

**FISHERIES DIVISION**  
**1996/1997**  
**ANNUAL REPORT**

**MINISTRY OF AGRICULTURE, FORESTS,  
FISHERIES & METEOROLOGY**

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December 1997

Apia, Samoa

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## HIGHLIGHTS

- ❑ Eleven (11) tilapia fish farms and 29 giant clam farms have been established to promote alternative sources of food and to provide measures to enhance and manage Samoa's inshore fisheries resources.
- ❑ A total of about 11,000 juveniles and adult tilapia have been introduced in several locations around Upolu and Savaii. Approximately 32,000 baby clams of half to one year old have also been given out to villages for farming.
- ❑ About 118.5 mt of inshore fishery resources valued to approximately 1.09 tala were harvested throughout the 1996/97 period. About 215.5 mt of offshore fishery resources valued to about 0.76 million tala were also landed and disposed of locally during the same period.
- ❑ With the success of the longline fishery, an estimate of about 1,789 mt of fish was exported. The value of the exported fish is estimated to 11.8 million tala. Tuna was the largest proportion of the exported fish. About 8.6 mt of dried bechedemer (sea cucumbers) were also exported with the estimate value of 33.7 thousand tala. In addition, about 16.3 thousand worth of aquarium items was also exported.
- ❑ The Fishermen Safety at Sea Communication Network has been implemented. Fishermen have now realised the important of this communication network while engaged in their fishing activities.
- ❑ A workshop that has now qualified local fish exporters to prepare HACCP plan has been successfully undertaken. The threat on our fish that might not be accepted by the United States market has been minimised a great deal.
- ❑ At the end of June 1997, the Fisheries extension process has been commenced in 50 villages, and 32 have produced fishery management plans so far. Out of this 32 villages, 26 had established village Fish Reserves. These are the first such community-owned fish reserves in Samoa, and possibly the whole of the Pacific.

## **PROGRAMMES**

### **1. AQUACULTURE**

Aquaculture activities implemented during the 1996/97 period involves the establishment of three demonstration tilapia farms at Chanel College, Moamoa, Letogo and Lotofaga, Safata. In addition, seven giant clam farms have been established in fisheries reserves at the following villages: Salua, Lepuiai, Faleu and Apai on Manono Island Fasitoo-uta on Upolu, Satoalepai and Fagamalo on Savaii Island.

Furthermore, survey for appropriate sites for trochus and green snail introduction had been carried out at various sites around Upolu Island. Several ideal and suitable sites have been identified.

The survey to assess the potential of Afulilo Reservoir for stocking fish has been completed with very positive results.

Three trial shipments of small giant clams to establish an aquarium market have been conducted and found encouraging.

#### **1.1 Tilapia fish farm project**

As reported previously, the SPADP aided the establishment of the Salani tilapia demonstration farm in 1993. However, as of the end of the 1996/97 fiscal year, the Salani fish farm ceased operation due to poor farm management by the farmer and poor feed (as reported) in the 1995/96 Annual Report. Because of the need to diversify fish farming and promote alternative seafood development, efforts have been focused on the development of fish farms that are readily accessible to ensure better monitoring. In addition, the development of new and additional tilapia fish farms was to promote alternative means of generating employment and protein as well. Additionally, farming fish inland is promoting an optional solution of alleviate high fishing pressure exerting on Samoa's exhausted inshore fisheries resources.

Despite of no provision for aquaculture developments in the current financial year, Fisheries Division managed to continue part of its work with limited assistance from the FAO South Pacific Aquaculture Development Project. In addition, funds were also given by AusAid under its commitment to develop Fisheries Extension assisting in the development of tilapia demonstration farms.

Three additional demonstration fish farms were constructed and established at the following locations during 1996/1997 period are: Chanel College at Moamoa, Letogo and Lotofaga at Safata. The three sites were very ideal and suitable for fish farm as confirmed and verified by a consultant from Fiji Fisheries in conjunction with thorough assessment of site suitability conducted by the Research Section of Samoa Fisheries. All

sites have good freshwater supply, excellent soil water retention capacity and ideally close in proximity to the Fisheries Division for monitoring purpose.

### 1.1.1 Establishment and farm size

Chanel College farm was established in October 1996. Letogo fish farm was followed by in 1997 and Lotofaga fish farm was recently established. Apart from Lotofaga, Chanel and Letogo have two large grow-out ponds each with size ranging from more than 1,000 m<sup>2</sup> to 300 m<sup>2</sup>. Only Chanel College fish farm has two small size nursery ponds used to withhold and breed tilapia fry prior transferring to grow-out ponds. Sizes of constructed grow-out ponds and nursery ponds per farm are presented in Table 1.

**Table 1.** Summary of sizes of grow-out and nursery ponds at each tilapia fish farm

Pond size	Chanel College	Letogo	Lotofaga
Date established	October 1996		
Grow-out P1	1,050 m <sup>2</sup>	578 m <sup>2</sup>	765 m <sup>2</sup>
Grow-out P2	300 m <sup>2</sup>		493 m <sup>2</sup>
Nursery N1	42 m <sup>2</sup>		
Nursery N2	72 m <sup>2</sup>		

### 1.1.2 Stocking density

Stocking of grow-out ponds with fish is depending on the size of the ponds. All the three farms were stocked using the mean stocking density of 1.5 fish/m<sup>2</sup> of surface area. Table 2 summarises the initial stocking numbers and biomass along with stocking dates. Additionally, mean weights of stocked fish per farm are also included.

**Table 2.** Summary of the total numbers and biomass of tilapia fry that initially stocked grow-out ponds in each farm

Fish farms	Grow-out pond 1			Grow-out pond 2			Overall Total wt (kg)
	Total nos.	Avg wt (g)	Total wt (g)	Total nos.	Avg wt (g)	Total wt (g)	
Chanel College	1,575	3	4,725	600	20	12,000	16.73
Letogo	800	3	2,400	-	-	-	2.40
Lotofaga	1,100	3	3,300	-	-	-	3.30

Note: - yet to be stocked

### 1.1.3 Feeds

Naturally grown algae was the main food source of feed for tilapia as well as the supplementary feed of 20 per cent fishmeal and 80 per cent 'penu'. Generally ponds were fertilised to enhance growth of natural food i.e. algae, to supplement artificial feeds



as one the important components of the supplementary feeds locally available is very limited. The supplementary feed is anticipated to give an appropriate crude protein level of 28 per cent. The supplementary feed for tilapia was recommended as follows:

- ❑ First month: 10 per cent fish body weight
- ❑ Second – fourth month: 4 per cent of fish body weight

#### 1.1.4 Harvesting

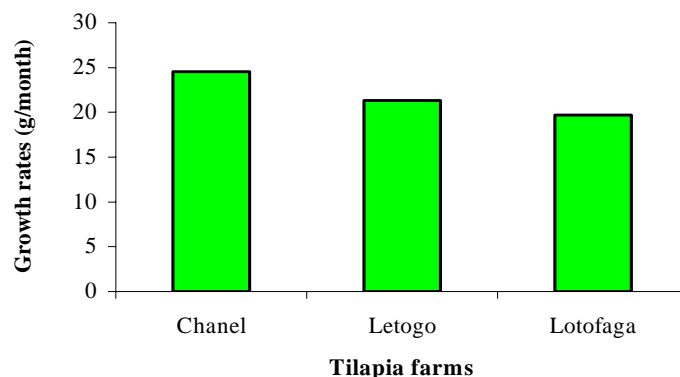
Both Chanel College and Letogo fish farms were harvested after six to seven months of culturing. Lotofaga is yet to be harvest as the fish are only cultured for five months. It is anticipated that Lotofaga fish farm will be harvested shortly when reaching six or seven months. Table 3 summarises mean body weight of fish harvested per grow-out pond per respective farm.

**Table 3.** Summary of the total numbers and biomass of the harvested fish grow-out pond

Fish farm	Total nos.	Total wt (kg)	Avg growth rate (g/month)	Biomass Increase (%)
Chanel College	2,800	413.8	24.8	96
Letogo	681	115.9	21.3	98
Lotofaga	-	-	19.7	-

Note: - yet to be harvested

Chanel College has indicated a slightly better overall growth rate as that of Letogo farm. Biomass of the initial stock of tilapia cultured at Moamoa has increased significantly by 96 per cent from the initial biomass as compared only to 65 per cent of those cultured in Letogo farm. Figure 1 illustrated the overall mean growth rate and biomass increases of tilapia fish cultured at each respective farm.



**Figure 1.** Average growth rate of culture fish at Chanel, Letogo and Lotofaga fish farms

### **1.1.5 Monitoring and maintenance**

The Aquaculture section of the Fisheries Division routinely carried out pond maintenance, monitoring and the collection of biological and physical parameters concerning growth, mortality, feed variation and water quality aspects. These tasks were part of the Fisheries on-going research programs to promote ensure maximum growth and this kind of venture is economically viable as an alternative food and income source.

Accordingly, the marketable size for tilapia is estimated to be 300 g, which is expected to reach in six or seven months of culturing. In spite of a significant increased in total weight of harvested fish, on average, fish yielded from both Chanel College and Letogo farms were lower by 51 per cent than the expected marketable size of 300g. The majority of fish harvested were generally smaller in size and the slow growth of fish may be attributed to many physical and environmental factors that are greatly impacted on organisms cultured in enclosed condition.

In the case of Chanel College farm, the quantity and the quality of the feeds, water temperature, high population density, less dissolved oxygen and the PH of the water were the main factors identified. In addition, the rapid reproduction of the initial stock, that took place in the third month, causing overpopulation and therefore directly affecting growth and preventing fish from reaching the marketable size of 300 g.

### **1.1.6 Conclusion and recommendations**

Several factors have been identified from the first six months of operation that need to consider and address in order to achieve better result of fish growth through artificial culture. The followings are the recommendations require for the improvement of the Chanel College fish farm and other farms as well.

- ❑ Mono-sex culture should apply in order to avoid rapid reproduction and overpopulation.
- ❑ Same size and age culture.
- ❑ Low stocking density to enhance better growth and prevent competition for food and space.
- ❑ Eliminate tilapia fry if they are abundant as a mean of controlling overpopulation and consequently promoting fast and better growth of tilapia from minimum.

## **1.2 Community or Village based Fish Ponds**

Three large natural freshwater ponds on Savaii were stocked with tilapia (*Oreochromus niloticus*) as an on-going effort by the Fisheries Division to introduce new food species. Additionally, the introduction of tilapia to village natural ponds and streams is by way of promoting alternative sources of food and income in order to assist subsistence communities. Furthermore, the introduction of tilapia thus facilitates the enhancement of

fisheries resources that is exploited by villagers for sustenance. Introduction of tilapia by location and date is presented in Table 4.

**Table 4.** Introduction of tilapia to natural ponds by location and date

Location	Initial stock	Stocking date
Sato'alepai	1,000	June 1996
Pu'apu'a	1,500	28 May 1997
Fagamalo	1,500	June 1997

### **Future Activities**

- ❑ Advise potential aquaculture farmers and communities on various farming systems including species selection.
- ❑ Conduct aquaculture trials of various species, particularly tilapia to test their viability for information of tilapia farmers.
- ❑ Operate breeding facilities for tilapia and giant clams to provide seeds for both culture trials and private farmers.
- ❑ Collect data pertaining to growth, mortality and general operation on different aquaculture systems.
- ❑ Analysis of parameters to determine technicality and economics of these ventures.
- ❑ Assist in designing ponds for tilapia farm.
- ❑ Further promote tilapia in the most suitable means as alternative source of food and income for subsistence communities
- ❑ Establish tilapia aquaculture centre at Afulilo Reservoir and Aquaculture Centres in Asau Savaii and Apia Upolu.

## **1.3 Giant clam farm project**

### ***1.3.1 Introduction of giant clam into Village Fisheries Reserves***

Between July 1996 and June 1997, a total of 12,150 giant clam yearlings (*Tridacna derasa*, *T. squamosa* and *Hippopus hippopus*) of different sizes ranging between 56.3 mm and 73.6 mm were placed in six village fisheries reserves. The introduction of clams was principally aimed for inshore resources enhancement. In addition, it also focussed on promoting the co-participation of resource users and the Fisheries Division in the management of village fisheries resources in order to ensure its sustainability.

Through out the 1996/97 period, the Research Section (RS) of the Division has monitored growth and survival of clams placed in reserves. Table 5 presents the summary of the giant clams introduced by date, numbers and place of introduction.

**Table 5.** Introduction of giant clams by date and location

Date	Place introduced	Numbers
16/9/96	Apai, Manono Island	1,500
16/9/96	Salua, Manono Island	2,000
16/9/96	Faleu, Manono Island	2,000
18/6/96	Lepuai, Manono Island	1,500
21/7/97	Satoalepai, Savaii	1,500
21/7/97	Saleaula, Savaii	1,500

### 1.3.2 Growth rates

Clams placed at fisheries reserves in Fasitoo-uta have indicated significant growth because of thorough maintenance and well looked after. Likewise, clams at Manono Island fish reserves have also shown significant growth per month. Overall, giant clams placed in the wild have achieved an average growth rate of 5.6 mm/month or 67.2 mm/year. The known maximum length of introduced clams ranging from 350-400 mm for *T. squamosa* and *T. maxima* and 500 mm for *H. hippopus*. Their reproductive lengths were known to between 150 mm to 200 mm. Based on the mean growth rate determined from clams cultured in reserves, *T. squamosa* and *T. maximum* could reach their maximum size within 5-6 years. *H. hippopus* could achieve its maximum length within 7 years. Reaching their reproductive sizes, *T. squamosa* and *T. maxima* will reach sexual maturity stage at 2 – 3 years and *H. hippopus* by 3.5 years. However, successful growth and survival of cultured clams depending on consistence monitoring and maintenance through elimination of competitors (algae and seaweeds) and predators (especially the *cymatium muricinu* snail). Despite of an indication better growth outcome of clams in reserves, it requires consistent monitoring and maintenance to ensure better growth and for resources enhancement objective to be achieved in the long run. The summary of mean growth rates of clams placed in each respective fish reserves is given in Table 6.

**Table 6.** Mean growth rate of giant clams placed in Fish Reserves.

Fish Reserve	Avg growth rate mm/month
Tauo'o, Faleasi'u	4.5
Moamo, Faleasi'u	5.6
Salua, Manono	7.5
Apai, Manono	2.9
Faleu, Manono	7.2
Lepuai, Manono	6.7
Fasitoota	10.2
<b>Mean growth rate</b>	<b>5.58</b>

### **Future Activities**

- ❑ Advise villages or communities on various monitoring and maintenance systems to ensure minimise mortality rate.
- ❑ Conduct aquaculture trials for giant clams to test their viability for information of giant clam farmers.
- ❑ Operate breeding facilities (hatchery) for giant clams to provide seeds for both culture and reseeded program.
- ❑ Collect data pertaining to growth, mortality and general culture systems to achieve resources enhancement.
- ❑ Analysis of parameters to determine technicality and economics of these ventures.
- ❑ Assist in provision of technical advice for establishment of giant clam farm.
- ❑ Continue site selection to assess suitable location for giant clams.

### **1.4 Other aquaculture and mariculture future activities**

- ❑ Assessment of status of trochus and site selection.
- ❑ Conduct further surveys of sites for trochus and green snail.
- ❑ Conduct mariculture trial of *Caulerpa*, sea grape (limu-fuafua).
- ❑ Conduct trial of translocation of commonly utilised shoreline shellfish (pae, asi, tugane and pipi).

## **2. FISHERIES STATISTICS**

The collection of fisheries landing statistics is one of the Division's on-going programs. Data collection surveys are conducted on randomly chosen days of the week at various commercial outlets. On each sampling day, major taxa (families to species) of fishes and invertebrates are recorded, lengths are measured and numbers counted. The weights are then estimated from lengths, using a table of weight/length relationship for various types of fishes produced for similar studies in Fiji. Other information on economic value and effort (fishing hours, location, fuel consumption, number of crew, fishing methods, etc.) are obtained from interviewing sellers, proprietors of other outlets or from receipt books. Data are entered into the fishery database, which is in ACCESS. On each sampling day, data are summarised and entered with landings estimated on a monthly basis and reviewed annually.

The fisheries surveys that were implemented by the Division in the 1996/1997 period are as follows:

- (a) Offshore tuna fishery survey at the Apia Fish Market.
- (b) Offshore bottomfish fishery survey at the Fish Market.
- (c) Inshore fishery survey at the Apia Fish Market.
- (d) Apolima landing site survey.
- (e) Wholesalers, retailers, restaurant survey.
- (f) Shellfish survey (Apia to Vaiusu).
- (g) Longline catch and effort survey

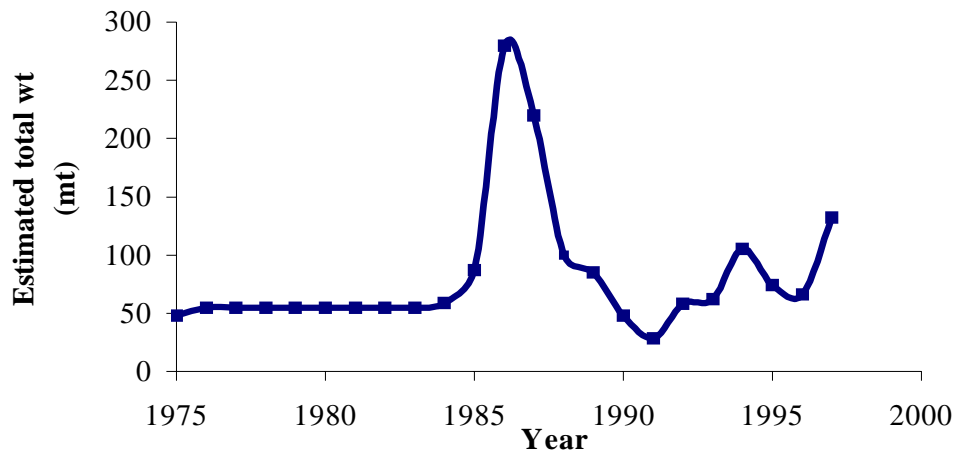
## 2.1 Artisanal and Commercial Landings

Marine and fisheries organisms have been, and generally still are, the major protein source in the diet of many coastal communities in Samoa. These fisheries organisms also provide the primary source of income for individuals and households in many coastal villages. Recent studies (Zann 1991; Mulipola 1997) have indicated that approximately between 35 and 40 per cent of all households in Samoa are classified as subsistence fishers with only 12 per cent is categorised as primary fishers. Subsistence fishers are known to have engaged in income generation through fishing but not as much as the 12 per cent of active household fishers.

The FD has monitored and collected catch and effort data from various known sources as part of their continuous assessment and management program. Many of the collected catch and effort data were obtained from surveys of artisanal and commercial fishers. Artisanal fishers were people who predominantly fish for income and barter exchange, but also retain part of their catch for consumption. However, commercial fishers were those who report predominantly selling all of their catch from all fishing trips undertaken.

### 2.1.1 *Inshore fisheries*

Figures 2 present an overview of the trend in landings of inshore fisheries annually based on the Division's on-going data collection program since 1975. Helm (1987) and Zann (1991) reported that inshore fishery landings prior to the 1986 were not statistically estimated as there was no consistent sampling program undertaken by Fisheries. However, a first statistically sampling program was initiated in 1986. Catch for inshore seems to have reached its highest level between 1986 and 1987 as related directly to increasing effort through the extensive use of mass captured techniques such as gillnetting and dynamiting. Following the peak is a steep decline in which Helm (1987) reported to be attributed to the dramatic decline in the landings of the **atule** (*Crumenophalus selar*). Zann (1991) and Mulipola (1992, 1993) also reported the absence of the seasonal and migratory atule, which in the past constituted a major portion of the inshore annual catches. Inshore fisheries have attained its lowest point in 1990 and 1991, which reflected the effects of cyclone Ofa and Valerie on the fishery resources and fishing effort.



**Figure 2.** Estimated annual landings (based on artisanal and commercial landings) of inshore fisheries in Samoa from 1975 to 1997

Inshore landings have steadily increased since 1992. The increase in landings reflects a possibility of resources regeneration and habitats recovery. Accordingly, many coral reefs around Upolu and Savaii have recovered remarkably well from cyclone effects (Green 1996). In addition, the increase also reflects the significant amount of fish and invertebrates exported to overseas market, in particularly to American Samoa (refer to export section). Likewise, the increase also indicated the consequential shifting of efforts from agricultural activities unto fishing as the taro, the main agricultural crop for income generation and staple food source was dramatically devastated by the taro leaf blight.

#### (a) *Fin-fish*

A total of 54.8 mt was estimated sold via the Apia Fish Market and Other Outlets (Retailers, roadsides, etc.) in 1996/97 period. Mullet (**anae**) consisted of 29.4 per cent of the total weight of lagoon and reef finfish followed by parrotfish (**fuga**) (15 per cent) and unicornfish (**ume**) which composed 15 per cent respectively. Although *Acanthurus lineatus* (**alogo**) and *Ctenochaetus striatus* (**pone**) were noted to be the most targeted fish group daily presented for sale at the market, they only comprised 6.7 per cent of the total landing weight.

Overall, approximately \$318,000 tala was generated from inshore finfish sold at through the Apia fish market and other outlets on an average rate of \$5.80/kg. Table 7 summarises the total landing of inshore finfish by species, total weight, total value and landing proportion for the period of 1996/97.

**Table 7.** Summary of the total inshore landing by species, weights and value for 1996/97 recorded from the Apia Fish Market and Other Outlets (Retailers, Roadsides, etc.)

Fish species or groups	Total Wt (kg)	Total Value (Tala)	Wt (%)
Bigeye scad (Atule)	477.43	2,769.09	0.9
Trevally (Malauli)	1,899.96	11,019.77	3.5
Emperors (Mataeleele)	6,109.71	35,436.32	11.2
Goatfish (Ululaoa, Vete)	1,422.53	8,250.67	2.6
Groupers (Gatala)	1,326.26	7,692.31	2.4
Moray eel (Pusigatala)	3,055.45	17,721.61	5.6
Mulletts (Anae)	16,092.72	93,337.78	29.4
Other fish (Isi i'a)	801.2	4,646.96	1.5
Parrotfish (Fuga)	8,235.02	47,763.12	15.0
Rabbitfish (Lo, Malava)	542.5	3,146.50	1.0
Snappers (Malai, Tamala)	1,003.48	5,820.18	1.8
Soldierfish (Malau)	835.95	4,848.51	1.5
Surgeonfish (Alogo)	1,559.1	9,042.78	2.8
Surgeonfish (Pone/Palagi)	2,134.7	12,381.26	3.9
Topsail drummer (Ganue)	633.2	3,672.56	1.2
Unicornis (Ume)	8,257.32	47,892.46	15.1
Wrasses (Sugale)	386.26	2,240.31	0.7
<b>Total</b>	<b>54,772.79</b>	<b>317,682.18</b>	<b>100.0</b>

**(b) Crustacean**

Estimated total volume of about 45.4 mt of crustacean was landed and sold via the Apia Fish Market and Other Outlets during the 1996/97 period. Approximately 711.6 thousands tala was generated from the landed amount of which was sold at an overall average rate of 8.57 tala/kg. Mud crab (*Scylla serrata*) dominated (84.8 per cent) the total volume of crustacean with the lobster (*Panilurus pencillatus*) composed 12.6 per cent of the total. Table 8 presents the summary of the total landing volume of crustaceans at the Apia Fish Market and Other Outlets between July 1996 to June 1997.

**Table 8.** Total volume of crustacean by species landed at the Apia Fish Market and Other Outlets (Retailers, Roadside, etc.) in 1996/97

Species	Total Wt (kg)	Total Value (Tala)	Avg Price/kg	Wt (%)
Lobsters	5,725.76	53,310.92	9.30	12.6
Mud crabs	38,474.10	649,953.70	16.80	84.8
Reef crabs	1,024.36	7,421.19	7.25	2.2
Slipper lobsters	97.80	933.87	9.50	0.4
<b>Total</b>	<b>45,322.02</b>	<b>711,619.68</b>	<b>8.57</b>	<b>100</b>



**(c) Shellfish**

Although other types of shellfish were sold through the Apia Fish Market and Other Outlets, giant clams of *Tridacna maxima* and *T. squamosa* were the dominant types of shellfish landed. Of the two types of faisua landed, *T. maxima* consisted of 92 per cent of the total landing weight with *T. squamosa* comprised only 2 per cent. A total of about 2 mt was estimated being landed which yielded a total revenue of about 2,000 tala. On average, faisua was sold at a price of \$1.44/kg throughout the year. Summary of major types of shellfish sold through the Apia Fish Market in 1996/97 is given in Table 9.

**Table 9.** Total volume of the main shellfish types landed at the Apia Fish Market and Other Outlets (Retailers, Roadside, etc.) in 1996/97

Species	Total Wt (kg)	Total Value (Tala)	Avg Price/kg	Wt (%)
Maxima ( <i>faisua</i> )	1,801.72	1,458.73	0.81	92
Squamosa ( <i>faisua</i> )	153.24	534.89	3.50	8
<b>Total</b>	<b>1,954.96</b>	<b>1,993.62</b>	<b>1.02</b>	<b>100</b>

**(d) Molluscs**

During the 1996/97 period, a total of approximately 16.4 mt was estimated to be landed and sold via the Apia Fish Market and Other Outlets (Retailers, Roadsides, etc.) which, produced about 68.3 thousands tala of revenue. Octopus (fee) comprised of 91 per cent of the total volume of molluscs sold during the year. Summary of the major types of molluscs landed and sold locally in 1996/97 interval is presented in Table 10.

**Table 10.** Total volume of molluscs by species landed at the Apia Fish Market and Other Outlets (Retailers, Roadside, etc.) in 1996/97

Mollusc species	Total Wt (kg)	Total Value (Tala)	% in Wt
Octopus (fee)	14,896.05	63,800.35	91
Topshells (aliao)	1,520.45	4,145.24	9
Other molluscs	14.23	331.12	
<b>Total</b>	<b>16,430.73</b>	<b>68,276.71</b>	<b>100</b>

**(e) Overall total of lagoon and reef fish and shellfish landed at Apia Fish Market and Other Outlets**

Based on the Fisheries Division's ongoing sampling program carried out in 1996/97 period, a total of approximately 118.5 mt of inshore fisheries was estimated to be landed and sold via the Apia Fish Market and Other Outlets (Retailers, Roadsides, etc.). A total of about 1.10 millions tala was estimated as the overall worth of inshore fisheries products landed and sold locally. Moreover, inshore products were overall sold at an

average price of about \$5.62 tala/kg. Finfish dominated (42.5) the total volume inshore fisheries resources in 1996/97. The second most landed item is the crustacean type which, accounted for about 32.5 per cent of the total landing weight. Table 11 presents the overall summary of the total inshore fisheries landed and sold through the Apia Fish Market and Other Outlets (Retailers, Roadsides, Fugalei, etc.) in 1996/97 period.

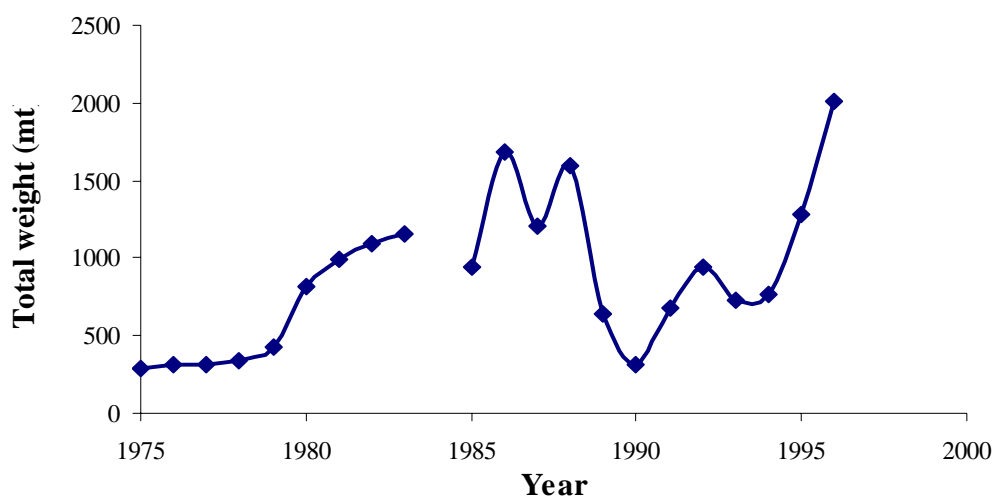
**Table 11.** Overall totals of inshore fisheries for 1996/97 period landed at the Apia Fish Market and Other Outlets (Retailers, Roadsides, etc.)

Fisheries	Total Wt (kg)	Total Value (Tala)	Avg price/kg	% in wt
Finfish	54,772.79	317,682.18	5.80	42.5
Crustaceans	45,322.02	711,619.68	15.70	32.5
Molluscs	16,430.73	68,276.71	2.96	20.7
Shellfish	1,954.96	1,993.62	1.02	1.50
<b>Total</b>	<b>118,480.5</b>	<b>1,099,572.19</b>	<b>5.09</b>	<b>97.2</b>

### 2.1.2 Offshore fisheries

#### (a) Tuna fishery

Total landings of offshore fisheries based on artisanal and commercial landings (pelagics and deepwaters) from motorised fishing *alias* in Samoa over a 20 years period is given in Figure 3. Since the introduction of motorised fishing *alias*, tuna species; skipjack (*Katsowanus pelamis*) and yellowfin (*Thunnus thunnus*) dominated landings of pelagic species every year. However, the introduction of the longline fishing technique recently (last three years) saw the albacore (*Thunnus thunnus*), yellowfin (*Thunnus albacare*) and bigeye (*Thunnus alalunga*) species composed a significant proportion of pelagic tuna landings annually.



**Figure 3.** Estimated annual landings of offshore pelagics fisheries in Samoa between 1975 and 1997

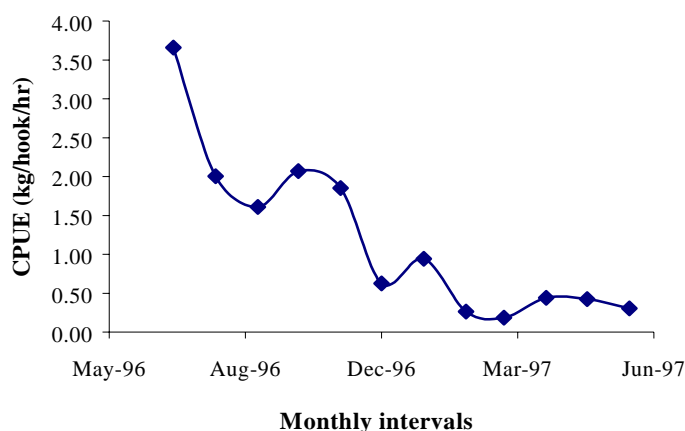
The landings for pelagic species reached its highest point from the mid to late 1980's and its lowest level in 1990-1991. The gradual increase of tuna catch from the 1970's correlated with the increase in fishing effort as the motorised fishing alia was first introduced under the FAO/DANIDA project. The lowest level in landings is therefore associated with the destruction of many fishing *alias* by cyclone Ofa and Valerie. Nonetheless, over the past three years, the annual landings of pelagic species have been increased significantly as the level of fishing effort have been enormously increased from only about 40 *alias* in 1992 to 180 *alias* actively engaged in the longline fishing in 1996/1997.

Furthermore, the availability of market overseas also contributed to the increase in volume of pelagic (tunas, etc.) landings recently. However, the majority of tuna landed and sold via the Apia Fish Market and Other Outlets was dominated (76 per cent) by skipjack (*K. pelamis*) and yellowfin (18 per cent). Skipjack tuna was sold on an average price of \$3.00 tala per kg throughout the year. Similarly, yellowfin was sold on an average price of \$3.70 tala per kg. Albacore and bigeye tuna were also highly priced than skipjack and yellowfin at local markets. Overall, tunas were sold on an average price of \$3.38 tala per kg during the year. In spite of the large volume of albacore and bigeye tunas landed locally, they were mostly exported due to their high and better meat contents which currently fetched better price than to disposed locally. Summary for the 1996/97 landing for tunas and other pelagic species at the Apia Fish Market and Other Outlets is given in Table 12.

**Table 12.** Estimated total landing of tunas and other offshore pelagic species landed through Apia Fish Market and Other Outlets in the 1996/97

Tuna species	Total Wt (kg)	Total Value (Tala)	Avg \$/kg	% in wt
Skipjack	141,554.93	423,565.78	3.00	76
Yellowfin	33,047.74	122,815.05	3.72	18
Albacore	5,990.08	30,681.18	5.12	3
Bigeye tuna	4,867.98	32,580.20	6.69	2
Dogtooth tuna	1,227.03	5,928.56	4.83	1
Stripped tuna	2.36	41.60		
<b>Total</b>	<b>186,690.12</b>	<b>615,612.37</b>	<b>3.34</b>	<b>100</b>

Based on the on-going monitoring program of the Longline fishery's conducted over the 1996/97 period, the average catch per unit effort (of all species combined) has ranged from 0.18 to 3.66 kg/hook/hr. The overall catch per unit effort was estimated to be 1.2 kg/hook/hr. Generally, the catch rate of the longline fishery has peaked in July 1996 and then gradually declined as fishing efforts (number of fishing boats/fishers and fishing hooks and line) have significantly increased. Figure 4 illustrated the trend of CPUE (kg/hook/hr) over the 12 months period.



**Figure 4.** Longline fishery's average catch rate per month from July 1996 to June 1997.

**(b) Other pelagic landings**

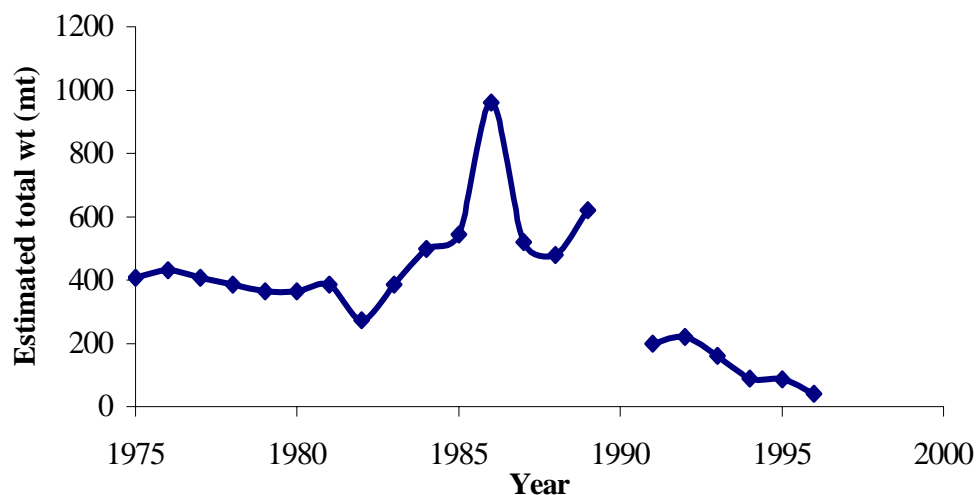
Masimasi, swordfish and wahoo dominated (87 per cent combined) the total volume of other offshore pelagic fish landed and sold through Apia Fish Market and Other Outlets in 1996/97 period. A total of approximately 7.34 mt was yielded which generated about 41.3 thousand tala of revenue. Throughout the year, other pelagic fish were sold at an average price of 4.67 tala per wt (kg) with the rainbow runner and swordfish being the most expensive fish. Larger fish types such as marlin, swordfish and sailfish were mainly sold in pieces ranging between 15-20 tala per piece. Given in Table 13 is the overall summary total landings of other pelagic fish landed and sold through the Apia Fish Market and Other Outlets (Retailers, roadsides, etc.) over a 12 months period of 1996/97.

**Table 13.** Landings of Other pelagic fish at Apia Fish Market and Other Outlets during 1996/97 period

Other pelagic species	Total Wt (kg)	Total Value (Tala)	Avg \$/kg	% in wt
Dolphinfish	3,423.38	17,660.26	5.16	47
Swordfish	1,635.64	12,084.58	7.39	22
Wahoo	1,335.13	5,930.22	4.44	18
Other Pelagic Fish	447.16	1,939.16	4.34	6
Rainbow runner	333.44	2963.63	8.89	5
Marlin	163.51	677.44	4.14	2
Sailfish	8.31	24.92	3.00	
<b>Total</b>	<b>7,346.57</b>	<b>41,280.21</b>	<b>4.67</b>	<b>100</b>

*(d) Deepwater fisheries*

With the majority of active fishing *alias* have been engaged in the tuna fishing industry recently, landings for deepwater species (Figure 5) continued to decline since 1991 and as well kept it in minimum level over the past five years. Clearly, landings of deepwater based on artisanal and commercial landed fish have reached its lowest level over the past three years. Increasing in fishing effort for the exploitation of highly priced tunas (albacore and bigeye) may be attributed to the decline in landings of deepwater species.



**Figure 5.** Estimated annual landings of offshore bottomfish fisheries in Samoa between 1975 and 1997

Table 14 presents the summary of the total annual landings of bottomfish species for the 1996/97 period.

**Table 14.** Estimated total landing of deepwater species landed at Apia Fish Market and Other Outlets (Apolima) during the 1996/97 period

Fish name	Total Wt (kg)	Total Value(T)	Avg \$/kg	% in wt
Baracuda	763.28	4,577.74	6.00	3.6
Emperor	19.98	59.27	2.97	0.1
Grey jobfish	2,142.74	9,375.84	4.38	10.0
Grouper	2.17	10.83	5.00	0.0
Humpback snapper	8,928.71	43,540.70	4.88	41.8
Other fish	6.88	57.35	8.33	0.0
Shark	506.06	9,437.30	18.65	2.4
Silverjaw jobifsh	2,088.23	3,509.09	1.68	9.8
Snapper	4,363.23	21,638.93	4.96	20.4
Soldierish	64.51	348.27	5.40	0.3
Trevally	2,466.32	13,258.74	5.38	11.6
<b>Total</b>	<b>21,352.10</b>	<b>105,814.06</b>	<b>4.96</b>	<b>100.0</b>

**(d) Total offshore landings**

An estimated total of 215.4 mt of offshore fish was harvested and sold through the Apia fish market and Other Outlets (Retailers, Roadsides, etc.) between July 1996 and June 1997. Of the total offshore fisheries landing, tuna species make up 87 per cent and deepwater species comprised of 10 per cent of the combined total weight. Estimated total revenue of about 762.7 thousands tala was generated from the total fisheries landings. Summary of the total landings of offshore by each respective fishery is given in Table 15.

**Table 15.** Overall summary of offshore fisheries resources landed at Apia Fish Market and Other Outlets in 1996/97 period

Fishery types	Total Wt (kg)	Total value (tala)	Average price/kg	% in wt
Deepwater	21,352.10	105,814.06	4.96	10
Tuna	186,690.12	615,612.37	3.34	87
Other pelagics*	7,346.57	41,280.21	4.67	3
<b>Total</b>	<b>215,388.79</b>	<b>762,706.64</b>	<b>3.24</b>	<b>100</b>

Billfish, swordfish, sailfish, dolphinfish, rainbow runner, etc.

## 2.2 Export fisheries

### 2.2.1 Fish

During the 1996/97 period, approximately 1,798 mt of fisheries products were exported to overseas markets which generated about 11.84 millions tala as revenue. Tuna fish species constituted (99 per cent) the majority of the total weight of fisheries items exported. The inshore and offshore deepwater fish species composed the remaining 1 per cent of the total export volume.

A total of 2.59 mt of reef and lagoon fishes were estimated being exported overseas during the 1996/97 period which, generated a total revenue of about 14.5 thousands tala. Throughout the year, inshore fisheries were sold at an average price of about 5.58 tala per kilogram. Of the total export volume of inshore originating fish species, surgeonfish (*alogo*, *pone* and *palagi*) accounted for about 50 per cent. However, out of the overall total volume of fisheries exports, inshore fin-fish comprised only 0.14 per cent of the total weight.

Approximately 1.48 mt of deepwater fin-fish was estimated being exported overseas in which correspondingly yielded about 7.98 thousands tala. During the year, deepwater fish was generally sold at an average price of about 5.40 tala per kilogram weight. *Lutjanus gibbus* (malai) accounted for about 70 per cent of the total weight of exported deepwater fish. Deepwater fish represented only 0.08 per cent of the total combine weight of fisheries export in 1996/97.

*Thunnus thunnus* (Albacore) constituted 62 per cent of the total volume of tuna exports during the year. Tuna species of high commercial value, such as yellowfin and bigeye make up the bulk of the total tuna exports in 1996/97 period. A total of about 11.8 millions tala was generated as the total estimated revenue based on the overall mean price of about 6.64 tala per kilogram weight. Out of the total tuna exports during the year, 48 per cent was shipped predominantly to the canneries in American Samoa.

Other offshore pelagic species such as marlin, sailfish, *masimasi*, etc. were also exported which totaled to about 13 mt combined. Predominantly, other offshore pelagic species were transferred directly from Apia to the canneries in Pago Pago whereby a total of approximately 42.6 thousands tala was produced as income revenue.

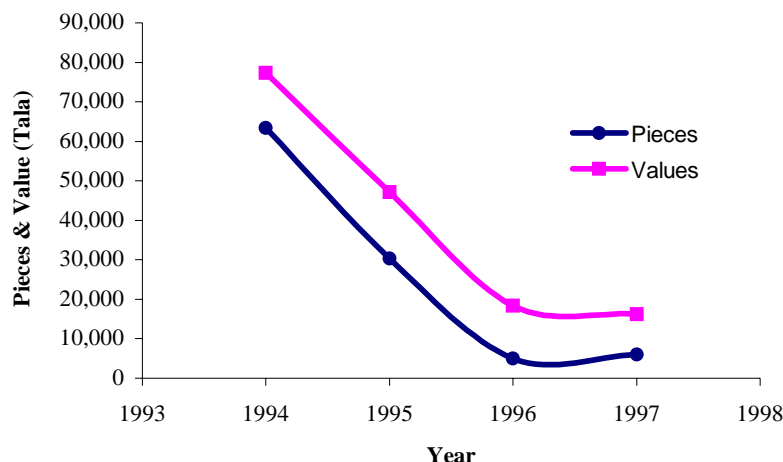
Fisheries products were mostly exported to American Samoa, United State of America, Australia and New Zealand. Out of the total export volume in 1996/97 period, 82 per cent was exported to Pago Pago to the canneries for processing, USA (15 per cent), Australia (3 per cent) and <1 per cent for New Zealand. Table 16 presents the total volume of fisheries resources being exported overseas from Samoa between July 1996 and June 1997.

**Table 16.** Total fisheries exports in 1996/97

Fisheries	Total Wt (kg)	Total Value (Tala)
<b>Inshore fish</b>		
Surgeonfish ( <i>alogo, pone</i> , etc.)	1,297	7,388
Parrotfish ( <i>fuga, fugausi</i> , etc.)	760	4,228
Groupers ( <i>gatala</i> , etc.)	165	917
Emperor ( <i>mataeleele</i> , etc.)	132	766
Other reef/lagoon fish ( <i>Isi i'a</i> )	236	1,174
<b>Total</b>	<b>2,590</b>	<b>14,473</b>
<b>Deepwater / bottomfish</b>		
Humpback snapper ( <i>malai</i> )	1,036	5,319
Longnose emperor ( <i>filoa vaa</i> )	218	1,375
Others ( <i>Isi i'a</i> )	221	1,286
<b>Total</b>	<b>1,475</b>	<b>7,980</b>
<b>Tuna</b>		
Albacore ( <i>alapakoa</i> )	1,098,640	5,885,000
Yellowfin ( <i>asiasi</i> )	655,640	5,767,300
Bigeye ( <i>pikiai</i> )	17,720	117,700
<b>Total</b>	<b>1,772,000</b>	<b>11,770,000</b>
<b>Other pelagic fish</b>		
Sailfish ( <i>sa'ula</i> , etc.)	5,598.90	14,918.00
Marlin ( <i>malini</i> , etc.)	5,731.00	15,251.76
Wahoo ( <i>uahu</i> )	1,197.80	7,862.00
Dolphinfish ( <i>masimasi</i> )	417.40	6,065.50
Swordfish ( <i>sa'u</i> )	37.90	167.20
<b>Total</b>	<b>12,983.00</b>	<b>44,264.46</b>
<b>Grand total</b>	<b>1,789,048</b>	<b>11,836,717</b>

### 2.2.2 Aquarium

Aquarium trade has been revived in early 1992 with the Lefaga Seaboard Ltd the only company involved in the exportation of mostly tropical fish for ornamental purpose. Figure 6 illustrated the trend of aquarium exports over the past five years. The export volumes of items for ornamental have been significantly declined which may attributed to the strict controls imposed by the Fisheries Division in a bid to retain the resource in its sustainable level.



**Figure 6.** Trend of aquarium exports between 1993/94 and 1996/97 periods.

Throughout the year, only two companies were actively engaged in the exploitation of colorful tropical fish and 'dead corals' known as bio-rocks for the aquarium trade. A total of 5,993 pieces of fish and bio-rock were altogether air-freighted to the USA mostly. In return, 16.3 thousands tala was acquired through exports for the aquarium trade. Summary of the total aquarium exports during the 1996/97 period is presented in Table 17.

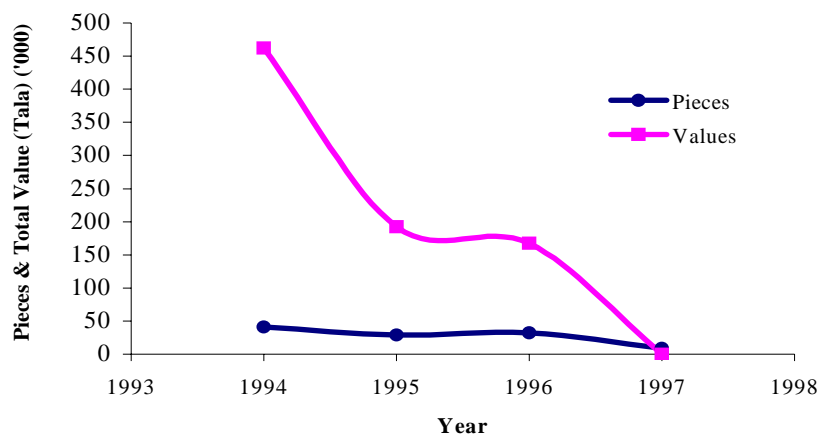
**Table 17.** Total exports of aquarium fishery in 1996/97 period

Items	Tot Pieces	Tot Value(T)	Avg \$(T)/pcs
Tropical fish	183	126.48	0.69
Algae	5	3.00	0.60
Anemones	880	1383.60	1.57
Bio-rocks	2729	8931.24	2.62
Crustacean	22	2.64	0.12
Shellfish	1504	4255.20	2.83
Sea urchin	10	11.76	1.18
Soft coral	40	159.60	3.99
Sea cucumber	128	248.38	1.94
Sand	5	2.40	0.48
Starfish	90	96.84	1.08
Unknown	397	1090.80	2.75
<b>Total</b>	<b>5,993</b>	<b>16,311.94</b>	<b>1.53</b>



### 2.2.3 Bechedemer

The beche-de-mer fishery has revived in Western Samoa in the late 1992 and early 1993 as reported previously. Beche-de-mer is the processed form of a sea cucumber after being boiled, smoked and sun-dried for a period of time. Figure 7 illustrated the general trend of total beche-de-mer being exported between 1993 and 1997.



**Figure 7.** Trend of total exports of beche-de-mer over the past five years

During the 1996/97 period, only two companies namely, Cheng Si Wang Ltd and Island Food Produce were involved in the exploitation, processing and exporting of sea cucumbers. A total of 8.6 mt of processed sea cucumbers was exported in which produced about 33.7 thousands tala as revenue. Summary of the total landing of beche-de-mer by species is presented in Table 18.

**Table 18.** Total volume of exported bechedemer in 1996/97 period

Species	Tot Wt (kg) (kg)	Total Value (T) (Tala)
Brown sandfish	5,170	19,513.75
Greenfish	271	1,704.00
Lollyfish	1,100	2,456.25
Tigerfish	1,770	8,565.00
White teatfish	10	65.00
Surf redfish	268	1,407.00
<b>Total</b>	<b>8,589</b>	<b>33,711.00</b>

### 2.3 Subsistence or village-level fisheries

Obtaining of subsistence estimates is relatively difficult because of the wide diversity of fishing communities. Additionally, lack of Fisheries staffs also contributed to the difficulty of collecting subsistence landings. Nevertheless, the survey of the subsistence fisheries was undertaken in 1996/97 period on Savaii Island. Similar surveys were

conducted in 1990/91 for both Upolu and Savaii (including Manono and Apolima). Based on these subsistence assessments, King (1990) estimated the subsistence landing for Samoa as 4,600 mt. Likewise, Zann (1990) and Mulipola (1997) estimated subsistence landing to be 3,200 mt in 1990 and 4,200 mt in 1996 respectively. Again, King and Faasili (1997) estimated the subsistence landing for the whole of Samoa as 4,600 mt. Averaging the landing volume of subsistence fisheries during the 1996-1997 as suggested by King and Faasili (1997) and Mulipola (1996), subsistence landing is estimated to be 4,400 mt which is expected to be valued at approximately 17.6 millions tala.

## 2.4 Total fisheries landing in Samoa

Based on the overall totals of fisheries landings originated from artisanal and commercial activities and from subsistence activities, the overall total of fisheries landings from Samoa waters is estimated to be 6,543 mt and is summarised in Table 19.

**Table 19.** Overall summary of fisheries landings in Samoa during 1996/97

<b>Fisheries Landing Source</b>	<b>Estimated Total Wt (mt)</b>	<b>Estimated Total Value (Million Tala)</b>
Artisanal & Commercial	2,143	14.04
Subsistence	4,400	17.60
<b>Overall Totals</b>	<b>6,543</b>	<b>31.64</b>

### Future activities

- ❑ Continuation of the Fisheries data collection program.
- ❑ Development of new database systems to accommodate surveys of Fisheries Reserves and Outer Reef Slope.
- ❑ Continuation of the compilation, databasing and analysing of collected and acquired fisheries data and information.
- ❑ Upgrading the databasing and analysing systems for efficient generation of reports and information.
- ❑ Impose sampling program and data collection to gather information on biological, technical, social and economical implications of the newly developed longline fishery.

## 3. RESOURCES ASSESSMENT AND MANAGEMENT

### 3.1 Fisheries reserves

The impositions of Village Fish Reserves, in which all fishing is banned, provide the possibility of establishing a network of fish refuges around the entire country. Objectively, the establishment of these fish reserves is to provide the means by which

lagoons and adjacent fishing may eventually be replenished by breeding and larval transport (King, 1995, 1996). Moreover, the establishment of reserves is therefore a more practical and realistically management approaches to ensure enhancement of fisheries resources in lagoon and reef habitats of Samoa.

As of the end of the 1996/97 period, 32 villages have already established and declared their Fish Reserves, in which all fishing activities are prohibited, in part of their traditional fishing areas. However, 20 of these reserves were declared during the 1996/97 period. Prior to the establishment of any Fish Reserve, the Resources Assessment and Management Section of the Fisheries Division assess the suitability of the selected site with regards to its existing resources and biodiversity status.

Recommendations concerning the acceptability of the location as a potential location for a reserve have always presented for consideration and deliberation by the Village Council before its establishment. The acceptance of these recommendations thus resulted to the declaration of the reserve and the prohibition of any fishing with the declared area. Summary of Fish Reserves by location and establishment date is given in Table 20.

**Table 20.** Establishment of Fisheries Reserves by location and date during 1996/97

Fisheries Reserve	Establishment date	Fisheries Reserve	Establishment date
<i>UPOLU ISLAND</i>		<i>MANONO ISLAND</i>	
Moamoa,	13 July 1996	Faleu, Manono	15 November 1996
Tauo'o, Faleasi'u	13 July 1996	Lepua'i, Manono	15 November 1996
Tafitoala	16 January 1997	Apai, Manono	27 November 1996
Fusi, Safata	30 January 1997	Salua, Manono	27 November 1996
Satitua	4 February 1997	<i>SAVAII ISLAND</i>	
Mutiatele	4 February 1997	Falealupo	27 February 1997
Lotopue	2 April 1997	Sato'alepai	4 March 1997
Salua-uta	3 April 1997	Saleaula	4 March 1997
Malaela	2 May 1997	Auala	7 April 1997
Tuana'i	29 May 1997	Vaisaulu	15 May 1997
Gagaifo, Lefaga	23 June 1997	Pu'apu'a	24 June 1997
Nofoalli	24 June 1997		

### 3.2 Feasibility study of Green Snail (*Turbo mamorata*) and Trochus (*Trochus niloticus*)

A feasibility study of green snail and *T. niloticus* was took place between August 30 and 13 September 1996. The study was funded by the South Pacific Aquaculture Development Project under the FAO. The study was prompted from a request put forward by the Fisheries as part of their continuing effort to rehabilitate Samoa's exhausted inshore fisheries resources. It was envisaged that the transplantation of trochus and green snail would therefore enhance Samoa's inshore marine resources.

Two technical experts from the Vanuatu Fisheries and Overseas Fishery Cooperation Foundation (OFCF) carried out the assessment with support provided by staffs of the Fisheries Division. The survey was aimed at identifying suitable areas for growing of juveniles and adult green snail and trochus. In addition, plan of green snail and trochus introduction, culture and ranching was also formulated.

There were 21 reef areas around the country have been surveyed; 16 on Upolu, 4 on Savaii and one on Manono. Out of the 16 selected reef areas on Upolu, Salamumu and A'ufaga had ideal habitat for juveniles and adult trochus and a further two exposed reef areas (Capes Niutoi and Mulitapauli) had suitable habitats for both juvenile and adult of trochus *niloticus* and green snail (*T. mamorata*). Moreover, 4 reef areas on Savaii and Lepuia'i village in Manono indicated potential and suitable location for trochus and green snail translocation.

#### Future activities

- ❑ Carry out the introduction and translocation of green snail and *trochus niloticus* in suitable locations
- ❑ Implement culturing and ranching of green snail and *trochus niloticus* based on the formulated plan arise from the feasibility study
- ❑ Continue to provide technical supports for the establishment of proposed fish reserves through profile assessment of selected reserve, clam and tilapia culturing sites.

#### **4. FISH AGGREGATING DEVICES**

Due to limited funds provided in the budget for this financial year the project was unable to implement the construction and deployment of any new devise. However visits were made to monitor the only two devises remained in place from last year. With severe weather conditions prevailing at the beginning of 1997 these devises were reported washed away and it was too risky and costly to carry out a salvage trip.

#### Future Activities

- ❑ Place order for FAD materials.
- ❑ Construct and deploy new devises.
- ❑ Monitor and maintain new devises.

#### **5. EXPLORATORY FISHING**

The success of the Long line fishery at present reflects the enormous effort the program has put in to trials dated back in early 1991 when the Fisheries and the South Pacific Commission joined effort in conducting the trials for the huge size tuna around the Fish Aggregating Devises. The trials were undertaken on **Tautai Matapalapala** and were later transferred to an ordinary size alia (9m). With few modifications a drum was designed for the alia and the results were more encouraging than the catch on the **Tautai Matapalapala**.

The technology was spread to the local fishermen through training carried out by the Fisheries Division. The best inventions of these trials were the designing of the new drum for the long line and the determination of the sea depth in which the huge size tuna swim (45 fathom downward).

A total of eight new fishermen have received training from the program this year on fishing gear and method construction and method demonstration on board.

The South Pacific Commission on Fisheries on request conducted a national workshop on Fish Handling, Procession and Storage of Sashimi tuna for overseas markets. There were 15 fishermen and 12 Fish Exporters and their selected supervisors attended the workshop.

#### **Future activities**

- ❑ Continue to carry out training for local fishermen on fishing gear and methods.
- ❑ Assessment of the bottom resources.

### **6. FISHERMEN SAFETY AT SEA COMMUNICATION NETWORK**

The Fishermen Radio Communication Network was officially handed over to the Fisheries in March 1997 and became operational at the same time. In April to May 1997 the Division has conducted a series of training both in Upolu and Savaii to demonstrate to the fishermen on the use, operation and the maintenance of the radios.

#### **Future Activities**

- ❑ Establish an appropriate system for the sale of the radio equipment.
- ❑ Establish the official registration of local fishing alias.
- ❑ Deploy a team to man the operation of the Network on a 24 hours service.
- ❑ Liase with the Police and other appropriate authority when a rescue mission is to take place.

### **7. FISHERIES SURVEILLANCE AND FOREIGN FISHING VESSELS LICENSING**

The enforcement of the Fisheries regulation had seen some changes with the rate of illegal fishing methods been practised. This was brought about by villages with Management Plans in place enforcing their by-laws. The management of the Fish Market and the Fisheries Officers conducting fish landing surveys had been keeping a close look at the fishes and fish products that were sold at the local markets for illegal evidence. The Police Department had been working jointly with the Fisheries on surveillance activities not only at the Market places but surveillance of our Exclusive Economic Zone (EEZ) through the use of the Nafanua Patrol Boat.

The Australian and New Zealand Air Forces had conducted aerial surveillance and we wish to record our sincere thanks to the two Governments for their continuous assistance to our national Surveillance program.

Four Long Line fishing vessels from the TROPAC Fishing Co. had their fishing licenses renewed for 1997 (January 1 - December 31) licensing period.

The Sub-regional attempt to license the Taiwanese longline fishery boats under the one arrangement was unsuccessful due to disagreement on the terms of the proposed arrangement. The Multilateral Fishing Treaty with the United States has reached its 9<sup>th</sup> licensing period. During this period, Samoa has earned about \$655,000 from this fishing treaty without any fishing operation conducted in our EEZ.

### Future Activities

- ❑ Cooperate with the Police Department on Surveillance activities both onshore and offshore.
- ❑ Participate in aerial surveillance if a seat is offered.
- ❑ Liaise and consult with the Forum Fisheries Agency on regional surveillance programs.

## **8. FISHERIES ADVISORY SERVICES (Extension and Training)**

The Fisheries Division Extension and Training Project (supported by AusAID) has made a major impact in rural areas during 1996/1997. The medium term goal of the project is to prevent a further decline in village near-shore fisheries resources. Reasons for this decline include, overexploitation, the use of destructive fishing methods, and environmental disturbances. The project was designed to promote the involvement of village communities in the management of their own marine environment and fisheries. The village extension process (summarised in Figure 8) culminates in each community producing its own Village Fisheries Management Plan including the resource management and conservation undertakings of the community, and the support undertakings of the Fisheries Division.

During 1996/97 fisheries extension staff have been active in many villages in Upolu, Manono and Savaii. Approximately 2 community meetings are required in each village, taking an average of 13.4 **weeks work** per village. *At the end of June 1997, the extension process had been commenced in 50 villages, and 32 have produced management plans so far.* These villages are now managing their fisheries resources with support from the Fisheries Division. Each village has set its own rules and activities relating to fisheries and the marine environment. An unexpected result was that many villages chose to ban fishing in part of their traditional fishing area by creating community-owned fish reserves. Up to the end of June 1997, **26 villages with management plans had established village Fish Reserves** – the first such community-owned reserves in Samoa, and possibly the whole of the Pacific. Progress in village extension work is summarised in Table 21.

One third of all village group meetings were for women only, and approximately one third of the members of the Village Fisheries Management Advisory committee meetings were women. The proportions for untitled men (*aumaga*) were similar. Staff of Fisheries agencies in several Pacific Island countries (including Tonga and Fiji) have sought advice on setting up similar community-based village programs.

The continuing public awareness campaign included a poster competition, a public open days, public workshops, press releases, radio talks and video presentations. The Fisheries Open Day held on 8<sup>th</sup> November 1996 was attended by many members of the public and school children.

Up to the end of June 1996, 12 Fisheries Information Sheets had been printed and were available to the public (an example is given in Annex 1). Releases to press, television and radio have been made on a continuing basis to publicise the extension process as well as to publicise special events. A poster was produced to publicise the Fisheries Regulations, approved by Cabinet in October 1996.

Training for extension personnel has been based on the requirement for a balanced understanding of both essential technical knowledge and community motivating/mobilising techniques. Fisheries Division staffs have been sponsored by AusAID to local and overseas workshops, short courses and formal tertiary training. Staffs have been enrolled in Certificate and Diploma of Tropical Fisheries Courses at the University of the South Pacific (USP).

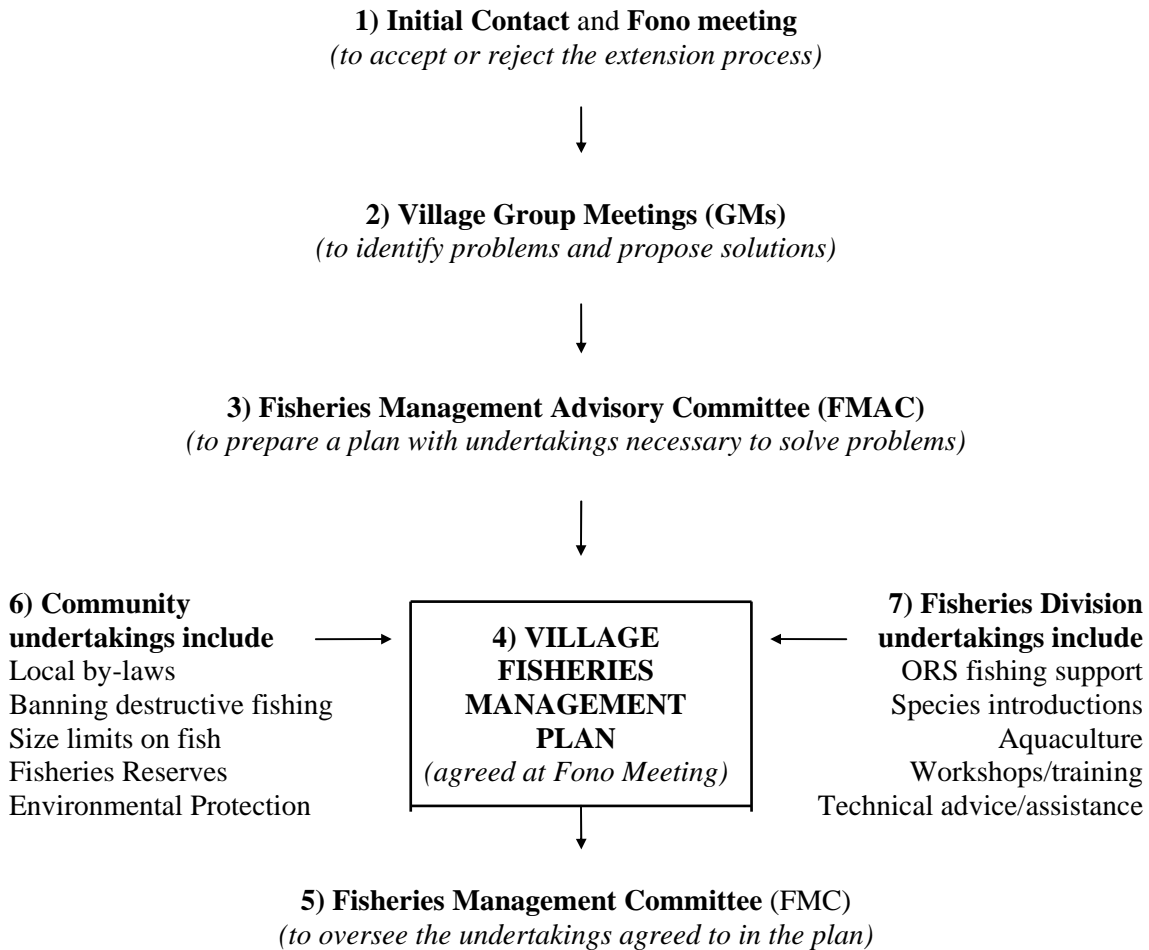
Public workshops have been run on Fish Smoking, Fisheries Regulations, Giant clams and Tilapia Farming and Sea Safety. Community workshops on fishing, sea safety, outboard maintenance, fish handling, and small business management connected with the operation of village fishing boats have also been run on demand.

A major event was the National Workshop attended by men and women from over 20 villages with Village Fisheries Management Plans, held in.

The Fisheries Division has been encouraging the development of alternative sources of seafood to those resulting from the present heavy exploitation of near-shore reefs and lagoons. The alternative means of obtaining seafood are **1)** the diversion of fishing pressure to areas beyond the reefs through the introduction of low-cost boats, **2)** the promotion of village-level aquaculture, and, **3)** the judicious introduction of new or depleted species. The results of these efforts are given in the Research Section of this annual report.

The Fisheries Division project has undertaken to facilitate the purchase of medium-sized, low-cost, boats and outboard engines for use in Outer Reef Slope (ORS) fishing from coastal villages. Boats have been imported from Australia for local assembly. The European Union (EU) is providing 65% of the cost of boat packages to approved applicants from villages with management plans. The official hand-over of the first 6 boats produced took place on 18 June 1997.

The project has encouraged village-level fish farming based on a fast-growing species of fresh-water *Tilapia*. By the end of June 1997, farming trials and demonstrations had begun in 6 different locations. The introduction of new species into village fishing areas has involved the re-introduction of giant clams into the waters and Fish Reserves of 2 villages by June 1997.



**Figure 8.** The Fisheries Extension Process in Samoan villages



**Table 21.** Villages targeted by Fisheries Extension Project. Dates shown for stages in the process include those for first contact with the village, the first fono (council) meeting, Group Meetings, FMAC meetings, and the date of approval of the final Fisheries Management Plan by the village fono. Villages on the island of Savaii are shown in bold italics.

VILLAGE ( <i>Savaii in bold italics</i> )	First contact	Fono meeting	Group Meetings	FMAC meetings	Plan approved
1) Moamoa, Faleasi'u.	20 Nov.95	22 Nov.95	6-13 Dec.95	20 Jan-28 Feb 96	<b>8 Apr.96</b>
2) Tauo'o, Faleasi'u.	1 Feb.96	5 Feb.96	5-13 Feb.96	18 Feb-12 Mar. 96	<b>15 May.96</b>
3) <b>Tafua</b>	7 Feb.96	12 Feb.96	12-21 Feb.96	21 Feb-15 May 96	<b>13 Jun.96</b>
4) <b>Satoalepai</b>	19 Apr.96	9 May.96	24 May-17 Jun.96	17 Jun-12 Jul.96	<b>23 Aug.96</b>
5) Leusoalii	22 Apr.96	5 May.96	18 Jun.96	(discontinued)	
6) Luatuanu'u	22 Apr.96	13 May.96	10 Jun.96	(discontinued)	
7) <b>Vaega-Satupaitea</b>	23 May.96	14 Jun.96	(discontinued)		
8) Apai, Manono	24 May.96	6 Jun.96	3-24 July 96	24 July-5 Sep.96	<b>27 Sep.96</b>
9) Salua, Manono	24 May.96	6 Jun.96	3-25 July 96	25 July-5 Sep.96	<b>27 Sep.96</b>
10) Faleu, Manono	24 May.96	11 Jun.96	4-24 July 96	24 July-4 Sep.96	<b>26 Sep.96</b>
11) Lepuia'i, Manono	24 May.96	11 Jun.96	4-25 July 96	25 July-4 Sep.96	<b>26 Sep.96</b>
12) <b>Satufea-Satupaitea</b>	18 Jun.96		(discontinued)		
13) <b>Pitonu'u-Satupaitea</b>	18 Jun.96		(discontinued)		
14) <b>Auala, Asau</b>	15 July.96	5 Aug 96	12-20 Aug.96	20 Aug.-18 Sep.96	<b>17 Oct.96</b>
15) <b>Sataua, Asau</b>	15 July.96		(discontinued)		
16) <b>Falealupo</b>	22 July.96	19 Aug.96	4 Oct-12 Nov.96	12 Nov-22 Nov.96	<b>11 Dec.96</b>
17) Salea'aumua, Aleipata	17 July 96		(discontinued)		
18) Mutiatele, Aleipata	17 July.96	29 Aug.96	19 Sep-8 Oct.96	8 Oct-25 Nov.96	<b>2 Dec.96</b>
19) Malaela, Aleipata	17 July.96	29 Aug.96	20 Sep-9 Oct.96	9 Oct-(delayed)	
20) Satitua, Aleipata	17 July.96	27 Aug.96	18 Sep-9 Oct.96	9 Oct-17 Oct.96	<b>29 Nov.96</b>
21) Mata'ili'ili, Faleasi'u	23 July.96	(declined)			
22) <b>Vaisaulu, Iva</b>	19 Aug.96	9 Sep.96	17-24 Sep.96	24 Sep-3 Oct.96	<b>13 Nov.96</b>
23) Pue, Aleipata	2 Sep.96	6 Sep.96	13 Feb-20 Feb.97	20 Feb-13 Mar.97	<b>27 Mar.97?</b>
24) Tafitoala, Safata	4 Sep.96	11 Sep.96	25 Sep-16 Oct.96	16 Oct-30 Oct.96	<b>13 Nov.96</b>
25) Fausaga, Safata	4 Sep.96	(delayed)			
26) Fusi, Safata	4 Sep.96	17 Sep.96	7-22 Oct.96	22 Oct-12 Nov.96	<b>22 Nov.96</b>
27) <b>Saleaula</b>	17 Sep.96	16 Oct.96	30 Oct-5 Nov.96	5 Nov-15 Nov.96	<b>27 Nov.96</b>
28) Nofoli'i	12 Nov.96	22 Jan.97	(delayed)		
29) Tuana'i	27 Nov.96	3 Feb.97	14 Feb-21 Feb.97	21 Feb-14 Mar.97	<b>7 Apr.97</b>
30) Salua-uta	17 Jan.97	28 Jan.97	6 Feb-12 Feb.97	12 Feb-5 Mar.97	<b>18 Mar.97</b>
31) <b>Lano</b>	7 Feb.97				
32) Fasitoo-uta	9 Feb.97	17 Feb.97	7 Mar- Mar.97		
33) <b>Pu'a pu'a</b>	10 Feb.97	7 Mar.97	14 Mar-Mar.97		
34) <b>Fagamalo</b>	10 Feb.97	7 Mar.97	12 Mar- Mar.97		
35) <b>Sapulu, Salelologa</b>	17 Feb.97	18 Feb.97	28 Feb-Mar.97		
36) <b>Saloga, Salelologa</b>	17 Feb.97	18 Feb.97	28 Feb-Mar.97		
37) <b>Sale Tagaloa, Salelol.</b>	17 Feb.97	18 Feb.97	28 Feb-Mar.97		
38) <b>Faala</b>	7 Mar.97				
39) Siumu west	10 Mar.97	24 Mar.97			
40) Gagaifo'olevao, Lefaga	11 Mar.97	25 Mar.97			
41) <b>Falesa</b>	17 Mar.97				
<b>TOTAL MEETINGS</b>	41	32	160	57	<b>19</b>
<b>TARGET MEETINGS</b>	(est) 75	(est) 55	(est) 210	(est) 90	(min) <b>30</b>
<b>% PROGRESS</b>	55 %	58%	76%	63%	<b>63%</b>

## 9. VEHICLE

As previously reported four vehicles were used for the Fisheries Division activities during 1996/97 period. The vehicles were donated by USAID in 1992 as part of their assistance for Fisheries. Three vehicles were based in Apia with only one was utilised for the implementation of extension activities on Savaii. Table 22 presents details concerning the use of vehicles that were operational during the year.

**Table 22.** Details on Fisheries vehicles use during the 1996/97 period.

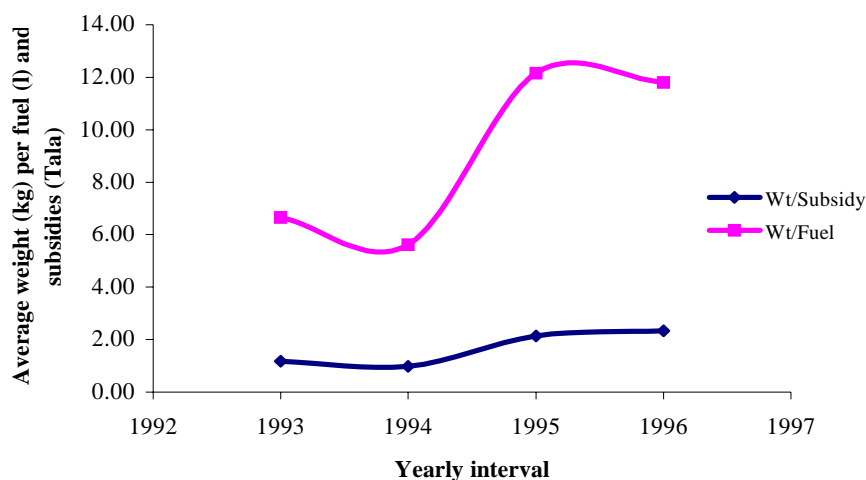
Vehicle No.	Location / Base	Type & Model	Year	Funding Source	Remarks
9031	Asau	Isuzu, Double cap	1992	USAID	Extension
9029	Apia Aquaculture Research Statistics	Isuzu Single cap	1992	USAID	Fisheries surveys, Resources Assessment, Fisheries reserve assessment Giant clams, Fish farming
9479	Apia Exploratory fishing	Isuzu Single cap	1992	USAID	Exploratory fishing trials, Safety at Sea, Vessel Inspection, Fishing training
9030	Apia Fish Market	Isuzu Single cap	1992	USAID	Market management and maintenance

## 10. MOTORISED ALIA FISHERY

### 10.1 Fuel rebate subsidies

Fisheries continue to issue permits to locally registered fishermen using motorised fishing vessels. The issued permit allows the purchases of pre-mixed fuel for use only for fishing. Additionally issuance of permit entitles fishermen for fuel subsidy, which is a refund of the duty on imported fuel. Recently, all motorised fishing vessels are required under the Fisheries Act 1988 to be registered and therefore eligible for the fuel rebate. Moreover, eligibility for fuel subsidy can only be acquired when the fishing vessel satisfies safety requirements.

A total of about 1.22 millions liters of fuel valued at approximately 0.6 million tala was subsidised by the Government as part of its assistance for the development of the fisheries industry in Samoa. Of the total amount of fuel subsidised by the Government during the year, Upolu based fishers accounted for 81 per cent and Savaii based fishers represented 19 per cent of the total. Apia based fishing alias accounted for 29 per cent of the total fuel rebate subsidies due to the large number of fishing boats based and moored at the Fisheries Wharf. Moreover, The close proximity of the Apia landing site to the fuel main depot and to the market and export companies attributed to the large number of boats based in Apia.



**Figure 9.** Average weight (kg) of fish yielded per one litre of fuel and subsidised amount for Upolu and Savaii combined

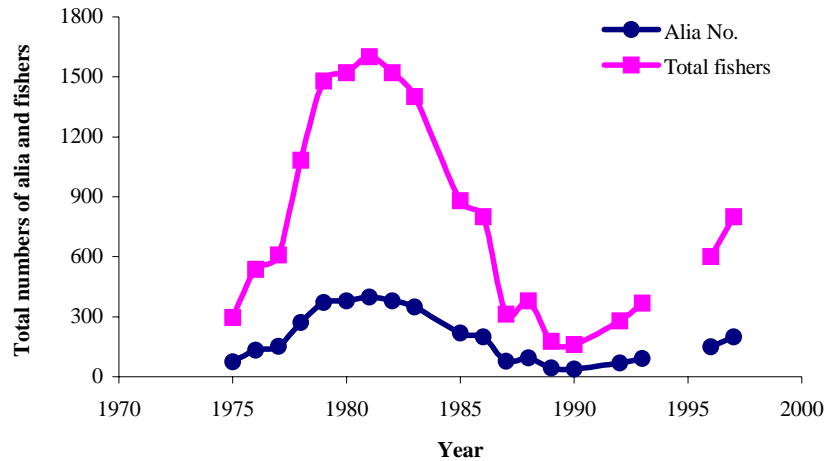
Figure 9 illustrated the mean weight of fish caught by motorised fishing boat per one litre of fuel and per subsidised value annually. The mean catch per one litre of fuel has been declined prior to the full development of the longline fishery. The decline in mean catch/fuel reflects the substantial amount of fuel required by boats fishing for skipjacks tuna by employing surface trolling technique. Between 1994 and 1995, the average catch/one litre of fuel has increased significantly which indicated that distances cover by vessels engaged in the longline fishery were shorter and generally exploited much closer areas. Likewise, the longline technique generally required minimal fuel for operation. However, as more boats enter the fishery, fishing become very distant and the demand for fuels was generally increased. As a result of increasing fishing effort, the mean catch (kg) per litre of fuel has declined as reflected by the average catch/fuel for the 1996-1997 period. Summary of the total fuel and values subsidised by the government under its rebate fuel system is presented in Table 23 for 1996/97.

**Table 23.** Fishing Boats Fuel Purchases sorted by Landing Base during the 1996/1997 period

Landing Base	Total 44-gal	Total Fuel (l)	Refunded Subsidy	Landing Base	Total 44-gal	Total Fuel (l)	Refunded Subsidy
Apia	2,983	596,600	104703.3	Asau-Sataua	265	53000	9301.5
Apolima	625	125,000	21937.5	Salailua	297	59400	10424.7
Aleipata	41	8,200	1439.1	Samalaeulu	111	22200	3896.1
Falealili	414	82,800	14513.4	Palauli	88	17600	3088.8
Siumu	437	87,400	15338.7	Fasaleleaga	305	61000	10705.5
Aana	142	28,400	4984.2	Avao	93	18600	3264.3
Anoama'a	298	59,600	10459.8				
<b>Total</b>	<b>4,940</b>	<b>988,000</b>	<b>173,376</b>	<b>Total</b>	<b>1,159</b>	<b>231,800</b>	<b>40,681</b>

## 10.2 Fishing alias and fishers

The current level of fishing effort has been increased significantly from only about 40 alias in 1990/91 period to 200 alias in 1996/97. Furthermore, the scale, capacity and capability of newly constructed vessels entered into the longline fishery have been substantially promoted from the original FAO alia design. Summary of the level of fishing effort in numbers of fishing boats and fishers that are directly engaged in the offshore motorised fishing activities per year is presented in Figure 10.



**Figure 10.** Level of fishing effort (boats and fishers) employed in the motorised fishery

## 11. MECHANIC WORKSHOP

The Mechanic Workshop continued to provide services of repairing outboard engines for the local fishermen at \$20 per repair work regardless of the magnitude and nature of the repair. Repair works were mostly done on big outboard engines ranging from 75 hp to 200 hp of Mariner types. Predominantly, about 50 per cent of repaired engines were of the types between 75 hp and 115 hp Yamaha and Mariner models. The increase of repairing activities involves big and powerful engines indicated that the fishing effort boats have been significantly expanded to larger and high capacity vessels. The meteoric growth of the motorised fishing industry due to the exploitation of high commercial value tunas attributed to the development of larger and powerful vessels.

About half of repaired outboard engines mainly E40GHP Yamaha model. Accordingly, there is a notable change of outboard engine used as quite a number of fishers are changed to diesel Yamaha engine because of less fuel consumption. Other repair work includes repairs of water pump generators, servicing of the fisheries vehicles and maintenance of fishing vessel Tautai Matapalapala.

Revenue generated from the services involving the workshop has been very minimal due to the arrangement of charges imposed. Fisheries Division is considering re-assessment of this arrangement so that repair charges would reflect the magnitude and nature of the repair required.

## 12. FISH MARKET

The daily operation and management of the Fish Market is become the responsible of the Fisheries Division since November of 1996. The Fish Market was previously rented out to private companies for operation, however poor management and massive unpaid rents thus return the management and operation of the market to the Fisheries.

The fish market was extensively damaged by both cyclones Ofa and Valerie and it is presently renovated. The enclosed side of the market is greatly improved from damages sustained by cyclones and also from poor maintenance by previous proprietors. Nevertheless, the public side of the market is the only part of the market that is currently used by members of the public to sell their fishery products

From November 1996 to June 1997, \$27,275 tala of revenue was generated based on the \$5.00 tala per block occupied per day. The daily operation of the market yielded an average of about \$110.41 tala revenue per day. The market is currently operated on a seven-day basis starting from 0500 hrs to 1800 hrs daily. Out of the seven days, Sunday is considered the busiest day of the week whereby activity is greatly heightening. The monthly summary of total revenues generated from renting is presented in Table 24.

In addition to the daily operation of the market, staffs have enforced the current fisheries regulation on size limits. All fish and invertebrates exposed for sale at the market are subject to inspection whether conforming with the stipulated size restrictions as part of the imposed management strategies on fisheries resources.

**Table 24.** Monthly summary of revenues generated from the Fish Market through block renting.

<b>Months</b>	<b>Total Revenue (Tala)</b>	<b>Weekly Avg (Tala)</b>
November 1996	512.00	102.40
December 1996	2,769.00	89.32
January 1997	2,658.00	85.74
February 1997	4,004.00	143.00
March 1997	4,232.00	136.52
April 1997	4,539.00	151.30
May 1997	4,730.00	157.67
June 1997	3,831.00	127.70
<b>Total</b>	<b>27,275.00</b>	<b>110.41</b>

**Future activities**

- ❑ Continue the daily operation and management of the market
- ❑ Continue with the general maintenance of the market
- ❑ Complete renovation of the enclosed section of the market
- ❑ Step-up enforcement of size limits on fish and invertebrates exposed for sale

**13. TRAININGS ATTENDED BY STAFFS**

During the 1996/97 period, several Fisheries staffs had the opportunities to undertake further training in their field of work. These long and short trainings were made possible through financial assistance provided by various funding agencies. Trainings were ranging from three years to few weeks. Table 25 summarised the list of courses and workshops attended by members of the Fisheries.

**Table 25.** Summary of courses and workshops attended by Fisheries Staffs in 1996/97

<b>COURSE</b>	<b>PERIOD</b>	<b>LOCATION</b>	<b>ATTENDEES</b>	<b>COMMENT</b>
MSc. (Fisheries)	July 96-Aug 97	AMC, Australia	Mulipola Atonio	*FETP
Introduction to Computers & CDS/ISIS	July 1996	Honiara, Solomon Island	Malama Siamomua	**FFA
Advance D/base Development & management	September 1996	Suva, Fiji	Malama Siamomua	+USP
Openwater I Dive Training	December 1996	Apia, Samoa	Posa Skelton, Patelesio Taulofa, Malama Siamomua	FETP
Green Snail-Spawning & Seed production	February 1997	Nukualofa, Tonga	Posa Skelton	JICA
BSc (Fisheries)	February 1996-	AMC, Australia	Etupati Ropeti	FETP
Vessel monitoring System	March 1997	Honiara	Malama Siamomua	FFA

\* Fisheries and Extension Training Program; \*\* Forum Fisheries Agency; + University of the South Pacific

**ACKNOWLEDGMENT**

The Fisheries Division wishes to record its thanks and appreciation to the following Governments and Regional Agencies for the kind assistance provided to the development of fisheries in Samoa during the year through the services of Consultants, services of Volunteers, supply of materials, supply of valuable information, funding Fisheries Division participation to Meetings and Trainings, provision of technical advises and many others:

1. Government of Australia
2. Food and Agriculture Organisation (FAO)
3. Forum Fisheries Agency (FFA)
4. South Pacific Aquaculture Development Project (SPADP)
5. South Pacific Commission (SPC)
6. United Nations Development Programme (UNDP)
7. Japan International Cooperation Agency (JICA)

Thanks are due to the various local Government Departments in particular the Ministry of Foreign Affairs for positive attitude shown to various matters requested by the Fisheries Division.

Lastly, but not least, thanks are extended to our Minister, Director, Deputy Director and Divisional Heads for the support they have given to the Fisheries Division throughout the 1996/1997 year period.

## Appendix

### MONTHLY ESTIMATES OF FISHERIES LANDINGS BETWEEN JULY 1996 & JUNE 1997

Months	*Inshore fisheries		*Offshore fisheries		Exports fisheries	
	Wt (kg)	Value (tala)	Wt (kg)	Value (tala)	Wt (kg)	Value (tala)
Jul-96	10,703.3	62,079.26	4807.0	23821.79	44707.62	324,911.84
Aug-96	2,508.5	14,549.91	1171.8	5806.88	51757.69	206,901.03
Sep-96	785.8	4,557.62	2607.6	12922.22	47283.37	357,902.46
Oct-96	5,582.5	32,378.32	367.0	1818.95	96618.4	533,209.02
Nov-97	3,446.9	19,991.91	1610.0	7978.79	142533.69	755,652.74
Dec-96	3,651.1	21,176.66	1705.4	8451.63	490634.77	2,317,431.70
Jan-97	2,551.5	14,798.44	1191.8	5906.07	23970.64	120,914.93
Feb-97	2,873.1	16,663.93	1342.0	6650.59	15757.06	322,238.94
Mar-97	2,980.0	17,283.93	1391.9	6898.03	37998.54	438,919.04
Apr-97	4,891.5	28,370.86	2284.8	11322.84	142983.89	1,378,242.52
May-97	3,934.8	22,821.55	1837.9	9108.11	522662.05	3,789,248.06
Jun-97	2,215.5	12,849.23	1034.8	5128.14	172140.26	1,291,144.72
<b>Total</b>	<b>46,124.5</b>	<b>267,521.62</b>	<b>21,352.10</b>	<b>105,814.06</b>	<b>1,789,047.98</b>	<b>11,836,717.00</b>
Note: * Sources: Apia Fish Market & Other Outlets.						