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CATCH DATA AND COLLECTION FROM MARKET SURVEYS IN WESTERN SAMOA

by

N. Horsman & A. Mulipola
Fisheries Division
Western Samoa

Catch Data and Collection from Market Surveys in Western Samoa

Nichole Horsman and Antonio Mulipola
Fisheries Division: Ministry of Agriculture, Forests, Fisheries and Meteorology
Apia, Western Samoa

ABSTRACT

This paper provides an overview of the Data Collection System (DCS) currently in use by the Fisheries Division of Western Samoa. General trends from the Apia Fish Market inshore landings since 1986 are identified. Offshore pelagic landing data is unreliable prior to 1989, and bottomfish up to that year were included with inshore landing figures, so trends have been identified from 1989 onwards.

Considering the limited resources available to the survey programme of the Fisheries Division, the DCS is valuable in spite of its shortcomings. A general list of points regarding the DCS is provided and includes major constraints and associated recommendations. The two most significant problems identified are:
(i) Almost no effort data is collected.
(ii) The lack of survey work at the fish market on Sundays, where large quantities of fish are sold for the traditionally important Sunday meal.

General findings are:
(i) Inshore landings declined from 1986 to 1991, with 1990 to 1993 being the three years of lowest landings to date (although some individual species landings actually increasing, see below). This is probably chiefly attributable to the two cyclones Ofa (Feb. 1990) and Val (Dec. 1991). There appears to have been a slight improvement in landings for 1993/1994, and possible reasons are discussed. There have been dramatic declines in landings of some seafood items of traditional importance in the Samoan diet, the notable example being giant clams which have been overfished nearly to the point of local extinction. Other fish landings that have notably declined 1986 include the emperors and mullet.
(ii) Cyclones Ofa and Val had a marked affect on offshore landings; immobilising half of the *alia* fleet. A corresponding rise in offshore landings followed in 1992 as *alias* were repaired and recommenced fishing. Bottomfish were also of higher market value than in 1991 and many *alias* ceased tuna trolling activities to start bottomfishing. This possibly contributed to the slight decline in pelagic landings the following year. A reduction in bottomfish landings in 1993 may be due at least in part) to the Maximum Sustainable yield (MSY) for the deepwater bottomfish resource being exceeded by approximately 30% the previous year.

1.0 INTRODUCTION

Western Samoa is located in the central South Pacific ocean. There are four inhabited islands; 'Upolu, Savai'i, Manono and Apolima which are generally surrounded by fringing and barrier reefs enclosing shallow lagoons. The total reef and lagoon area of depths less than 50m has been estimated to be 231 square kilometres (Johannes, 1982). Beyond the surrounding reefs is the offshore fishing area of 120, 000 square kilometres which is one of the smallest Exclusive Economic Zones in the Pacific. Western Samoa has a total land mass of 2,930 square kilometres which supports a population of about 170,000 people.

Historically, Samoans were highly dependent on locally caught fish and shellfish as a protein source. Samoans tend to utilise a wide range of marine fish and invertebrates obtained from the easily accessible reefs and lagoons. Exploitation of these areas has traditionally been purely for subsistence purposes. However, the advent of a "cash economy" has resulted in the subsistence fishery transforming into inshore and offshore fisheries with varying degrees of commercialisation. The development of the offshore fishery was initiated by the DANIDA/FAO project in the 1970's, this project resulted in the introduction of the 28 ft aluminium catamarans powered by 40 hp outboard engines known as '*alias*'. In June 1993, ninety two of these *alias* were operational (Mulipola and Vaofusi, 1994).

The purpose of this paper is to provide an overview of the Data Collection System (DCS) currently in use by the Fisheries Division, as well as briefly examine catch trends. As the accuracy of information prior to 1986 is questionable, only post-1986 trends from the landings at the Apia fish market are addressed.

2.0 THE DATA COLLECTION SYSTEM (DCS)

The DCS used by the Fisheries Division is a relatively recent introduction to the Research Section's tasks. Collection of sales information of inshore fish and shellfish from the Apia Fish Market in 1986 was the first statistically based sampling programme conducted.

The value and standard of survey work conducted has evolved with experience and progressive modification to methodology (ie to coverage and survey data collection sheet design) by Research staff and external experts. However, due to limited resources (eg expertise, funding and staff), the DCS currently in use still has problems that need to be addressed.

Survey work is conducted on 'Upolu and Savai'i. Raw data collected in Savai'i is sent to the Apia Fisheries Office to be recorded in a Microsoft Access Database and analysed. The Marine Biologist of the Research Section in 'Upolu is responsible for the entire DCS system.

There are currently five types of surveys conducted by the Fisheries Division:
Inshore surveys, Offshore surveys, Landing Site surveys, Roadside surveys and Other Outlets surveys.

2.1.1 Inshore Surveys; Apia ('Upolu)and Salelologa (Savai'i) Fish Markets

At the markets, seafood from inshore and offshore areas is sold every day of the week:
- Monday to Friday, fish are usually brought to the market from 0600 to mid-afternoon;
- Saturdays, activity generally halts at midday (Helm, 1992);
- Sunday, starts just after sunrise (0400 => 0500)and ceases around 0800.

Small fish are sold on strings, which are either single or multi-species. String values are generally the same regardless of species, if fish lengths are approximately uniform. Larger fish are sold individually.

The Apia market Inshore survey is performed four times a week, survey days are selected by choosing four numbered papers from seven (each of the seven representing a day of the week), surveys falling on a Sunday are not performed due to difficulties in obtaining use of Government vehicles and staff overtime. At Salelologa, this survey is conducted every working day (ie Monday to Friday). Every effort is made to interview each person who brings fish to sell directly to the consumer (Helm, 1987), ideally, soon after sellers arrive at the market. At the Apia Market, experience has shown 3 usual periods of incoming sellers. Surveys are therefore conducted during these times: 0800 => 0900, 1100 => 1200, 1400 => 1500.
At Salelologa, the survey is only conducted at 0700 hrs.

Reef and lagoon resources are sampled at these markets using a datasheet to record information. The number of strings per seller is noted and the seller is questioned on fishing method used. There are three major question categories on the datasheet which cover:
- string detail (I'a o le Taui'a);
- fish sold individually (I'a laui'a faatau taitasi);
- shellfish/crustaceans etc (ie non-fish items, eg Ula, Pa'a, Figota, Fe'e).

If a seller has strings, one string that is representative of the whole catch (in weight and composition) is chosen, more than one string should be chosen if no single one appears representative. A record of each representative string price is made, as is species composition, species quantity, and caudal fork length (CFL) or total length (TL) pending the tail morphology of each fish (a few fish that approximately represent different size groups of the string are measured). As noted by Dalzell and Burgess (1995), classification of fish generally only occurs to the family taxon level, rarely to species.

From each fishers' catch of shellfish and crustaceans, representative specimens of the size classes present are meant to be weighed and priced. Average weights and prices are calculated after each survey (weights are obtained by use of length/weight conversion tables).

2.1.2 Offshore Surveys; Apia and Salelologa Fish Markets

Offshore catches from *alias* are sold in a variety of locations to a variety of purchasers. Offshore fish species are divided into three categories for the purpose of conducting surveys: tuna; pelagics (other than tunas) and demersal (ie bottomfish).
Frequency, selection and times performed for these surveys is as detailed for the inshore surveys. A fresh data collection form is used to record information for this fishery. Only rudimentary data is collected for each seller (vessel owner, species caught, numbers, CFL's and prices). The general fishing method used is indicated at the top of each form, regardless of the number of different fishers that may be listed on the one form. Again, average weights and prices are calculated after each survey (with the aid of the length/weight conversion tables).

2.1.3 Landing Site Surveys; Apia Fisheries Wharf, Siumu, Falealili, Apolima-uta and Savai'i

A different data collection form is used to collect data from the landing *alias*.
The Landing site survey is the only survey type where any form of effort data is gathered. The standard data such as species caught, numbers, CFL's and price are noted. In addition details including fishing time, number of hooks and lines, number of crew and fuel used are also noted. The location fished is obtained as is the depth in fathoms and fishing method used. In regard to the fishing method used, this form is better designed than the Offshore Fish Market survey form. It allows this to be stated for each seller interviewed, rather than being generalised at the top of the form upon which many fishers responses are recorded. Average weights and prices are calculated once the survey is completed.

The landing site surveys for Apia Fisheries Wharf, Siumu and Falealili are conducted at the Apia Fish Market at similar times of the day to the Inshore surveys. Frequency and selection of days for these three are also as described for the Inshore surveys. Apolima-uta is a village on the western end of 'Upolu, this is a "true" landing site survey whereby the data collector questions fishers as they land their catch. Currently, the catch landed at this site is bought by a private shop owner, who exports some of the landings to American Samoa and sells to institutions, the public and other shops. This survey is conducted two to three times a week, being selected in a similar manner to the inshore and offshore surveys. The same data collection form is used as for the fisheries wharf, Siumu and Falealili surveys.

In Savai'i, due to restricted staffing and particularly limited vehicle resources, the data collection forms are distributed to the *alia* skippers and collected once or twice a month.

2.1.4 Roadside Surveys

This survey is only conducted on 'Upolu along the road from Apia to Faleolo International Airport (approximately 45 minutes drive) once a week. Timing is dependent on vehicle availability and other survey commitments, generally this survey is performed in one of the three following time slots: 0800 => 1000, 1300 => 1400, 1500 => 1700. Any roadside sellers of seafood seen on the way to the airport are interviewed; any newcomers after the Fisheries staff have passed through are usually accounted for on the return trip (staff are now familiar with the "regular" sellers, where their stalls are and when they set up). Catches recorded here are generally of an artisanal nature and taken from the lagoon areas; lagoon fish, bottled sea cucumber intestines (*se'a)* and bags of small bivalves (*pipi's*) are common items for sale.

A separate data collection form is used for this survey, with details of fish strings and individuals being noted as per the inshore survey. In addition, the quantity and prices of other items, including *se'a* bottles (large and small), bags of small bivalves and baskets of sea urchins, crustaceans and giants clams, are recorded. Average weights and prices are again calculated after the survey is completed.

2.1.5 Other Outlets; Wholesalers and Retailers

Thirteen vendors in'Upolu and three from Savai'i participate in this survey. Forms are issued to the store/hotel and collected once a week. The categories used are very broad: bottomfish, lagoon and reef fish, pelagics, lobsters and crabs, with only weights and monetary value being recorded for each of these generic headings. Where participants are willing, their receipt books are used in conjunction with the forms to verify purchases of seafood for that week.

2.2.0 General Constraints and Recommendations

Considering the limited resources available to the Fisheries Division for survey programmes, the DCS is essentially good. Nevertheless, there are some constraints placed upon its effectiveness that threaten its accuracy and worth.
This list of general points is by no means thorough, as that is beyond the scope of this paper. However, the most restrictive constraints and more prudent recommendations are included within the following list.

- General lack of fishing effort data (with the exception of the Landing site surveys). Catch per unit effort data are essential for fisheries management to assist monitoring the status or health of resources. Collection of effort data, even a crude indication, should be made one of the important priorities for the DCS. Collection is complicated by the fact that very often it is the wives or family of the fisher selling the fish. Method used should also be noted for each interviewee, this is particularly important for offshore fishing where method used is not always evident by condition of the catch (eg spear holes of speared inshore fish), see section 3.1.2. For example Tuna may be trolled or caught by vertical longlines and the corresponding CPUE data should be linked accordingly.

- Information missed prior to and after sampling in Fish Market surveys. An additional question to ask the seller what has already been sold in the morning sample and what remains to be sold in the last afternoon sample would suffice.

- Lack of any sampling activity on Sundays. The Apia Fish Market generally only operates from 0430 to 0800 on Sunday mornings, but large volumes of inshore fish are sold for the important Sunday meal (Mulipola, 1994), that are consequently unaccounted for. Anecdotal data suggests that a greater volume of fish are sold on Sunday mornings than during an entire week (Dalzell and Burgess, 1995).
The problem for all surveys on Savai'i is exacerbated by a total lack of weekend surveys due to difficulties obtaining vehicles. More importantly the difficulty in obtaining a vehicle on Savai'i also hinders the performance of the Landing site survey where staff have no choice but to rely upon skippers to complete data forms (or even obtain data through conversation and estimating landing size, composition, fish lengths/weights etc). Although limited resources dictate against Sunday surveys, Dalzell and Burgess (1995) suggested even just one Sunday every one or two months to enable some impression of seasonal influences on landings to be determined, as well as a more accurate total landings estimate.

- Disinformation given by sellers preventing accurate data from being collected. Data forms believed to be from unreliable sources should be marked as such by the samplers.

- Less co-operative fishers or vendors leading to data being unrecorded or missing.

- Where strings are of mixed species, usually only one string is chosen to be representative of the catch and only a "few" fish from each size class are measured.
This effectively results in estimates of total landings being drawn from a very small sample size and may provide dubious results. An extension of string numbers sampled

and fish measured could be introduced without complicating nor extending sampling time significantly. As previously noted, family taxon is the usual level of identification. Dalzell and Burgess (1995) recommended several fish identification texts that would be appropriate for samplers to become familiar with identifying common fish to species level.

- Amongst other comments, Dalzell and Burgess (1995) recommended the purchase of callipers to enable lengths of crustaceans (carapace) and molluscs to be taken. This would indeed be beneficial but it must be ensured they are actually used (and done so correctly and by a standard method to be made clear to all samplers).

- Also noted by Dalzell and Burgess (1995) is the omission of many large fish such as sharks and marlin which are often cut into steaks and sold (to increase returns). This practice obviously discounts estimates of fish weight being estimated from measured lengths. Perhaps the seller could be asked to indicate how long the item was originally and note that length to be used for conversion. This would be crude but better than nothing as "steaks" are a common feature at the market.

-Problems of duplication in sampling as well as absolute omission also warrant investigation. For example, fish recorded in the landing site survey one day may turn up in one of the offshore surveys in the market the following day to be recorded again, or sold to a vendor that records fish purchases for the Fisheries Division as well. The easiest way to resolve these difficulties would be to have an additional question on the relevant forms regarding from whom fish were purchased, when and where.

- Regular 'gatherings' of staff involved in the sampling should be held to stimulate interest as to why these surveys are being done and their importance to the management of Western Samoa's fisheries, and where their work fits into 'the big picture'. This will promote greater care to be taken when the surveys are being conducted and ensuring ALL details are obtained (and accurately as well). Results should be regularly shared with the staff who do the 'ground work' and discussed as to their meanings, developing trends etc. At such gatherings, input and ideas should be encouraged from staff at all levels. Those doing the actual sampling are one of the best sources for feedback on problems/difficulties of applying the surveys in the field.
Lack of interest and motivation quickly leads to half-hearted survey work and the quality of data is seriously compromised, as are the all important results from analysis.

3.0 Landing trends, Apia Fish Market

Catch landings at Apia Fish Market have been used to determine general trends as this was the location of the first statistically based sampling programme conducted in 1986 (see section 1.0). Consequently the Fish Market surveys provide the longest data set of all locations currently surveyed.

All data used to determine trends was derived from FFA Report No. 95/18: Western Samoan Fisheries Resources Profiles compiled with the assistance of Lui Bell. The data collaborated in this report is sourced from many references of various dates, hence methods used to estimate total landings, categorisation of species etc means that each

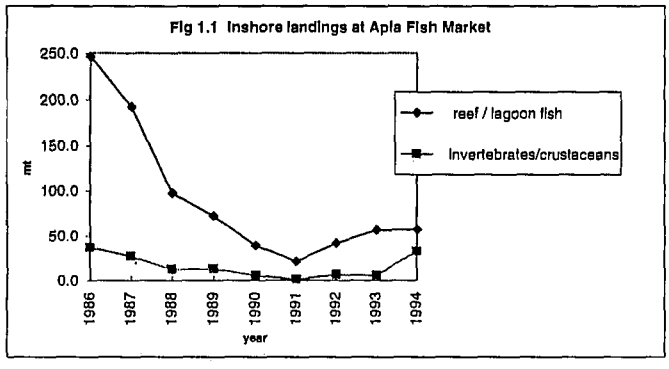
specific result is most unlikely to be completely accurate. General trends however are distinguishable as the authors of the Resource Profile adjusted figures where possible when they were obviously unreliable.

3.1 General inshore landing trends

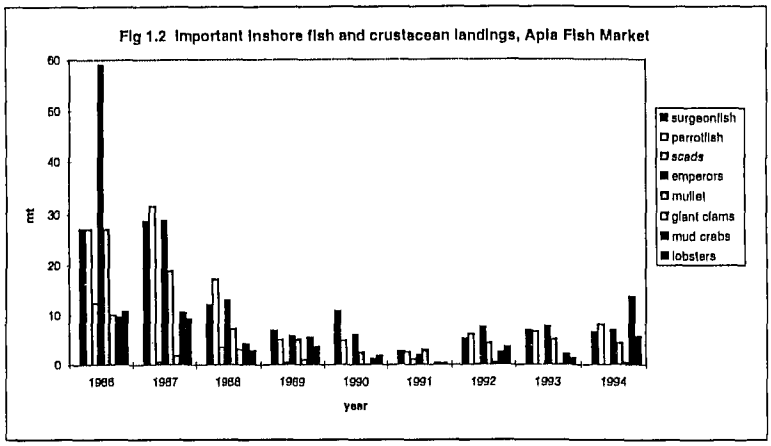
There was a general decline in inshore landings (ie catches from lagoon and reef areas) from 1986 to 1991, with 1990 - 1993 being the three years of lowest landings to date (although some individual species landings actually increased, discussed below), see Fig. 1.1. This is probably chiefly attributable to the two cyclones Ofa (Feb. 1990) and Val (Dec. 1991).

There appears to have been a slight improvement in landings for 1993/1994 (see Fig. 1.1), this may be due a combination of factors such as:

- incomplete data (important families of fish appear to be 'missing' from certain data sets);
- some species (eg mudcrabs, lobsters and octopus) landings increased significantly from 1993 to 1994;
- accuracy of estimated total landings for various species;
- resources beginning to recover from cyclones (eg habitat stabilisation);
- changes in demand through dietary preference (ie to turkey tails and mutton flaps) and
- taro blight (1993/94) increasing pressure on fish as a food source.

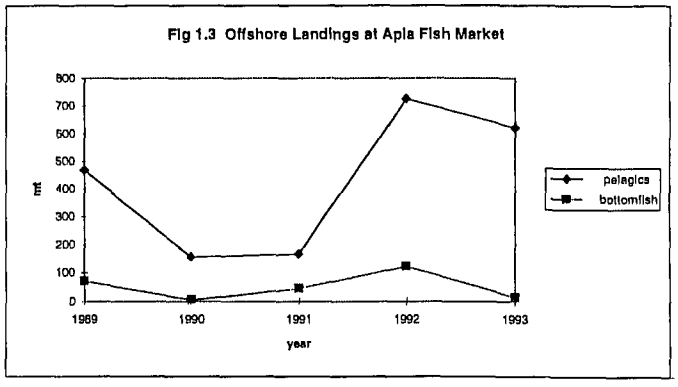


There have been some dramatic declines in seafood items that have traditionally been of great importance in the Samoan diet, the notable example being that of giant clams that have been overfished very nearly to the point of local extinction (see Fig.1.2). Other fish landings that have notably declined 1986 include the emperors and mullet.



3.2 General offshore landing trends

Offshore pelagic species landings were unreliable prior to 1989, similarly bottomfish data collected up to 1989 was included with inshore landing figures. Hence trends for offshore landings have only been derived from landing data collected since 1989, see Fig. 1.3.



Cyclones Ofa and Val had a marked affect on offshore landings; immobilising half of the *alia* fleet. A corresponding rise in offshore landings followed in 1992 as *alias* were repaired and recommenced fishing. Bottomfish were also of higher market value than in 1991 and many *alias* ceased tuna trolling activities to start bottomfishing (Mulipola, 1993 res for 92/93). This may help explain the slight decline in pelagic landings the following year. King (undated) estimated the Maximum Sustainable Yield (MSY) for the deep water Snapper (Lutjanids) resource to be 88mt, the total landing in 1992 was 121mt. A reduction in bottomfish landings in 1993 may be due (at least in part) to the MSY for the

deepwater bottomfishing resource being exceeded by approximately 30% the previous year.

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