netting with 2,009 participants or 11%, while other methods followed in third with 1,668 participants or 3% of night participation (Table 3).

## CATCH PER UNIT EFFORT (CPUE)

Other methods had the highest daytime CPUE of 2.12 kg/gh for weekday fishing and gill netting followed in second with 0.87 kg/gh. Snorkel spear was third with 0.69 kg/gh

Table 1. Combined estimated inshore participation, effort, and total harvest (kg) for all methods during the day and night in FY97.

METHOD	Persons	Gears	Trips	Per-Hrs	Gear-Hrs	Catch	Finfish	Inverts	CPUE†
Hook & Line	44,774	44,158	26,003	156,509	154,829	15,012	14,913	99	0.15 wd
Cast Net	10,055	8,826	7,637	23,266	20,423	7,778	7,621	157	0.78 wen
Gill Net	7,637	3,581	2,411	28,839	13,548	6,258	5,901	357	0.87 wed
Surround Net	0	0	0	0	0	0	0	0	0.0
Spear Snorkel	2,829	2,455	1,222	5,863	5,036	3,374	2,771	603	0.84 wn
Spear SCUBA	36	36	32	37	37	39	37	2	1.32 wen
Drag Net	175	32	32	292	53	87	87	0	1.67 wn
Hooks & Gaffs	519	665	333	976	1,177	307	0	307	0.28 wd
Other††	2,323	2,323	1,266	3,910	3,910	5,626	773	4,853	2.12 wd
<b>TOTAL</b>	<b>68,348</b>	<b>62,076</b>	<b>38,936</b>	<b>219,692</b>	<b>199,013</b>	<b>38,481</b>	<b>31,560</b>	<b>5,925</b>	<b>0.19</b>

†CPUE summary derives the greatest weekday (wd), weeknight (wn), weekend day (wed), or weekend night (wen) values from Tables 2 and 3. The greatest CPUE value for hook and line was in region 3.

††Other Methods usually include: gleaning, hand nets, traps, and spears.

Table 2. Estimated inshore participation, effort, and total harvest (kg) for all methods during the day in FY97.

METHOD	Persons	Gears	Trips	Per-Hrs	Gear-Hrs	Catch	Finfish	Inverts	CPUE†
Hook & Line	30,180	30,148	18,824	112,384	112,494	11,771	11,675	96	0.15 wd
Cast Net	9,989	8,759	7,570	23,147	20,303	7,742	7,585	157	0.54 wd
Gill Net	5,628	2,660	1,605	23,229	10,966	4,853	4,534	319	0.87 wed
Surround Net	0	0	0	0	0	0	0	0	0.0
Spear Snorkel	1,348	1,063	616	3,026	2,357	1,432	1,027	405	0.69 wed

Spear Scuba	0	0	0	0	0	0	0	0	0.0
Drag Net	0	0	0	0	0	0	0	0	0.0
Hooks & Gaffs	519	665	333	976	1,177	307	0	307	0.28 wd
Other††	1,668	1,668	912	2,675	2,675	4,610	773	3,837	2.12 wd
<b>TOTAL</b>	49,332	44,963	29,860	165,437	149,972	30,715	25,594	5,121	0.20

†CPUE summary derives the greatest weekday (wd) and weekend day (wed) values. The greatest CPUE value for hook and line was in region 3.

††Other Methods usually include: gleaning, hand nets, traps, and spears.

(Tables 1 and 2). Drag netting had the highest nighttime CPUE of 1.67 kg/gh for weeknight fishing and SCUBA spearfishing followed in second with 1.32 kg/gh. Snorkel spearfishing was third with 0.84 kg/gh (Tables 1 and 3).

The information concerning effort and harvest for methods not discussed are included in the summary Tables 1-3. Other nearshore fisheries harvests on Guam, including snorkel and SCUBA spearfishing off berthed and trailered boats, were recorded in the FY97 Offshore Fisheries Report (Study F-1, Job 1).

Table 3. Estimated inshore participation, effort, and total harvest (kg) for all methods during the night in FY97.

<b>METHOD</b>	<b>Persons</b>	<b>Gears</b>	<b>Trips</b>	<b>Per-Hrs</b>	<b>Gear-Hrs</b>	<b>Catch</b>	<b>Finfish</b>	<b>Inverts</b>	<b>CPUE†</b>
Hook & Line	14,593	14,010	7,179	44,124	42,335	3,240	3,237	3	0.12 wn
Cast Net	66	66	66	120	120	36	36	0	0.78 wen
Gill Net	2,009	921	806	5,610	2,582	1,404	1,366	38	0.63 wn
Surround Net	0	0	0	0	0	0	0	0	0.0
Spear Snorkel	1,481	1,392	606	2,837	2,679	1,942	1,744	198	0.84 wn
Spear SCUBA	36	36	32	37	37	39	37	2	1.32 wen
Drag Net	175	32	32	292	53	87	87	0	1.67 wn
Hooks & Gaffs	0	0	0	0	0	0	0	0	0.0
Other††	655	655	354	1,235	1,235	1,017	1	1,016	0.14 wd
<b>TOTAL</b>	19,015	17,112	9,075	54,255	49,041	7,765	6,508	1,257	0.16

†CPUE summary derives the greatest weeknight (wn) and weekend night (wen) values. The greatest CPUE value for hook and line was in regions 1 and 2.

††Other Methods usually include: gleaning, hand nets, traps, and spears.

## **SPECIES COMPOSITION**

### **Species and Family Harvests**

The expanded species composition for the FY97 expanded harvest for combined, day, and night efforts were calculated for FY97. The top non-seasonal reef fish species caught was the bluespine unicornfish, *Naso unicornis*, with 3.7 mt or 12% and *Caranx i'e'* was the top

seasonal species caught, with 1.1 mt or 3.41% of the overall finfish total (Table 4). Acanthuridae was the top family of finfish harvested, with 7.1 mt or 22.46% of the combined harvest in FY97.

The top day species for seasonal and non-seasonal remained the same with *Naso unicornis* accounting for 3.3 mt or 12.99% (96% by hook and line, 3% by cast net, and 1% by gill net) and *Caranx i'e'* with 0.8 mt or 3.05% for the day finfish total (Table 5). Acanthuridae remained the top family for day, with 6.3 mt or 24.55% of the finfish harvest.

*Selar crumenophthalmus* was the top seasonal species caught for night, with 0.8 mt or 12.19% and *Naso unicornis* was second for night, with 0.4 mt or 5.53% of the finfish total (Table 6). Carangidae was the top family for night with 1.7 mt or 25.37% of the finfish harvest.

SCUBA spearfishing did not account for a significant amount of fish caught during the survey period, despite the high catch rate (personal observation) using this method. One reason for this occurrence is that a small percentage of SCUBA spearfishermen shore-dive at any given time, making it difficult to encounter them during an inshore catch survey. The greatest number of SCUBA spear interviews were obtained during the offshore survey (Study F-1, Job 1) in FY97.

The seasonal catch of certain juvenile fishes is widely anticipated by local fishermen. The FY97 catches of ti'ao and i'e' were well represented within the expansion estimates (Tables 4-6), especially *Caranx i'e'*. During FY97, pulses of recruiting ti'ao and i'e' occurred from June - September. I'e' (*Caranx* spp.) and ti'ao (*Mulloidis flavolineatus*) ranked sixth and seventh of the day harvest respectively (Table 5) and i'e' ranked third (Table 6) for the night harvest in FY97.

Table 4. FY97 combined day and night catch composition for the top ten species and families of finfish harvested. Juvenile *Caranx ignobilis*, *C. melampygous*, *C. papuensis*, and *C. sexfasciatus* (i'e'  $\leq$  200mm), *Mulloidis flavolineatus* (ti'ao  $\leq$  100mm), and *Siganus spinus* (mañahak), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total day and night catch (31,560 kg).

SPECIES	Harvest		FAMILY	Harvest	
	kg	%		kg	%
<i>Naso unicornis</i>	3,683.56	11.67	Acanthuridae	7,087.78	22.46
<i>Siganus spinus</i>	2,592.00	8.21	Carangidae	4,657.41	14.76
<i>Acanthurus triostegus</i>	2,043.76	6.48	Siganidae	3,805.50	12.06
<i>Lethrinus harak</i>	1,203.76	3.81	Lethrinidae	2,125.74	6.74
<i>Caranx i'e'</i>	1,074.77	3.41	Mugilidae	1,943.74	6.16
<i>Liza vaigiensis</i>	1,008.17	3.19	Mullidae	1,876.29	5.95
<i>Selar crumenophthalmus</i>	958.25	3.04	Lutjanidae	1,405.23	4.45
<i>Mulloidis ti'ao</i>	811.45	2.57	Gerreidae	1,076.28	3.41
<i>Mulloidis flavolineatus</i>	788.01	2.50	Labridae	1,062.71	3.37
<i>Caranx ignobilis</i>	653.37	2.07	Scaridae	812.49	2.57
<b>TOTAL ANNUAL COMBINED CATCH</b>	14,817.10	46.95		25,853.17	81.92

Table 5. FY97 combined day catch composition for the top ten species and families of finfish harvested. Juvenile *Caranx ignobilis*, *C. melampygous*, *C. papuensis*, and *C. sexfasciatus* (i'e'  $\leq$  200mm), *Mulloides flavolineatus* (ti'ao  $\leq$  100mm), and *Siganus spinus* (mañâhak), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total day catch (25,594 kg).

SPECIES	Harvest		FAMILY	Harvest	
	kg	%		kg	%
<i>Naso unicornis</i>	3,323.83	12.99	Acanthuridae	6,282.97	24.55
<i>Siganus spinus</i>	2,256.10	8.81	Siganidae	3,401.79	13.29
<i>Acanthurus triostegus</i>	1,815.35	7.09	Carangidae	3,006.59	11.75
<i>Liza vaigiensis</i>	969.82	3.79	Mugilidae	1,815.20	7.09
<i>Lethrinus harak</i>	966.25	3.78	Mullidae	1,637.66	6.40
<i>Caranx i'e'</i>	780.53	3.05	Lethrinidae	1,561.77	6.10
<i>Mulloides ti'ao</i>	773.74	3.02	Lutjanidae	919.19	3.59
<i>Mulloides flavolineatus</i>	663.45	2.59	Gerreidae	868.31	3.39
<i>Caranx ignobilis</i>	596.04	2.33	Labridae	862.67	3.37
<i>Dussumieria spp.</i>	568.42	2.22	Clupeidae	568.42	2.22
<b>TOTAL ANNUAL DAY CATCH</b>	12,713.53	49.67		20,924.57	81.76

Table 6. FY97 combined night catch composition for the top ten species and families of finfish harvested. Juvenile *Caranx ignobilis*, *C. melampygous*, *C. papuensis*, and *C. sexfasciatus* (i'e'  $\leq$  200mm), *Mulloides flavolineatus* (ti'ao  $\leq$  100mm), and *Siganus spinus* (mañâhak), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total night catch (6,508 kg).

SPECIES	Harvest		FAMILY	Harvest	
	kg	%		kg	%
<i>Selar crumenophthalmus</i>	793.37	12.19	Carangidae	1,650.82	25.37
<i>Naso unicornis</i>	359.73	5.53	Acanthuridae	804.81	12.37
<i>Siganus spinus</i>	335.90	5.16	Lethrinidae	563.97	8.67
<i>Caranx i'e'</i>	294.24	4.52	Lutjanidae	486.04	7.47
<i>Lethrinus harak</i>	237.51	3.65	Siganidae	403.71	6.20
<i>Caesio caerulaurea</i>	230.93	3.55	Scaridae	310.78	4.78
<i>Lutjanus argentimaculatus</i>	228.64	3.51	Holocentridae	278.86	4.28
<i>Acanthurus triostegus</i>	228.41	3.51	Mullidae	238.63	3.67
<i>Gerres acinaces</i>	195.67	3.01	Caesionidae	235.57	3.62
<i>Caranx sexfasciatus</i>	191.51	2.94	Gerreidae	207.97	3.20
<b>TOTAL ANNUAL NIGHT CATCH</b>	3,095.91	47.57		5,181.16	79.61

## Method Harvests

The top harvest of finfish species for hook and line method was calculated for FY97 (Table 7). *Naso unicornis* ranked first for day, with 3.2 mt (27.42%) and the top seasonal species went to *Caranx i'e'* (ranked sixth), with 0.6 mt (4.74%). The first and second ranked finfish species were the seasonal *Selar crumenophthalmus* and *Caranx i'e'*, with 0.8 mt (24.51%) and 0.3 mt (8.10%) respectively and the river snapper, *Lutjanus argentimaculatus*, was the top non-seasonal species for night, with 0.2 mt (6.82%) of the total hook and line harvest.

The top harvest of finfish species for gill net method was calculated for FY97 (Table 8). The scribbled rabbitfish, *Siganus spinus*, ranked first for day, with 0.7 mt (14.39%), while the scissor-tailed fusilier, *Caesio caurulaurea*, ranked first at night, with 0.2 mt (14.45%). No seasonal finfish ranked in the top-ten for gill net harvest in FY97.

The top harvest of finfish species for snorkel spear method was calculated for FY97 (Table 9). *Siganus spinus* ranked first for day, with 0.1 mt (13.88%), while *Naso unicornis* ranked first for night, with 0.4 mt (20.62%).

Table 7. FY97 day and night catch composition for the top ten species of finfish harvested by hook and line method. Juvenile *Caranx ignobilis*, *C. melampygous*, *C. papuensis*, and *C. sexfasciatus* (i'e' ≤ 200mm) are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total day (11,675 kg) and night (3,237 kg) hook and line catch.

Day Species	Harvest		Night Species	Harvest	
	kg	%		kg	%
<i>Naso unicornis</i>	3,201.01	27.42	<i>Selar crumenophthalmus</i>	793.37	24.51
<i>Lethrinus harak</i>	751.81	6.44	<i>Caranx i'e'</i>	262.07	8.10
<i>Liza vaigiensis</i>	674.69	5.78	<i>Lutjanus argentimaculatus</i>	220.91	6.82
<i>Caranx ignobilis</i>	596.04	5.11	<i>Abededuf sexfasciatus</i>	182.31	5.63
<i>Caranx melampygous</i>	566.75	4.85	<i>Caranx sexfasciatus</i>	178.83	5.52
<i>Caranx i'e'</i>	553.85	4.74	<i>Lethrinus harak</i>	159.26	4.92
<i>Decapterus macrosoma</i>	459.73	3.94	<i>Lethrinus xanthochilus</i>	142.54	4.40
<i>Aprion virescens</i>	417.84	3.58	<i>Lutjanus fulvus</i>	140.57	4.34
<i>Siganus spinus</i>	349.64	2.99	<i>Decapterus macrosoma</i>	97.86	3.02
<i>Chielio inermis</i>	307.24	2.63	<i>Lutjanus monostigmus</i>	73.39	2.27
<b>Total Top Ten Hook &amp; Line Catch</b>	7,878.60	67.48		2,251.11	69.54
<b>Total Combined Hook &amp; Line Catch</b>	10,129.71	67.93			

## Seasonal Harvests

FY97 marked a good recruitment year for maññak (ha'tang or *Siganus spinus* and lessor' or *S. argenteus*). Runs occurred 31 May - 3 June, 29 - 31 June and 13 July with a total estimated catch of 7.1 mt. The achemsom run occurred 29 - 31 June with an estimated catch of 2.5 mt in FY97. As of June 1997, DAWR suspended the collection of maññak harvest

data. The decision was made by upper management to avoid potential conflicts between fishermen and data collectors during this popular fishing event. Seasonal harvests of mañhák were manually expanded for 31 May - 3 June and included in the inshore expansion on 29 June and 13 July (Table 10).

The atulai (*Selar crumenophthalmus*) season was moderately successful with 1.0 mt or 3% of the total catch for FY97. The total inshore harvest of atulai (100% of day and night harvest) were caught with hook and line, due to the high incidence of catch interviews at the Agana Boat Basin channel (Fig. 1, location 9 and Table 7).

Table 8. FY97 day and night catch composition for the top ten species of finfish harvested by gill net method. Juvenile *Caranx ignobilis*, *C. melampygous*, *C. papuensis*, and *C. sexfasciatus* (i'e'  $\leq$  200mm), *Mulloidides flavolineatus* (ti'ao  $\leq$  100mm), and *Siganus spinus* (mañhák), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total day (4,534 kg) and night (1,366 kg) gill net catch.

Day Species	Harvest		Night Species	Harvest	
	kg	%		kg	%
<i>Siganus spinus</i>	652.32	14.39	<i>Caesio caerulaurea</i>	197.40	14.45
<i>Gerres oblongus</i>	550.87	12.15	<i>Leiognathus equulus</i>	172.39	12.62
<i>Valamugil seheli</i>	321.83	7.10	<i>Gerres acinaces</i>	171.79	12.58
<i>Mulloidides flavolineatus</i>	323.72	7.14	<i>Acanthurus triostegus</i>	150.61	11.03
<i>Liza vaigiensis</i>	289.48	6.38	<i>Mulloidides flavolineatus</i>	91.85	6.72
<i>Crenimugil crenilabis</i>	218.38	4.82	<i>Crenimugil crenilabis</i>	75.88	5.55
<i>Acanthurus triostegus</i>	195.68	4.32	<i>Lethrinus harak</i>	58.33	4.27
<i>Gerres acinaces</i>	188.48	4.16	<i>Siganus spinus</i>	48.23	3.53
<i>Myripristis murdjan</i>	185.50	4.09	<i>Diodon hystrix</i>	42.27	3.09
<i>Caranx papuensis</i>	175.44	3.87	<i>Siganus randalli</i>	41.09	3.01
<b>Total Top Ten Gill Net Catch</b>	3,101.70	68.41		1,049.84	76.86
<b>Total Combined Gill Net Catch</b>	4,151.54	70.35			

### Invertebrates Harvested

In addition to finfish, a significant number of marine invertebrates were harvested from Guam's reefs. An estimated 0.8 mt of octopus (13% of the total invertebrate harvest) were caught island-wide in FY97. Daytime octopus harvests accounted for 0.7 mt (17% by gill net, 37% by snorkel spear, and 46% by hooks and gaffs), while nighttime harvests accounted for 0.1 mt (100% by snorkel spear) in FY97.

Table 9. FY97 day and night catch composition for the top ten species of finfish harvested by snorkel spear method. Finfish harvest percentages were derived from the total day (1,027 kg) and night (1,744 kg) snorkel spearfish catch.

Day Species	Harvest		Night Species	Harvest	
	kg	%		kg	%
<i>Siganus spinus</i>	142.55	13.88	<i>Naso unicornis</i>	359.58	20.62
<i>Acanthurus triostegus</i>	90.21	8.78	<i>Siganus spinus</i>	280.52	16.08
<i>Cheilinus trilobatus</i>	62.64	6.10	<i>Cheilinus trilobatus</i>	122.56	7.03
<i>Lutjanus fulvus</i>	43.31	4.22	<i>Epinephelus merra</i>	96.44	5.53
<i>Diodon hystrix</i>	39.45	3.84	<i>Naso lituratus</i>	84.21	4.83
<i>Synanceia verrucosa</i>	39.45	3.84	<i>Acanthurus triostegus</i>	75.24	4.31
<i>Scarus sordidus</i>	29.85	2.91	<i>Scarus psitticus</i>	68.65	3.94
<i>Scarus psittacus</i>	27.66	2.69	<i>Scarus ghobban</i>	57.19	3.28
<i>Lethrinus harak</i>	22.53	2.19	<i>Parupeneus barberinus</i>	45.47	2.61
<i>Epinephelus merra</i>	12.14	1.18	<i>Naso tuberosus</i>	39.93	2.29
<b>Total Top Ten Spear Snorkel Catch</b>	509.79	100.00		1,229.79	70.52
<b>Total Combined Spear Snorkel Catch</b>	1,739.58	62.78			

Table 10. FY97 maññhak harvest from 31 May to 3 June, 1997 (maññhak survey) and 29 June to 13 July, 1997 (inshore creel survey and incidental information). Catch data (kg) was obtained from the following locations: Adelupe; Asanite'; E. Agaña Bay; Gã dao-Fofos; Gun Beach; Ipan; Jones Beach; Pago Bay; Piti Channel; Tagachan Beach; and Tumon Bay.

#### Maññhak Survey

Method	Persons	Gears	Gear-Hrs	Catch	CPUE
				kg	kg/gh
CN	149	123	336	911	2.71
SN	16	7	27	308	11.41
<b>TOTAL</b>	165	130	363	1,219	14.12

#### Inshore Creel Survey

#### Maññhak and Achemsom Harvest

Method	Catch	Species	Catch
	kg		kg
CN	792	Maññhak	2,500
OM	133	Achemso m	2,500
<b>TOTAL</b>	925	<b>TOTAL</b>	5,000

Sea cucumbers topped the list of harvested invertebrates with a day and night island-wide harvest of 1.7 mt (100% by gleaning) and included the following species: *Bohadschia argus* (0.09 mt), *Holothuria* spp. (0.2 mt), *H. atra* (0.6 mt), *H. leucospilota* (0.5 mt), and



## RECOMMENDATION

Since approximately 22% of the participants and gear-units are not surveyed on the inshore participation route (based on FY97 data), it is recommended that the aerial surveys be continued. The sampling technique has improved since the initiation of the aerial surveys and an improved quantitative analysis has been completed for island-wide inshore fishing effort.

Considering the inshore fisheries survey provides information important for management and planning, it is recommended that this job be continued. Due to the inadequacies of the "inshore-catch" survey window (especially nighttime for certain methods), harvests were not representative of the actual participation and includes the following methods for day: surround net, spear SCUBA, drag net and other methods; and night: cast net, surround net, hooks and gaffs, drag net, and other methods. Methods encountered more frequently, i.e., hook and line, cast net (day only), gill net, spear snorkel, spear SCUBA (night only), and hooks and gaffs (weekend day only), had confidence intervals less than 33% for daytime and less than 28% for nighttime fishing activity.

The increased availability and affordability of certain fishing gear methods has also changed on Guam. Hook and line has shown a significant increase since the early 1980's and has grown in popularity, especially with the i'e' and atulai fishery. Gill net use has remained high over the last decade, but the poor quality and disposability of the cheaper nets has created a situation of "ghost-netting" on our reefs. It is recommended that an increase in net dimensions, decrease in fishing time, and reduction in net length be made in order to reduce the overall destructiveness of this method. Inshore data compiled since 1985 supports the need for gill net restrictions with the alarming reduction of some species from the catch estimates.

Snorkel spearfishing has decreased in many inshore locations as a result of reduced fish stocks. Several species of parrotfish, i.e., *Scarus microrhinos* and *S. rubroviolaceus*, once common in the creel survey, have disappeared in favor of the smaller and more abundant species of parrotfish, e.g., *Scarus sordidus* and *S. psitticus*. It is the division's intention to protect many of the species of fish impacted by this and other methods through the implementation of the marine preserves.

SCUBA spearfishing has also increased with the aid of depth finders, bang sticks, and greater volume airtanks. It is recommended for equipment restrictions be placed on spear SCUBA, e.g., banning of bang sticks and high volume air tanks, in order to safeguard the rapid decline of our adult reef fish.

Overall declines in annual harvests and shifts in species composition have been documented in the last thirteen fiscal years. With the recent legislative approval of marine preserves and the implementation of new fishing regulations, we can begin to manage destructive fishing methods and preserve critical areas for reef fishes to mature and reproduce. As the success of the marine preserves are documented over the next few years, the evidence needed to restrict the most destructive methods, e.g. gill nets and SCUBA spearfishing, will be possible. In addition, the marine preserves will decrease the survey locations and will require the addition of new

ones, e.g. location 91, and 92 to region I; 35 to region II; and, 39 and 73 to region III, (Fig. 1) for the inshore survey.

The future status of our fishery will depend on the overall success of these management techniques to conserve and protect this essential resource for generations to come.

### **PROJECT COST**

The estimated cost of this project was \$100,000.

Report prepared by: Todd J. Pitlik

## **APPENDIX 1**

### **INSHORE AERIAL SURVEY**

**PERIOD COVERED:** October 1, 1996 to September 30, 1997

#### **SUMMARY**

A total of 20 “inshore aerial” surveys were conducted in FY97 for a total of 1,034 persons and 915 gear units. Hook and line was the most frequently encountered method with 614 persons and 603 gear units. A ratio of participants / method observed in areas outside the inshore participation route to the total number for all methods surveyed during the “inshore aerial” were calculated as variables ( $P_2$  values) for the inshore expansion. The values ranged from 63% for weekday cast net and weekend snorkel spear to 100% for rare and night-practiced methods, e.g., surround net, drag net, and SCUBA spear fishing.

Incidental biological sightings resulted in a total of 170 turtles, 14 pods of dolphins, 1 pod of pilot whales, 19 sharks, 7 eagle rays, and 4 sting rays for FY97.

#### **BACKGROUND**

Inshore fishing surveys have been conducted by the Division of Aquatics and Wildlife Resources (DAWR) since the early 1960's to monitor and collect a long-term database on the total fishing effort and catch from Guam's reefs. The “inshore-catch” and “inshore-participation” surveys were developed to collect catch and effort data in near-shore areas easily accessible by motor vehicle. In addition, the inshore-aerial survey was established in the early 60's and reinstated in FY90 to survey effort in areas that could not be easily accessed by a vehicle.

#### **PROCEDURES**

Inshore-aerial surveys were conducted twice monthly on regularly scheduled participation days (one weekday / weekend). Start times are moved up in one-hour intervals for each subsequent survey (0800-1200h), then repeated after reaching 1200h. Visual observations of areas not covered in the “inshore-participation” survey (Fig.1 locations: 18, 22, 27, 28, 35-39, 44-50, 54, 55, 58, 59, 70, and 73-92) included fishing effort data. The first scheduled weekday and weekend participation survey dates of each month were selected to allow rescheduling in the event of poor weather conditions.

Each survey started in location 11 and proceeded in a clockwise direction all the way around the island to location 12 (Fig. 1). The seaward flight distance from the reef margin was 200-300m with an altitude of 170-200m. The aerial itinerary also included a semi-circular flight

pattern within Cocos Lagoon and Apra Harbor. In addition, the pilot was instructed to circle over reef flat areas when it was difficult to observe or determine activity.

The aerial survey observations were sorted by method and type day (weekday / weekend). A ratio of the persons / method observed in areas outside the inshore participation route were compared to the total number of persons / method observations for the island for each type day. The resultant  $P_2$  values provided variables (%) that could be used to expand inshore participation values to island-wide participation values.

Other biological data collected, included incidental observations of marine mammals, turtles, sharks, and rays at or near the surface of various reef zones, e.g., Pauliluc Bay and the fore reef slope, along the aerial survey route.

The FY97 inshore harvest estimates were statistically expanded by a computer software package for Macintosh known as the Fourth Dimension database program (4D). The 4D program utilizes formulae described in the FY83 report (Project FW-2R-20, Sub-Project F, Study F-1, Job 2) to compile and expand inshore survey data for the fiscal year.

## RESULTS

The most frequently encountered methods included hook and line, cast net, gill net, snorkel spear, hooks and gaffs, and other methods, while surround net, SCUBA spear, and drag net methods were less common. Ratio frequencies were highest (100%) for the least common methods, which were due to the rarity of their use during the day, e.g., SCUBA spear and drag net are primarily night methods. Hook and line, cast net, gill net, surround net, snorkel spear, hooks and gaffs, and other methods (weekday and weekend days respectively) had  $P_2$  values (Table 1) listed as percentages: (82 / 87), (63 / 76), (64 / 76), (100 / 100), (92 / 63), (100 / 68), and (79 / 79), respectively for FY97.

Table 1.  $P_2$  values derived from aerial survey data in FY97. Ratios were calculated from a ratio of method sightings within aerial locations to participation locations. Methods abbreviations are listed as follows: Hook and Line (HL); Cast Net (CN); Gill Net (GN); Surround Net (SN); Spear Snorkel (SpSn); Spear SCUBA (SpSc); Hooks and Gaffs (HG); Drag Net (DN); and Other Methods (OM).

Ratios	HL	CN	GN	SN	SpSn	SpSc	HG	DN	OM
<b>Weekday</b>	37/168	16/27	16/29	0/4	1/11	0/0	0/2	0/0	4/15
<b>Weekend</b>	52/357	21/67	18/56	0/37	15/26	0/0	8/17	0/0	6/22
<b>WD Ratio</b>	168/205	27/43	29/45	4/4	11/12	0/0	2/2	0/0	15/19
<b>WE Ratio</b>	357/409	67/88	56/74	37/37	26/41	0/0	17/25	0/0	22/28
<b>WD <math>P_2</math></b>	82	63	64	100	92	100	100	100	79
<b>WE <math>P_2</math></b>	87	76	76	100	63	100	68	100	79

The greatest number of people fishing in participation areas during the aerial survey used hook and line on weekdays and weekends for a total of 525 and 517 persons and gear-units respectively, while hook and line was also the most frequently used method in aerial areas for a total of 89 and 86 persons and gear units respectively for FY97 (Table 2).

Dolphins topped the list of the most frequently sighted marine animals during the aerial surveys with 700 sightings. The greatest monthly total of 300 dolphin sightings occurred in June (Table 3). Turtle, pilot whale, and shark sightings ranked second, third, and fourth, respectively with annual totals (Table 3). The greatest monthly total of turtles were sighted in October, June, and August, with 29 and sharks in October with 9. The only month pilot whales were sighted was in September with 20. In addition, a total of 7 eagle rays (6 in Cocos Lagoon) and 4 stingrays were sighted in FY97 (Table 3).

Table 2. Total number of people and gear units observed during aerial surveys in FY97. Method abbreviations are listed in Table 1 with weekday (WD) and weekend (WE) days listed below.

Methods	Within Par Route				Outside Par Route			
	Persons		Gears		Persons		Gears	
	WD	WE	WD	WE	WD	WE	WD	WE
<b>HL</b>	168	357	165	352	37	52	34	52
<b>CN</b>	27	67	22	58	16	21	15	19
<b>GN</b>	29	56	16	25	18	18	9	8
<b>SN</b>	4	37	1	5	0	0	0	0
<b>SpSn</b>	11	26	11	26	1	15	1	15
<b>SpSc</b>	0	0	0	0	0	0	0	0
<b>HG</b>	2	17	2	24	0	8	0	8
<b>OM</b>	15	22	15	22	4	6	4	6
<b>Total</b>	256	582	232	512	76	120	63	108

Table 3. Number of turtle, dolphins, shark, and ray sightings by aerial surveys around Guam in FY97.

SPECIES	MONTHS												TOTAL
	O	N	D	J	F	M	A	M	J	J	A	S	
Turtle	29	6	10	7	3	22	11	9	29	7	29	8	170
Dolphin	190	0	10	0	15	0	0	0	300	0	10	175	700
Shark	0	0	0	0	0	0	0	0	0	0	0	20	20
Sting Ray	9	0	1	1	0	4	0	0	0	0	3	1	19
Eagle Ray	0	0	0	0	0	0	2	1	0	0	0	4	7
Manta Ray	2	0	0	0	0	0	0	0	0	0	0	2	4

Cancellations due to poor weather conditions, were a moderate problem in FY97. Four cancellations occurred on the following weekday (WD) and weekend (WE) survey dates: WD (11/22/96); and WE (1/18/97, 2/23/97, and 8/30/97).

## **FLIGHT COST**

The cost of the project was \$9,500.

Report prepared by: Todd J. Pitlik

## **APPENDIX 2**

### **KID'S FISHING DERBIES**

**PERIOD COVERED:** 1 October, 1996 to 30 September, 1997

#### **SUMMARY**

A marine fishing derby for kids, event was co-sponsored by DAWR in FY97 in cooperation with Andersen Air Force Base. This two-day event, held at Tarague Channel, was open to 150 participants, or 75 kids per day. A total of 53 participants signed up for the two one-day fishing events. This was the eighth marine derby sponsored by the Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR). Andersen Air Force Base has co-sponsored four marine derbies with DAWR.

#### **OBJECTIVES**

To encourage fishing as a form of recreation for children by promoting at least two kids fishing derbies per fiscal year, and to use these events as opportunities to teach environmental and fishing conservation ethics.

#### **PROCEDURES**

##### **Coordination and Logistics**

Derby preparation and planning took at least 4-6 weeks in advance. A fishing site and potential date had to be selected, which provided safe shoreline for the participants and good habitat for fishing. Fishing dates required an a.m. high tide to increase the chances of catching fish.

Kid's fishing derbies held in cooperation with military installations had individuals from both agencies serving as points of contact. This ensured that requirements of both agencies were met and that duties assigned to each agency were completed. Chief Conservation Officer Dan Works of Andersen Air Force Base and DAWR Fisheries Biologist Veronica Cummings were the designated points of contact for this kid's derby.

Logistics included providing: rest areas with chairs and tables as well as refreshments, staff to serve as officials, organizing a safety briefing and the awards ceremony, and ensuring that official representatives from both agencies were present for the awards presentation. Certificates of Participation and fish posters were provided to all participants. A draft post-derby report has been completed, which includes comments and suggestions from derby participants to improve future derbies.

## Advertisements

The advertising strategy employed intended to ensure maximizing derby exposure to children ages seven to twelve both on and off base. This was done by providing flyers to all elementary and middle schools, having highway banners displayed in strategic locations, providing the media with press releases periodically, and making derby pitches through various radio talk shows.

## Derby Rules and Clinic

The derby had a harvest size limit and a bag limit for the fish caught to encourage the practice of conservation. Fish had to be over 6 inches (152 mm) in length in order to qualify for the derby awards and to be kept. Although there was an individual bag limit of five fish, participants were encouraged to practice “catch and release” during the event.

The derby was open to children from seven to twelve years of age, and was preceded by a fishing clinic open to the public on June 14, 1997. The fishing clinic provided an opportunity for parents and children to learn about and practice basic fishing skills including knot-tying and casting. Demonstrations were also conducted to aid parents in selecting and purchasing fishing gear and in preparing for the fishing event.

## RESULTS

The derby was initially scheduled for June 7-8, but was rescheduled for the weekend of June 21-22 to avoid conflicting with another derby scheduled on the same day. This derby had the lowest number of registrants despite extending the registration period to June 18. Although only 53 participants signed up, the derby was kept to 2 days in order to ensure the best fishing opportunity. Thirty-nine children actually participated in the event.

Table 1. Kid’s Derby Winners in FY97

<b><u>MOST FISH on SATURDAY</u></b>		
First Place	Jadine Leonen	3 fish
Second Place	Charly Leonen	2 fish
Third Place	Matthew Paulino	2 fish
<b><u>LONGEST FISH</u></b>		
First Place	Esther Cardenas	7.1” Honeycomb Grouper
<b><u>LONGEST TRIGGERFISH</u></b>		
First Place	Tony Meno II	7.5” Wedge Picassofish
Second Place	Chelcy Reyes	7.4” Picassofish
<b><u>MOST FISH on SUNDAY</u></b>		
First Place	John Pangelinan	4 fish
<b><u>LONGEST FISH</u></b>		
First Place	Joseph Pangelinan	7.8” Lowfin Rudderfish
Second Place	Raymond Blas	7.3” Honeycomb Grouper
<b><u>LONGEST TRIGGERFISH</u></b>		
First Place	Ariel Lozada	6.3” Picassofish
Second Place	Jay Horton	6.26” Wedge Picassofish

Derby results are listed in Table 1. Prizes for the derby were solicited for a two-day event in accordance with Executive Order 91-08, resulting in thirty-seven prizes being donated. Since there were only six winners from the actual fishing, the remaining prizes were distributed by lottery to the non-winners. Food was also donated by businesses, with donuts and soft drinks being provided as refreshments.

## **RECOMMENDATIONS**

### **Evaluations and Comments**

1. Just a big Thank-You to the dedicated and nice folks at the Department of Agriculture Division of Aquatic and Andersen Air Force for this activity. My son and I enjoyed the day. Ben Carbullido.
2. I am amazed with how well the whole activity is organized. For first-timers like my kids, it was truly a fun experience for them. This is really a good and encouraging activity for kids. Thanks to all those who braved the rains and who woke up very early to get this going. Marites Fojas.
3. Very good program by both the DOA and Andersen. Now if only we can get the fish to cooperate. Wil Paulino.
4. The Derby has been very well organized. We like the location - AAFB. Don't change anything. Felix Reyes.
5. Thanks, I think the program is great and you took care of everything imaginable. Thanks again. Chuck Talley.
6. Very Satisfactory. Kids enjoy themselves . Special Thanks.
7. This is the 5th Derby for my son and like always we really enjoyed ourselves. Hope that this event will continue for future generations.
8. Excellent job. I think the kids enjoyed it. Mages.
9. It was fun, good knowledge for everyone.
10. Great Fishing Derby. It should be done at 2x a year. It's good for the kids to look forward to.
11. The safety should be held before day of fishing so that kids can just go fishing upon arrival due to fishing upon arrival due to fish-feeding schedules. That's it. Albert Benavente.

12. This event provides a great opportunity and good excuse to take my boys fishing. I missed this clinic but I hope that future ones have specifics on bait and riggings for our area. This is our 3rd and will do all future ones. Jack Kuhn.
13. I don't know much about rod and reeling only that I take my kids whenever they want to go. But today's derby was nice and calm. I just hope next derby maybe, the older brothers may be allowed to help during the derby. Thanks !!! From all of us!
14. I think this is an excellent program and should be continued in the future. The DAWR did an excellent job at hosting the derby as well as the AAFB personnel. Thank You. John Jocson.
15. We got lots of bites but we didn't catch any fish. Alex D. Numann.
16. Hope to be here next year!
17. Not quite good catch today but it was a lot of fun. I believe that this program is beneficial to everyone, therefore, it should be continued. Also, give chance to the adult. Quilantip.
18. It was a good experience (Thank You). The boys learned a lot from the clinic and from the Derby. Jerome Quigley.
19. How about a new area for the derby - Ritidian? Would a late afternoon derby get more anglers/better participation? Good program.
20. I enjoy my fishing from the Agriculture sponsored. It's encouraging from a age like young people. It gives us good pleasure learning to be good fisherman. Tony Meno II.

The derby program has been well received and is a valuable educational tool for those who participate. However, an increase in the number of participants is essential for the program to effectively continue. This can be achieved by adding radio advertisements to our other methods of advertising. In addition, hosting more events and targeting special groups like the Boy Scouts, Girl Scouts, or village programs could work well.

Another factor concerning participation in derbies is to find a location that is more centrally located, instead of going to strictly military sites.

The response from participants and parents was positive. There have been requests by participants and parents to include a category for teenage anglers. Some of the older participants are interested in staying in the program, while some parents have older children who usually help their younger siblings to fish. This might help in making the derby more family oriented and decrease the chance of turning away potential participants.

## **PROJECT COST**

The estimated cost of this project is \$1,000.

Report Prepared by: Veronica Cummings