



TONGA NATIONAL SNAPPER & GROUPER FISHERIES MANAGEMENT PLAN

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Ministry of Fisheries



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ABBREVIATIONS:

- ARGOS VMS:** Argos Vessel Monitoring System
- CPUE:** Catch per Unit Effort
- SFA:** Snapper Fishers Association
- SFMC:** Snapper Fisheries Management Committee
- FMAC:** Fisheries Management Advisory Committee
- FAO:** Food Agriculture & Food
- FFA:** Forum Fisheries Agency
- FMA 2002:** Fisheries Management Act 2002
- MSY:** Maximum Sustainable Yield
- MEY:** Maximum Economic Yield
- MCS:** Monitoring, Control and Surveillance
- SPC:** Secretariat of the Pacific Community.
- TAC:** Total Allowable Catch

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SNAPPER & GROUPEL FISHERIES MANAGEMENT PLAN

PART 1 INTRODUCTION

The Government of Tonga began promoting exploitation of deep slope resources of snapper, grouper and emperors in Tonga in 1980. The fishery was developed on a commercial purpose through exporting the resources so as to generate greater economic benefits from foreign revenue. Domestically its intent was to redirect and relieve fishing pressure from the inshore reefs. Tonga was a net importer of fish products at the end of the 1970's, however, since then the nature of the fisheries has changed, and in recent years, the majority of the target species are exported, while the by-catch and shallow water species are sold locally.

The plan is one of many actions taken by the Ministry of Fisheries to cover the most important fisheries of the Nation.

Under the Fisheries Management Act 2002 the Minister for Fisheries "*be responsible for conservation, management, sustainable utilization and development of fisheries resources in the Kingdom and its fisheries waters*", includes control of the use of local Tongan fishing vessels for fishing or any related activity on the high seas. The Minister, in exercising his powers, must consider, "*the need to ensure the long term conservation and sustainable use of fishery resources, and to this end adopt management measures to promote the objective of optimum utilization and to achieve economic growth, human resource development, employment creation and sound ecological balance*" (Sect 4.(a)).

1.1 Policy Statement

The policy direction for the Snapper & Grouper Fisheries Management Plan is to ensure a responsible fishing, participation by stakeholders, sustainable utilisation and an economically viable fishing sector for Tonga. The Snapper & Grouper Fisheries Management Plan (SFMP) will be a document that; which will require ongoing input and scrutiny, the plan is dynamic. Once developed, it should be reviewed annually and/or amended as needed. The fisheries have the potential to provide sustainable economic benefits for Tonga.

1.2 Purpose of the Snapper & Grouper Fisheries Management Plan:

This plan is developed under the Fisheries Management Act 2002 (Section 4&7) for the conservation, management, sustainable utilization and the further review of this fishery in the fisheries waters of Tonga, and to exercise control of any Tongan fishing vessels of this fleet fishing on the high seas. And it is to support and ensure that the working policies, Terms and Conditions of licenses provided by the Secretary for Fisheries are adhered to by those which have been given the limited rights to fish. The Plan is a *framework* to guide those license fishers and the enactment of specific and future measures. It is considered a guideline for future management, regulation as well as a mechanism focusing on consultation and agreement rather than containing detailed measures. The use of hydraulics, bottom-set long

line, trotlines and trawling into the fishery will increase fishing effort leading to unsustainable fishing. Therefore for the purpose of this fishery management plan, these fishing methods shall not be permitted.

The plan encourages co-managing the resources. Fundamentally providing much needed active partnership with fishers and other stakeholders. It generally follows that there arises economic benefits from such arrangements and it ensures long term sustainable use of the resources. It is important that management measures are established. Past crises in the ad hoc approached management system of the fisheries have now called for a need to formulate and approve a management plan. Increase in fishing effort is currently pushing the biological reproductive nature of the fish under stress. Not surprisingly, overcapacity coupled with drastic climate change in the past has affected ocean currents and their patterns. Fisheries management basically aims at controlling fishing efforts so that it co-incites with the socially optimal level.

1.3 Preparation of the Snapper & Grouper Fisheries Management Plan;

This management plan has been developed with stakeholder input in conjunction with the Fisheries Management Act 2002. It is also a compilation of draft plans since 1990. This management plan is one of a series that aims to cover the important marine resources of Tonga. This plan *aims*, through participatory mechanisms, to:

- provide the direction to fishers
- foster fisheries cooperation and co-management of the fish resources
- ensure harvesting is maintained at a sustainable level given the unpredictable nature of the resources and its environment
- provide food security for domestic market
- maximize the benefits to the economy through export
- preserve the environment
- provide measures to control fishing effort, fishing capacity ... “ *the need to take measures to prevent or eliminate over-fishing and access fishing capacity and to ensure that levels of fishing effort do not exceed those commensurate with sustainable use of fishery resources*” (FMA 2002; Section 4(g)); and
- provide precautionary measures in the absence of best scientific assessment.

1.4 Scope of the Plan

The plan’s scopes are only those that are mention and described here forth;

1.4.1 The Snapper & Grouper Fisheries Management Plan and its scope are for the purpose defined as:

- a) All vessels fishing commercially not more than 15 meters in length (LOA) and is licensed as a ‘Drop line (Deep Bottom Fishing) Fisheries vessels to fish from slopes and seamounts in depth deeper than 50m.
- b) In completing (a) above, the fishing gear permitted to fish snapper & grouper are the manually operated Samoan style hand-reels (drop line).

- c) to target , non-target, associated or dependent species taken in the course of fishing for the following species (Table 1):
- d) And other reef or slope fish species not specifically listed in Table 1 such as reef groupers, wrasses and parrotfish (as occurred from change of market preferences).

Table 1: Table of species that may be targeted and non-targeted in this fishery.

Scientific Name	Common Name	Tongan Name
<i>Aphareus rutilans</i>	rusty jobfish	palu polosi
<i>Aprion virescens</i>	green jobfish	utu
<i>Carangidae</i>	trevallies and jacks	lupo
<i>Etilis carbunculus</i>	short-tailed red snapper	palu malau
<i>Etilis coruscans</i>	longtail snapper	palu tavake
<i>Epinethelus morrhua</i>	comet grouper	ngatala pusi
<i>Epinethelus octofasciatus</i>	eight bar	mohuafi
<i>septemfasciatus</i>	convict grouper	mohuafi
<i>Pristipomoides filamentosus</i>	crimson jobfish	paluhina
<i>Pristipomoides flavipinnis</i>	golden eye jobfish	palu sio'ata
<i>Pristipomoides argyrogrammicus</i>	ornate jobfish	
<i>Lethrinus chrysostomus</i>	sweetlip emperor	manga
<i>Paracaesio kusakarii</i>	saddleback snapper	palu mutumutu
<i>Gymnocranius radiosus</i>	silver snapper	palu hina

The vessels define above shall have all the “Vessel Identification Markings as prescribed in Schedule 3 of the Fisheries (Local Fishing) Regulations 1995; Sect 9(c) , 17 (c) .

The Snapper & Grouper Fisheries Management Plan applies to all fishers as defined above in Tonga’s fisheries waters. The Plan also supports the Port State control principles whereby any fishing vessel that enters any port of Tonga, can be subjected to a full inspection for compliance of Tongan, regional, or international agreements or third party fisheries laws.

The plan endorses national legal stances on pollution of any kind in the fisheries waters of the Kingdom of Tonga.

1.4.2 This Plan covers:

The plan, for ease of understanding, is commonly known to fishers as Drop Line Bottom Fisheries, Deepwater Drop Line Fisheries and Deepwater Snapper Fisheries. It covers;

- a) Fishing for deep bottom fish (dermersal) species (as defined and list in Table 1 above), including, but not limited to;
- drop lining (the above definition) also known as;
 - hand lining; a fishing line that is weighted at one end and has not more than the prescribed hooks attached to it and is being hauled by hand or by assisted through a traditional Samoan type hand-reel gear.

b) Secretary shall consider this plan when exploratory or test fishing authorisations are granted to any applicant for any kind of deepwater fishing activity of which it will affect this fisheries. And includes marine scientific research fishing

c) all “related activities”, as per the FMA 2002, including, but not necessarily limited to:

- Transshipping,
- Bait fishing,
- Provisioning and all other services relating to the snapper & grouper fisheries, including
- On-shore processing and
- Provision of port facilities.

d) The plan does not cover the following:

- i) subsistence fishing
- ii) recreational fishing

PART II. SNAPPER & GROUPER FISHERIES TRENDS AND RESOURCE STATUS

2.1 *Biology and ecology*

The drop line fishing exploits multi-species assemblages which principally comprise of members of the family *Lutjanidae* (snappers), *Lethrinidae* (emperors) and *Serranidae* (groupers). Drop line bottom fishing occurs to depths ranging from 50 to 450 m (Bell et al, 1995) in which catches are derived from both shallow coastal shelves and banks, however some main species are mainly taken at offshore seamounts at depths exceeding 200m.

The snapper & grouper fisheries are based principally on seamounts and are believed to be influenced by volcanic activity in the deep-sea. This fishery is export oriented and 6 historically target species (*Pristipomoides filamentosus*, *Pristipomoides flavipinnis*, *Etelis coruscans*, *Etelis carbunculus*, *Epinephelus morhua* and *Epinephelus septemfasciatus*) constitute around 80% of the historical catch. A shallower banks fishery also operates providing fish for the domestic market (MRAG,1994)

Species of these families are bottom dwelling carnivores that feed on benthic fishes and crustaceans (Bell *et al*, 1995). The life history characteristics of these species make them vulnerable to over-fishing and exploitation; longevity, slow-growing, low rates of natural mortality, large size at sexual maturity and spawning aggregations. Although there is uncertainty about the degree of migration between seamounts, limited data does suggest that seamounts support relatively isolated meta-populations (MRAG, 1994 Annual Report).

Research has been conducted in Tonga and in other areas of the Pacific to obtain life history parameters to aid in management. Biological information about local populations of Tonga is however limited, hence the details provided in the table below (Table 2) were compiled from research conducted on populations outside of Tonga waters by FAO. However, they are of the same nature.

Table 2: Biological characteristics of target and non-target species of the drop line bottom fishery

TL – total length; SL – standard length; K – growth rate; tm – age at first maturity; tmax – life span; target species ** (major export species (Langi et al, 1992)).

1. <i>Aphareus rutilans</i>	
Family	<i>Lutjanidae</i> (Snappers)
Common name	Rusty jobfish (palu polosi)
Max. size	110 cm TL (male/unsexed); max. published weight: 11.3 kg Spawning months are from September through to February
Environment	Reef-associated; marine; depth range 100 – 330 m
Resilience	Medium, minimum population doubling time 1.4 - 4.4 years (K=0.16)
Biology	Inhabits reefs and rocky bottom areas to depths of at least 100 m. Feeds on fishes, squids and crustaceans.
2. <i>Aprion virescens</i>	
Family	<i>Lutjanidae</i> (Snappers)

Common name Green jobfish ('utu)
Max. size 112 cm TL (male/unsexed); max. published weight: 15.4 kg
Sexual maturity Both males and females generally reach spawning condition between 24 to 30 inches (over 2.6 years but under 5years)
Environment reef-associated; marine ; depth range 0 - 180 m
Resilience Medium, minimum population doubling time 1.4 - 4.4 years (K=0.29; tm=4-5)
Biology Inhabits open waters of deep lagoons, channels, or seaward reefs. Usually seen singly, but also in groups. Feeds mainly on fishes, but also on shrimps, crabs, cephalopods and planktonic organisms. Large individuals may be ciguatera poisoning

Caranx melampygus

Family Carangidae (Jacks and pompanos)
Common name Bluefin trevally (lupo)
Max. size 117 cm FL (male/unsexed); max. published weight: 43.5 kg
Environment reef-associated; brackish; marine; depth range 0 – 190 m
Resilience Medium, minimum population doubling time 1.4 - 4.4 years (K=0.23; tm=2; Fec=49,700)
Biology A coastal and oceanic species, associated with reefs. Juveniles occur seasonally in shallow sandy inshore waters. Found in rivers. Occasionally in schools. Feed mainly on other fishes, also crustaceans. Often toxic when it reaches a length of more than 50 cm. Reports of ciguatera poisoning.

Epinephelus morio

Family Serranidae (Sea basses: groupers and fairy basslets), subfamily: Epinephelinae
Common name Red grouper (ngatala kula)
Max. size 125 cm TL (male/unsexed); max. published weight: 23.0 kg; max. reported age: 25 years
Environment reef-associated; non-migratory; marine; depth range 5 – 300 m
Resilience Low, minimum population doubling time 4.5 - 14 years (K=0.1-0.18; tm=4-6; tmax=25; Fec=1.4 million)
Biology Occurs mainly over rocky and muddy bottoms. Uncommon around coral reefs. Usually rests on the bottom. Juveniles may be found in shallow water, but adults are usually taken from depths of 70-330 m. Feeds on a wide variety of fishes and invertebrates. A protogynous hermaphrodite. Most females transform to males between ages 7 to 14. Susceptible to red tide toxin (*Ptychodiscus brevis*).

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3. Epinephelus morrhua

Family Serranidae (Sea basses: groupers and fairy basslets) , subfamily: Epinephelinae
Common name Comet grouper (ngatala pusi)
Max. size 90.0 cm TL (male/unsexed); max published weight: 6,700 g
Environment reef-associated; non-migratory; marine ; depth range 80 - 370 m
Resilience Low, minimum population doubling time 4.5 - 14 years (Preliminary K or Fecundity.)
Biology Deep-water habitat. Considered rare in Tahiti but quite common in atolls. The species is easily confused with *E. poecilnotus*, *E. radiatus*, or *E. tuamotuensis*, three closely related deep-water groupers. Known to be ciguatera at Mauritius. Reports of ciguatera poisoning.

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4. Epinephelus octofasciatus

Family Serranidae (Sea basses: groupers and fairy basslets) , subfamily: Epinephelinae
Common name Eightbar grouper (mohuafi)
Max. size 130 cm TL (male/unsexed); max. published weight: 80.0 kg
Environment bathydemersal; marine; depth range 150 – 300 m
Resilience Very low, minimum population doubling time more than 14 years (Preliminary K or Fecundity.)
Biology Probably occurs in rocky reefs. Its apparent rarity may be due to its preference for relatively deep water. Reports of ciguatera poisoning

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5. Etelis coruscans**

Family Lutjanidae (Snappers) , subfamily: Etelinae
Common name Flame snapper / longtail snapper (palu tavake)
Max. size 120 cm TL (male/unsexed)
Sexual maturity One fish reported to reach sexual maturity at about 20.6 inches; 55-80 cm FL (5 years) and spawning season from May to October similar to *Etelis carbunculus*
Environment reef-associated; marine ; depth range 90 - 400 m

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Resilience	Low, minimum population doubling time 4.5 - 14 years (k=0.12)
Biology	Inhabits rocky bottoms. Feeds on small fishes, squids and crustaceans.
<i>Lethrinus miniatus</i>	
Family	Lethrinidae (Emperors or scavengers), subfamily: Lethrininae
Common name	Longnose emperor (ngutukao)
Max. size	90.0 cm TL (male/unsexed); max. published weight: 9,600 g; max. reported age: 22 years
Environment	reef-associated; non-migratory; brackish; marine; depth range 5 – 30 m
Resilience	Medium, minimum population doubling time 1.4 - 4.4 years (K=0.06-0.17; tm=2-3; tmax=22)
Biology	Inhabit coral reefs during daytime where they feed occasionally in sand and rubble areas between coral heads. At night, they move out over the sandy sea floor and forage actively. Usually occur in small schools. Feed mainly on crustaceans, echinoderms, mollusks and fish, with crabs and sea urchins predominating.

6. *Lethrinus chrysostomus*

Family	Lethrinidae (Emperors or scavengers) , subfamily: Lethrininae
Common name	Sweetlip emperor (manga)
Max. size	
Sexual maturity	
Environment	
Resilience	
Biology	Feeds on crustaceans, echinoderms and molluscs, crabs and sea urchins. Carnivorous bottom feeders quite selective and individualistic in their diet.

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7. *Paracaesio kusakarii*

Family	Lutjanidae (Snappers) , subfamily: Apsilinae
Common name	Saddle-back snapper / sea bream (palu mutumutu)
Max. size	60.0 cm SL (male/unsexed)
Environment	reef-associated; marine ; depth range 100 - 310 m
Resilience	Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity.)
Biology	Occurs over rocky bottoms.

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Pristipomoides argyrogrammicus

Family	Lutjanidae (Snappers) , subfamily: Etelinae
Common name	Ornate jobfish ('utu)
Max. size	40.0 cm SL (male/unsexed)
Environment	reef-associated; marine; depth range 70 – 350 m
Resilience	Medium, minimum population doubling time 1.4 - 4.4 years (Preliminary K or Fecundity.)
Biology	Occurs over rocky bottoms. Feeds on small fishes, crustaceans and squids.

8. *Pristipomoides filamentosus* **

Family	Lutjanidae (Snappers) , subfamily: Etelinae
Common name	Crimson jobfish (palu hina)
Max. size	100.0 cm TL (male/unsexed); max. published weight: 8,154 g; max reported age: 18 years
Sexual maturity	Females generally reach spawning condition at a fork length of 19.2 inches. Reach sexual maturity at about 1.8 years and generally at about 2.2 years.
Environment	benthopelagic; marine ; depth range 40 - 400 m
Resilience	Medium, minimum population doubling time 1.4 - 4.4 years (K=0.16-0.31; tmax=18)
Biology	Occurs over rocky bottoms; off Guam, caught most abundantly between 180 and 270 m. At night, it migrates vertically to the upper part of its habitat to feed. Feeds on small fishes, shrimps, crabs, amphipods, ascidians and salps.

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9. *Pristipomoides flavipinnis*

Family	Lutjanidae (Snappers) , subfamily: Etelinae
Common name	Golden eye jobfish (palu sio'ata)
Max. size	50.0 cm SL (male/unsexed)
Environment	reef-associated; marine ; depth range 90 - 360 m
Resilience	Medium, minimum population doubling time 1.4 - 4.4 years (K=0.27-0.36)

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Biology	Occurs over rocky bottoms; off Guam, caught most abundantly between 180-270 m. Feeds primarily on benthic fishes and to a lesser extent on crustaceans, squids, and pelagic tunicates.
10. <i>Hyperoglyphe antarctica</i>	
Family	Centrolophidae (Medusafishes)
Common name	Antarctic butterfish (sifisifi)
Max. size	140 cm TL (male/unsexed; Ref. 9563); max. published weight: 60.0 kg; max. reported age: 15 years
Environment	benthopelagic; marine; depth range 40 – 1500 m
Resilience	Low, minimum population doubling time 4.5 - 14 years (K=0.03-0.3; tm=5-7; tmax=15)
Biology	Most common over or near rocky areas at 100-300 m. Generally, blue eye remain close to the sea bed during the day and move up in the water column at night, following concentrations of food. The fish are found over rough ground and at the edges of canyons and steep drop-offs. Blue eye appear to prefer cold water as part of their general behavior. Juveniles inhabit surface waters, sometimes in association with floating debris. Feed primarily on the pelagic tunicate <i>Pyrosoma atlantica</i> which is found near the sea bed during the day but dispersed throughout the water column at night. They also feed on squid, mollusks and crustaceans and fish ranging from small lanternfish (Myctophidae) to large fish such as gemfish (<i>Rexea solandri</i>). Juveniles consume small planktonic and sedentary organisms.
11. <i>Etelis carbunculus</i>	
Family	Lutjanidae (Snappers) , subfamily: Etelinae
Common name	Ruby snapper / red snapper / short-tailed red snapper (palu malau)
Max. size	127 cm FL (male/unsexed)
Sexual maturity	Reach this at about 11.7 inches fork length (2.8years). A fish 20 inches in fork length can release over 1.3 million eggs per spawn and may release 2 or more batches during a spawning season. Spawn in May to October
Environment	reef-associated; marine ; depth range 90 - 400 m
Resilience	Medium, minimum population doubling time 1.4 - 4.4 years (K=0.13-0.31)
Biology	Inhabits rocky bottoms. Feeds on fishes and larger invertebrates such as squids, shrimps and crabs; also takes planktonic organisms, including pelagic urochordates.
<i>Epinephelus septemfasciatus</i>	
Family	Serranidae (Sea basses: groupers and fairy basslets) , subfamily: Epinephelinae
Common name	Convict grouper (mohuafi)
Max. size	155 cm TL (male/unsexed); max. published weight: 62.8 kg
Environment	reef-associated; non-migratory; marine; depth range 5 – 30 m
Resilience	Very low, minimum population doubling time more than 14 years (Preliminary K or Fecundity.)
Biology	Occurs near shore, including semi-enclosed sea areas in rocky reefs in shallow waters.

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(Sources: FishBase, Current Line Fish Facts for Bottom Fishes of Hawaii)

2.2 Research History

The South Pacific Commission (SPC - now the Secretariat for Pacific Communities) Deep Sea Fisheries Development Project ran between 1974 and 1988 with the collaboration of the Fisheries Division to assess the deepwater drop line resources and develop to economic fisheries. The Overseas Development Administration (ODA) Fish Management Science Programme (FMSP) started a comprehensive research and data gathering project in the second half of 1986. The main objective of this project was to get the biological data necessary for the effective management of the deepwater snapper and grouper fishery. By 1991, after five years of data gathering, the Tonga snapper fisheries became one of the most researched small-scale fisheries in the Pacific Islands. The studies continued with the added collaboration of MRAG from 1993 until 1998. Other includes Viliami Langi and Sarah Langi, Saia Tulua and Tevita Latu and Dr. Michael King in 1992.

The AusAID funded Tonga Fisheries Project began a 4-year project in 2002-2006 with the aim of further developing and refining management plans and enforcement procedures for key fisheries.

Collection of catch, effort and size frequency data began in the 1980's, however has not been collected consistently, often due to limited staff and funds. This has resulted with high levels of data deficiencies at certain times. Continuous data collection occurred between 2000 and 2001 as more staff was available and allocated to the task. The establishment of the Fuel Concession in 2000 provided a mechanism for encouraging supply of quality log-sheet and offloading data from licensed fishers. The Fisheries Management Act 2002 provides the legislative support for the compulsory supply of accurate fisheries data.

Lack of staff and funding in 2004 resulted in incomplete and less accurate data collection. Data collection systems were reviewed in 2004 and since then checking and validation mechanisms have been in place to ensure data quality and completeness. More specific seamount data per fishing reels are required for future management.

2.3 *Fleet Dynamic and Effort*

In 1988, the FAO/UNDP boat-building scheme completed a fleet of 40 vessels designed for snapper fishing. These vessels were 28ft long and, equipped with four Samoan style hand-reels. A few privately built fishing vessels also participated in the fishery, and by the end of 1988, the fleet size was 44 vessels (Bell *et al*, 1995). However due to the lack of consistent maintenance and attention to safety, the number of fishing boats constantly decreased so that in 1992, only 19 boats were estimated to be active (King, 1992).

King (1992) estimated that 7 - 13 deepwater snapper fishing boats of the type operating in 1991 would be the best number to maximize profit-per-vessel (based on a surplus yield assessment of the fishery). However, 20 or so such vessels could possibly operate without exceeding the biological sustainability of the stock. Latu and Tulua (1992) calculated that maximum profit occurs at a fleet size of 16 - 17 vessels noting fish prices at the time. There are differences between the two studies yet derived from the same period. The later study does not reveal if it refers to maximizing profit-per-vessel or what type of assessment was carried out. It merely suggests in conclusion that a range of sizes (length) would result in maximum profit. It is also agreeable that the study by King was a thorough bio-economic assessment of the resource.

In 2002, it was decided by the deepwater Drop line Fishery stakeholders' meeting that limiting vessel number and their lengths was the best way of controlling effort and to catch at sustainable levels. It was approved by the, then, Secretary for Fisheries that the fishery would be closed to new entrants from the 19th of December, 2002, during a Deepwater Management Meeting. It was challenged in 2007 as to the legality of that decision.

In 2005, 18 vessels were licensed and based in Tongatapu and 5 in Vava'u. There is reason to believe that under the current licensing requirements (FMA 2002) there are

numerous unlicensed vessels that operate in the fishery today. The fleet is currently comprised of two basic classes of boats: the older, smaller vessels constructed under the UN project in 1988 and the modern, larger vessels of greater capacity. However, since 2005 when quarterly reports started it revealed that a maximum of 13 vessels would actively fish in a quarter.

In 2007 there were 28 known vessels of which only 18 are valid license holders with a few vessels yet to decide on their future. There are several vessels being rebuilt under the Cyclone Waka Project. Hence altogether there may be around 35 fishing vessels for this fishery. A notice under section 19 of the Act 2002 was submitted to cabinet for its consent and to be gazette. Its aim is to cap the current numbers of participants and included only four manually Samoan style hand-reel to be used. The measure was taken as a precautionary approach to the increased fishing effort and the increase knowledge of some seamounts being over fished.

MRAG reported in their assessment that the greatest catch (563 tonnes) and effort (123,547 reel hours) occurred in 1987, and for years when data are available declined to 1990 (catch, 238 t; effort, 59,340 rh) increasing in 1991, and 1994 (catch, 358 t; effort, 74,210 rh). Most catch and effort related to seamount (and some bank) locations in the south (83% in 1987, 88% in 1990 and 80% in 1994). Catch rates were similar in the north and south in any one year during the period 1987-1991, but varied between years (3.6-5.3 kg.rh-1). In 1994 (and for 2 months of 1993 and 8 months of 1995 for which data were available) catch rates in the north were less than those in the south (N, 4.18 kg.rh-1; S, 5.95 kg.rh-1 in 1994). This difference was even more pronounced considering catch per trip (N, 232 kg.trip-1; S, 702 kg.trip-1) and is believed to relate to the differences in the nature of the fleet, already described, although vessels from the south do fish in the north.

2.4 Fishery Economics and Performance

Three studies, referred to below, have analyzed the economic viability of the fishery however there have been no studies in recent times and economic data are rarely collected. Latu and Tulua (1992); Fakalolo (1992); King (1992) agreed that the fishery at this time was likely to be running close to its maximum economic yields, and suggested enforcement of the moratorium on the number of boats participating in this fishery.

This fishery produces over TOP\$2-3million of export revenue, and employs approximately 200 people in fishing, marketing and other ancillary services ('Alatini and Maritime pers comm., 2004). This fishery is Tonga's third major fisheries export earner, contributing around 27% of the total fisheries contribution to the national economy in 2006. The highest earning the fishery has experience has been in 2002 at approximately TOP\$2.7 million (FOB).

In the last 5 years the major target species have been Palu tavake (*Etilis coruscans*) and Palu hina (*Pristipomoides filamentosus*), due to their higher export value. The current FOB value underestimates the true value and contribution of this fishery to the Tongan economy.

PART III. OBJECTIVES, CHALLENGES AND CONSTRAINTS

In this section, the plan explains its desired objectives, acknowledge that there will be challenges to overcome and the importantly the ongoing constraints.

3.1 Fishery Overview, Challenges

Species targeted by this fishery have the biological characteristics of species that are sensitive to fishing pressure and vulnerable to over fishing; they are slow growing, long lived fish and potentially populations are localized to specific seamounts with limited migration inter seamount migration. Seamounts receiving high fishing pressure can be fished to levels of low productivity. (refer to the Biology section by FAO). The effective management of this type of fishery offers a challenge to managers. Some countries with similar fisheries have experienced fishery collapse due to unsuccessful or insufficient management and enforcement regimes.

The estimates of MSY and MEY have been exceeded previously (Latu and Tulua (1992); Fakalolo (1992); King (1992)). The lack of commitment to MCS controls, specifically unlicensed fishing have resulted in effort to creep far above recommended economic levels and biological levels of effort. Now the challenge in this fishery is to reduce or control effective effort to a level that the fishery can operate profitably and sustain ecologically in the long term. The focus of the Ministry of Fisheries should be to control unlicensed fishing and compliance of licensed fishers with the existing management measures. The enforcement capacity of the Ministry of Fisheries (MoF) and its capacity to mount successful prosecutions will potentially inhibit effective control.

However anecdotal evidence from fishers suggests that populations on certain seamounts have been reduced and catches are displaying higher proportions of smaller fish. The use of new technology such as the Cabinet approved ARGOS VMS allows validation of fishing locations. Future challenges for the Ministry are to use the VMS and maintain a data collection regime that will allow for the status of the fishery, especially status of populations on individual seamounts to be assessed. But human resource capacity within the MoF to use this tool effectively will be a challenge in acquiring it. Providing the required legislation framework such as regulations of VMS is essential for its implementation.

Assessing the fisheries economic performance and viability will be possible with the collection of good economic, fishing activity and catch data. The Ministry of Fisheries needs to focus resources and effort on producing a clear and reliable economic assessment prior to the review.

In light of this quality scientific and economic evidence the challenge to the Ministry of Fisheries, within the next three years, will be to determine, implement and enforce an effective management strategy that specifically addresses depletion of certain populations in certain areas and economic viability of the industry. This may result in reducing national levels of fishing effort or management on a seamount by seamount basis

3.2 *Management Objectives and Constraints*

These broad objectives have been developed in line with the Fisheries Management Act 2002 and tailored for the Fishery. These objectives should be re-assessed annually with stakeholders to adjust to meet new situations and parameters of the fishery.

3.2.1. *The objectives are for conservation, economic and management of the Snapper & Grouper Fisheries Management Plan are to:*

- Objective 1: To ensure that utilization of the deep bottom fish resources are for long term conservation and sustainable benefit;*
- Objective 2: To maximize economic welfare to Tonga from utilization of its deep bottom fish resources including harvesting, processing and exporting;*
- Objective 3: To contribute to the food security and livelihoods of Tongan subjects through sustainable utilization and employment.*

3.2.2 *Specific Goals for the achievement of the objectives*

The following goals are expected to be the main outcomes in pursuing the objectives of the conservations and long term management of the snapper & grouper fishery. Strategies have been developed to address these goals and are outlined in Chapter 4.

- Sustainability of the deep bottom fisheries resources, including food security
- Best available Scientific Data of Catch of seamounts, Effort on reels and Size Frequency by length
- Implementation of appropriate review, revision and evaluation procedures for the Snapper & Grouper Fisheries Management Plan
- Increase revenue generated to fishers through export earnings by diversification and value added and not limiting export.
- For license holders to establish and maintain an effective consultative process to support formation and review of this management plan with MoF .
- The effective use of Vessel Monitoring System (VMS).
- An review of appropriate fisheries management measures in place.

3.2.3 *Constraints to achievement of the goals include:*

- Concurrence and commitment of stakeholders to conserve their deep bottom fisheries resources;
- Commitment of Ministry of Fisheries to establish controls for a sustainable fishery, including regulations, and consistency in their application;
- Capacity of the fishers and Ministry to establish and maintain an appropriate and accurate data collection, analysis and reporting system;
- Capacity of fishers and the Ministry to collectively ensure appropriate monitoring and compliance with the management plan; and

- Capacity of the Government of Tonga to mount successful prosecutions will be a constraint to effective compliance and enforcement.

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PART IV MANAGEMENT MEASURES FOR THE SNAPPER FISHERIES MANAGEMENT PLAN

The following sections describe the important technical issues that must be met by this fishery. It emphasise the need for co-managing the resources, data information, MCS and management measures.

4.1 Institutional Strengthening

The Fisheries Management Act 2002 Section 4 states the responsibilities of the Minister in terms of fisheries conservation, management, sustainable utilization and development. This management plan will be formed in a manner consistent with the objectives. The fulfilment of these objectives will be assessed by the Ministry of Fisheries, the Fisheries Management Committee and the Fisheries Management Advisory Committee.

Consultative Framework

The Minister Responsible for Fisheries will manage the fishery in cooperation with stakeholders through participatory (co-management approach) management. The Ministry of Fisheries will still be the overriding decision makers. Participatory management facilitates the sharing of information, input into the development of MCS measures and promotion of voluntary compliance, fostering of co-management with the industry so they can assist in monitoring their fishery and report on non-compliant activity. The Fisheries Management Act 2002 states that there may be established a committee for each major fishery in Tonga. The following sections address first the Snapper Fisheries Management Committee (SFMC), and second, the Fisheries Management Advisory Committee.

The Snapper Fisheries Management Plan needs the co-operation and coordinated actions by all license holders. An Association of license holders for this fishing is of most essential for co-management. If this is not possible then license holders are advice to register with the broader Tonga Export Fishers Association (TEFA). Benefits are only great when there is a greater co-management arrangement and understandings.

4.1.1 Snapper & Grouper Fishery Management Committee

Consistent with the Section 7(4) of the Fisheries Management Act 2002, a Snapper Fishery Management Committee (SFMC) is established under this Plan. The Committee

“shall be primarily responsible for the implementation and review of the fishery plan or otherwise monitor the performance of the fishery subject of the fishery plan or perform such other duties and responsibilities as are given it under the fishery plan consistent with this Act”.

The Ministry shall provide the SFMC with sufficient information to review the fishery and advise the Minister on any appropriate action.

a) Functions

The main functions of the SFMC will be to:

- Advise the Minister and Secretary for Fisheries through the requirements of the FMA 2002 and on the effective management and administration of the Snapper Fisheries;
- Provide a forum for discussion of issues and strategies that require the input of all stakeholders, industry, other government ministries and the MoF ;
- Implement, monitor and review the management plan
- Provide recommendations and advice to the Head of Ministry of Fisheries relating to the snapper & grouper fisheries operations on a regular basis for management and operational purposes; and
- Ensure transparent decision making in regards to the snapper & grouper fishery.

b) Membership

The SFMC will have representation from all major stakeholders and should include the following representatives:

- Fisheries Management representative from the Ministry of Fisheries;
- Compliance representative from the Ministry of Fisheries;
- Representatives from such other government ministries/departments as selected by the Head of the Ministry of Fisheries;
- Representatives from the Vava'u snapper & grouper fisheries license holders;
- A representative from the Tongan Fish Exports Association¹;
- Three representatives of the licensed snapper fishers (at present they do not have any association);
- *ad hoc* advisors and members as determined by the Committee Chair.

The representatives of the snapper & grouper license fishers will be selected as with accordance to their total number per registered station. *Such as; one representative from every five license holders per station of registry and license.*

When the association will be fully legally recognise and registered, representation will be as accordance with their prescribed constitution. The constitution shall be forwarded to the Ministry of Fisheries

¹ The current association is known as TEFA. It currently is responsible for the fisheries export companies. The name is slightly different however the functions performed is as intended legally to perform.

c) Chairmanship

Meetings of the SFMC will be chaired by Secretary for Fisheries.

d) Frequency of Meetings

The SFMC shall meet at a minimum of once annually, and further as required by the Chair to address specific matters.

4.2 Research and Development

The subsection provides some background into the requirements for research and developments,

4.2.1 Stock assessment – data collection

Collapse of fisheries of similar species has been experienced in many countries due to insufficient management regimes. Anecdotal evidence of significant changes in the resource in Tonga due to environmental changes and fisheries induced change (over-fishing, etc.) highlight the need for continual assessment.

Currently in Tonga there are a number of sources data of for the snapper & grouper fishery.

1. Log sheets: All requirements of the log sheets are detailed in the Terms and Conditions of licenses.

2. Port Sampling: All requirements of the log sheets are detailed in the Terms and Conditions of licenses.

3. Packing Sheets: Export data are submitted (pre-export) to the Ministry of Fisheries in a (MoF) prescribed Packing List. A fully detailed packing list is submitted to Customs and stamped when approved. This copy is submitted (post export) to the Ministry of Fisheries. These data include destination, weight, species, local price and in some cases a value for export price.

4. Local Market Records: Ministry staff at the Tuimatamoana Market currently record catch landed from both licensed and unlicensed vessels by species, weight, boat owner, trip departure and arrival dates and times.

5. Vessel Monitoring System: All licensed drop line (deep bottom fishing) fishing vessels are required to operate with VMS. The MoF receives location, speed and bearing information with a vessel signature every four hours. Special condition may apply.

4.2.2 *Monitoring the fishery's performance*

Collation and presentation of information required for monitoring and assessing the fishery performance is the responsibility of the MoF. However the MoF requires that stakeholders contribute data and information at least as required by terms and conditions of licence. Monitoring of fisheries performance should be incorporated into the consultative process.

It is recommended that any detailed management measures be implemented separately, by notice (under section 19 of FM Act 2002), and appended to the plan as they occur. These measures would not be *prescribed* in the Plan itself, but be consistent with the broad principles, background information, and committee agreements described under the Plan.

Any resolutions agreed by the Management Committee would also be appended to the plan. Monitoring of the fisheries will be set according to the authorisation as stipulated by Section 19 of the Fisheries management Act 2002 as required from time to time to implement necessary management measures or when precautionary approached is necessary.

Basics analysis of fishery data needs to continue on a quarterly basis and reported to stakeholders via a Quarterly Information Bulletin. Competition and increased efficiency will occur in the industry due to technological advances and improved knowledge concerning the resource. However, only the Ministry of Fisheries will approve any such methods to used other than that currently being utilized such as the manually Samoan type hand-reels.

A second step to merge effort with sustainable fishing limits is through a regular review of the MSY figure sustainability with respect to stocks and fishing pressures. In 1992 it was recommended that the MSY limit be set at 350 tonnes, this becoming the trigger point for overexploitation. This value has only been reached once in 1987, but evidence of reduced catch for effort and reduced average size of fish in certain areas indicates a fishery under stress and the need for a reassessment of the MSY trigger. In 2006 a preliminary assessment has provided a new global MSY. However, due to problematic of data collection this MSY figure was later discouraged in which the MSY has been clearly halved.

Table 3: Summary of the number of licensed drop line (deep bottom) fishing vessels, total catch and effort (by trip) 1993 – 2005 (not all vessels were licensed or active for the full calendar year)

Year	Number of licensed vessels	No. of fishing trips (by licensed vessels with known catch quantities)	Total Catch (kg)
1993	17	35	45702
1994	24	249	110565
1995	23	175	92790
1996	19	149	88005
1997	22	172	125983
1998	14	161	106193
1999	12	135	94314
2000	10	244	189307
2001	18	285	230745
2002	25	75	56225
2003	23	98	132813
2004	25	89	227412
2005	23	303	187492

Sources: 1993-2003 data: Snapper spreadsheet (missing data); 2004 & 2005 data: Snapper database (2004 weight known for only the 10 known species mentioned in Table 3)

Since the decision to include snapper fisheries in the fuel concession subsidy in 2000, clear indication of increased catch (total catch) is seen as in Table 3. This has raised concerns on the validity of the fuel concession for this fishery as the fish stock has come under severe pressure. The differences in number of trips in the 90's cannot be compared to the number of trips from 2000-2005. The 2002, data is unreliable as data collection was not performed regularly by the MoF. However, lesser fishing trips were recorded in 2000 onwards as compared to the 90's but consequently there have been an increase in total catches from 2004. Increase landing of undersize snapper has been reported to MoF in 2006 and 2007. The table provides a clear indication of the history of this fishery both in terms of inadequate data from fishers and in the lack of resources (financially and human) in the MoF to efficiently manage it.

4.2.3 Data Considerations and Focal Points

1. In future, MoF shall establish and maintain a database that incorporates and cross references (relational and hierarchical database) log sheets, VMS and port sampling data.
2. A mechanism for collection of spatially disaggregated catch, effort and size frequency data must be established and adhered to.
 - a. Review of log sheet data required (by licence terms and conditions or fuel concession)

- b. Data has to be collected per seamount separately and effort required.
 - c. Separation or tagging of catch (on board) by location
 - d. Deployment of observers
3. The MoF will review the system for collection of export data to ensure accurate export figures are available for economic analysis and its appropriate export fees.
4. The MoF will be responsible for the collection and analysis of economic information, relating to this fishery, sufficient for a comprehensive economic analysis as soon as possible.
5. Regular reporting of accurate data to stakeholders is required on a quarterly basis and more detailed reporting on an annual basis.

4.3 Export Quality

The following sections explain the essentials development for exports

4.3.1 Quality Improvement for Export Species

There is scope for development in quality and quantity enhancement of export products. This is in the areas of:

- overseas marketing of the species that are currently only sold locally; and
- marketing value-added products from the by-catch for overseas markets to increase revenues, potentially relieve fishing pressures and financial reliance on the main species such as *Etilis coruscans* (longtail snapper – palu tavake)

4.3.2 Training in Quality Enhancement

There is a need for more training and better education of the stakeholders with respect to post harvest matters such as health and food safety, and “handling of fish from sea to table” as a quality improvement exercise.

Deepwater species (as in Table 1) are to be caught, processed on board, and landed only by holders of local drop line fisheries licenses, using only hook and line methods as provided in the definition in chapter 1. This is a first step in ensuring high quality fish is maintained.

4.4 MCS Issues

The monitoring, control and surveillance (MCS) issues for this fishery are dependent on the approved management plan as the purpose of MCS is as an implementing tool for management planning. The initial challenge would be the gathering of data and collating and validity cross-checking before using it for sustainable management planning.

Second will be the legislation to support the management plan. This will need to be specific to the fishery and will fall under the parameters of the Fisheries Management Act 2002 as Snapper Fisheries Regulations. These regulations will address such issues as:

- Confirmation of authorities under the Act and others required for the fishery;
- Principles of the fishery management plan, e.g., priority or exclusive access for local communities to reef areas ; TAC's; trigger points; Special Management Areas; conservation/protected areas; etc.
- Terms and conditions of licenses to include: identification of vessel; authorized fishing operations; areas, gear, seasons; fish sizes; by-catch limits where appropriate; reporting requirements; landing requirements; and inspections/observers/fishery officer access, VMS, criteria for entry into the fishery, license transfers, etc.
- Zoning, if appropriate;
- Schedules for fishing areas;
- Reports

Criteria for identifying when over fishing have occurred maybe signalled by the following:

- Mean size of the catch of any species in any area is a pre-reproductive size
- Significant decline (50 % or more) in the CPUE from baseline levels
- Entry/exit of fishermen in any area
- Per-trip costs exceed per-trip revenues for a significant percentage of trips depending on vessel type.
- Significant decline or increases in total landings in any area
- Change in species composition of the catch
- Habitat degradation or environmental problems

4.5 Management Measures

a) Management measures on effort;

- All fishing vessels fishing commercially in this fishery (local fishing vessel) shall be registered and licensed to fish for snapper and grouper species.

- The plan recommends that a maximum number of 20 hooks per line permitted on a Samoan style hand-reel at any given time. And shall use only the permitted size, class of hooks as from time to time authorised by the Ministry of Fisheries. As a precautionary approach to stop fishing for juvenile fish the plan recommends that the fishery uses only size 13 circular hooks. These recommendations shall be added to the Terms & Conditions of licenses.
- The total length of vessels licensed for snapper and grouper fisheries must not be more than 15m (Length Overall, LOA) and markings shall be used as stipulated in the Fisheries (local Fishing) Regulation 1995. The total length shall be added to the terms and conditions of the licenses and be regulated through proper legislations.
- The fishery is aimed at reducing the number of snapper licenses to a maximum of 15 licenses (Adams, 2007; King 2002; Latu and Tulua 1992; Fakalolo 1992; Langi and Langi, 1987). The limited entry capacity will be in place until further studies permits changes.
- Exporting companies shall impose a minimum differential pricing system based on average length and/or size to discourage the fishing of small fish.
- Vessels shall land no more than **20%** undersize fish of its total catch (*Some agreed available research length of sexual maturity of species of such has been confirmed by MoF as Palu Tavake (Eteline coruscans) is recorded at 55cm FL which corresponds to 2.0kg; Palu Malau (Eteline carbunculus) is at 30cm FL(0.7kg); Palu Hina (Pristomoides filamentosus) is at 43cm FL(1.6kg)* (Everson, 1984; Kikawa, 1984; Grimes, 1987, Haight, Kobayashi and Kawamoto 1993).
- Vessel masters shall be required to avoid seamounts where small fish (immature) has been caught. They are to note and report to the MoF and other fishers of any such seamounts.
- The fish resources (covered in this plan) shall be exploited (fished) by the license vessels using not more than permitted number of manually operated traditional Samoan style hand-reels at any given period.

b) Management measures on ‘Areas of No-take’;

- The license vessels shall not fish in all designated closed areas, marine reserves or Communities Special Management Area (SMA) unless the SMA is established only for the use of this fishery.
- The vessel master shall avoid areas known to be juvenile nursery grounds and to selectively target areas and depths with larger fish. Information sharing is crucial to this measure for any precautionary approach. Voluntary compliance is encouraged at all times.
- Any further management measures may be announced in the authority prescribed in Section 19 of the Fisheries management Act 2002. And will be appended to the plan in its entirety.

c) Other Management measures;

- Vessels licensed for snapper & grouper fishing are fitted with VMS and adheres to the VMS regulations and other legal VMS requirements as set by MoF, special condition may apply as may be deem fit by the Secretary for Fisheries in relation to availability of VMS equipment.
- Applications for license to fish shall not automatically qualify an applicant for a right to be given a license. Fees are non refundable.
- Suspension policy shall apply to any license vessel breaching any conditions of the license or any other fisheries law of the Kingdom of Tonga.
- The Fuel Concession Scheme is to be reviewed this year and a recommendation on its appropriateness made to Cabinet. This would be in accordance to CD No.1871, 25th October 2001;

- “That an assessment of the value of the fuel concessions be reported to cabinet on an annual basis until such a time when the concessions can be withdrawn”.

4.6 Review of Management Measures

The Ministry of Fisheries, in light of available scientific and economic evidence, will review the management measures prescribed here, whenever it is required or yearly subsequent to the approval of this Management Plan. During this period there will be a focus on collecting quality reliable data to monitor and assess the fishery. Regular monitoring information shall be prepared by cooperation between license holders and MoF. If any of these data suggest a downturn of fishery performance a review of the existing management measures is recommended to be performed.

Future outlook should be:

- Diversification of the fishery into separate categories. That is to develop a Reef slopes fisheries and an offshore seamount fishery. Sizes of vessels and hooks to be used, species to be fished are major factors to consider.
- There needs to be a careful consideration of the community management areas of which their claim areas may affect the availability of slope species to the Drop line (Bottom Fishing) license holders.
- Allow recovery of areas where production is low compared to previous years. Certain areas, particularly in the southern zone of Tongatapu (that vessels displaced from closed areas due not unduly impact seamounts in the northern zone, or the reef-slope areas fished by smaller boats), be closed to fishing for 2-3 years to allow these seamounts to recover a measure of productivity.
- A future reduction in fishing effort is required in order to reduce the risk of long-term damage to stocks through recruitment over fishing, and a potential ecological “phase-change” that replaces high-value species with low-value species

- The use of the Fuel Concession Scheme shall be reviewed and a recommendation made to Cabinet on its appropriateness in the snapper & grouper fishery. This is; *“because the deepwater line fishery is already fully developed. This is a mature commercial fishery in no need of further development as such, but rather of scaling back to levels that more appropriately match the renewable capacity of the natural resource, and thus assist in maintaining its contribution to the economy”* (Tim Adams, SPC unpublished, 2007)
- Future effort limitations would be assessed for its suitability and considering the human resource and its capacity to manage, monitor and control the fishing activities. Such efforts limitations as Total Annual quota for target species (tonnes/boat/year), Total Annual Quota of Total Catch (tonnes/boat /year). Total Effort Days.
- A stock assessment of all seamount in Tonga should be conducted in the near future when funds and human resources are readily available. The assessment shall be to establish an MSY per seamount.

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- Past and current staff of the Ministry of Fisheries
- Assistant from the Secretariat of the Pacific Community, Tonga Fisheries Project (AusAID),

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