Kaledupa Fisheries Report: Easterly Season 2007

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CONTENTS

INTRODUCTION

PURPOSE OF REPORT

The main purpose of this report is to assess the health of the reef fisheries of Kaledupa with the aim to make recommendations for fisheries management to the Kaledupan community and Wakatobi government. This is the first quarterly (seasonal) report produced by the Darwin Initiative with the intention of being used to compare fisheries data from the same season each year, data from consecutive years and data from Kaledupa in relation to similar reef fisheries in South-East Asia and the Western Pacific. As this is the first report it also presents a template for future reporting by local Darwin Initiative Kaledupan staff, a responsibility which they will take on by 2009. It is also hoped that these reports are expressed in a clear uncomplicated style so that the information can be understood by the general public and that Kaledupans may appreciate and support management recommendations.

GENERAL CONCEPTS OF FISHERIES MANAGEMENT

(Note: in this section when referring to fish this includes marine invertebrates unless stated.) Fish stock decline is caused by excessive numbers of fishers, a large number of fishers using fishing gear that target species before they mature (unsustainable fishing gear) or normally a combination of a large numbers of fishers using many unsustainable fishing gears. When there are too many fishers fishing for too long using unsustainable fishing gear and catches decline year after year this is called overfishing.

Overfishing occurs where there is no management controlling the individualistic behaviour of fishers to maximise their own catch without consideration of long term sustainability of a shared resource. Fisheries monitoring in 2005 indicated that stock decline is occurring around Kaledupa. Action needs to be taken by communities to stop overfishing by managing the fishery for the profitable and equitable economic benefit of the whole community. Moreover, the fisheries need to be managed to protect food security for the local community.

Note: Stock decline is compounded by the use of habitat damaging techniques, such as bomb, cyanide or crowbar use, which reduce the capacity of the reef to support large numbers of fish or invertebrates.

Catch per Unit Effort (CPUE)

CPUE is an estimate of the relative abundance of fish stocks. Maximum CPUE is attained when few fishers catch a high number of fish, where the level of fishing still leaves enough fish to reproduce, replenishing stocks and maintaining catches for future years. This situation is one of the targets of sustainable fisheries management. If too many people are fishing for too long or there are too many fishers using fishing gear that catches too many fish too fast, CPUE declines as fish are less easy to catch and stocks struggle to replenish themselves. Unfortunately fishers tend to fish harder when stocks start to decline as they still require an income and the price of fish increases as fish are scarcer in the market. This increase in price also normally compensates for the increased distance fishers have to travel to new fishing grounds or the increased investment in numbers of fishing gear or lengths of nets required to make the same level of income. In this situation the CPUE is declining rapidly as fishers increase their capacity to catch fish, by rapidly increasing fishing effort and change to very efficient fishing techniques, it does not allow enough fish to escape capture and reproduce. Eventually CPUE declines to a point where fishers are forced to 'chase the last fish' in a futile attempt to make a living, which drives stocks so low they can not replenish themselves and eventually stocks collapse to unfishable levels – and in some cases this causes local extinction.

By plotting the CPUE each year fisheries managers can establish if CPUE is still increasing and the fisheries has not yet reached Maximum CPUE (reflecting a healthy fishery), or detect if CPUE is declining (indicating a collapsing fishery and confirming that management action is required). Local CPUE can also be compared to other similar tropical fisheries to check if the local CPUE is good or bad.

Species Composition

Change in species composition is the change the percentage of different species within a multi species catch. As species can be grouped into similar feeding habits (predators, omnivores, detritivores, coralivores, herbivores and planktivores), the change in the percentage of different feeding groups caught

can be examined every year. The change in the percentage of feeding groups and even of specific species can provide an indication of the level of fishing and can indicate whether fishing is causing irreversible changes in fish species caught. Changes in fish species caught are normally from high value fish to small species with little market value.

Percentage of sexually mature individuals

The percentage of sexually mature individuals per species in catches indicates the impact of fishing techniques on the reproductive capacity of stocks. The percentage of sexually mature individuals is calculated by comparing the mean fish (from Creel Surveys) or invertebrate (from Trader Logbooks) lengths of a species to the sizes of maturation required for each species. The sizes of maturation required for each species are listed in scientific publications. Generally, management should try to minimise any capture of fish or invertebrates below the size of maturation to avoid the capture of most fish before they can reproduce.

DATA COLLECTION AND ANALYSIS

CENSUS

A census of house holds with residents involved in fishing or seaweed farming activities was conducted in 9 villages (Balasuna, Darawa, Mantigola, Sama Bahari, Peropa, Langge, Laulua/Lewuto, Lentea, and Sombano) in July and August 2007. These 9 villages were selected as they were found to contain 70% of fishers in Kaledupa in 2003. A rapid census of the remaining 30% of fishers will be completed early in 2008 and whole data set analysed in the next quarterly report. This data will be used for estimations of incomes from fishing, and help develop an alternative income and fisheries management strategy.

REEF FISH CATCH MONITORING 'CREEL SURVEYS'

Reef fish catch monitoring was conducted during a 24hr period on randomly selected days by two Fisheries Monitors (FM) in each of the villages of Balasuna, Darawa, Peropa, Langge, Laulua/Lewuto, Lentea, and Sombano, and by four FM in each of the villages of Mantigola and Sama Bahari. FM positioned them so that they could see all fishers returning to their village and questioned the fishers and measured their catches before the fishers distributes the catch. FMs attempted to record all fishers but if there were a number of fishers returning at one time FM focused on accurately recording as many catches from each gear type as possible, irrespective of how large their catch was. Fishers returning from fishing without catching anything were also questioned, as they indicate that there may not be many fish left. Information gathered by FM is shown on the catch recording sheet in appendix II.

Fisheries Monitors weighed the entire catch (to the nearest 0.1kg) and identified fish to species names using local names and cross referencing them to the book 'Marine Fishes of South-East Asia' by Jerry Allen. Fish of each species were counted and the length of up to 20 randomly selected fish from each species was measured to the nearest 0.5cm. If there were over approximately 100 fish of one species an estimate of the number of fish was made by the number of buckets of fish. Fisheries monitoring started on 23rd July 2007 and data used in this report are for the months of August and September 2007.

INVERTEBRATE CATCH MONITORING 'TRADER LOGBOOKS'

Within the 9 villages, individuals who bought marine invertebrates for export were identified and asked to fill out log books which were periodically checked by FM. Species caught, total weight caught per fisher per day, fishing area, name of fisher and purchase price were recorded. Recording started on 1st September 2007 and data used in this report are for the months of September and October 2007. Values do not include collection of invertebrates for subsistence or resale on Kaledupa.

RESULTS: INDICATORS OF HEALTH OF FISHERY

REEF FISH

Currently the database is undergoing new additions to allow the analysis of 'percentage mature' fish and 'species composition' of catches from different years which will be completed in early 2008, thus the analysis for this report is based on CPUE data only and surmised in tables 1 and 2.

Bubu

Use of paired Bubus in Darawa in 2007 had same effect on CPUE calculation as placing two single Bubus close together and considering the catch from two Bubus to be from one paired Bubu. Thus the doubling of CPUE seen by the use of paired Bubus in 2007 compared to single Bubus in 2005 is not real, and once corrected by dividing by 2 no significant difference in CPUE is seen in Darawa between 2005 and 2007. Lentea and Sombano also show no difference in CPUE between 2005 and 2007, though CPUE for Lentea and Sombano are both significantly lower by double than in Darawa, which probably reflect the healthier reef able to support more stock at Darawa. Generally, no significant change in 'Normal Bubu' CPUE was detected between 2005 and 2007. Normal Bubu CPUE of 0.44kg/day/trap in 2005 and 0.34 kg/day/trap in 2007 is on the low end of the range of CPUE's expected for Bubus (0.1-3.4 kg/day/trap).

Fish fences

Though a reduction in average CPUE between 2005 and 2007 was recorded the high variability in total catch in 2005 and the use of very different sample sites in 2007 means that no conclusion can be made regarding fish fences using this CPUE data. However, very precise measurements taken at Peropa and Laulua/Lewuto indicate a significantly larger CPUE (almost 3 times) in Peropa and this data will be very useful for future comparisons. No comparative figures are available from scientific publications.

Speargun

No comparison can be made due to only 3 records in 2005 and 3 from 2007 and because both years are from different sites. However, a general CPUE of around 1kg/hr for both years is below the average CPUE expected for Speargun fishing

from scientific publications (2.4kg/hr) and at the bottom end of the range (0.4-8.5kg/hr).

Line

A significant increase in average CPUE between 1.36kg/hr in 2005 and 2.21kg/hr 2007 can not be considered to reflect the actual situation due to the samples coming from different sample sites. There are indications of an increase in CPUE between 2005 and 2007 at both Darawa and Lentea, and a CPUE as high as 2.5kg/hr would be considered to be good. However, CPUE for line fishing is generally at the low end of the range expected from scientific publications (0.59-5.1kg/hr.

Table 1: Average CPUE with standard error and sample size for bubu, fish fence, speargun, trawled lure and line fishing around Kaledupa in 2005 and 2007. Use of '?' denotes an absence of samples where monitoring would have been expected to sample.

	Bubu			Fish	Spear	Trawled	Line
	Normal (kg/day)	Pair (kg/day)	Large (kg/day)	fence (kg/day	Gun (kg/hr)	Lure (kg/hr)	(kg/hr)
Balasuna 2007	?			7.17 (3.56:3)			1.89 (1.06:3)
Darawa 2005	0.55 (0.04:15)	?	0.63 (0.18:3)	32.92 (18.03:3)		1.16 (0.21:4)	1.40 (0.63:3)
Darawa 2007	?	0.91 (0.15:18)	0.87 (0.16:3)	?		1.00 (_:1)	2.49 (0.90:7)
Langge 2007	0.63 (0.02:4)			10.81 (3.74:4)			2.40 (0.41:5)
Laulua/ Lewuto 2007	?			5.78 (1.17:27)			
Lentea 2005	0.26 (0.13:2)			4.83 (1.91:3)			1.33 (0.30:8)
Lentea 2007	0.27 (0.09:4)	0.46 (0.12:4)		?			1.94 (0.39:3)
Mantigola 2007					1 (0.00:3)	0.75 (_:1)	0.46 (_:2)
Peropa 2007	?			16.61 (2.58:36)			
Sama Bahari 2005					1.32 (0.25:7)	1.42 (0.48:8)	1.38 (0.34:6)
Sama Bahari 2007					?	1.00 (_:1)	5 (_:1)
Sombano 2005	0.36 (0.06:18)			13.47 (2.96:3)			
Sombano	0.30	0.21		6.00			0.90

2007	(0.04:19)	(_:1)		(_:1)			(0.12:3)
Average 2005	0.44 (0.04:35)	N/A	0.63 (0.18:3)	17.07 (6.74:9)	1.32 (0.25:7)	1.33 (0.32:12)	1.36 (0.20:17)
Average 2007	0.34 (0.04:27)	0.80 (0.12:23)	0.87 (0.16:3)	11.62 (1.52:71)	1 (0.00:3)	0.92 (0.08:3)	2.21 (0.36:22)

Gill net - active encircling

The average CPUE for Darawa in 2007 is not considered to be accurate as it only represents 2 samples and both are of unusually high CPUE. However, both at Lentea and Sama Bahari (also with small sample sizes) there a drop in CPUE can be seen between 2005 and 2007. Moreover, the average CPUE's for 2005 (0.004kg/m/hr) and 2007 (0.002kg/m/hr) were below the CPUE expected from a poor fishery (0.024kg/m/hr).

Gill net - active parallel to the reef

Sama Bahari shows a significant reduction in CPUE between 2005 and 2007, and Darawa shows a high CPUE in comparison to other villages. No comparative figures are available from scientific publications.

Table 2: Average CPUE with standard error and sample size for net fishing around Kaledupa in 2005 and 2007.

	Gill net set		Gill net active			
	Parallel (kg/m/hr)	Perpendicular (kg/m/hr)	Encircle (kg/m/hr)	Parallel (kg/m/hr)	Night Parallel (kg/m/hr)	Seine Net (kg/m/set)
Balasuna 2007	0.003 (0.001:4)	0.025 (0.021:2)				
Darawa 2005			0.05 (0.01:8)			
Darawa 2007		0.230 (0.039:3)	0.57 (0.18:2)	0.11 (0.02:5)		
Langge 2007	0.004 (0.004:2)			0.02 (0.01:2)		0.08 (0.03:3)
Laulua/ Lewuto 2007						
Lentea 2005	0.028 (0.022:2)		0.03 (0.01:4)	0.01 (_:1)		0.80 (_:1)
Lentea 2007	0.010 (_:1)		0.02 (0.01:2)	0.05 (0.01:16)		
Mantigola 2007	0.009 (0.003:22)	0.001 (0.000:2)	0.01 (0.00:6)	0.03 (0.01:34)		0.17 (0.04:5)
Peropa 2007						
Sama Bahari	0.007 (_:1)	0.035 (0.004:7)	0.05 (0.01:9)	0.08 (0.05:6)		

2005						
Sama Bahari 2007	0.019 (0.002:9)	0.016 (0.002:24)	0.03 (0.01:4)	0.03 (0.00:12)	0.03 (0.02:2)	0.42 (_:1)
Sombano 2005	0.037 (0.011:15)			0.01 (_:1)	0.04 (0.03:3)	
Sombano 2007	0.003 (0.001:11)	0.042 (_:1)			?	
Average 2005	0.034 (0.009:18)	0.035 (0.004:7)	0.04 (0.01:21)	0.07 (0.04:7)	0.04 (0.03:3)	N/A
Average 2007	0.009 (0.002:49)	0.036 (0.012:32)	0.02 (0.02:12)	0.04 (0.01:70)	0.03 (0.02:2)	0.04 (0.01:9)

Gill net - set parallel to the reef

Sombano 2005 and 2007, Sama Bahari 2007 and Mantigola 2007 are large samples with a low standard error, and thus results from analysis are likely to strongly indicate if there are differences in CPUE. A significant drop in CPUE at Sombano between 2005 and 2007, and low CPUE at Sombano, Sama Bahari and Mantigola in 2007 indicates that there is a significant three fold decrease in CPUE between 2005 and 2007. Generally an average CPUE 0.034 kg/m/hr for 2005 would be considered to be low and a CPUE of 0.009 kg/m/hr in 2007 would indicate a very poor fishery.

Gill net - set perpendicular to the reef

Sama Bahari 2005 and 2007 are good samples and indicates a significant decline in CPUE between 2005 and 2007. The non significant difference in Average CPUE between 2005 (0.035kg/m/hr) and 2007 (0.036 kg/m/hr) are due to 3 extremely high CPUE records for Darawa in 2007 and are likely to be a recording error. CPUE's as low as 0.004kg/m/hr would indicate a very poor fishery.

Seine Net

Insufficient numbers of catches were recorded for analysis in both years.

INVERTEBRATES

During September and Octobers 2007 log books were completed by three traders in Sama Bahari (1 trading octopus, 1 trading Seacucumber and 1 trading Octopus and lobster), two traders in Mantigola (1 trading Seacucumber and live fish and 1 trading seacucumber), two traders in Peropa (both trading in octopus) and two traders in Sombano (1 trading octopus and abalone and 1 trading abalone). CPUE data collected on octopus on east and west Kaledupa can not be compared to each other as CPUE for octopus is greatly affected by wind conditions. No comparisons can be made for any invertebrates due to the lack of specific data recorded in log books. Tables below indicate data collected and data required (?) for analysis.

Octopus

Species	Village	Fishing Area	Fishers/day (catches recorded)	CPUE (SE)	Sex, Mean and range size (kg)
Octopus	Sama Bahari	East Kaledupa	7 (424)	2.26kg/day(0.05)	?
	Sombano	North Kaledupa	0.5 (29)	?	?
	Peropa	West Kaledupa	0.5 (105)	4.01kg/day(0.21)	?

Abalone

Species	Village	Fishing Area	Fishers/day (catches recorded)	CPUE (SE)	Mean and range size	% Mature
Abalone	Sombano	North Kaledupa	3.5 (220)	?	?	?

Seacucumber

Seacucumber Species	Village	Fishing Area	Mean and Range Size	% Mature
?	Sama Bahari	East Kaledupa	?	?
	Mantigola	Kaledupa atoll	?	?
	Mantigola	West Kaledupa	?	?

Lobster

Lobster Species	Village	Fishing Area	Fisher per day	Mean and Range Size	% Mature
?	Sama Bahari	East Kaledupa	0.5 (27)	1.01kg (0.10) 0.4-2.6kg 31 lobsters	?

?	Sama Bahari	Kaledupa Atoll	1 per month (2)	?	?

Live fish

Live fish Species	Village	Fishing Area	Mean and Range Size	% Mature
?	Mantigola	Kaledupa atoll	?	?

CONCLUSIONS: ESTIMATED STATUS OF THE FISHERIES

REEF FISH

Reef fish are essential and preferred food fish for the Kaledupa population with very few alternative protein sources available (such as meat or soya beans) due to the limited agricultural land. The reef fish fishery forms an essential internal economy with most reef fish caught being sold on Kaledupa. Over the last 10 years tuna has increasingly filled the gap where reef fish can no longer be supplied in quantities required. In terms of food security maintaining sufficient reef fish is the number one priority of Kaledupans.

Overall 2007 CPUE's are lower than would be expected from a healthy fishery and have generally declined or similar from 2005 CPUEs. Results from a 2005 report indicated that catches consisted of more herbivorous species than would have been expected from a healthy fishery and that most gears targeted undersized fish leaving few mature fish to reproduce. Analysis of species composition and percentage mature for Easterlies 2007 data will be shown in the next report. General indications from easterlies 2007 show the reef fishery as poor and declining in status, with the worst fishery in Sombano and Sama Bahari, and the best in Darawa.

INVERTEBRATES

Invertebrate fisheries (and live fish) are mostly for export from Kaledupa, with some subsistence value and internal resale on Kaledupa. As such the Invertebrate fishery forms an important economy for Kaledupans and remains one of the few sources of income coming into Kaledupa besides remittance and government jobs. This fishery should be protected so that it can continue to operate indefinitely without overfishing and collapsing.

For the months examined in this report (September and October 2007) insufficient data was collected to analyse the status of the invertebrate fisheries. The reasons for poor data collection are likely to be due to this being the first time invertebrate data was recorded by traders, and introduction and understanding of the log book by all traders will take time. Recommendations on improving data collection are covered below.

IMPROVEMENTS TO MONITORING

Reef Fish

As this is the first year of data collection there may be errors in randomness of samples with surveyors selecting easier fishers or times to monitor. In addition, fisheries monitors need to ensure that they record at least 3 samples from one fishing gear per village per month so that good statistical analysis can be performed. These errors appear to be occurring in 2007 as some villages clearly have more fishing occurring than are being recorded, as the following observations on the data collected so far can be made:

Insufficient fish fence catches were recorded from Sombano and no fish fence catches were recorded from Darawa and Lentea. No speargun catches were recorded in Sama Bahari and Mantigola has 3 records but they were of exactly 1kg/hr each. Very few trawled lure or line catches were recorded for Darawa, Mantigola and Sama Bahari. In Balasuna and Laulua/Lewuto no bubu catches were recorded even though there are 3 fishers with 28 traps and 3 bubu fishers with 35 traps respectively. Very few night net catches recorded.

These errors should be being checked by a tally of the estimated total numbers of fishers per technique fishing that day, which has not been recorded. This record of fishers should be made and sent with the catch record sheets to the Ambeua office. This will help check on whether FM are doing their jobs well.

Lastly, in 2007 the number of 'sets' of active gillnets has been recorded as the same as the total number of hours fishing (unlike 2005). Fisheries monitors need to be checked to ensure they are recording both the number of sets and total number of hour fishing for active gillnets and data entry needs to be checked to ensure it is being recorded properly.

Invertebrates

1. All sections in tables indicated with a '?' need to be filled in for analysis of the status of the fisheries to be made. This can be achieved by encouraging the recording of more precise data in the log books - data which in most cases is already collected by traders as part of their businesses. Species of seacucumber, lobster and live fish need to be

clearly identified as each species has a specific size of maturation. Total weight of catch per fisher is required for catches of octopus and abalone (this is not required for lobster, seacucumber or live fish). Size of individual animals within a species needs to be recorded for all catches so that an average size, maximum and minimum range of sizes and percentage of mature animals in catch can be calculate (percentage mature not needed for octopus). Octopus needs to be individual weighed and the individuals sex determined; lobster need to be individually weighed; for the measurement of abalone and seacucumber use wet weight, size class or number per kg depending on how the trader pays the fisher (and FM should try and standardise measurement types used across Kaledupa).

2. Data needs to be collected from all traders within all the 9 villages. It is clear from my experience that not all the traders were recorded and this needs to be done.

General

A rapid census of the remaining Kaledupan fishers outside the 9 surveyed villages is expected to be completed by the next quarterly report.