National prioritization of key vulnerable reef fish species for Fiji, for targeted research

Coral reef fish and invertebrates sold at the Suva market. Photo by: Sangeeta Mangubhai/WCS

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MINISTRY OF FISHERIES & FORESTS
"Our Forest, Our Ocean, Our Future"

Introduction

The majority of Fiji's population is coastal and therefore highly reliant on inshore fisheries for their subsistence and local economic needs (Hunt 1999). At least 33 percent of all animal protein consumed in Fiji comes from fish, and subsistence and artisanal fisheries contribute at least US$59.1 million to Fiji's annual GDP (Gillett 2009). There is growing concerns for the impacts of present day harvesting rates and methods, especially for vulnerable fish and invertebrate species in Fiji. This is resulting in a progressive decline in fish belonging to higher trophic (feeding) groups, a pattern that is termed "fishing down food webs" (Pauly et al. 1998).

Coral reef fish vary in their vulnerability to fishing pressure, and how well they can recover, if fishing is stopped or significantly reduced. Recovery potential relates to the rate at which a species can replace the individuals that are lost to natural mortality and to fishing. In general, the medium to larger carnivorous fish high in the food chain are thought to be more vulnerable to fishing (e.g. groupers) requiring in decades to recover, while smaller fish (e.g. herbivores such as rabbitfish) are thought be less vulnerable (Abesamis et al. 2014). Certain life history characteristics of fish species together can be good predictors of vulnerability at the population level to fishing pressure, including: (a) maximum size; (b) body growth rate; (c) lifespan; (d) natural mortality rates; (e) age at maturity; and (f) length at maturity (Abesamis et al. 2014).

Despite the importance of inshore fisheries to Fiji very little is known about the biology and ecology of fish that are collected, eaten and sold in villages and town centres. The absence of information has implications for the decisions that are being made on the management of Fiji's inshore fisheries. For example, in the absence of information on life-history parameters such as size and age at maturity, Fiji applied information from other countries to set size limits for fish and invertebrates within the Fisheries Act (1942). Because length at maturity data are generally fairly easy to acquire, many authorities develop regulations for minimum catch size to ensure that a certain proportion of the population is sexually mature in order to sustain reproduction. However, these measurements of length at which 50% of the population is sexually mature (L_{mat}) are not necessarily transferrable between countries because, for the same species, L_{mat} may differ as fish adjust their biology in response to fishing pressure.

With growing concerns for inshore fisheries, especially for vulnerable species in Fiji, it is imperative that research is focused and target species that requires management. A workshop was held at the Department of Fisheries Lami Office on 3 February, 2015 with scientists and managers from government and non-government organizations. The objective of the workshop was **to identify 15-20 key vulnerable coral reef fish species important for subsistence and/or artisanal fisheries in Fiji that should be prioritised for targeted research for management.** The results of the workshop will be used to prioritise fish for investigating locally relevant Lmat and assess of the status of reef fish stocks.

Criteria and their application

Five criteria were used to identify help identify and prioritise reef fish species:

1. Importance both for consumptions and commercial purpose[1];
2. Cultural and socioeconomic importance to local communities[2];

[1] Only the top 25 species were listed, based on FLMMA CPUE data.

3. Priority species for Fiji's Department of Fisheries;
4. Species has a key ecological role on reefs[3]; and
5. Life-history patterns make them vulnerability to fishing patterns.

Criteria 1 to 4 were based on expert opinion, and information gathered through surveys across Fiji (Table 1). Vulnerability to fishing pressure was based on the 'Vulnerability Index' listed in Abesamis et al. (2014) paper titled "The Intrinsic Vulnerability to fishing of coral reef fisheries and their differential recovery in fishery closures," published in the international journal Review of Fish Biology and Fisheries. A copy of the supplementary materials Abesamis et al. (2014), which lists the vulnerability index for different reef fish, is provided in Appendix 1. For species where the vulnerability index was not provided, the data was extracted from FishBase (http://www.fishbase.org/). Estimates of vulnerability were based on the "fuzzy logic system" described by Cheung et al. (2005), who estimated the intrinsic vulnerability to fishing of more than 1,300 species of marine fish, by integrating life history and ecological characteristics.

Table 1. Summary of availability of information from the Department of Fisheries and partner organisations in Fiji. WCS=Wildlife Conservation Society, DoF=Department of Fisheries, WWF=World Wide Fund for Nature, USP-IAS=University of the South Pacific Institute of Applied Science. PHCs=periodically harvested closures or *tabu* areas, UVC=underwater visual census. CPUE=catch per unit effort.

Organisation	Type of data	Years collected
WCS	Underwater videos PHCs	2012-2014
	UVC surveys	2007-2014
	Market surveys	2010, 2013
	CPUE (PHCs)	2012-2013
	CPUE	2014
DoF	Market Surveys	Long term data
	CPUE (rapid assessment)	2004-2014
WWF	Proxy indicator/Size maturity of 20 species	2014-present
WWF	CPUE	2014
USP-IAS	CPUE	2008-2009

Main Outcomes

A preliminary list of species was developed based on the five criteria, and listed in order of their vulnerability index as listed on Fishbase (Table 2). This list was refined to **twenty** priority species (Table 3) that have vulnerability scores ≥ 30 and are caught in sufficient numbers in Fiji to potentially conduct assessments to evaluate length at maturity. This list can be used by the Research Division in the Department of Fisheries, NGOs and academic institutions to prioritise the limited resources they have for research towards these species. It is recommended that upcoming work to look at size at maturity of fish and spawning potential ratios target these priority species. This work should be complemented with more detailed studies at University of the South Pacific by Masters or PhD-level students to gather data on life history characteristics of these priority fish species.

[2] While participants notes that all fish species were important, only those of special interest were highlighted
[3] All coral reef species have a role and function on reef. This criterion was used to highlight those that had a particularly unique role, based on scientific evidence.

Table 2: Priority list of fish species in order of Vulnerability Index (VI) generated on five main criteria. Fish species highlighted in BOLD are critically endangered and is included in the Endangered and Protected Species Act of Fiji. Fish species marked with an asterisk (*) are important species for local and export markets, hence are vulnerable to overfishing. Priority species are those that are important to the Department of Fisheries. The humphead wrasse (bold) is currently protected in Fiji.

Common name	Scientific name	Fijian name	VI	Important for consumption	Commercially valuable	Cultural or socioeconomic important	Priority species	Key ecological role on reefs
Bull shark	*Carcharhinus leucas*	Qio	88				√	√
Whitetip reef shark	*Triaenodon obesus*	Qio	83				√	√
Barracuda	*Sphyraena barracuda*	Ogo	79	√	√			
Humphead wrasse	***Cheilinus undulatus***	**Varivoce**	**74**	√	√			
Crocodile needlefish	*Tylosurus crocodilus*	Saku	72	√	√			
Blacksaddled grouper	*Plectropomus laevis*	Lava	72		√		√	√
Speckled blue grouper	*Epinephelus cyanopodus*		70	√	√			√
African Pompano	*Alectis ciliaris*	Saqa	69	√	√	√		
Bumphead parrotfish	*Bolbometopon muricatum*	Kalia	67	√	√	√	√	√
Camouflage grouper	*Epinephelus polyphekadion*	Kawakawa	64	√	√	√	√	√
Blacktip shark	*Carcharhinus melanopterus*	Qio	64				√	√
Mangrove red snapper	*Lutjanus argentimaculatus*	Damu	60	√	√			
Puffer	*Arothron stellatus*	Sokisoki	60					√
Bluespine unicornfish	*Naso unicornis*	Ta	57	√	√			√
Yellowlip emperor	*Lethrinus xanthochilus*	Kacika	57		√	√		
Areolate grouper	*Plectropomus areolatus**	Donu	56	√	√		√	√
Many-spotted sweetlips	*Plectorhinchus chaetodonoides*	Sevaseva/Drekeni	54		√			
Fringelip mullet	*Crenimugil crenilabis*	Kanace	51		√	√		
Leopard grouper	*Plectropomus leopardus**	Donu	51		√		√	√
Brown marbled grouper	*Epinephelus fuscoguttatus**	Kawakawa	50		√		√	√
Blue fin trevally	*Caranx melampygus*	Saqa	50		√			
Grey reef shark	*Carcharhinus amblyrhynchos*	Qio	47				√	√
Spangled emperor	*Lethrinus nebulosus*	Kawago	46	√	√	√		
Tripletail wrasse	*Cheilinus trilobatus*	Draunikura	43	√				
Spanish mackerel	*Scomberomorus commerson*	Walu	41		√			
Malabar grouper	*Epinephelus malabaricus**	Soisoi/Votonisiga	40		√	√	√	√
Yellowtail emperor	*Lethrinus atkinsoni*	Sabutu	35	√	√			
Indian goatfish	*Parupeneus indicus*	Daunau/Cucu	34	√	√			

Orangespine unicornfish	*Naso lituratus*	Jila	34					√
Common name	**Scientific name**	**Fijian name**	**VI**	**Important for consumption**	**Commercially valuable**	**Cultural or socioeconomic important**	**Priority species**	**Key ecological role on reefs**
Longspot snapper	*Lutjanus fulviflamma*		34	√				
Humpback snapper	*Lutjanus gibbus*	Taea	32	√	√			
Titan triggerfish	*Balistapus undulatus*		31					√
Thumbprint emperor	*Lethrinus harak*	Kabatia	29	√	√	√		
Dussumier's halfbeak	*Hyporhamphus dussumieri*		29		√			
	Hemiramphus far	Busa	26	√	√	√		
Honeycomb grouper	*Epinephelus merra*	Kasala	23	√	√	√		√
Yellowfin goatfish	*Mulloidichthys vanicolensis*	Ose	23	√	√			
Forktail rabbitfish	*Siganus argenteus*	Mulu	22					√
Bullethead parrotfish	*Chlorurus sordidus*	Kakarawa	20	√	√			√
Vermiculate rabbitfish	*Siganus vermiculatus*	Nuqa	20	√	√	√		
Brown surgeonfish	*Acanthurus nigrofuscus*		18	√				
Long-jawed mackeral	*Rastrelliger kanagurta*	Salala	18	√	√	√		
Lined bristletooth	*Ctenochaetus striatus*	Dridrinitoga	17	√				
Common ponyfish	*Leiognathus equulus*		16	√				

Table 3. List of fish species, their vulnerability index, and whether they can be harvested in sufficient numbers for research.

Common name	Scientific name	Fijian name	VI
Barracuda	*Sphyraena barracuda*	Ogo	79
Crocodile needlefish	*Tylosurus crocodilus*	Saku	72
African Pompano	*Alectis ciliaris*	Saqa	69
Camouflage grouper	*Epinephelus polyphekadion*	Kawakawa	64
Mangrove red snapper	*Lutjanus argentimaculatus*	Damu	60
Bluespine unicornfish	*Naso unicornis*	Ta	57
Yellowlip emperor	*Lethrinus xanthochilus*	Kacika	57
Fringelip mullet	*Crenimugil crenilabis*	Kanace	51
Leopard grouper	*Plectropomus leopardus*	Donu	51
Brown marbled grouper	*Epinephelus fuscoguttatus*	Kawakawa	50
Blue fin trevally	*Caranx melampygus*	Saqa	50
Spangled emperor	*Lethrinus nebulosus*	Kawago	46
Tripletail wrasse	*Cheilinus trilobatus*	Draunikura	43
Spanish mackerel	*Scomberomorus commerson*	Walu	41
Yellowtail emperor	*Lethrinus atkinsoni*	Sabutu	35
Indian goatfish	*Parupeneus indicus*	Daunau/Cucu	34
Orangespine unicornfish	*Naso lituratus*	Jila	34
Longspot snapper	*Lutjanus fulviflamma*		34
Humpback snapper	*Lutjanus gibbus*	Taea	32
Titan triggerfish	*Balistapus undulatus*		31

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Appendix 1: List of 145 species of coral reef fish that were included in this review. Data on maximum size (length), maximum age, trophic level, vulnerability and AFS (American Fisheries Society) productivity index were directly extracted from Fishbase (Froese and Pauly 2012). Calculation of the vulnerability index was based on Cheung et al. (2005). Species with some data on age and/or growth in FishBase are denoted by a plus sign. Nominal categories of vulnerability are as follows: L – Low, M – Moderate, H – High, VH – Very High. Calculation of the AFS productivity index is described by Musick (1999). Nominal categories of productivity are as follows: VL – Very Low, L – Low, M – Medium, H – High. Trophic classification are as follows: F – Piscivore; I – Invertivore; Z – Zooplanktivore; H – Herbivore; D – Detritivore; C – Corallivore. Data on IUCN Category was obtained from the IUCN Red List of Threatened Species, version 2012.2. (www.iucnredlist.org): CR – Critically Endangered, EN – Endangered, LC – Least Concern, VU – Vulnerable, T – Threatened, NT – Near Threatened. CT – Coral Triangle. Source: Abesamis et al. (2004).

Family	Genus	Species		Max. Size (cm TL)	Max. Age (years)	Trophic Level/ Classification	Vulnerability Index	AFS Index	IUCN Category
Carcharinidae (sharks) n = 8	Carcharhinus	amblyrhyncos	+	255	25	4.1 (F)	47 (M to H)	VL	NT
	Carcharhinus	brevipinna	+	300		4.2 (F)	62 (H)	VL	NT
	Carcharhinus	melanopterus		200		3.9 (F)	64 (H)	VL	NT
	Carcharhinus	sorrah	+	160	8	4.2 (F)	46 (M to H)	VL	NT
	Triaenodon	obesus	+	160	25	4.2 (F)	83 (VH)	VL	NT
	Negaprion	brevirostris	+	340	25	4.4 (F)	87 (VH)	VL	NT
	Carcharhinus	leucas	+	400	28	4.3 (F)	88 (VH)	VL	NT
	Galeocerdo	cuvieri	+	750	50	4.5 (F)	64 (H)	L	NT
Serranidae (groupers) n = 14	Cephalopholis	leopardus		24		4.0 (F)	28 (L to M)	H	
	Cephalopholis	argus		60		4.5 (F)	49 (M to H)	M	
	Cephalopholis	miniata	+	45		4.4 (F)	61 (H)	L	
	Epinephelus	fasciatus	+	40		3.7 (F)	47 (M to H)	L	
	Epinephelus	fuscoguttatus		120		4.1 (F)	50 (M to H)	M	NT
	Epinephelus	lanceolatus		270		4.0 (F)	85 (VH)	VL	VU
	Epinephelus	itajara	+	250		4.1 (F)	70 (VH)	L	CR
	Epinephelus	striatus	+	122		4.1 (F)	63 (H)	L	
	Mycteroperca	venenosa	+	100		4.5 (F)	53 (M to H)	L	NT
	Mycteroperca	bonaci	+	150		4.5 (F)	63 (H)	L	NT
	Mycteroperca	interstitialis	+	84		4.5 (F)	68 (H to VH)	L	VU
	Plectropomus	leopardus	+	120		4.5 (F)	51 (M to H)	M	NT
	Plectropomus	areolatus		73		4.5 (F)	56 (H)	L	VU
	Plectropomus	laevis		125		4.1 (F)	72 (H to VH)	VL	VU

Carangidae (jacks and scads) n = 13	Selaroides	leptolepis		22		3.5 (Z/I)	13 (L)	H	
	Selar	boops		25		3.5 (Z)	14 (L)	H	
	Atule	mate		30		4.5 (F)	19 (L)	H	
	Carangoides	ferdau		70		4.5 (F)	44 (M)	M	
	Carangoides	orthogrammus		75		4.5 (F)	38 (M)	M	
	Caranx	lugubris	+	100		4.5 (F)	36 (M)	L	
	Caranx	melampygus	+	117	7	4.5 (F)	50 (M to H)	M	
	Caranx	sexfasciatus	+	120		4.5 (F)	45 (M to H)	M	
	Gnathodon	speciosus	+	120		3.8 (F/I)	37 (M)	L	
	Alectis	indica	+	165		4.1 (F)	62 (H)	L	
	Caranx	ignobilis	+	170	11	4.2 (F)	74 (H to VH)	M	
	Elegatis	bipinnulata		180		3.6 (F/I)	41 (M)	M	
	Seriola	dumerili		190		4.5 (F)	54 (M to H)	M	
Lutjanidae (snappers) n = 17	Lutjanus	ehrenbergii	+	35		4.4 (F/I)	29 (L to M)	M	
	Lutjanus	fulviflamma	+	35		3.8 (F/I)	34 (L to M)	M	
	Lutjanus	carponotatus	+	40		3.9 (F/I)	32 (L to M)	M	
	Lutjanus	fulvus	+	40		4.1 (F/I)	23 (L)	M	
	Lutjanus	kasmira	+	40		3.6 (F/I)	40 (M)	M	
	Lutjanus	monostigma		60		4.3 (F/I)	40 (M)	M	
	Aphareus	furca	+	70		4.1 (F/I)	36 (M)	M	
	Ocyurus	chrysurus	+	86	14	4.0 (F/I)	65 (H)	L	
	Lutjanus	griseus	+	89		4.3 (F/I)	40 (M)	M	
	Lutjanus	bohar	+	90		4.1 (F/I)	69 (H to VH)	M	
	Lutjanus	johnii		97		4.2 (F/I)	60 (H)	M	
	Lutjanus	campechanus	+	100		4.0 (F/I)	55 (H)	L	
	Aprion	virescens	+	112		4.0 (F/I)	61 (H)	M	
	Lutjanus	sebae	+	116		4.3 (F/I)	59 (H)	M	
	Etelis	coruscans	+	120		4.5 (F/I)	45 (M to H)	L	
	Lutjanus	jocu		128		4.3 (F/I)	66 (H to VH)	L	
	Lutjanus	argentimaculatus	+	150		3.6 (F/I)	60 (H)	M	
Lethrinidae (emperors)	Gnathodentex	aurolineatus		30		3.3 (I/F)	29 (L to M)	M	
	Lethrinus	ornatus		45		3.4 (I/F)	26 (L to M)	H	

n = 10	Lethrinus	harak		50		3.6 (I/F)	29 (L to M)	M	
	Lethrinus	lentjan	+	52		4.2 (I/F)	35 (L to M)	M	
	Monotaxis	grandoculis		60		3.2 (I/F)	42 (M)	M	
	Lethrinus	erythracantus	+	70		3.4 (I/F)	46 (M to H)	M	
	Gymnocranius	grandoculis		80		3.4 (I/F)	42 (M)	M	
	Lethrinus	nebulosus		87		3.3 (I/F)	46 (M to H)	L	
	Lethrinus	miniatus	+	90		3.5 (I/F)	53 (M to H)	M	
	Lethrinus	olivaceus	+	100		3.8 (I/F)	40 (M)	L	
Labridae (wrasses) n = 17	Bodianus	mesothorax		25		3.2 (I)	33 (L to M)	M	
	Halichoeres	hortulanus		27		3.4 (I)	21 (L)	H	
	Choerodon	fasciatus		30		3.4 (I)	35 (M)	M	
	Pseudodax	molucannus		30		2.8 (I)	35 (M)	M	
	Bodianus	macrourus		30		3.5 (I)	36 (M)	M	
	Choerodon	anchorago		38		3.9 (I/F)	51 (M to H)	M	
	Bodianus	rufus		40		3.4 (I)	41 (M)	M	
	Coris	gaimard		40		3.5 (I)	41 (M)	M	
	Choerodon	fasciatus		40		3.5 (I)	54 (M to H)	L	
	Cheilinus	trilobatus		45		3.5 (I/F)	45 (M)	M	
	Cheilinus	chlorourus		45		3.4 (I)	46 (M to H)	M	
	Bodianus	loxozonus		47		3.6 (I)	49 (M to H)	L	
	Chelio	inermis		50		4 (I/F)	60 (H)	L	
	Hemigymus	fasciatus		80		3.2 (I)	62 (H)	VL	
	Hemigymus	melapterus		90		3.3 (I)	64 (H)	VL	
	Coris	aygula		120		3.4 (I)	73 (H to VH)	VL	
	Cheilinus	undulatus	+	229	32	4.0 (I/F)	74 (H to VH)	L	EN
Caesionidae (fusiliers) n = 8	Pterocaesio	pisang		21		3.4 (Z)	14 (L)	H	
	Pterocaesio	diagramma		30		3.4 (Z)	31 (L to M)	M	
	Pterocaesio	tile		30		3.3 (Z)	24 (L)	H	
	Caesio	caerulaurea		35		3.4 (Z)	26 (L to M)	H	
	Caesio	teres		40		3.4 (Z)	28 (L to M)	H	
	Caesio	lunaris		40		3.4 (Z)	28 (L to M)	H	
	Caesio	xanthonota		40		3.4 (Z)	28 (L to M)	H	
	Caesio	cuning		60		3.4 (Z)	35 (M)	M	

Pomacanthidae (angelfishes) n = 10	Pomacanthus	diacanthus		25		2.7 (I/H)	38 (M)	M	
	Geniacanthus	lamarcki		25		3.4 (Z)	30 (L to M)	M	
	Apomelichthys	trimaculatus		26		2.6 (I/H)	31 (L to M)	M	
	Pomacanthus	navarchus		28		2.7 (I/H)	32 (L to M)	M	
	Pomacanthus	xanthometopon		38		2.7 (I/H)	36 (M)	M	
	Pomacanthus	semicirculatus		40		2.5 (I/H)	50 (M to H)	M	
	Pomacanthus	imperator		40		2.7 (I/H)	50 (M to H)	M	
	Pomacanthus	sextriatus		46		2.6 (I/H)	41 (M)	M	
	Pomacanthus	maculosus	+	50		2.7 (I/H)	56 (H)	L	
	Pomacanthus	arcuatus		60		2.9 (I/H)	51 (M to H)	L	
Acanthuridae (surgeonfishes) n = 26	Zebrasoma	flavescens	+	20		2.0 (H)	35 (L to M)	H	
	Acanthurus	nigricans	+	21	34	2.0 (H)	34 (L to M)	L	
	Ctenochaetus	binotatus		22		2.0 (D/H)	24 (L)	H	
	Acanthurus	achilles		24		2.0 (H)	25 (L)	H	
	Acanthurus	pyroferus	+	25	28	2.0 (H)	29 (L to M)	M	
	Ctenochaetus	striatus	+	26	36	2.0 (D/H)	17 (L)	H	
	Naso	minor		30		2.6 (Z/H)	36 (M)	M	
	Paracanthurus	hepatus		31		3.4 (Z/H)	29 (L to M)	H	
	Acanthurus	olivaceus		35	33	2.2 (D)	31 (L to M)	M	
	Acanthurus	lineatus	+	38	42	2.0 (H)	23 (L)	M	NT (CT)
	Acanthurus	bahianus		38	31	2.0 (H)	32 (L to M)	M	
	Acanthurus	chirurgus		39	13	2.0 (H)	37 (M)	L	
	Acanthurus	coeruleus		39	37	2.0 (H)	59 (H)	M	
	Acanthurus	sohal		40		2.0 (H)	33 (L to M)	M	
	Zebrasoma	veliferum	+	40	27	2.0 (H)	37 (M)	M	
	Zebrasoma	scopas	+	40	33	2.0 (H)	66 (H to VH)	M	
	Acanthurus	blochii	+	45	35	2.0 (D/H)	38 (M)	L	
	Naso	lituratus		46	39	2.3 (H)	34 (L to M)	M	NT (CT)
	Acanthurus	mata	+	50	23	2.5 (Z)	39 (M)	L	
	Naso	brevirostris	+	60	25	2.2 (H/Z)	33 (L to M)	M	
	Naso	vlamingii	+	60	45	2.2 (Z/H)	38 (M)	L	
	Acanthurus	xanthopterus	+	70	34	2.9 (H/D/Z)	37 (M)	L	
	Naso	unicornis		70	30	2.2 (H/D)	57 (H)	L	NT (CT)

	Naso	hexacanthus	+	75	44	3.3 (Z)	41 (M)	L	
	Naso	brachycentron	+	90	31	2.7 (H/D/Z)	67 (H to VH)	L	
	Naso	annulatus	+	100	23	2.1 (H/Z)	45 (M to H)	L	
Labridae: Scarinae (parrotfishes) n = 22	Sparisoma	aurofrenatum		28	7	2.0 (H/D)	37 (M)	M	
	Scarus	chameleon	+	31	6	2.0 (H/D)	22 (L)	M	
	Scarus	hypselopterus		31		2.1 (H/D)	25 (L)	H	NT
	Scarus	trispinosus		36		2.0 (H/D)	36 (M)	M	EN
	Chlorurus	sordidus	+	40	9	2.0 (H/D)	20 (L)	M	
	Scarus	niger	+	40	23	2.0 (H/D)	23 (L)	H	T (CT)
	Chlorurus	bowersi		40		2.1 (H/D)	29 (L to M)	H	NT
	Scarus	dimidiatus		40		2.0 (H/D)	29 (L to M)	H	T (CT)
	Scarus	flavipectoralis		40		2.0 (H/D)	29 (L to M)	H	T (CT)
	Scarus	frenatus	+	43	19	2.0 (H/D)	24 (L)	M	LC
	Sparisoma	rubripinne		48	7	2.0 (H/D)	26 (L to M)	H	
	Chlorurus	bleekeri		49		2.0 (H/D)	33 (L to M)	M	T (CT)
	Calatomus	carolinus		54		2.0 (H/D)	35 (L to M)	M	
	Hipposcarus	longiceps		60	12	2.0 (H/D)	29 (L to M)	H	
	Sparisoma	viride	+	64	9	2.0 (H/D)	31 (L to M)	M	
	Scarus	prasiognathus		70		2.0 (H/D)	39 (M)	M	
	Chlorurus	microrhinos	+	70	15	2.0 (H/D)	41 (M)	L	
	Hipposcarus	harid		75		2.0 (H/D)	42 (M)	M	
	Cetoscarus	bicolor	+	90	21	2.0 (H/D)	58 (H to VH)	L	
	Scarus	ghobban	+	90	13	2.0 (H/D)	37 (M)	L	T (CT)
	Scarus	guacamaia		120		2.0 (H/D)	42 (M)	M	
	Bolbometopon	muricatum		130	33	2.7 (H/C)	67 (H to VH)	L	VU

Appendix 2: Participants list

Name of Participant	Organisation/Department
Nanise K. Tuqiri	Department of Fisheries
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Jacqueline Nalomaca	Department of Fisheries
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Diana	Department of Fisheries
Stacy Jupiter	Wildlife Conservation Society
Sangeeta Mangubhai	Wildlife Conservation Society
Yashika Nand	Wildlife Conservation Society
Colin Shelley	University of the South Pacific
Qela Waqabitu	World Wildlife Fund
David Yeeting	University of the South Pacific