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People and Fish in Fiji: an ethnobiological study of a coral reef ecosystem

by

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ABSTRACT.--People are active participants in coral reef ecosystems. This ethnobiology study considers and contrasts folkbiological knowledge of people living in two groups of artisanal fishing villages in Kadavu Province, Fiji. The high level of biological diversity on the Astrolabe Reef provides insights into folk categorization and classification methods that include colour, shape, size, physical features, and habits of certain reef fish and marine animals. Surveying large numbers of experts and novices on defined groups of creatures yields more depth and range of responses allowing higher confidence levels in response accuracy. A comparison of the data with Berlin's (1992) proposed principles yields mixed results. Sea cucumbers have high ecological salience and their identification requires attention to the affect of two centuries of trade on Fijian society. Effective ethnobiological research provides productive options to contribute to coral reef sustainability programs with long term benefits for local people and marine life. Key words: Kadavu, naming and classification of fish, coral reef ethnobiology.

Preface

This study is about, by, and for the people of several villages on the Ono Channel between Kadavu and Ono Islands in Fiji who live in a rich and unique environment, their *vanua*, that extends under the sea and out beyond the Great Astrolabe Reef; the fourth largest coral reef in the world. I first visited the area for two weeks in 1997, and returned to spend nine weeks here in 2009, learning of local people's folkbiological knowledge of fish and marine animals in this high biological diversity environment. I provide a definition of the term 'folkbiology' in Section iii of the Introduction. This thesis reflects these people's insights into innovative ways of perceiving biological environments and negotiating balances between established traditional ways of living and adjustment strategies for changing environmental circumstances and rapidly changing lifestyles.

People are thinking about their environments in new ways as the weather patterns, which define daily life, change in ways that traditional knowledge does not anticipate. Elders and middle aged people speak of climate change often. Many homes are only a metre or two above current peak tide levels. We had two tsunami warnings in the short time I was there, which were uneventful in the Ono Channel, but were the first warnings that people could recall in decades. In December of 2009, after I left, cyclone Mitch hit the area hard, toppling century-old trees onto homes in Lagalevu village.

I do not mean to overdramatize the topic, but people here are thinking about their environment in new ways. Fish stocks are under pressure and several conservation focused organizations have been working on sustainable coral reef management projects here over the last few years. At the same time technology and communication tools, such as cell phone service introduced in late 2008 and now cell-based internet service, change daily life in places where most people do not have electricity and cook their food with wood fires. In 2009, a young lady from down-island connects with a young Tiliva man using text messaging and eventually elopes with him, meeting him in person for the first time in the dead-of-night to leave her home village to settle in Tiliva village. The people of Tiliva respond enthusiastically with a four day and night *yaqona* party and a two day hangover. Life changes and stays the same.

So what does all this have to do with ethnobiology? Much of this thesis is devoted to presenting the results of the ethnobiological research, and nomenclature collection, performed in relation to the work of other ethnobiologists and fieldworkers. I see this work as a starting point towards a better understanding for local people and those people interested in folkbiologies, to understand how people perceive and engage high diversity coral reef environments; using what Scott Atran and Douglas Medin (2008:3) refer to as a “distinct module of the mind that is associated with universal patterns of categorization and reasoning.” There are a number of ways that research of this nature can be productive and in each of the four main analytical chapters, I investigate a specific group of fish or marine animals in a different manner and suggest different uses for the research.

Like any successful project, many people supported my efforts in the field, and getting ready to be there in the first place. I appreciate the support of the Fijian Government Ministries that approved the project. This research would not have been possible without the kind assistance and direction of Rogo, Tulala, La, and Isoa in Kadavu and Ono. I thank the leaders and people of Buliya, Lagalevu, Matasawalevu, Tiliva, Waisomo, Vabea, and friends from Nakasaleka and Narikosa who contributed their knowledge and time to this research, and their warm Fijian hospitality to me. Thank you to Cheryl, Justin, and their team for support of the diving and underwater photography, and concurring on our decision not to ‘wait out’ the tsunami warning underwater, as advised by officials unknown. I appreciate the generosity of time and information provided by academic colleagues including Eugene Anderson, Aporosa, Mark Calamia, Paul Geraghty, Sharon Jones, Ritsuko Kikusawa, Meredith Osmond, Andrew Pawley, and Matt Tomlinson. I thank the faculty and staff of the Department of Anthropology at the University of Alberta, and in particular, my supervisor, Gregory Forth, for providing the training, inspiration, encouragement, and scholarship support to allow this research to go forward.

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Table of Pictures

Ross Gordon took all photographs, except Pictures 3.1, 3.3, and 7.1. In order to better simulate what the human eye would see underwater, many photos were taken with natural light.

List of Abbreviations

CKS: cultural keystone species

FCNC: first choice name consensus

FLMMA: Fiji Local Marine Managed Area Network

IP: intermediate phase

JP: juvenile phase

LRFT: Life Reef Fish Trade

MPA: Marine Protected Areas

NGO: non-governmental organization

SCNC: second choice name consensus

SCRFA: Society for the Conservation of Reef Fish Aggregations

TP: terminal phase

Introduction

In this thesis, I summarize and analyze the ethnobiological research in different ways that relate and contribute to existing ethnobiology literature, studies of folk taxonomy and coral reef sustainability, and records of life-ways and knowledge of people living in artisanal fishing villages in Kadavu Province. The introduction begins with a summary of Brent Berlin's (1992) proposed ethnobiological classification system to refer to, and my approach to the integrated processes of identification, categorization, and classification of organisms. A terminology guide and a short summary of each chapter follow.

i) The general principles of Brent Berlin (1992) for ethnobiological classification

I will refer to Brent Berlin's (1992) general principles for ethnobiological classification and nomenclature on many occasions in the chapters that follow. The core element of Berlin's (1992) scheme is the idea that all folkbiology classification systems share similarities of ranking, relative numbers of organisms, and biological content. Correspondence with scientific taxonomic classifications will be greatest at the folk generic level, with Berlin's intermediate level matching portions of scientific families, and subgeneric ranks showing the least correspondence. Berlin (1992) offers related principles of folk nomenclature as summarized in Figure A. A core concept underlying these principles is that folk taxonomies are shallower than Linnaean systems with the strongest correlations at the generic level, as it is here that most people recognize what Berlin (1992) calls natural categories that are available for pan-human perception. In the present study, I use Berlin's (1992) scheme as a set of valuable reference points to note consistencies and discrepancies found in a coral reef environment folk biology.

Figure A: Overview of the general principles of ethnobiological classification of Brent Berlin (1992)

Berlin's ranks	Characteristics	Nomenclature	Example in English
Kingdom or Unique Beginner	-single members -subsumes all other taxa	seldom named	plant or animal
Life Form	-Broadly polytypic -only 10-15 per system -subsume many lesser rank taxa	-may or may not be named	tree, bird, fish

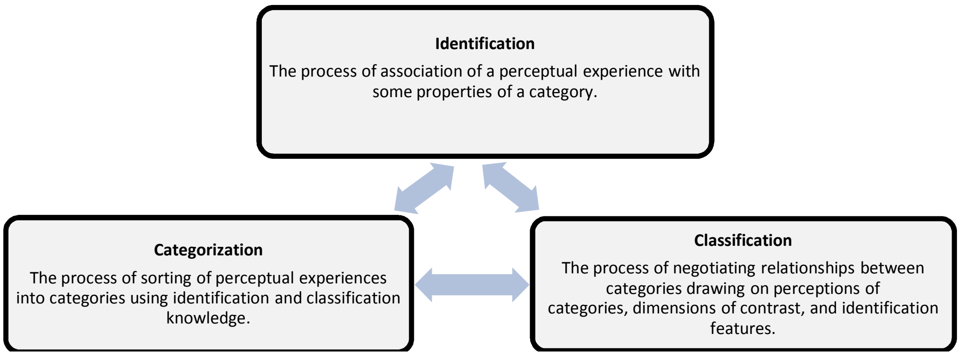
Berlin's ranks	Characteristics	Nomenclature	Example in English
Intermediate	-often covert or unnamed -subsume small numbers of folk generics with perceptual similarities.	-often covert or unnamed	deciduous tree
Folk Generic	-most numerous taxa -80% of taxa are monotypic -taxa learned first by children -some are prototypes	uninomial	oak
Folk Specific	-less numerous and subdivides folk generics -organisms often domesticated or tied to human subsistence	-generic name and a modifier = binomial -uninomial when prototypical or as an exception	white oak
Folk Varietal	-less numerous and subdivides folk generics -small differences -unused by foragers	-often a compound with one or two modifiers	swamp white oak

Andrew Pawley (2008:2) notes the key difference between Linnaean classifications uniquely based upon evolutionary relationships of organisms, in contrast with folkbiological taxonomies based on observable morphology and behaviour. For example, a scientific system contrasts a dolphin flipper with a human hand using internal anatomy, while a folkbiological one might use visible morphology.

ii) <u>Ethnobiological terminology and concepts referred to in this study</u>

There are many varying definitions of identification, categorization, and classification. I draw on a few sources here to define these terms, as they are critical concepts for what follows.

Figure B: The inter-relationship of identification, categorization, and classification



Identify is defined in Collins Gage (2006:444) as ‘to recognize as being a certain person or thing,’ while identification is ‘something used to identify a person or thing.’ I would add ‘organism’ to this list of perceptual experiences and clarify that to ‘identify’ is an action and part of the three activity process shown in Figure B, which may or may not include the use of identification manifesting a term, sound, signal, or symbol. Identifications may be made covertly by people without the use of linguistic terms.

Categories for Roy Ellen (2006:1) are entities created by the human mind, which use similarities and differences to organize diverse, things, attributes, and phenomena of the world into groups. Brent Berlin (1992:8) has argued that nature has a basic plan that constrains human conceptual recognition of biological diversity in their natural environments. I describe Berlin’s proposal for this basic plan in this introduction and will use it as a comparison tool throughout this study. George Lakoff (1987:8) argues that the ‘peculiarities of human understanding’ produce categories through experience and imagination, which in turn underlie human reason and are thus critical to human thought and perceptual organization.

Categorization is the process of sorting of perceptual experiences into categories, which incorporates identification and classification in what Ellen (2006:1) refers to as an impulsive human behaviour. In regards to the type of categorization considered in this study, Atran and Medin’s (2008:3) concept of biology, as a distinct module of mind, underlies universal human categorization and reasoning patterns, some of which require contact with the natural world, while others are culture dependant. Sorting out the natural and cultural factors is a particularly challenging aspect of any folkbiological study.

Classification is the process of negotiating relationships between categories, their dimensions of contrast, and how categories are established. This process is not fixed in Linnaean taxonomy or in folk taxonomies and may reflect biological realities and / or cultural patterns, which in turn produce cultural patterns that may shape processes of perception, identification, category construction, and categorization (Berlin 1992:8-9,106, Ellen 2006:1).

iii) <u>Terminology guide</u>

Attributives are secondary terms that represent some characteristic that differentiates members of a class, much as the specific name differentiates members of a genus in Linnaean classification.

Binomials are uninomials with a modifier, attributive, or secondary lexeme that distinguishes members of a class established by the uninomial component of the term (Pawley 2008:6). For example in Fiji, the term '*ikaloa*' combines the terms *ika* and *loa*, or fish and black. Binomials may also be called binary compounds.

Covert in taxonomy studies refers to categories recognized, but not named.

Diandric in this study refers to types of fish that may be either biological males or females at certain life stages, such as some parrotfish (Randall 2005:444).

Ecological salience refers to organisms with high recognition properties for people within a people's biological environment.

Ethnobiology as used in this study is the research, study, and analysis of folkbiology systems and people's ways of knowing their biological environments.

First Choice Name Consensus model is a method developed in this study to determine consensus levels of term use, knowledge items, or opinions of people tracked by village or village group.

Folkbiology in this thesis describes the terms and categories that people use and the way people use them to describe, comprehend, and interact with their biological environment. This spelling of 'folkbiology' draws upon that used by Douglas Medin and Scott Atran (1999).

Fuzzy Set theory developed by Lofti Zadeh explains graded categories, where members of a category have some properties of one category and some properties of an adjoining category, such as the graded category of tall men (Lakoff 1987:21).

Interviewee in this study refers to an individual, a couple, a family, or small group of people interviewed at one time to produce a single set of responses. The 80 interviews included 112 people.

Monotypic in biology refers to a taxon with a single subgroup.

Polythetic classification as proposed for use in anthropology use by Rodney Needham (1975) allows category members to share a number of common features, but not necessarily the same common features in any two cases. This concept allows for the grouping of category members based upon high overall similarity, without the requirement of any single feature defining membership, although in practice all members may well share a particular feature in common.

Polytypic in biology refers to a taxon with more than one subgroup.

Prehension, or to grasp, for Ellen (2006:27-29) who established the term, is a way to understand identification, categorization, and classification of an organism as a web of interactional processes, rather than as an action. These processes occur at a nexus of relevant knowledge, context, purpose, and cognitive architecture to place the organism in question into a framework in the mind of the viewer. Further details and examples are found in Chapter 5-v.

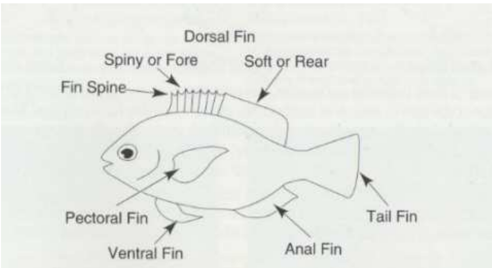
Proto-Oceanic describes a theoretical proto-language used by the ancestors of the first groups of settlers in the islands of the South Pacific. By collecting terms, such as Meredith Osmond's (in press) work on fish names from diverse island languages, researchers have been reconstructing common words. Similar terms used in this study, such as Proto-Central Pacific or Proto-Fijian are linguistic subgroups of Proto-Oceanic.

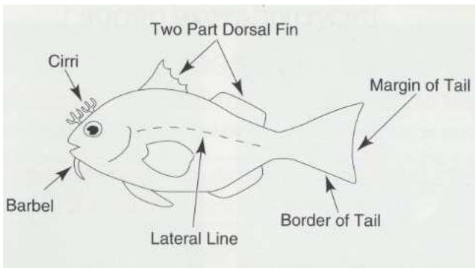
Prototype theory in categorization studies posits that there is often a best example for a given category that people see as most representative of the category, such as 'robin' in relation to the category of birds in Canada.

Simple Distinctive Features are key morphological features used consistently in discussions to describe birds (Forth 2004:28), or for fish as applied in this study.

Uninomials are names consisting of either a single morpheme such as 'oak' or are multimorphemic, but have an idiomatic meaning such as 'blackberry.' Uninomials are the same as monomonials or primary terms (Pawley 2008:6)

Figures C and D: Finfish anatomy diagrams (Allen et al 2003:15)





iv) <u>Outline of the thesis</u>

Chapter 1 provides a brief introduction to the islands, covering their history, the physical location, the Great Astrolabe Reef, and the social world of the villages on the Ono Channel. Since much of this thesis is devoted to organizing and understanding the Fijian terms used for fish and marine animals in Kadavu and Ono, sections 1.iv and 1.v provide helpful background information on Fijian language use with a pronunciation guide in Figure 1.5. A discussion on engaging effective interpreters and establishing social relationships in the villages follows, along with suggestions for productive reciprocity arrangements in similar situations.

In Chapter 2, I provide a summary of various research methods planned, attempted, and those carried out in the development of this study. I introduce methodologies produced in this study, such as the ‘first choice name consensus’ model used to organize the thousands of names collected into varying levels of consensus for each fish or animal to allow consideration as to why people agree or disagree on identifications.

Chapter 3 contains an in-depth analysis and inter-island comparison of naming and categorization systems used by Ono Channel people for various members of the large and diverse group of parrotfish. The interview sample used in this research recorded a deeper than average folk taxonomy for this group of fish. Colour terms are key differentiating factors in Fijian parrotfish folkbiology, and I provide relevant background on research in colour categorization studies to establish a base for a discussion of how colour perception affects identification and categorization of fishes. I also consider the affect upon colour perception studies of using natural subjects such as colourful coral reef fish as analytical tools in contrast with standard out-of-context Munsell colour chips. The relatively greater length of Chapter 3 reflects the depth and complexity of the subject matter. I also consider the affect of parameters of size and shape on the complex folk taxonomy of parrotfish. Finally, I consider possible prototypes for the group with mention of fuzzy set theory and polythetic classification issues, and I touch upon the possibilities of a new idea for ethnobiology, ‘fuzzy prototype theory.’

Chapter 4 is an investigation of the folk taxonomy of *sasalu*, or sea cucumbers in Kadavu and Ono, with consideration of the connection between the high ecological salience these creatures have for people and the significant affect that 200 hundred years of boom-bust export trade in these animals has had on social interaction, economics, and the environment in Fiji. Historical records from 19th century Western traders offer insights into older folk nomenclature not available for other fish and marine animals. Interviewees were enthusiastic about this category of animals and provided a wealth of information. I again use the first choice name consensus model to identify patterns in identification and categorization. I also present people’s responses in regard to their categorization of whales and dolphins as fish or otherwise, and their reasons given for this categorization, which yield some interesting results.

The chapter concludes with a discussion of utility in naming practices and the problem with applying this concept to a society where local exchanges of goods and services tightly entwine with social relationships.

Chapter 5 presents a more traditional ethnobiological analysis of the populous and highly salient fishes of the scientific Acanthuridae family, and other common Ono Channel fish and creatures that have venomous properties at some point in their life cycle. Poisonous things prove to be good conversation starters. A good depth of nomenclature is presented using the first choice name consensus method to consider prototype selections for different groups and why some sets of features in a single organism of what I term 'aggregate features' confuse people and make identification challenging. I utilize more micro-focus methods here to consider a wide range of diverse responses for individual fish types and learning about folkbiology perceptual practices. I also discuss some unusual names for poisonous creatures.

In **Chapter 6**, I consider the popular group of food fish known in Fiji as *kawakawa* and *drodrouwa,* Family Serranidae in Linnaean taxonomy, and groupers in English. Some members of this fish group are under considerable fishing pressure due to their vulnerable practice of predictable seasonal spawning aggregations. Attempts by conservation organizations to establish and encourage sustainable fishing practices are underway in Ono Channel villages, providing an opportunity to consider the potential role of ethnobiologists in contributing to both local people's wellness and the inter-related success of sustainability and education programs. A detailed ethnobiological analysis of the fish group is presented using the first choice name consensus model. The results suggest a need for more effective communication between sustainability program leaders and local people, as well as indications of how local people could be encouraged to take pride in maintaining 'at risk' types of fish, which are also high status fishing targets. The thesis then concludes with a summary of the main findings in Chapter 7.

Chapter 1: Setting and background to the study

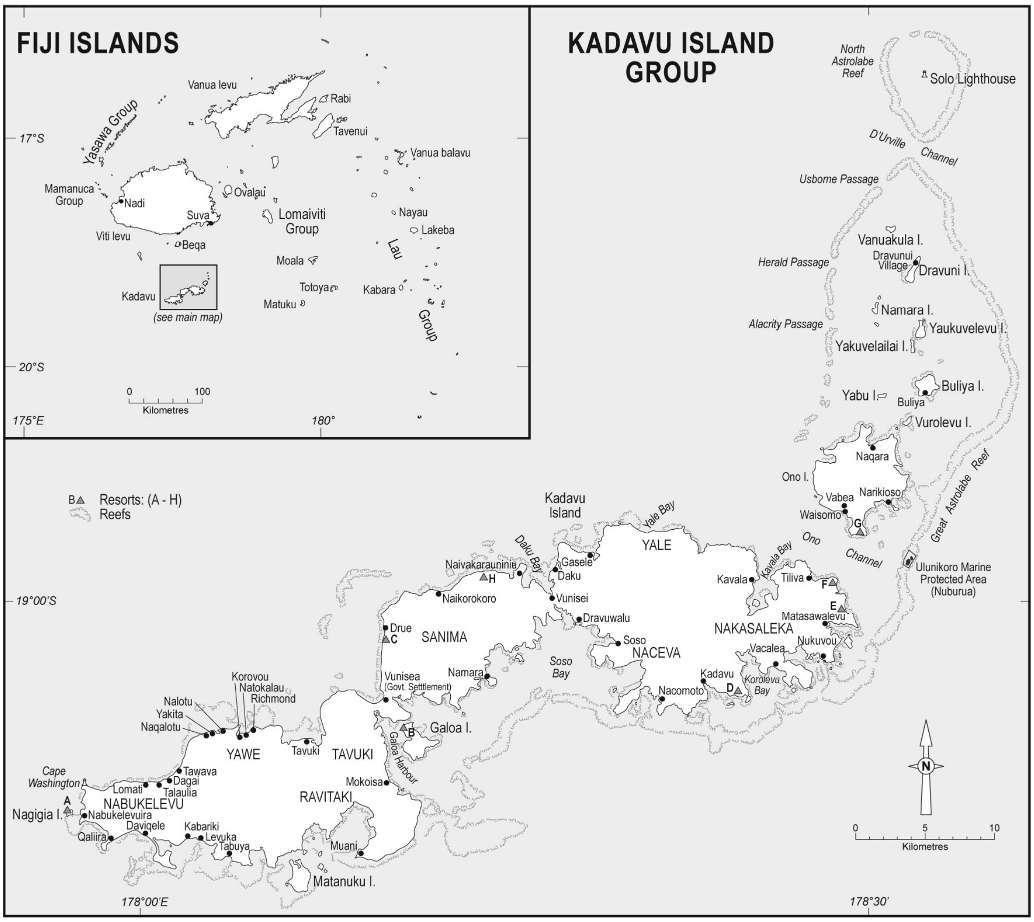
i) Introduction to Fiji's Kadavu and Ono Islands

Fiji's Kadavu Island Group is located south of Fiji's central Viti Levu Island and the capital city of Suva as shown on Figure 1.1. Authors of a 2009 travel guidebook describe the 408 square kilometer main island of Kadavu with phrases such as "wild and untamed" as they write of the luminescent seas, volcanic peaks, and intense forest of the near-prehistoric landscape (Starnes et al 2009:211). In 1889, J.P. Thomson described the volcanic rock, shrub lands, dense forest and jungles of Kadavu as prehistoric in a description of the land, flora, people, climate and economic potential of Kadavu, for Royal Scottish Geographic Society readers (1889:637-653). Indigenous residents of Kadavu describe their land with fewer superlatives, as most of us do when speaking of our home. Sense of place is a key concept in Kadavu where many of the 75 villages are centuries old. Fijians use a special word, *vanua, which* means home, one's social relationships and status, communal landownership, knowledge systems, culture, spirituality, and values (Nabobo-Baba 2006, 2005). This concept is somewhat intangible for visitors. However, after nine weeks in Kadavu, I sensed the meaning of *vanua*, when I took leave of new friends, their hospitality, their songs, and the rugged land and sea of Kadavu. In this report, I will attempt to reflect the warmth, generosity, humour, and friendship that it was my privilege to experience in Kadavu, during my two months of fieldwork in 2009.

ii) Kadavu Island Group: Physical location and getting around

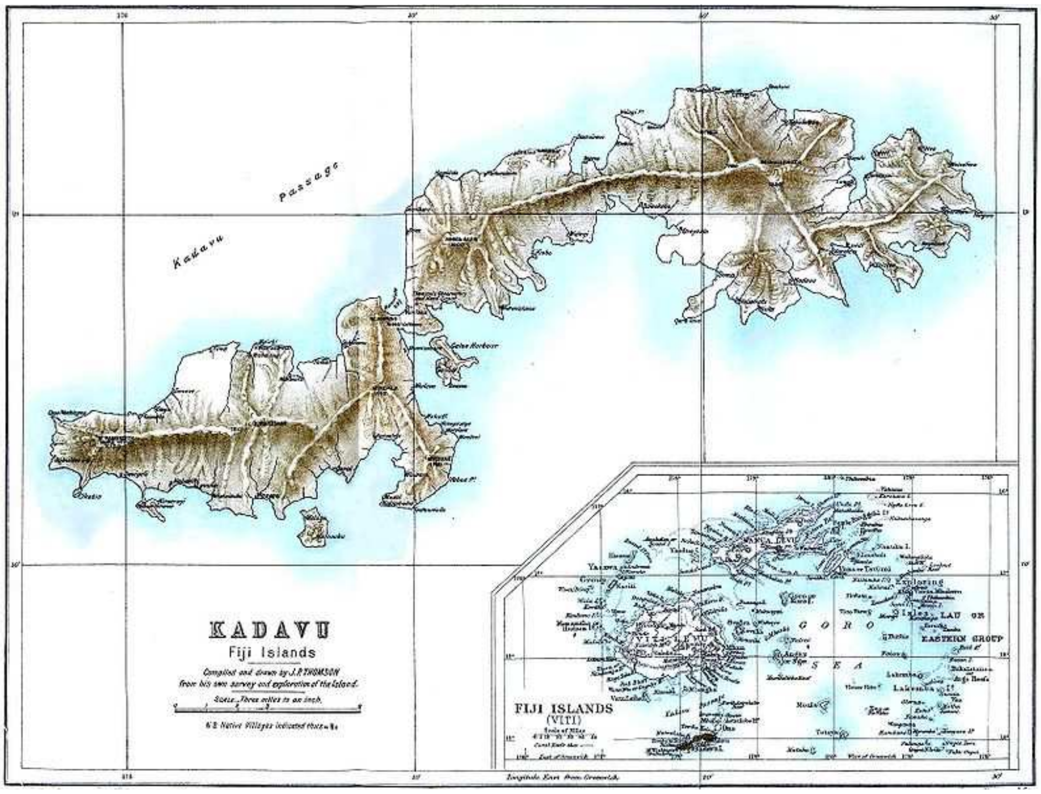
Kadavu has long had links with the outside world, despite geographic isolation. Kadavu people were key suppliers of produce, marine resources, wood, and other natural resources to the Viti Levu based Rewan Empire, before Rewa's mid 1800s missionary-assisted decline as the dominant Fijian polity in favour of the Bauan Empire (Thornley 2005). Between 1873 and 1877 Kadavu was a port of call and supply depot for San Francisco to Sydney steamships, until supplanted by the new capital of Suva on Viti Levu (Thomson 1889:638-639). Today, Kadavu people send quantities of produce, kava, fish, sea cucumbers, and more on the weekly ferryboat to Suva for marketing. Many Kadavu people live in Suva or have relatives living there, where some secondary students and all tertiary students attend school. I observed a significant expansion of the local population during the August school holidays. Economic opportunities are limited in Kadavu; many young people seek opportunities for work in bigger centres off-island. Transport options across the 70 to 100 kilometres of open ocean between Kadavu and Suva include the unpredictable weekly ferry, sharing a bouncy ride in a standard 23 foot outboard boat, or a 45 minute small plane ride that is expensive for most local people. All of these options are subject to cancellation or delays of days or weeks, due to poor weather or mechanical difficulties.

Figure 1.1: Fiji and Kadavu Map



(Calamia et al 2008:9)

Figure 1.2: J.P. Thompson's 1889 map of Kadavu showing topography.



(Thompson 1889: Wikipedia 1.1)

The Kadavu Group Islands, surrounded by open ocean, are a classic tropical paradise some days, but tropical storms and difficult weather conditions are not uncommon, as implied by a local term *cagiwalu*, which refers to eight days of high wind without relent, which I experienced in August and September 2009. The predominant weather movement flows from southeast to northwest, driving wind and waves to deliver nutrition to the substantial coral reef fringing the southeast coast of Kadavu. Tropical cyclones affect the islands some years, such as December 2009's Cyclone Mick that blew trees onto homes and destroyed some buildings in the villages where I had worked. Bad weather limits fishing options and people's ability to obtain protein for meals. In these stretches, many people fall back on tinned fish or corn beef obtained from a small village store, depleting precious cash.

Ono Island lies to the northeast of Kadavu. The word *ono* translates as the number six in Fijian, reflecting the six villages on the island. The Ono Channel separates Kadavu and Ono Islands where a variable current funnels through the Naigoro Passage in the Great Astrolabe Reef as shown in Figure 1.1. This is a rich fishing ground that provides much of the protein component of people's diet. Whales and dolphins pass though the Ono Channel on occasion.

Coral reefs create a range of habitats for fish and marine animals. The following summary draws upon the transect surveys of Obura and Mangubhai (2003:3-4), my discussions with local people, and my observations made over the course of a number of dives and a fishing expedition. The windward or outside reef zone has the most diverse range of corals and consequent scientific species richness of fish and marine animals. Ocean currents deliver plankton, but waves and winds on the outside of the reef challenge and limit access for small boat fishers. The Naigoro Passage is a marine reserve, technically off limits to fishermen, and a popular dive site, bearing names like "Fish Market" and "Purple Wall." This reflects the large grouper fish and soft coral colonies visible at 20 to 25 metres of depth along the Passage walls, where strong tide-driven currents can bowl divers erratically along. The leeward or inside of the barrier reef has less coral diversity and consequent density of dependant life forms than the windward reef face; leeward, smaller waves create more moderate environments for handline and spear fishermen to access when the weather cooperates. I discuss fishing practices further in Chapter 6.

Inshore or lagoon patch reefs have less coral, more algae cover and are home to even less diverse populations of smaller fish, which include juveniles of some barrier reef fish kinds. Here, bivalves and sea cucumbers are common invertebrates, some of which do well in lagoon areas with runoff from the land (Obura and Mangubhai 2003:3-4). Local people gather these animals regularly for food or export. Unused remains of stone wall fish traps visible along the shore at low tide suggest that inshore fish densities have declined to a point to make the constant work of rebuilding these traps unproductive. Kadavu Island Group people are significant players in the ecology of the local marine environment; I sought to gather local knowledge and perspectives of this environment from people in villages on both sides of the Ono Channel.

iii) <u>Ono Channel villages, the local people, and social interaction</u>

Kadavu Island is home to 10,167 people as of the 2007 FIBS census, living in 75 villages or settlements, down from the 11,131 people reported in the 1998 Kadavu Hospital statistics (Calamia 2008). Thomson (1889:647) estimates the Kadavu population as 7,500 people, likely based on the 1880 census of 7,408 people then living in 89 villages divided into eight districts (The Committee 1880:86). This reflects a significant drop in the mid 1800s as epidemics swept through Fiji. Whooping cough decimated the population in 1868; in 1875 alone, 1,200 to 1,800 of an estimated population of 10,000 people died of measles, according to missionary accounts reviewed by Tomlinson (2009:43). For more in-depth background on Kadavu, the first chapters of Matt Tomlinson's 2009 book, *In God's Image: The Metaculture of Fijian Christianity,* provide a well researched history of Kadavu, with a focus on the role of the now indigenized Wesleyan Methodism, the dominant religion and a key social force on the island. Tomlinson's regional focus is the politically dominant southwestern Tavuki district, which is located one to two weather-dependant hours of travel by outboard motor boat from the Ono Channel villages.

In Kadavu, I visited with people from the villages of Tiliva, Lagalevu, and Matasawalevu to conduct 53 of the 80 interviews for this study. Unnamed on Figure 1.1, Lagalevu occupies the cove to the south of the triangle marked 'E' between Tiliva and Matasawalevu. Kadavu villages are spaced along the ocean shoreline with defined *qoliqolis* or village fishing grounds. Thompson's 1889 map in Figure 1.2 shows Tiliva and also Waisalima, which is no longer a village as such (Δ F: Figure 1.1). Inter-village connections include strong social ties of intermarriage, religion, and a shared primary school for teaching 80 students in Tiliva, the largest village of an approximate 100 residents. As estimates and actual numbers of village populations vary, I provide rough numbers only. Most of Lagalevu's 40 plus residents and the 60 people living in Matasawalevu send their 6 to 13 year old children to board at the Tiliva primary school from Monday to Friday. An adult from these villages takes a turn staying at the boarding hall for a week and cooking for the 40 to 50 boarders. Older children go further west to the secondary school in Kavala Bay for the term, or to stay with relatives in Suva where academic standards are higher and more computer training is available. Each village has its own Wesleyan Methodist Church. A single pastor rotates between the three villages each week. On the first Sunday of the month, each village takes a turn hosting a combined church service followed by an impressive feast of fish, root crops, and greens for two hundred people. Preparation for this feast involves days of fishing, harvesting, and women cooking, for enthusiastic consumption by everyone, within one to two hours.

Travel between any two villages is an hour's walk at low tide in good weather, or 15 minutes by the more popular but expensive-to-run outboard motorboats. Premix fuel for outboards in 2009 was $13.50 FJD or $8.00 CAD per gallon, which covers a return trip between two villages depending on the vintage of the motor and boat, the load, and the waves. Paid work, when available, pays $2.00 to $3.00 FJD per hour. I observed steady foot traffic every day between villages along the main path, just two metres from the door of my *bure*, or thatch house, at Waisalima, between Tiliva and Lagalevu. Further east, Matasawalevu is located in a deep mangrove-bordered inlet that allows high tide boat access, or at low tide, a walk through deep black muck. The alternative is the overland trail to Lagalevu. A dozen or so other families have homes and small plantations scattered along the coast between the villages. Most of these families maintain social connections to a village, but prefer more privacy than village life affords.

In the villages, established here for many generations, relations by blood and marriage are complex and important. Family relationships determine a requirement to provide for people in need. This may include significant impositions such as housing and feeding several extra people in one's already full single-room house for weeks, or just borrowing some sugar or tea. *Kerekere* is defined by Capell (1968:95) as a recognized system in Fijian society of gaining things by 'requesting' them from one's group members. The word *kerekere* also serves as an introduction to request something (Geraghty 2008:52-53, Hazelwood (1872:54). These requests are impolite to refuse and this can be a strain at times, as some people use the system to their advantage. However, the system does allow for resource sharing when necessary in small isolated communities and intertwines relationships in clans and families in a system of generalized reciprocity. The *kerekere* approach carries over into English conversation, where the word *please* most often prefaces a request to be given something.

In Kadavu, I did not learn of any inter-marriage rules based on birth village, which in the case of Lagalevu village is occupied for the most part by a single clan. Tiliva has two clans and may have different rules. Lagalevu village was a spin-off from a chief residing at Waisalima, many years ago when a castaway Irish sailor named Paddy O'Connor married the chief's daughter. I have yet to ascertain if this is the same infamous Paddy Connor, an escaped, "depraved" New South Wales convict driven from Rewa in 1840 after the death of his patron grand chief, who settled elsewhere in Fiji to raise livestock and achieve fatherhood of his fiftieth child from an uncertain number of wives (The Committee 1880:2-3). The couple received rights to the cove where Lagalevu village stretches along the shoreline. Today, O'Connor is the surname of most Lagalevu residents. For the analysis to follow, the key point with these three villages is the frequency of people's interactions and associations. Interactions include regular visiting with extended family relatives, cooperation in church and school support, cooperating on weekly trips to the ferry terminal to ship produce and receive goods from the mainland, and some cooperative fishing trips.

These villages are in the region of Nakasaleka, named for the dominant village, and the referent for a language group encompassing Ono, Buliya, the other northern islands, as well as northeastern Kadavu (Pawley 1982:38). I interviewed two knowledgeable people from Nakasaleka village. On the Ono side of the channel, just six kilometers across the Channel from Tiliva and Lagalevu, roughly 60 people live in the adjoining villages of Waisomo and Vabea, which are defined by people's membership in two separate clans. Here, 21 interviews took place. Two further interviews on Buliya Island to the north and two interviews with people from Narikosa village in Ono Island, provides responses from eight villages in total. Some variant responses came from people raised in other Fijian islands who came to the Kadavu Group through work or marriage.

For brevity, a reference herein to Kadavu interview results means the three adjacent Kadavu villages and Ono references relate to Waisomo, Vabea, Narikosa, and Buliya, unless otherwise stated. Interaction across the Channel is limited and antipathy was detectable at times towards “those people” on the other side. There are stories told by local people of great battles and killings between these groups in bygone times. The Reverend Wallace Deane (1921: 47-57) recorded an interesting legend from Ono residents about Tanóvu, an Ono clan-hero mythologized into a deity, associated with building Ono’s mountains in rivalry with Kadavu deities. Tanóvu was said to have made other landforms, such as the shapes like giant footprints visible on opposing rock faces on Kadavu and Ono as he pushed the islands farther apart with his feet, creating deeper water to enable him to better dip his drinking vessel.

Fishing territories, or *qoliqoli*, are well defined; the middle of the Naigoro Passage through the barrier reef defines the boundary between the *qoliqoli* of Waisomo and Vabea, and the *qoliqoli* of Matasawalevu. Clan rules in Waisomo and Vabea prevent in-clan and village intermarriage, but allow a cross Waisomo and Vabea marriage. My Ono interpreter and her husband, along with his brother and a Waisomo lady, were the only couples I met, who had married across the channel. A Waisomo and Lagalevu marriage gave these fishermen access to both fishing territories, and options to live in either village. I reviewed a 2007 YouTube video of a wedding held in Vabea on Ono, but did not recognize attendees from the three Kadavu villages across the channel. I suspect many of the guests came from Suva, given the concluding photos taken on the ferry (Mandy’s Wedding 2007). There are a number of seldom occupied, but well-appointed homes in Vabea, including that of the chief, who lives in Suva and visits for a month or so each year. This hereditary chief is a woman, which is unusual in Fiji. Waisomo and Vabea villages contain the regional school on south Ono where Narikosa village children board.

A Tiliva woman had married in from Buliya, where these people's ancestors are said to have arrived from Matuka Island in Lau some 200 years ago. This lady made occasional visits to see family on Buliya; other visiting opportunities between communities happen at the ferry terminal each week. I seldom saw boat traffic crossing the channel between Kadavu villages and Ono, suggesting that cross-channel social relations are minimal despite the relatively short distance. On one occasion, I was out hand-line fishing with two Kadavu men in an open 18' outboard boat, when we were caught in a bad storm of rain and wind, with waves lapping at our gunnels. Seeking our way home through rough seas, but disoriented in the dense fog, we ended up on the Ono shore in error, requiring a long passage directly into the teeth of the gale to make the Kadavu shore. Sheltering in an Ono cove or stopping at an adjacent Ono village was not an option, as we set off for the bone-jarring passage back to Kadavu.

The ferry sails from Suva on Tuesday nights to Kadavu's administrative centre of Vunisea, site of the island's hospital and single paved airstrip, a significant improvement from the bumpy grass airfield that I experienced in 1997. The 1481 ton, Sinu-I-Wasa ferry's hold is filled with freight and a few vehicles carrying loads to deliver on Vunisea's few short roads. The Sinu-I-Wasa, built in 1972 in New Zealand as the Straitsman for short-haul car and passenger ferry work (Nautical News 2006), has one drawbridge style entrance at the bow where in Fiji passengers, livestock, building supplies, freight of every description, fuel drums, and a few vehicles loaded with freight are unloaded and loaded more or less simultaneously.

Up a spiral staircase from the ferry's hold is an inside deck filled with wooden benches for passengers. People often bring foam or blankets for children to sleep on the floor. A few sleeping cabins are available to rent for premium prices; a small upper outside deck allows people to seek fresh air. After unloading and loading freight and people in Vunisea, the ferry travels up-island to the Kavala Bay jetty where a fleet of outboards loaded with people and outbound freight converge from northeastern Kadavu, Ono, Buliya, and other islands. The ferry ride from Suva to Kavala Bay is a 15 to 18 hour trip, and one arrives mid-afternoon on Wednesdays. Ferry day is a key social event as young men and ladies exchange flirtations; relatives and friends meet to exchange news and goods. Permanent thatched awnings on posts near the Kavala Bay jetty cover a mini-market where ladies set out soft drinks, snacks, and light foods for sale, while people wait for the ferry and visit.

Near the Kavala Bay jetty is the regional health centre, the post office, a Western Union service, and the largest shop in the area incorporating a busy fuel concession. The large inlet of Kavala Bay has several settlements and the regional high school; trips to the ferry include many errands, visits with school children, and considerable socializing. Boats on ferry runs are well loaded with people and goods.

The two Kadavu jetties built for a large ferry are relatively new. Previously there was a barge that circled the island, docking in harbours, or stopping offshore at villages for small boat transfers. This barge was wrecked upon a reef on Kadavu's southeast coast. Suva based Vuna Shipping then established the current system. I visited Kadavu in 1997 and people were reliant on a small ferry that left Suva and circled the island every week or two, stopping offshore, but it was unreliable in bad weather conditions.

Picture 1.1: Ono Island from Kadavu and an old fish trap

Picture 1.2: Kadavu Island from atop Ono across the Ono Channel

Picture 1.3: The Great Astrolabe Reef from atop Ono Island

Picture 1.4: Astrolabe Reef inner valley

Picture 1.5: Astrolabe Reef coral garden

Picture 1.6: Village at low tide

Picture 1.7: Ferry day

Picture 1.8: Friday school bus

iv) Fijian languages, dialects, and communalects: an overview and linguistic setting for Kadavu and Ono Channel villages

Fijian languages belong to the Central Pacific branch of the Austronesian language group, although variations, such as a lack of aspirates as compared to Tahiti, confused some early visitors to Fiji as to common linguistic origins for Central Pacific Island languages (Schütz 1972:3, 43). The Proto-Oceanic language that spread eastwards across the Pacific with Lapita culture settlers diverged into the Central Pacific language group in the Fiji region from other language groups, such as the Western Oceanic of the Bismarck Archipelago and the Southern Oceanic of New Caledonia. The Central Pacific language broke up into dialect regions with the divergence of Proto-Polynesian from the Fiji centered dialect region (Pawley 2008:2, Osmond in press, Geraghty 1994). There is some consensus that two significant migrations into Fiji followed the first of 3000-2900 BP by Lapita culture settlers. Outflows of settlers to Polynesia and consequent isolation led to further linguistic variation to the east, and more recent backflows of Tongan words into eastern Fiji and the islands of Lau in particular (Geraghty 1983:381-389). For example, a lady in this survey had grown up in Lau's Matuka Island and used a number of consistent terms foreign to Ono Channel people such as *ponē* for several species of Acanthuridae fish. The *p* sound is a sign of a loanword in Fijian. Capell (1968:160) includes only six dictionary entries under *p* for introduced items or concepts. Geraghty (1994:162) identifies *ponē* as a Tongan loanword for the surgeonfish *Acanthurus nigrofuscus* with Fijian usage confined to Lau.

Language variation in Fiji reflects uneven migration flows, geographic isolation of mountainous islands where speakers living on one coast or mountain valley may have little contact with people living a short distance away, isolated by geography or social incompatibility. Fijians have adopted many English loan words with small changes such as *bisikete* used for biscuits and applied to certain vertically compressed Chaetodonidae fish in some places. Schütz (1972:103) confirms *tabaka*, now *tavaka for tobacco,* and *penikau* or pen of wood were early 19th century loanwords. I recorded *vurovuro ni tavako,* meaning 'ashtray*,' for* a *Herpolitha* species of mobile coral, which makes a fine ashtray when dried out. *Penikau* is a common attributive for types of *ta*, or unicorn tang fish with single horns. Adding an *i* or *ee* sound to a word ending is a way of Fijianizing the word. My Fijian name is Rossi.

English language use in villages is minimal unless dialogue with foreigners is required. Teaching English language skills is a major focus in primary schools. I found that 10 to 11 year old children in their fifth and sixth school years communicated reasonably well in English, but first and second year children understood little English. The three primary schools that I saw in Kadavu posted establishment dates from the 1940s, but not all people would have attended then, as some still do not today. English language skills of adults vary from none at all to very good, with a rough correlation between advanced age and less English. There are a few small resorts in the area and tourists have been showing up in small numbers since the late 1970s, according to a Waisomo elder. The resorts provide important, but unpredictable, cash employment sources for those with appropriate skills; English skills are a marketable commodity here and even more so in Suva where many young people seek opportunity.

Linguists subdivide language use within Fiji into Western and Eastern groups, with a number of regional variations of sound systems. Variation in vowel use is restricted to a lengthening of vowels that changes emphasis patterns in words, which shows up in common fish names such as *tabacē*, pronounced 'tambathay,' or *bōsē*, pronounced 'boosay' using Canadian diction.

Figure 1.3: Fijian pronunciation (Calamia et al 2008:10-11)

The Fijian alphabet is almost perfectly phonetic.

a as in 'father' or 'lark' e as in 'bed' i as in 'machine' o as in 'core' u as in 'true'

Vowels are pronounced either short or long, with a long vowel having a much longer sound. Linguists show the long vowels with a macron over them. Most consonants are pronounced as they are in English, with these differences:

b 'mb' as in 'thumb' c 'th' as in 'this' d 'nd' as in 'candy' g 'ng' as in 'wing'

j 'ch' without the following puff of breath k 'k' without the following puff of breath

p 'p' without the following puff of breath q 'ngg' as in 'anger'

r rolled t 't' without a following puff of breath , often 'ch before 'i'

v with lower lip against upper lip, somewhere between a 'v' and a 'b'

My interpreter in Kadavu had completed tertiary education, with considerable exposure to Fijian language variations obtained from being a child of a schoolteacher, who stressed education amid career relocations for teaching assignments to several islands, including Western Fijian influenced southwest Kadavu. My interpreter on Ono had completed most of the Kavala Bay secondary education, and with family relations on both sides of the channel showed cognizance of dialectical differences. However, lacking training as linguists, neither interpreter was familiar with the use of macrons, such as linguists apply above the vowels to the term *bōsē* to mark the extended vowels pronounced 'boosay.' The interpreters did add extra vowels for emphasis on occasion.

Consonant variation is common in Fijian dialects with the sounds represented by the letters *k, t, d, q*, and *s* showing regional variation (Shütz 1972:97). Key variations in the Eastern Fijian Nakasaleka communalect are the use of *j* for *ti,* as in *bajilumi*, and the use of a prenasalized alveolar affricate *z* for *di,* according to Geraghty (2007:136-137). Shütz (1972:18) connects the *j* use to Tongan influences. In practice, the Kadavu interpreter recorded *batilumi* consistently, while the Ono interpreter recorded *bajilumi* consistently. The *di* seldom appears in the fish names that I recorded except in the word *dina,* an attributive meaning real or true, and I did not notice or record this *z* pronunciation variation.

Given my own limitations with the Fijian language, the unfamiliarity of my interpreters with diacritic use, and variations in perception and use by experts, I have not applied macrons to the results at this time to eliminate guesswork and possible confusion. The names presented in this study are spellings as recorded by my interpreters. In regular interview follow-up sessions with the interpreters, I clarified possible inconsistencies or unusual variances.

As Geraghty (1983:17-19) notes, people in Fijian villages have high awareness levels of speech community differences and linguistic boundaries. People contrast themselves with other groups based upon the differences, but their estimate of degree of difference may not match that of a linguist. People on Kadavu often referred to Ono people as speaking very differently, with estimates of as much as half of their words being different. I suspect that this estimate is exaggerated, reflecting minimal interaction. Inter-group politics and attitudes may expand such estimates (Gregory Forth: personal communication 2010). Geraghty (1983:315-317) confirms that Ono has recent word borrowings from Rewan or similar dialect on Viti Levu, and also notes higher prenasalizations of *t* and *r*, among other differences. Historic tales told around the kava bowl recount battles fought and atrocities committed between Ono people and Kadavu people living six kilometres apart across the Ono Channel. Evidence of negative attitudes to “those people” on the other side were not uncommon and frequent fires from slash and burn agriculture practiced on the poorer soils of Ono are perceived as signs of laziness by some Kadavu folks.

Another noticeable difference is the significant Roman Catholic presence in Vabea and Waisomo on Ono Island, but not in Lagalevu or Tiliva where Wesleyan Methodism dominates. There are a couple of other small churches in Matasawalevu that I know little about. People do have linguistic and pronunciation differences across the channel. My Ono interpreter and her Lagalevu husband provided insights into the cross channel variations of fish names. They had been living in Waisomo for some years, but made regular social trips to Lagalevu. For example, this interpreter noted differences in people's pronunciation of the grouper term *drodrouwa* versus the *droudrouwa* in more common use by some speakers on Ono. One major language difference across the channel was the common use of the colour term *karakarawa* for blue and green on Kadavu villages and the use of the standard Fijian *drokadroka* for the colour green on Ono and Buliya. This will receive further discussion in Chapter 4.

v) <u>Language issues for fish names</u>

Robin Hooper (1994) proposes the resilience and stability of fish name use in Oceanic languages, as people spread out across the Pacific Islands and languages diversified. Andrew Pawley's (2008:30) preliminary investigation of Hooper's proposal is inconclusive so far, noting considerable variation in resiliency among names of different kinds of fish, but he recognizes statistical limitations of a relatively small sample size. Meredith Osmond (in press:99), working with Pawley at Australia National University, has proposed 145 Proto-Oceanic fish names based on cross referencing the work of researchers across the Central and Western Pacific. The term 'Proto-Oceanic' is defined in Section iii of the Introduction. Osmond notes issues of uneven comparisons due the variability of information that reflect the depth of research done in a specific area and the availability of older wordlists. There are a number of language issues to consider when recording fish names, which reflect the number of shifting variables in the process.

Hooper (2004:186-189) notes challenges in comparing scientific names to folk names, such as the shifting nomenclatures of Linnaean fish categorization, folk practices that lump a family, a genus, or a species under a single name, and folk naming practices driven by what Hooper quotes from Lakoff (1987:37) as 'interactional properties.' Hooper's example of interactional properties is the application of the term *palu* in many Pacific languages to diverse kinds of fish, which all share the property of being caught on long lines in very deep water. Thus, the required fishing method defines the fish name. Lakoff draws on Brent Berlin's work in his explanation of interactional properties and this is consistent with Berlin's (1992:185-186) later observations of alternative utilitarian classification systems cross-cutting other classification systems, such as morphology. The term *nene,* used in Ono Channel villages for small dark cylindrical fish including the juvenile phase of several scientific species of parrotfish found on inshore reefs and reef flats, and gathered in nets, is such an interactional category. The application of variant terms is common in folk naming for some fish kinds that change shape, colour, habits, and habitats as they pass through growth stages. Hooper (2004:191) investigates this practice to propose a covert superordinate category for the genus *Caranx*. In Chapter 4, I propose a covert superordinate category for at least 3 genera of the family Scaridae or parrotfish found in the Ono Channel.

vi) Establishing interpreters and communication

Establishing effective interpreters for the collection of fish names in Fijian villages is complex. The interpreter must be quite literate, speak or be aware of multiple communalects, have high integrity levels, legible handwriting, and interest in the work. A key attribute is the level of respect given the interpreter within the community, which determines the number of people willing to participate and the effort and time that people contribute. Given the complex social relations in the villages discussed above, relatives of any sort of interpreters were on the whole more available and focused in interviews than people unrelated to interpreters. Interpreter connections to families of chiefly status or long established village lineages also affect interviewee interest in a positive manner. An interpreter well connected with community has a degree of fore-knowledge of what other people are up to and may anticipate the best time to interview, if possible making some loose arrangements in advance. It is often hard to tell what people's immediate plans are, as they may be sitting around talking and not look busy, but they may be waiting for fuel, tide or weather changes to go fishing or expecting companions to join them to work in their plantations.

Another unique challenge to doing research in Kadavu is the risk of excess kava or *yaqona* consumption by researchers, who need to spend nighttime hours soberly going over notes and updating records. Kadavu produces the best and most potent *yaqona* in Fiji, according to local talk and the higher than average prices paid at market in Suva. *Yaqona* is a psychoactive drink derived from the root of the shrub, *Piper methysticum*, a pepper plant harvested after 2 to 5 years, and sun dried, to be stored, sold, or pounded into a fine powder before immediate consumption. At one time *yaqona* is said to have been for elders at council, and was prepared by women chewing the roots. Today many village men drink it most nights and often to excess, with a number of side effects including nervous system disruption and, as S. G. Aporosa (2009) recounts, irritability problems, quenchable only with more *yaqona.*

Sharing *yaqona* is a standard social lubricant for any sort of visit or get together by men, and for many women. One often hears a rhythmic metal clang noise in a village after 3 to 4 PM, punctuated by a dull thud. *Yaqona* roots are being ground into a powder with a large mortar and pestle, often a tall cylindrical metal pot with a pole pounded into the pot by a young man, who taps the base of the pole on the rim of the pot on each clanging withdrawal stroke. The noise carries some distance and men will make their way towards the community hall or place of assembly adjacent to the kava preparation. Special events such as a man bringing a new woman to a village justify multiday *yaqona*-fests, which may start early in the day. Village women may have their own *yaqona* celebrations. Interviewing people during celebrations of this sort is unproductive for the most part, although one attempt at this produced novel sexual terms and innuendoes from a group of village women, for various sea cucumbers, and great amusement for the ladies, as they attempted to embarrass me. Recounting this event did become a good shared joke during subsequent interviews in this village with these ladies and their friends.

Drinking *yaqona* involves sitting in a rough circle with a kava bowl overseen by a young mature man who is responsible for mixing the *grog*. The powder is poured into a fine mesh bag or stocking. The man pours a small amount of water into the bowl and the overseer squeezes the bag in the water to make a thick brown soup. Once a certain consistency is realized, more water is added with hand stirring until the desired drinking mix is obtained. Traditional *yaqona* bowls are broad round one piece wooden bowls measuring less than a metre across, with three or four wooden legs for stabilization. When the mixture is prepared, the overseer claps his cupped hands three times and a coconut half-shell is passed to the most senior resident man to start the drinking. The cup is passed back to the overseer, who is never a chief or headman, to be refilled and everyone receives the cup in turn around the circle. Before accepting the drinking cup it is appropriate to clap your cupped hands three times, and once afterwards along with calling out the word *mocā*. One can request low, mid, or high tide levels in the coconut shell, or the new term "tsunami bowl" for extra full, coined after two novel, but uneventful, tsunami warnings in September 2009. Less formal *yaqona* sessions in people's houses may involve a smaller hand pounder and a plastic mixing bucket. A common question put to me by men as a measure of manhood was "how many bowls of *yaqona* can you drink?" I respond with "three or four bowls," which is on the light side. In practice, I find the drinking component is not the problem; the difficulty is the summoning of motivation to get anything done effectively the next day and be thinking with clarity.

Yaqona consumption by a male interpreter during each interview would limit the quality, accuracy, and quantity of interviews, not to mention the researcher trying to follow conversations in Fijian and remember details of every interview. I was fortunate to engage a female interpreter in Kadavu of good social standing with a dislike for kava drinking, which is unusual in these villages.

My interpreter explained our approach, and I often repeated that I did not drink *yaqona* while working, while I would look forward to sharing a bowl when the project was completed. This decision did slow down getting to know some of the men, but I do not feel it had a negative affect upon the results overall, as people drunk on *yaqona* made for poor interviews. I did share *yaqona* in each village on the last day working there, and it made the event more special for everyone as we exchanged speeches of gratitude, much as in the traditional Fijian use of *yaqona.* Thus, I negotiated a middle ground between traditions, effective research, productivity, and my health. I have also found *yaqona* drinking the night before scuba diving to be a bad practice. This study required several dives per week to collect underwater photos and observe the local marine life, further motivating me to minimize consumption.

A *sevusevu* ceremony involving a gift of *yaqona* is an essential ritual for a newcomer to enter a village for socializing of any sort. I ordered and purchased one half of a kilogram of good quality *yaqona*, per village, beforehand from a reputable vendor. We would approach the village, removing hats, sunglasses, and shoulder bags to seek out the headman and determine availability. In some villages, a male elder agreed with my female interpreter to act as my proxy or sponsor, to present gifts of *yaqona* and other items to the village headman, or available elders.

The *sevusevu* format consists of everyone sitting down in a circle on the normal floor covering of pandemus leaf mats in the headman's house or the village community hall. The sponsor provides an explanation of who the visitor is and what they wish to do in the village, along with any reciprocity offered to the headman or village. The sponsor holds the bundle of dried *yaqona* roots, turning it in firm hands and explaining my purpose in Fijian, while looking down or away from the headman, who also looks away in a manner that would signify distraction and boredom in Canadian culture. In fact, he is listening carefully to every word. A series of questions and answers follows and if everything is satisfactory, the *yaqona* bundle is passed across the circle to the headman. The headman then picks up the *yaqona* bundle, if all is well. While rotating the bundle in firm hands and looking away, the headman delivers a speech to signify the researcher is welcome in the village to interview and visit people. My process deviated from the norm here as we declined to initiate a *yaqona* session at this point, which would establish a precedent to join daily *yaqona* sessions when visiting the village. Some people showed some surprise at this, but foreigners are odd creatures anyway, and as I became better acquainted with a couple of elders involved in these ceremonies, no offence seemed taken.

vii) <u>Reciprocity</u>

To provide appropriate reciprocity for this research, I avoided making individual payments, which could generate ongoing negotiation, affect the quality of results, and go against the community focused values or *vanua* ingrained in village life. After some consultation with local people in Kadavu, I offered to contribute some funds to the primary school serving the three villages where I planned to work. This offer was accepted, and disposition of funds was discussed for several weeks by teachers and involved parents. Concerns came up regarding unequal disposition of the donated funds. A good compromise emerged of a fuel purchase to run the generator at the school for one to two hours after 6 PM, allowing children in the dormitory, and I assume children from the village if they desired, lights to do homework each night for the balance of the term. Fuel is a precious de facto currency in these communities, which lack electricity and surplus cash to run the few generators available. Expanding use of cell phones, rechargeable flashlights, and other electronics attracts visitors with chargers in hand anytime a generator starts up. In Vabea and Waisomo on Ono a similar offer of a cash contribution to the village school was made, but circumstances were different there and I honoured the elders' request to contribute the funds to a village fund for each village. Village elders appreciated this and commented upon it as a positive and novel approach to doing research in their villages.

A contribution to Tiliva School was made of 15 small books that describe basic reef ecology. These books published by the University of the South Pacific in Suva may motivate teachers to include some local ecological and biological knowledge in their curriculum. Education is important for children's life chances in Fiji as in most places. Children attending school learn little traditional knowledge, in particular boarders who leave home for five days a week at the age of six. At the end of the project, I was asked to make a small speech in each of the four classrooms at Tiliva primary school. In response, each class sang a favourite song in Fijian, except the youngest class who performed an interesting version of *My Bonnie Lies Over the Ocean*, in English, with I suspect little comprehension of the words.

Further reciprocity will be in the form of a summary of the Fijian names most used in each village for the fish kinds discussed. I will send this to the village leaders who have expressed interest in it, as well as copies for the three Fijian Ministries with an interest in this information. This may take the form of an article in published in DomoDomo, The Journal of the Fiji Museum.

Chapter 2: Research Methods

The key goals of this study are the following:

1) Create records of local folk nomenclature and taxonomy knowledge of fish and marine animals.
2) Create and supply useful records of the local knowledge to contributors, and the people of Fiji.
3) Consider the historical, environmental, social, perceptual, and ecological input and output factors that relate to the knowledge of fish and marine animals recorded.
4) Contribute to the field of ethnobiological knowledge and development of research methods.
5) Contribute to sustainability projects that balance requirements for human wellness and coral reef ecosystem health.

i) Planning

The first step in this project was to decide which fish and marine animals to focus on from the well over 300 hundred scientific fish species and hundreds of invertebrates and other animals living on the Great Astrolabe Reef. Based on a recent transect survey (Obura and Mangubhai 2003), my preliminary snorkels and dives on site, analysis of fishing records (Kuster et al 2003, Veitayaki 1995), and discussions with local people and divers, I settled upon three large groups of fish and the category of sea cucumbers to focus upon. The fish groups are the scientific families of Acanthuridae and allies, Scaridae, Serranidae and allies, and a few types from each of the families of Balistidae, Chaetodontidae, Haemulidae, Holocentridae, Pomacanthidae, Pomacentridae, Priacanthidae, Siganidae, Signathidae. These other sample types help establish categorical boundaries and provide insights into the depth of folk taxonomies for possible future research.

The three core groups selected represent three of the four dominant groups of fish comprising fishing catches, according to Fijian creel census studies (Kuster et al 2003). I sought fish groups with high ecological salience. The fourth dominant group, Lethrinidae, or Emperors, was rejected to manage interview times and people's attention spans, on the basis that this smaller group had the least in-group variation of colour, morphology, behaviour, and general diversity, but will be used in future research.

I brought a small photo printer to Kadavu. The original plan called for extensive diving, snorkeling, and underwater photography in the first two to three weeks to generate photos to use for identification. Poor weather and sinus congestion limited opportunities for diving and fish photography early on. However, observations made while diving and snorkeling were of great assistance in discussing fish with people. I moved ahead with interviews using field guides and a smaller number of photographs than planned. By cross-referencing transect survey results (Obura and Mangubhai 2003) and my underwater observations with good quality images in the field guides (Allen et al 2003, Colin and Arneson 1995), I chose 101 field guide images of the fish groups and the sea cucumbers, along with 29 photographs taken on the reef and printed out. The photographs included images of some creatures in the field guide for comparisons, some not in the guides, and a number of local invertebrates, some of which are said to be unnamed in Fiji (Seeto 2007), but as it turns out, not by everyone.

Learning Fijian language skills in advance of the research was difficult. The dialects spoken in Ono Channel villages have considerable variations from the standard Bauan Fijian language used in the few grammars and phrasebooks available. Given the time available for this research, I established arrangements with interpreters who played critical roles in negotiating arrangements with villages and setting up interviews as discussed in Chapter 1.iv. Later on in the research period, I was able to ask some basic questions in Fijian, understand ideas in many answers, and on one occasion identify when an interpreter was modifying questions, although the speed of normal Fijian dialogue continued to be a challenge. Better language skills would be an important asset for future research, since listening to people talk about fish would reveal naming and categorization criteria, as noted by Gregory Forth (2004:28) for ethno-ornithological study. However, socially connected interpreters would still be required to gain access to a broad base of people to interview, to translate terms and nuances, and spell responses correctly.

One objective of this study was to explore methods to deal with the unique difficulties associated with determining accurate local names for fish and marine creatures. It is hard for interviewers and interviewees to be looking at the same fish specimen at the same time and be able to talk about it, as one can do with plants, some birds, and other animals. Two common methods of collecting fish names are either showing people pictures of fish or asking them to free-list names and verifying their fish names with pictures. The limited time and resources available for this research, required a focus on specific groups of fish, thus, showing pictures to people was the best option.

However, the use of pictures for identification has some problems. People use colour, size, morphology, behaviour, location, and other factors to identify fishes. With certain groups of coral reef fish, such as members of the family Scaridae, many kinds of fish look similar and may go through dramatic colour phases and body shape changes during growth, adding to the complexity of using pictures for identification. Key challenges for interviewees are judging scale, the effect of a flash on colour, the angle of the fish in the photo, features that are over- emphasized or obscured, background contrast, and habitat contextual clues.

Further problems arise from determining which kinds of fish exist in the area frequented by the interviewee. Fish identification books provide broad range estimates that have fuzzy boundaries with no guarantees of a given type’s presence on a particular reef, and frequent surprises of fishes found well outside of their stated range. I photographed batfish of the scientific species *Platax boersii* in Kadavu, when their eastern range is said to be the Solomon Islands (Allen et al 2007:42), some 2200 kilometres west of Fiji. A marine biologist knowledgeable on the subject confirmed the identification. Without going swimming and photographing these fish myself, I would assume that an interviewee identifying an image of this fish was confused with the similar common batfish *Platax orbicularis*.

Alternative identification methods include going fishing with people or inspecting people's catch upon their return, when identifications can be made; however, there are obvious logistical difficulties regarding what fish happen to be caught and the researcher being in the right place at the right time. A further issue is the variances between people's names for a given fish. Gary Barnett (1978) in his classic study of folk taxonomy on many Pacific Islands recommends working with a group of elder fishermen who can discuss terms to settle on the right name. However, social structure may advantage one person's opinion over another to the detriment of the research, and women may often go fishing apart from men, using different methods and use different terminology. I believe that individual and small group interviews are more productive to learn folk taxonomy if one has the time.

ii) <u>Interviews</u>

I often interviewed people in their homes, or in some cases adjoining a social area where people gather to talk or process pandemus leaves used for roofs, and weaving mats. Individuals could leave the group to join us for an interview, of which the identification portion took about one hour. Inclement weather days were often good interview days for interviewing in homes, if we could get to the village as wind and rain make boat travel difficult. Flexibility proved to be the key as interview days, much as is daily village life, were subject to weather, tides, meetings, the ferry schedule, fuel shortages, school holidays, and people out fishing or working in their 'plantations' or gardens. Mid- afternoon was an optimal time to find people resting and socializing in their homes, with sufficient daylight to view pictures and identify fish. People were often at home on Saturday afternoon, which proved to be a good interview day when we needed to catch up on missed weekday interviews. Sunday is a special social day in Kadavu and Ono; no interviews occurred on Sunday, although I attended church in one of the villages each week, which provided opportunities to get to know people better after the service.

Field guide images were marked with coloured adhesive labels marked with a letter for each section and a number for each image. Using a notebook with a page for each fish group and numbered interview, the interpreter recorded the interviewee's response beside each picture's code such as A1, A2, A3, etc. Most people were familiar with and used these English letters and numbers, even when the interviewees spoke only Fijian. Some people required assistance to turn pages or pick out the right image to identify; we always sat on floors Fijian style in a small circle allowing me to guide the interviewee as required, but more often I could listen, observe, clarify responses, and make my own notes. At times helping to entertain small children was useful to allow parents to focus on the interview. At the end of each section of fish, we would ask questions about what certain kinds of fish ate, or what people's favourite kind of fish was, which prompted interesting discussions. I recorded these answers with translation assistance as required. At the conclusion of the formal interviews, I often distributed small gifts and we would sit for a time while interpreters and interviewees visited and exchanged news. There is a steady flow of people in and out of most Fijian homes, which may increase when something interesting is going on. Curious visitors became our next interviewee on many occasions.

We typically did four or five interviews in a day and I would enter all of the results of an interview day into excel spreadsheets each evening to organize the data and to check everything while it was fresh in my mind. This process screened the results for minor recording errors. I accumulated separate spreadsheets with a master list of all names collected, and another master list of all attributives used. I met with interpreters to go over and record local meanings for all attributives and uninomial names collected, with assistance from the interpreter's husbands, both of whom were experienced fishermen. Local meanings of terms often varied from those of the Bauan Fijian dictionary (Capell 1968), which were also entered into the spreadsheet to refer to. We verified any remaining unknown meanings with the providers if possible or asked other people in subsequent interviews. I introduced more background questions as the study progressed and I became more familiar with the terms, dialects, and local knowledge base.

I adjusted the photograph selection after the first few interviews as I acquired more and better photographs. Several adjustments to the order of the photographs were made to encourage interest and confidence in interviewees. Hard to name or less familiar images at the beginning, or in sequence discouraged participation. Starting off with images of well known organisms increased interviewee enthusiasm. Some people saw the interview as a test and at times interpreters and interviewees would fall into the tone of a student answering a schoolteacher in a call and response fashion. At times, I would interrupt this flow with a question to encourage dialogue. In future research of this sort, I would build more dialogue into the structure of the interviews, as once my interpreters became familiar with the interview process that focused on name collection, it proved difficult to expand or modify the interview structure. Given that both interpreters were relatives, friends, or neighbours of many of our interviewees, the interpreters felt a responsibility to be protective of interviewees and were uncomfortable asking people any questions that positioned interviewees as 'subjects of research.' I believe that for the most part, the interview process was viewed locally as a sharing of information as part of the system of social exchange that underlies Fijian society as discussed in Chapter 4 of this thesis, and reflects the reciprocity arrangement described in Chapter 1.

iii) <u>Data Analysis</u>

While in Kadavu and Ono, I had very limited access to electricity to charge my laptop battery. Computer use time was by necessity restricted to data entry and logging notes and observations on each day's activities. Upon return to Canada, I began to put the raw data into formats to allow analysis. To demonstrate the method that developed into what I term the 'first choice name consensus" (FCNC), I will provide examples here for responses to images of squirrelfish of the scientific family Holocentridae, not dealt with elsewhere in this thesis.

Figure 2.1: Raw data entry form excerpt from Waisomo Village responses

ID#	Genus	species	Interview # W2	Note # W2	# W4
P21	*Myripristus*	*berndti*	*matakiji*	Black squrrelfish is corocoro	*corocoro*
P22	*Sargocentron*	*spiniferum*	*taikuru*	0	*taikuru*
P23	*Priacanthus*	*hamrur*	*waisu mei radinibau*	0	*misijeke*

Figure 2.2: Data analysis sheet excerpt for the image shown of the scientific species *Priacanthus hamrur.* These results are summarized in the first choice name consensus sheet shown in Figure 2.3.

Fijian Term	**LL**	**Mt**	**Til**	**Nk**	**KD sub total**	**Bu**	**Nr**	**Wa**	**Vb**	**Ono sub total**	**total**	**% of total**	**Kadavu %**	**Ono %**	**KD /Ono**
bou	0	0	1	0	1	0	0	0	0	0	1	1%	2%	0%	2%
damuda	0	0	0	0	0	0	0	1	0	1	1	1%	0%	4%	-4%
iloilo	0	0	0	0	0	2	0	0	1	3	3	4%	0%	12%	-12%
matailoilo	0	1	0	0	1	0	0	0	0	0	1	1%	2%	0%	2%
matakiji	0	0	0	0	0	0	0	1	0	1	1	1%	0%	4%	-4%
misijeke	**11**	**13**	**22**	**2**	**48**	**0**	**0**	**2**	**0**	**2**	**50**	**63%**	**87%**	**8%**	**79%**
nene	1	0	0	0	1	0	0	0	0	0	1	1%	2%	0%	2%
senirosi	0	0	0	0	0	0	1	0	0	1	1	1%	0%	4%	-4%
sulutavoi	0	0	0	0	0	0	0	1	0	1	1	1%	0%	4%	-4%
toga	0	0	0	0	0	0	0	1	0	1	1	1%	0%	4%	-4%
wainisu	0	0	0	0	0	0	0	0	2	2	2	3%	0%	8%	-8%
wainisu mei radinibau	0	0	0	0	0	0	0	2	2	4	4	5%	0%	16%	-16%
waisu mei radanibau	0	0	0	0	0	0	0	4	2	6	6	8%	0%	24%	-24%
no ID	1	0	3	0	4	0	1	1	1	3	7	9%	7%	12%	-5%
Total responses	13	14	26	2	55	2	2	13	8	25	80	100%	100%	100%	0%
***wainisu* & variants**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**6**	**13**	**13**	**16%**	**0%**	**52%**	**-52%**

Picture 2.1: *misijeke* in Kadavu (*P. hamrur*)

This data analysis format shown in Figure 2.2, proved to be a productive one for organizing the close to 10,000 naming responses collected. I subtotal the villages for each island group, putting the two responses of Buliya Island with Ono, which in this case trend differently. The subtotals, percentages, and variance between village group percentages allow clear definition of name use by village. For example, the term *misijeke* had 87% use in Kadavu where it was often repeated several times by people as 'Miss Jeke,' in a play upon words that people found quite funny. In Ono, only two people used this term and both of them grew up in Kadavu. However, 55 of the 80 interviews were done in Kadavu, so an overall first choice name consensus (FCNC) is misleading, thus FCNC data in this study is presented for each island in most cases. A high positive or negative number in the far right column labeled 'KD/Ono' shows variance between the two data sets. For this fish name, Ono residents favoured variants of the term '*wainisu mei radanibau,*' which translates as 'fish water good enough for the first wife or queen of Bau.' Fish water is the broth made from the water this type of fish is cooked in. This sharp distinction in names for this fish between islands illustrates the stronger Bauan influence in the Ono dialect; no one used this name in Kadavu where residents had a high level of agreement on *misijeke*.

The method allows a quick back-check to the appropriate raw data spreadsheets as shown in Figure 2.1 and even field notebooks if required to look up the three people in Kadavu who gave alternate names for this fish. The term '*bou,*' came from a man originally from an island in the eastern Fijian province of Lau with Tongan language influences. The term *matailoilo* is a variation on the term *iloilo* used in the two Buliya responses, which means mirror or reflective, while *mata* means face. A rough translation of *matailoilo* is shiny face. These fish commonly known in English as Bigeyes live in the shadows under reef overhangs and are quite reflective, in particular the surface of their large eyes. The man that gave the term *matailoilo,* also gave *misijeke* as an alternate which was recorded. *Nene*, the term given in the third Kadavu interviewee exception to *misijeke* is a broad term applied to a range of small inshore fish including cardinalfish and some immature parrotfish and wrasses. On more than one occasion in this study, *nene* is used for small unrecognized fish types. Of the four Kadavu interviewees who did not name the *P. hamrur* image, several of them were people who knew very few names for any fish. Thus, the FCNC method provides a useful toolbox to illustrate high consensus terms and variability between interview groups as shown in Figure 2.3, and methods to explore reasons for low consensus terms and isolating outliers. The statistics included in the bottom of Figure 2.1 become more meaningful with a larger data set and provide a detailed analysis of data spreads.

Figure 2.3: Holocentridae and Priacanthidae scientific family First and Second Choice Name Consensus (FCNC, SCNC) by island with percentage of interviewee responses recorded using the Allen et al (2003) field guide images.

ID #	Linnaean	Kadavu A	FCNC %	Kadavu B	SCNC %	Ono A	FCNC %	Ono B	SCNC %
P21	*M. berndti*	*corocoro*	78.00	*matakiti*	16.00	*matakiji*	48.00	*taikuru*	24.00
P22	*S. spiniferum*	*taikuru*	95.00	-	-	*taikuru*	100.00	-	-
P23	*P. hamrur*	*misijeke*	87.00	-	-	*waisu mei radinibau*	24.00	*wainisu mei radinibau*	16.00
mean			86.67		16.00		57.33		20.00
min			78.00		16.00		24.00		16.00
max			95.00		16.00		100.00		24.00
SD			8.50		0.00		38.85		5.66

In-depth analysis of terms with low consensus levels from this data model is shown for other fish kinds in Figures 5.2 and 5.4 in Chapter 5 of this thesis. The methods developed for this study have proven to be productive analytical tools for this research. The first choice name consensus results will form the core of the information provided to Fijian people as records of traditional knowledge.

iv) <u>Summary</u>

To measure the effectiveness of my research method and quality of results, I compared the data collected for the three main groups of fishes with the results of Andrew Pawley (2008) who has recorded 484 fish names in Wayan Fijian and provides a breakdown of number of names recorded by scientific family for Wayan Fijian and seven other Oceanic languages. The terms recorded in the current study are comparable to these numbers and exceed Pawley's counts in some groups, as should be the case, given the language and name variation between Kadavu and Ono, as well as possible immigrant terms from Lau and other islands. Thus, the methods achieve the twin goals of recording in-depth folk taxonomies of the targeted fish groups and determining consensus names to send to the participating villages who are interested in the results.

The first choice name consensus method also provides a screening tool to help sort out standard proper names for fish and animals as distinct from descriptive phrases. Descriptive phrases are certainly recorded in the data, but being subject to variation are unlikely to be given in the same way by any significant number of interviewees. Use of descriptive names as representative names for a given animal is then unlikely, given the 80 interviews in the survey.

The methods used to shape the data have been productive to meet the third goal of considering a number of input and output factors around the data as demonstrated in Chapters 3 to 6 in this study. This use of the data and methods such as the first choice name consensus model then contributes to ethnobiology studies. Whether this project can contribute to coral reef sustainability projects remains to be seen, but the resources and methods are established.

To improve the methods significantly in the future, I would focus on the input quality. Improving my language skills is important to gather more background information. Field guide images or photographs are static images that may or may not invoke recognition of shape, movement, and behaviour that are critical elements used by many folk biologists to identify fish. I recently acquired a DVD identification set entitled *Marine Life of Fiji and Tonga* (Jensen and Harlin 2007) that contains short video clips of many of the fish and invertebrates found on the Astrolabe Reef. The clips, designed to show typical behaviour patterns, show scale and context better than do photographs. These would be excellent tools for further folk taxonomy research. This DVD set also includes un-described endemic animals, such as a type of tunicate, similar to a sea sponge that is unique to Fiji and common on inshore and offshore Ono Channel reefs. My photograph of this animal was not specifically identified by anyone until the very last interview when a woman promptly identified the tunicate as a *vecu*, and went on to explain how to pry them off the reef with a stick for cooking and eating, as she learned to do growing up on another island. The point is that the DVD set was shot in Fiji and Tonga and shows a range of fish and animals likely to be found in Fiji. I mention this because people can be overzealous in identifying creatures from elsewhere in pictures when the creature may be similar with local fauna (Forth 2004:27).

A small DVD player with efficient power consumption would allow portable use of these DVDs and provide considerable entertainment value in Ono Channel villages, in addition to improving the accuracy of identifications. I carried two flashlights on most interview days to illuminate photographs when necessary. The DVD method would extend the working day, as dusk comes quickly close to the equator and most homes do not have access to electricity. This would also allow the researcher to shoot and display underwater video footage for further identification options.

Chapter 3: Colour, Categories, and Confusing Fish

i) Introduction

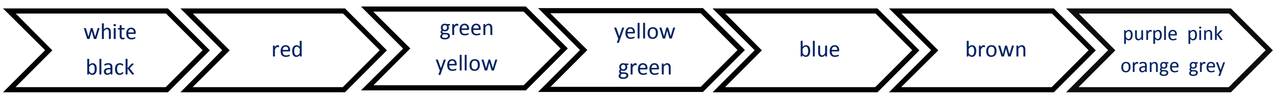
The great diversity of life forms inhabiting Fiji's Great Astrolabe Reef attracts marine biologists, ichthyologists, divers, snorkelers, and fishermen from around the world. In 2009, I spent two months visiting with the local people, who live in villages of 50 to 100 people, on both sides of the Ono Channel. The channel intersects both the offshore reef at Naigoro Passage and the mountainous islands of Kadavu and the much smaller Ono. During the course of 80 interviews with approximately 112 people, I invited people to identify pictures of five different groups of local fishes and marine animals, and to discuss their knowledge of these creatures. I provide relevant details on local culture and a summary of methods used in Chapters 1 and 2. Key sources used for identification were Allen et al (2003), Colin and Arneson (1995), and this author's photographs of local organisms. This chapter will consider classification models for fish and marine animals, drawing upon relevant categorization theory, with a focus on the issues raised by a comparison of folkbiological and scientific classification of the *Scaridae* family, also known as parrotfish. I will argue that the complex intersections of perceptions of gender, colour, shape, size, and other boundaries found in classifications of these fish offer ideas for the development of more organic and meaningful methods of studying colour categorization, prototype theory, and ethnobiology.

As proposed by Brent Berlin (1992:106-107), common semantic dimensions of folkbiological categorization are structured by the perceptually based parameters of colour, relative size, shape, habitat, habits, tastes, sex, smell, and analogy with some object. At the subgeneric taxa level, it is common to find principal differentiating dimensions encoded into the taxa names, often as attributives that modify generic names. I discuss these parameters with a focus on colour, size, and shape in relation to naming practices in Ono Channel villages for reef fish of the scientific *Scaridae* family. Colour is an important differentiating dimension with this group of fish. I begin with a review of some key studies on colour categorization and associated research to establish a base to discuss the fish categorizations.

ii) The Parameter of Colour

Brent Berlin and Paul Kay's well known 1969 study of cross-linguistic colour term comparisons attempted to establish human universal patterns for colour categorization. The authors proposed a common cross-cultural colour perception categorization system that expands to eleven basic colour term categories, which become, as users require, encoded into a given language in a somewhat predictable sequence. Noting Harold Conklin's (1955) advice that terms for colours encode more than just colorimetric information, Berlin, Kay, and associates asked speakers of 98 languages to state the colour terms of their language, before showing them a selection of colour chips to pick out the best colour matches or prototypes for their colour terms. Based on the results, the authors proposed the diachronic sequence of universal colour term language development shown in Figure 3.1. My research does not support their emergence sequence of the colour blue from yellow or green. Key criteria for recognition of a basic colour term are a stand-alone meaning not predictable by its parts, nor included in another colour term, high salience for informants, and no restrictions to a narrow class of objects such as hair or furniture (Berlin and Kay 1969:6).

Figure 3.1: Berlin and Kay's (1969:4) colour term progression.



Since 1969, this colour-term database project has expanded into the World Colour Survey (WCS) contributing to theories of categorization. George Lakoff (1987) provides a helpful summary of the theoretical progression. The key ideas still attract debate about colour perception and the presence of human universals, as will be discussed. The complex physiological aspect of human colour perception adds strength to the case for universal attributes. However, Barbara Saunders (2007:475) criticizes the key aspects of the universal and neurophysiological basis of the Berlin and Kay programme on the basis that colour categorization is learned through relational processes and what passes for a universal is just people's adoption of colour categorization systems already culturally naturalized. Saunders maintains that colour terms are fragments of meaning that do not exist outside of their context of use. Thus, having people categorize colour chips is meaningless and the idea of an evolving pathway of colour term use by a given society then positions people who use a small colour vocabulary at a lower evolutionary level, because they have not naturalized certain colour perception skills. Recognizing the risk of the present discussion slipping into extreme cultural relativism, I will consider how various colour theories relate to my research findings and suggest ways that colour perception studies that utilize colourful fish in place of colour chips provide contextualization and lessen the affect of technological categorization. In short, natural organisms, such as fish, may provide better insights into possible universal hard-wired categories than technologically derived colour chips, even if the fish are unfamiliar.

Paul Kay and Luisa Maffi (1999:745) justify the common use of smaller selections of lexical colour palettes in technologically simple societies on the basis that there are fewer natural items or artefacts distinguishable only by colour, with the exception of some closely related birds or fishes. Kay and Maffi do not expand on the bird and fish examples in their essay, but I will consider this idea below.

Kay and Maffi (1999:745-746) propose that most organisms or things possess other differences such as shape, size, texture, or movement that enter into categorization and descriptions, while technological objects like colour coded strands of electrical wire are identical, except for the important difference in specialist wire use between the black, white, or green strands. Electrical wire choices are examples of practical applications for colour categorization. However, does the broad use of categories of things differentiated by colour alone feed into what psychologist and neuroscientist Daniel J. Letivin (2008:17) describes in respect to relational processing of musical patterns, as the human brain's propensity of quickly categorizing and guessing the rest? The term 'prehension' has been applied to this phenomena by Roy Ellen (2006:27-30), and is defined here in the Introduction. Colour-only classification may be a prehension shortcut, or what I will term *simple prehension* as opposed to *complex prehension*. Therefore, if we practice colour-only simple categorizing and then apply this to complex organisms, does this then lead to devolution of in-depth knowledge of the natural world? An obvious example of this is the practice of classifying other humans into skin-tone based stereotyped racial groups. Does human categorization of organisms by colour alone then reflect an intersection of our brains seeking categorical shortcuts and technology-influenced over-emphasis on colour categorization?

While there is much evidence for societies adding terms for colours and expanding a linguistically defined colour categorization system with some universal features, this does not need to be seen as an evolutionary model at all. In fact, we may just be trading off knowledge and thinking processes of one sort in favour of another, as we deal with increased complexity levels by choosing simple categorization strategies at the expense of in-depth observation, communication, and paying attention to contextual knowledge. This adaptive strategy drove the development of Linnaean categorization in the first place, as a reaction to explorers bringing a large influx of un-described specimens of plants and animals back to Europe from around the world. The classification structure that resulted reflects classification and scientific naming of organisms outside of their natural environmental context. Saunders (2007) is concerned that false preconceptions underlie attempts to establish colour categorization as a human universal. One of these false preconceptions is considering an expanding colour categorization system in a society as evolutionary progress. If we agree that colour-only categorization reduces the attention that we pay to the context, detail, and ecological role of the organism, we then have a contrasting devolutionary digression. Are we thinking more about less, or less about more?

The significant use of colour terms in naming closely related fish, such as some coral reef fish in Fiji, provides opportunities to investigate the idea of Kay and Maffi (1999:745) that few people describe organisms in the natural world by colour alone. An interesting component of my study results is the varied and conflicting application of colour terms to fishes by the interview population. In order to consider validity of the results and reasons for variations, I will further review some key sources on colour perception, categorization, and terminology.

Kay and Maffi (1999) review research that supports the validity of Berlin and Kay's (1969:5) assertion that languages "gain colour terms in a partially fixed order," but languages seldom lose colour terms at all. The use of a single term for blue-green, referred to as *grue* in English, is a common practice in many languages used in tropical countries located within an average deviation from the equator of 16 degrees (Bornstein 2007:17). Kadavu and Ono are located between 18 and 19 degrees south of the equator. Observations that refer to Kadavu villages reflect 53 interviews in only three of Kadavu's 75 villages and two interviews from Nakasaleka village. My Ono records refer to 21 interviews from the side-by-side villages of Waisomo and Vabea along with two interviews from each of Narikosa village and nearby Buliya Island village. The term Ono Channel villages refers to all villages surveyed, although both of the two-interview villages are not right on the Channel. All villages are in the Nakasaleka district and language group (Pawley 1982:38).

In the Kadavu villages, I heard little use of the term *drokadroka* for green, as listed in the travelers' phrase book by Geraghty (2008). I am told that Kadavu people use the Fijian term for blue, *karakarawa,* for blue and green. In total only three people use *drokadroka* as an attributive in a fish name and they were all from Ono. In these three uses, the term *drokadroka* modified *kakarawa* or *kamotu*, two common parrotfish names.

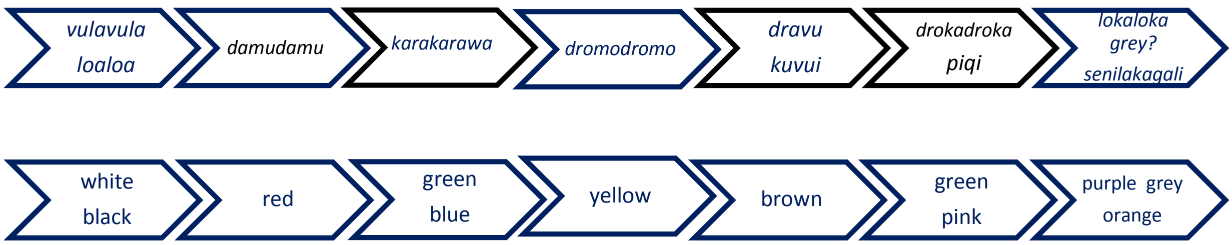
The assumption that *karakarawa* is the traditional word for green and blue, or grue, is supported by Richardson's 1811 record of *karakarawa* for green or blue, Endicott's 1831 record of *a droka* for raw, and *karakarawa* for green colour, Osborn's 1833 record of *karakarawa* for grue (Schütz 1985:581, 604, 611), Hazelwood's *karakarawa* dictionary definition of green, purple, or blue, with *drokadroka* defined as "green, as of wood" (1872:49), and Capell's dictionary confirmation of the use of *karakarawa* for green and blue. As per Capell, *drokadroka* describes green wood or as cō *drokadroka* to mean green or raw grass (Capell 1968:60, 85). I noted that in 1831 Endicott grouped blue with black as *loaloa* (Schütz 1985:604). Current standard Fijian colour terms are listed in Figure 3.3 below. Of the 22 people on Ono who told me about their use of colour terms for green and blue, 19 people used *drokadroka* for green, as distinct from *karakarawa* for blue. This number may be a little high, as I was unaware of the term's possible application to grass, and I asked a few people to name the colour of some immediately visible grass to help determine green and blue category separation. Given Kay and Maffi's (1999) confirmation of Berlin and Kay's (1969) assertions that languages gain colours but do not lose them, it would seem that *drokadroka* has been adopted on Ono as a colour term, but less so on Kadavu. Paul Geraghty (1983:316) confirms Ono's recent history of language borrowing from the Rewan dialect on the main island of Viti Levu and consequent language crossovers to Kadavu from Ono. However, the pattern of a green term splitting off from the blue term contrasts Berlin and Kay's (1969:4) proposed sequence that a term for green is the core term and a blue term is added on as colour term use diverges, as shown in Figure 3.1. Further diachronic inquiries in Kadavu regarding people's use of *drokadroka* and other colour terms may provide a simple language change monitor in Kadavu.

In Kadavu and Ono, people when speaking English or Fijian use the term '*greenfish*' for the sea cucumber, *Stichopus chloronotus*. This may be a wildcard term that is not otherwise connected to colour descriptions, and this may also occur in other languages as far away as the Torres Strait (Raudzens 2007:18). Many people that I interviewed in Fiji knew Fijian names for a dozen other sea cucumbers, but still applied the name *greenfish* to *S. chloronotus*. Some people used the term *amberfish* for the sea cucumber species *Thelenota anax*, as is used in the Torres Strait, but no one that I queried in the Ono Channel area seemed to know the word amber as a colour term. The collection of sea cucumbers for sale to Asia via traders has been a thriving industry in Fiji for at least two hundred years (Cary 1972).

Adoption of these names may reflect trading terms. I found a single reference to the term *ambure* recorded for the colour yellow by Richardson in 1811 (Schütz 1985:581), but none of the other early lists compiled by Schütz refer to the colour yellow except in Endicott's 1831 grouping of yellow with white under *i vula*, an established term for white, and for the moon (Schütz 1985:603-604). The dictionaries of Hazelwood (1872:37) and Capell (1968:61) both apply the current term *dromodromo* to yellow, a term well used as a fish name attributive for yellow and orange colours. From what I have seen of pictures and dried specimens, live *greenfish* are black and brown when dried, as in Picture 4.6, and amberfish are red (Colin and Arneson 1995:262). These examples of sea cucumber names illustrate how colour terms travel through long distance trade with little relevance to the associated colour. This is less likely to occur with names of fishes harvested in inshore fisheries for consumption or local trade. As to just why the English terms for sedentary sea cucumbers include the word fish is a good question for another day.

Drawing upon the frequency of colour term usage recorded in Figure 3.4 below, and the historical accounts reviewed, I provide a preliminary and general estimate of development of colour terminology in the Ono Channel villages, as below in Figure 3.2. By the broad use of *dromodromo* or yellow as a attributive in fish names as shown below in Figure 3.4, and confirmed in Hazelwood's 1872 dictionary, I surmise that the term *dromodromo* has been in use since at least the mid 1800s when missionary work began in Fiji, well before the adoption of *drokadroka* for the colour green. I will discuss the reduplication of colour terms later, as this varies among speakers and applications.

Figure 3.2: Estimates of Fijian colour terminology development in Ono Channel villages, Fiji.



As I interviewed people in Fiji, I was intrigued by the inconsistent use of colour modifiers found in fish names. Local parrotfish come in many colours. Multiple colours on the same fish attracted different colour modifier applications from different people. Webster and Kay (2007:49) confirm WCS results demonstrating that variation of inter-individual in-language focal colour term application can exceed cross language variation. Possible human physiological cause factors are variations in the lens, macular density, and the relative number of cone receptors. While visual perception is determined in the brain, this occurs after the rod and cone visual pigments absorb the light passing into the eye and convert it into electricity (Goldstein 2007:29-41). Density of pigment levels in the lens increases with age making short spectrum wavelengths like blue harder to distinguish. Webster and Kay (2007) dispute Lindsay and Brown's (2002) assertion that excess sunlight driven lens pigment increases and retinal damage as causes for conflating green and blue terms, on the grounds that this cannot account for in-population variation. In a broader explanation, Lakoff (1987:30) suggests a fuzzy set model for colour perception that allows for neuro-physiological variances as universal generative mechanisms. Cognitive variance may then result in perceptions by different people of different focal points within colour categories and differing category parameters.

My anecdotal observations from discussing the pictures with people was that older Fijians had quite good close-up vision for their age, but older people struggled with some underwater photos taken without flash or at distances that yielded strong blue backgrounds and blue casts on the fish. This would support Bornstein's (2007:14-17) proposal that increased UVB rays at the equator drive increased yellow pigmentation absorption in pre-retinal filters over time, resulting in good visual acuity, but decreased perception of short wavelengths. From these reports, it seems that colour perception has a physiological basis, but perception and categorization of colour reflects interplay between cognitive, environmental, cultural, and linguistic factors (Webster and Kay 2007:50). Furthermore, colour perception patterns may be a moving matrix as per the evidence reviewed by Webster and Kay (2007:36-37) of ongoing human colour perception adaptation by individuals to arid or lush environments, and even adaptation of colour perception to seasonal variations with foliage changes.

Fiji has two major Fijian language groups, over 300 dialects, and many communalects, which may comprise a village or group of villages. Standard or Bauan Fijian is the language that was chosen by missionaries for biblical translation in 1843 (Tomlinson 2009:39), and also adopted for bureaucratic purposes. Figures 3.3 and 3.4 compare some standard Fijian and Ono Channel colour terms below. It is worth noting that *kala*, the Fijian word for colour, is identified by Schütz (1978:45) as an English loanword. Conklin (1955:339) notes the lack of a term for colour in many languages including Hanunóo.

Figure 3.3: Colour term translations from Fijian Lonely Planet Phrasebook (Geraghty 2008).

Standard Fijian colour terms	English
braun, masikuvui	brown
butō	dark
damudamu	red
drokadroka	green
dromodromo	yellow
karakarawa	blue
loaloa	black
lokaloka	purple
piqi	pink
rārama	light
seninawanawa	orange
vulavula	white

Fijian pronunciation tips
(Calamia 2008:10-11)
b 'mb' as in 'thumb
c 'th' as in 'this'
d 'nd' as in 'candy'
g 'ng' as in 'wing'
q 'ngg' as in 'anger'
a as in 'father'
e as in 'bed'
i as in 'machine'
o as in 'core'
u as in 'true

Figure 3.4: Colour terms recorded by Gordon during fish name recording project in 2009.

Kadavu colour terms (used only as attributives*)	English equivalent	# of times used in fish names
damu	red	128
damudamu	red	total (134) 6
dravu	brown or covered with ashes	10
dravudravu	brown or covered with ashes in Matuka Island, Lau	0
drodrolagi	rainbow	3
drokadroka	green (recorded in Ono only)	3
dromo	yellow	152
dromodromo	yellow	total (245) 93
greenfish (exception)	common name used for a sea cucumber type	75
karakarawa or karawa	blue/green	9

Kadavu colour terms (used only as attributives*)	**English equivalent**	**# of times used in fish names**
karakarawa takali	dark blue/deep sea	In conversation
kuvui	brown (abbreviation of *masikuvui*?)	In conversation
loa	black (385 of 492 uses are within the name ikaloa)	492
loaloa	black: used as a sea cucumber name	total (512) 20
lokaloka	purple: one use as *kamotu* modifier in Kadavu	1
piqi	pink: two users as modifier for sea cucumbers	6
senilagakali	orange (*dromo / dromodromo* often used instead)	0
vula	white, white spots, or the moon	234
vulavula	white or white spots	total (237) 3

*Ryan (2000:132) confirms the use of *karawa* for Mako sharks (*Isurus oxyrinchus*) and Grey reef sharks (*Carcharhinus amblyrhynchos*).

Reduplicated colour terms are broken out from single colour terms for the reader's benefit in Figures 3.3 and 3.4. I queried a number of people on the significance of using the single or double term such as *damu* versus *damudamu* and I was told consistently that there was no difference. Maxwell Churchward (1941:81) differs, stating that Fijian reduplication reflects repetition, frequency, or plurality among others things, and gives the example of *vula* meaning moon and *vulavula* meaning the colour white. Reduplication may also reflect similarity (Gregory Forth: personal communication 2010). I consider reduplicated fish names like *kawakawa* or *corocoro* as uninomials in this study. Figure 3.4 shows the common colour terms used most often as modifiers in binomial names recorded. Alternate use of the term *vula* for the moon renders this term suspect as a basic colour term under Berlin and Kay's (1969:6) definition. Terms for the colour orange, *senilagakali* and *seninawanawa* are included in Figures 3.3 and 3.4 to highlight language differences in Kadavuan from Bauan Fijian. Both terms begin with *seni* which Capell (1968:190) records as a prefix for several plants. I found *seni* to be used as a prefix for a number of fish such as *senigaragara* or *senikawakawa* to indicate smaller size. Capell (1968:109) translates *lagakali* as a term for, an endangered Pacific Island mahogany tree (*Aglaia saltatorum*)(Wikipedia 3.1), and *nawanawa* as a term for a common Indo-Pacific tree in the borage family with floating fruit and bright orange flowers (*Cordia subcordata*)(Wikipedia 3.2). Are *senilakagali* and *seninawanawa* examples of parallel colour term additions to Fijian dialects?

The most common colour terms used in names for marine animals in Ono Channel villages are white, black, red, and yellow. Given that, these animals live in a blue-green environment it may be a natural reaction to focus on colours that contrast with the environment, when using colours to differentiate fishes. Blue/green, or grue, is evident in the uninomial parrotfish name *kakarawa*. I consider *ikaloa*, or blackfish as a uninomial, as the term names a number of small fishes of the scientific Acanthuridae family, which may be brown, blue, or even yellow. I discuss how shape, deportment, and behaviour take precedence over colour to define the category of *ikaloa* in Chapter 5. However, the meaning of a compound word, such as *ikaloa*, is often not predictable from the parts (Lakoff 1987:147).

Figure 3.4 shows the absence of use of orange and grey, and minimal use of *lokaloka* or purple, and *piqi* or pink in fish names. These are the last four colours in Berlin and Kay's (1969:4) proposed sequence of expanding basic colour term use. The colours consistently recorded by early visitors to Fiji and compiled by Schütz (1985) are *damu, karakarawa, loaloa,* and *vula*. Hooper (1994) and Osmond (in press) have established that fish names are more stable linguistic terms than average across the Pacific. There is an argument that fish names and naming practices could contribute to colour perception surveys in a unique contextual way. If Kay and Maffi (1999) are correct that expanding linguistic colour term palettes reflect increases in use of technological items, which are identical except for colour variation, then would it not make sense to use biological organisms that have high degrees of colour differentiation to understand how people do perceive colour, rather than using Munsell chips to understand how people are being taught to perceive colour? The Munsell chip method is important, but it may be a different kettle of fish altogether.

Use of the term *kakarawa* in Kadavu and Ono for parrotfish draws on the term *kaka* for parrots in Fiji, of the scientific genus *Prosopeia,* and *karakarawa* for blue. As shown in Figure 8 below, *kakarawa* is often applied to green or blue kinds, or colour phases of parrotfish. In Australia National University's Proto-Oceanic language reconstruction project, Osmond (in press:66) confirms *makarawa* or *karawa* as root terms for green/blue colour, and as root terms for the green parrotfish. In Kadavu, the term *karawa* came up as a short form for *karakarawa* on occasion. The term *karawa* also applies in Fijian to certain sharks, as shown in Figure 3.4 (Ryan 2000:132). The linguistic comparison to the onomatopoeic term for *kaka*, used in Fiji for the scientific genus of *Prosopeia* parrots (Geraghty 2007:130), is appropriate for *kakarawa* fish, as will be discussed further in the section dealing with shape. In the discussion to follow, I use the standard terminology and abbreviations to describe parrotfish life phases of juvenile phase (JP), intermediate phase (IP), and terminal phase (TP). Some scientific species of parrotfish have more than one intermediate phase and / or terminal phase variation.

I questioned people about how they told the difference between *kakarawa* and *kamotu*, as well as the other popular names applied to parrotfish such as *ulurua*, *ulavi,* and others, in order to get a sense of people's views of their own perception parameters. Based on two separate picture sorting exercises performed by two elders and by a group of four youths, various conversations, and interview results, parrotfish comprise a covert taxon of fishes, which may overlap with some wrasses (*Labridae*). Andrew Pawley (2008:13) notes that it is rare to find generic terms in Oceanic languages for fish of the scientific *Scaridae* and *Labridae* families. I will discuss the importance of shape on external definition of the covert parrotfish category further on. Colour is an important dimensional parameter within this category, as I will demonstrate. Figures 3.5 and 3.6 below provide details about how people differentiated between similar kinds of fishes.

Before moving on to the dominant factors, it is worth explaining the touch and sound entries in Figures 3.5 and 3.6. The common and salient black and yellow marked intermediate phase (IP) of the Bicolour parrotfish (*Cetoscarus bicolor*) shown in Picture 3.2 is named *sovi ni kie* in Kadavu for its extra slimy skin, but in Ono it is named *kurukurulase* or "thunder coral" to reflect its noisy coral eating habits.

Yet, many kinds of parrotfish eat coral. Yellow and black colours attract attention, which explains their common use to warn of highway curves and other dangers. Given the distinctive colouration of the Bicolor parrotfish, earning its Latin and English names, I was surprised that just three colour modifier applications, of only the term *loa*, were recorded from 131 responses to viewings of two different pictures of this fish. The Latin and English term bicolor may derive from the white and orange solitary and elusive 5 to 9 centimetre juvenile phase (JP) shown in Picture 3.1, which no one recognized in the first 17 interviews, before I replaced it with a more recognizable image.

Bicolor parrotfish (*Cetoscarus bicolour*): The three growth and colour phases.

Pictures 3.1: juvenile phase (JP) (Allen et al 2003:179) **3.2** intermediate phases (IP) taken without flash (Gordon 2009) **3.3** terminal phase (TP) (Allen et al 2003:179)

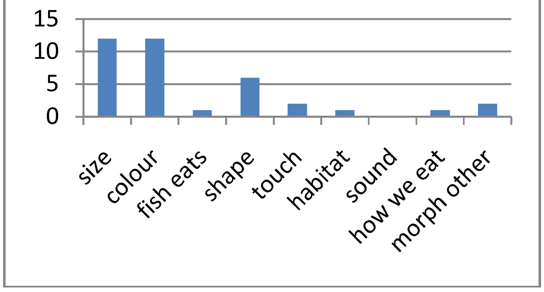


Figure 3.5: 37 parrotfish ID factors given in 21 Kadavu interviews.

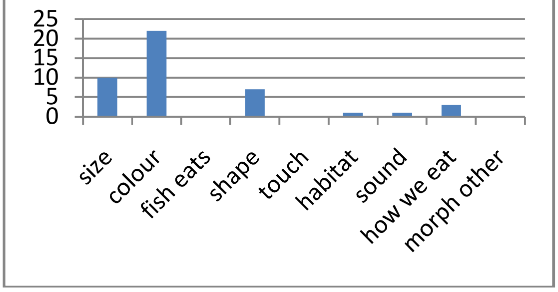
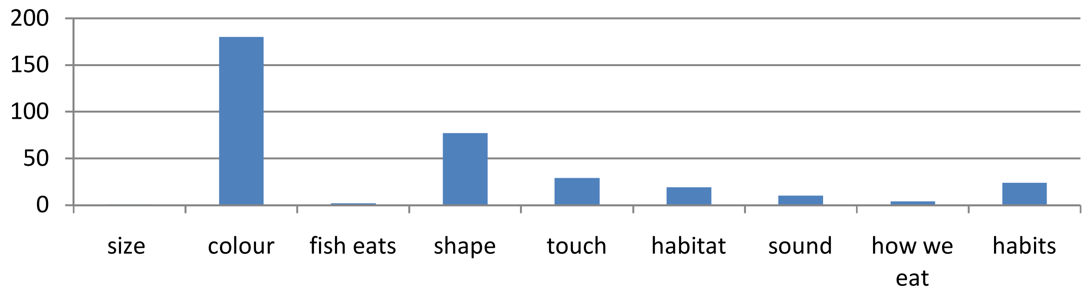


Figure 3.6: 44 parrotfish ID factors given in 23 Ono interviews.

Note on Figures 3.5 and 3.6: 'morph other' refers to morphological features not listed in the charts.

Figures 3.5 and 3.6 show that colour, size, and shape are the dominant categorization factors with equal weight given to size and colour in Kadavu responses, in contrast with Ono opinions that colour is much more important in differentiating kinds of parrotfish. A higher percentage of Ono interviewees are active fishers than were Kadavu interviewees, which could influence cross-channel variances.

Figure 3.7: 346 parrotfish binomial modifier types used in Kadavu and Ono



The responses shown in Figures 3.5, 3.6, and 3.7 provide an opportunity to compare the factors that people volunteer as categorization tools and their actual terminology used to name the fishes. Figure 3.7 differs in several ways with Figures 3.5 and 3.6, in that size modifiers are inconsequential, colour dominates, habits are added, and shape is significant, but this is skewed by the name *[baji]bati lumi* meaning plant tooth, which represents 80% of the shape responses, and should perhaps be considered as a uninomial.

The interesting question here is why the secondary lexemes for parrotfish do not include size. Size modifiers, such as *seni*, small; *lailai*, small; and *levu*, large, are common features in Fijian fish names and used in many contexts. Examples include the terms: Viti Levu, applied to the main island in Fiji, Lagalevu, a Kadavu village, and *valelailai* translated as small house, but meaning a bathroom. Is size a covert parameter for parrotfish in Fiji?

An analysis of the use of binomials versus uninomials and in particular the secondary lexemes used as attributives or modifiers in naming a fish kind provides insights. The data in Figure 3.8 supports the emphasis on colour in modifier choice. This chart reflects the first choice name consensus (FCNC) for each kind summarized from 80 interviews, as people viewed and named 36 pictures in a field guide (Allen et al 2003), representing unique colour and growth phases of 17 scientific species of parrotfish.

Figure 3.8: Total uses of common uninomial (U) parrotfish names by pictures (pics) and associated secondary lexemes (SL). First Choice Name Consensus is by village group. FCNC terms are in bold.

common U names	total # of pics given this U	# of pics given this U + SL	# of this U uses alone	# of this U uses with SL	# unique SL/U	# unique SL colour terms/U
bajilumi	17	0	23	0	0	
batilumi	23	0	37	0	0	
bose	23	4	26	4	3	3
drevu	14	1	24	1	1	1
lauwi	10	2	45	2	2	1
kakarawa	34	24	860	29	19	12
kamotu	36	71	726	150	24	15
ulavi	25	12	191	12	6	8
ulurua	16	3	115	7	3	3
total			2047	205		

110 unique names are on record for this group of pictures including 35 uninomials and 75 binomials, which often included one of the uninomials. In total, 2570 names are on record for these 36 pictures with 1701 names from Kadavu people in 55 interviews and 869 names from Ono and Buliya people in 25 interviews, providing a broad sample. Discounting some names that are applied a very few times, which may be misidentifications, there are 22 uninomial names recorded for the Scaridae family images. This number suggests that this study has achieved a thorough inventory of names when compared against the total of 16 names, including binomials, recorded by Andrew Pawley (2008:13) in Wayan Fijian for fish of the Scaridae family, alongside the development of a Wayan dictionary.

Tabulated responses for each population yielded the most popular name for each picture, along with a second choice, if it represented a relatively substantial percentage of responses. In order to identify the names most often used for each kind of fish or animal picture shown, marine animal image identification responses were tabulated separately for the people from Kadavu villages and Ono villages, and a first choice name consensus (FCNC) was established for each image. I established the method and term 'first choice name consensus' in this analysis as a tool to organize the large amount of data collected and to provide feedback to interviewees on results. Further details of FCNC methods are provided in Chapter 2.

First choice name consensus levels varied between fish pictures, as shown in Figure 3.9. Agreement on first choices was significantly higher in Ono at a mean of 59%, as compared to 44% in Kadavu, while both groups had a 20% mean agreement level on second choices. Not being able to identify a picture is a valid response in the percentages, but not an item of agreement. Most people interviewed in the Ono sample live quite close together, while the Kadavu villages are some distance from each other, so greater in-group interaction may explain higher consensus levels, although second choice consensus levels match.

Figure 3.9: First choice name consensus (FCNC) for parrotfish by village group

Village group	mean	minimum	maximum	standard deviation
first choice Kadavu	44%	15%	67%	14
first choice Ono	59%	24%	88%	15
second choice Kadavu	20%	11%	29%	5
second choice Ono	20%	12%	28%	6

First choice names in both populations for all of the 36 pictures are listed in Figure 3.8 and consist of nine unique uninomials that show up 2047 times, and also form the base of a further 205 binomials. Agreement levels on first choices are high between the two populations, in particular for the terms *kakarawa* and *kamotu* that comprise 1585 out of the 2570 total names recorded for the group. Is there a prototype name for parrotfish? *Kakarawa* is the most common uninomial at 860 uses, but attracts a modifier only 29 times in a total of 889 uses as a uninomial or binomial root, and *kakarawa* does not attract *kamotu* as a secondary lexeme. In contrast, *kamotu* at 760 uninomial uses, attracts secondary lexemes 150 times, including *kakarawa* twice, and *karakarawa* or *karawa*, the related term for blue or green blue six times, for a total of 876 uses. Clearly, blue and green parrotfish are most often called *kakarawa*, while *kamotu* is most often applied to brown, yellow, red, and black parrotfish. Does the linguistic and semantic relationship between the term *kakarawa* and the colour term *karakarawa* preclude the requirement of a colour based modifier for *kakarawa*? The opposing colour contrasts of blue versus yellow, and red versus green are built into this naming dichotomy, matching the human neural system's fundamental blue-yellow and red-green *opponent response cells*, which determine colour hue perception (Lakoff 1987:26).

iii) <u>The Parameter of Colour: Summary</u>

Parrotfish provide a rich media to undertake colour studies. Few natural objects come in such varied hues of colour. Anders Steinvall (2007:348) points out a key weakness in traditional colour studies, such as the World Color Survey, in that the use of colour chips takes the colour out of context in a way that, as Kay and Maffi (1999) state, only members of a technologically well developed society have experienced.

Does colour term use support the Whorfian idea that language affects non-linguistic behaviour? Lakoff (1987:330-334) considers the Kay and Kempton (1984) experiment, where blue / green colour chip sorting exercises contrasted choices of English speakers with Mexican Tarahumara speakers who have a single word for green and blue, to support an argument that language is an integral component of cognitive categorization, rather than an after-the-fact labeling tool. However, I wonder what difference in meaning and context did the colour chips provide the Tarahumara speakers in contrast to the English speakers who were more accustomed to using only colour as a singular sorting method?

One interesting point in my research is that participants state size as a key factor in parrotfish classification in both populations, but there is only one response among 75 uses of binomial names that refers to size, and from my records, it may have been made up on the spot. Given that the terms *levu* for large and *lailai* for small are used a lot in Fijian discourse, and size is a category marker for parrotfish, people must associate or prehend certain uninomial names with certain sizes of fish. In contrast, colour terms comprise 12 of the 19 referent secondary lexemes applied to *kakarawa* and 15 of 24 attributive modifiers for *kamotu*. Barnett (1978:57) provides five modifiers that determine fish kinds for the To'ambaita parrotfish term *kosa*, all of which are colour terms.

Colour matters in Ono Channel fish categorization, providing insights into possible study models for colour categorization perception using biological organisms. A simple test of this would be to query people for their colour terms as Berlin and Kay did in 1969, but next present people with colourful fish images for colour term naming, before offering Munsell chips of colours similar to the fish images for comparative naming. Other tests include sorting of fish images as compared to colour tile grouping and more specific tests similar to Kay and Kempton's (1984) comparison could compare responses of English speakers and non-English speakers. Comparisons of people who have experience observing fishes contrasted with novices from the same social group could test for the affect of folkbiological knowledge on colour perception.

iv) <u>The Parameter of Size</u>

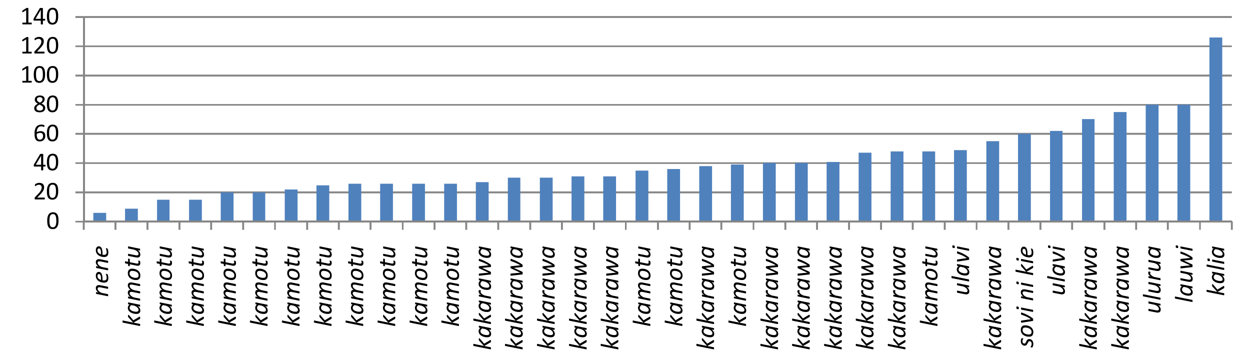
As shown in Figures 3.5, 3.6, and 3.7, people confirmed size as a factor in subdividing parrotfish types, despite not providing any significant size referents in uninominal or binomial names during specific fish kind identification. Inquiries into general ranking of fish names by size yielded 18 responses that fell consistently along the relative fish size pattern shown in Figure 3.10. The three exceptions were: one opinion that *kamotu* and *kakarawa* were the same size, another that *ulurua* and *kakarawa* were the same size, and a third person positioned *ulurua* as smaller than *lauwi*, but larger than *kakarawa*. Specific answers as to size classification of *nene* were not elicited, as the term is broadly applied to a number of small five to nine centimetre long black and white parrotfish, wrasses, and other kinds of fish.

Figure 3.10: What people said about the relative sizes of parrotfish kinds by first choice name consensus (FCNC). Terminal Phase (TP), Intermediate Phase (IP)

relative placement on a size scale	Fish kinds: FCNCs only	Average maximum size (Allen et al 2003) of kinds in all pictures viewed and given these names as FCNC	Gordon's 2009 observations of relative abundance on inshore and barrier reefs
largest	*kalia:* *Bolbometropon muricatum*	126 cm	Rare: many people had never seen this fish. The picture drew special interest from most people
large	*lauwi*, *ulavi*, or *ulurua* various kinds *lauwi*: *C. bicolour* TP	*ulurua*: 80 cm *ulavi*: 68.5 cm *lauwi*: 80 cm	Rare on the inshore reefs. Regular sightings on the outer reef.
medium	*kakarawa:* various kinds most often TPs	49 cm	Some inshore reef sightings. More outer reef sightings.
smallest	*kamotu:* various kinds most often IPs	32 cm	Very common on inner and outer reefs.

In order to determine if the fish names applied to each image show consistency with actual sizes of the fish, Figure 3.11 shows the first choice name consensus (FCNC) given for each fish and the maximum size given by the field guide for the particular life phase of the fish shown (Allen et al 2003). Kadavu results shown in Figure 3.11 are similar for Ono. There is consistency between relative size placement in Figure 3.10 and actual fish sizes of FCNC fish images in Figure 3.11.

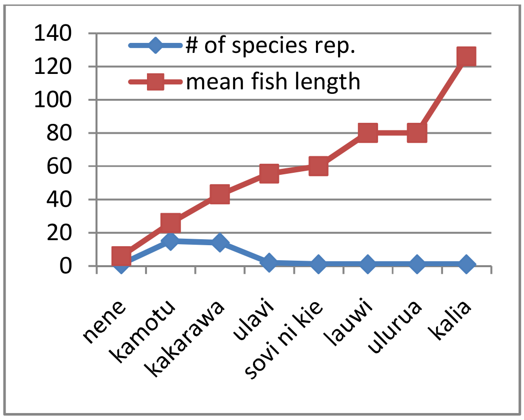
Figure 3.11: Kadavu FCNC fish kind maximum sizes in cm (Allen et al 2003)

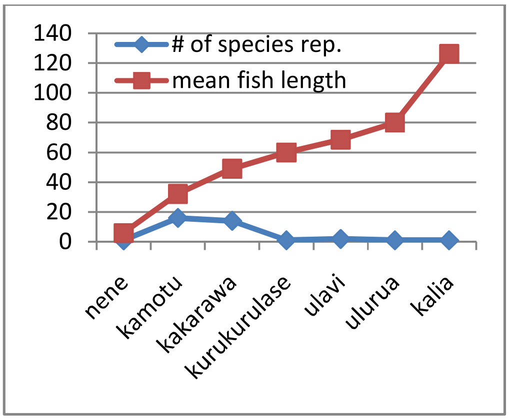


Figures 3.12 and 3.13 show the mean size of the fish given for each first choice name consensus (FCNC) and the total number of scientific Scaridae fish species given a single Fijian FCNC name. The

graphs show that the terms *kamotu* and *kakarawa* are often the first choice name consensus for multiple species of smaller size fishes. The other FCNC names are applied to a single scientific species in the responses in this study; however, not all endemic Scaridae scientific species were shown, so there may be one or two more species described by each Fijian name. *Nene* is applied to many non-Scaridae scientific species including members of the Cardinalfish of the large Apogonidae family (Calamia et al 2008), which I suspect would rival the 14 to 16 species described by *kamotu* and *kakarawa*.

Figure 3.12: Kadavu responses **Figure 3.13:** Ono responses
Mean fish length in centimetres and the number of scientific species represented by first choice name consensus (FCNC) for each Fijian name.





Excluding *nene*, Figures 3.11, 3.12, and 3.13 illustrate that people lump small and medium sized scientific species of parrotfish into broad categories, while the larger sized species receive more diverse names. I estimate that the names *kalia* for *B. muricatum,* and *kurokurolase* or *sovi ni kie* for *Cetoscarus bicolour* intermediate phase (IP) are monotypic and the other Fijian names listed are polytypic, given their broader use by people for various kinds of parrotfish. The two monotypic kinds in the folkbiology model match the monotypic Scaridae genera in Linnaean classification as per Randall (2005:444). This is worthy of note given the many re-classifications of Scaridae by ichthyologists. However, the polytypic *kakarawa* and *kamotu* kinds are a different matter. Gender related colour phase differences within scientific species complicate attempts to relate species recognition to folkbiological naming, as the gender colour links are tenuous. *Kakarawa* often represents the colourful male terminal phase of a parrotfish scientific species, while *kamotu* often represents the blander intermediate and assumed to be female stage of the same species, but not by intention. *Kakarawa* is applied as first choice name consensus to at least one phase of 14 scientific species in three genera; *kamotu* is applied to at least one phase of 12 scientific species in two genera, with frequent overlaps between *kakarawa* and other first choice name consensus types. Pictures 3.4 and 3.5 show a terminal and juvenile phase of what I suspect is what Allen et al (2003) term the 'highly variable' scientific species *Chlorurus sordidus*, and provide examples of what most people would term respectively as *kakarawa* and *kamotu.*

Picture 3.4: *kakarawa* example.

Picture 3.5: *kamotu* example (no flash)

These results present an interesting folkbiological question. Is this a case of a folk taxon subdividing a Linnaean species? Berlin (1973:268) terms this phenomenon as *overdifferentiation*. While there are numerous examples in many languages of different names for male and female members of the same species, in this case local people do not know that *kakarawa* and *kamotu* are males and females of the same kind of fish. We know that a bull is clearly a male bovine, and a hen is a female chicken. To confuse the matter further, in many parrotfish species, intermediate phase (IP) fish often classed as *kamotu* are most often *diandric*, meaning that the IP includes immature males and mature females that look the same. In most species successful females undergo a hermaphroditic sex change and a colour change to reach full terminal phase (TP) maturity, where some males of diandric species with IP males change colour to reach the TP. Terminal phase males are the biggest, brightest, most aggressive and reproductively successful parrotfish, but also the least numerous (Allen et al 2003:174). I asked a number of Fijian people how to tell male and female *kakarawa* and *kamotu* apart and no one had any idea. Therefore, if people are not aware of sex differences as they clearly subdivide a Linnaean species, then they are overdifferentiating.

Given the number of species thus grouped under these terms, even beyond those selected for the survey, *kakarawa* and *kamotu* have high ecological salience on inshore and offshore reefs as shown in Figure 3.10, creating opportunities for human-parrotfish interaction. Eugene Hunn (1999) has demonstrated the significance of ecological salience and organism size in species recognition and naming. Ecological salience of an organism is a function of the likelihood of people noticing an organism, and for people and marine animals, this means people getting wet or having someone bring the animal home. Larger organisms with strong ecological salience levels are more likely to be differentiated. Hunn (1999) provides statistical models to correlate these factors positively with total salience by measuring what is termed as the scientific species ratio. Since the data that I collected have a relatively small range of sizes and components, I provide a simple analysis of the results. Figures 3.9, 3.11, 3.12, and 3.13 confirm that the larger scientific species of parrotfish are differentiated more than small ones in the fish identification naming responses, as do the size related responses to questions about how these fishes are differentiated. This result corresponds to Hunn's model of increased terminological recognition of biodiversity in tandem with increases in organism size.

In the Ono Channel between Kadavu and Ono there are at the very least 21 scientific species of parrotfish representing six genera based upon my underwater photos or observations, confirmed fishermen reports, and transect surveys by Obura and Mangubhai (2003). The 2009 survey sample contains 36 images of 17 scientific species, all of which have at least two distinct development stages with visible colour, size, and shape changes. 17 of the images are terminal phases (TP) and 17 are intermediate phases (IP), but not necessarily in matching pairs, as some species were represented by images of males only, and others have multiple IP phases. Excluding *nene*, the FCNC provides nine names describing 17 species, of which *kalia* describes one, and *sovi ni kie* or *kurukurulase* describe the IP phase of another. The remaining five names describe 16 species and likely other species found in the area, but not presented for naming. What is the prototype kind or best example of the covert category of parrotfish? Figure 3.14 provides a summary of frequency of name use as a uninominal and the mean maximum sizes of the kinds identified. Binomial use is dominated by various colour terms with some concentration of *dromodromo* or yellow with *kamotu*, reflecting similarities in the yellow intermediate phase (IP) of four scientific species.

Figure 3.14: First choice name consensus **(**FCNC) frequency of use and mean size of the fishes so named.

fish kind name	# of uninomial uses	# of binomial uses	# of total uses	mean size (cm)
kamotu	726	150	976	26
kakarawa	860	29	889	43
ulavi	191	12	203	55
ulurua	115	7	122	80
lauwi	45	2	47	80
nene	42	0	42	6
kalia	29	0	29	126
sovi ni kie	28	0	28	60
kurukurulase	10	0	10	60

Berlin (1992:112-113) provides support for large organism size as a key factor in prototype selection, but there are exceptions as Rosch (1978) and Hunn (2008) found with birds. However, Hunn's Zapotec informants did not consider chickens or vultures to actually be birds, whereas Fijians seem to recognize a covert category of parrotfish that matches the English term parrotfish, and people used *kakarawa* or *kamotu* most often in conversations about the category. This reflects frequency of FCNC use and probable ecological salience patterns, but does contradict ideas about the prominence of large size as the prototypical kind in this case. *Kakarawa* and *kamotu* are applied to the physically small and midsize fishes in the group, as *nene* is a common term applied to many small black cylindrical fishes including cardinalfish, juvenile wrasses, and parrotfish. The term *kamotu* was applied at some point as a uninomial for all 36 images and *kakarawa* was used for 34 images, except the two dark juvenile phases of *C. sordidus.*

As is common elsewhere, Fijians have a word to confirm true or real. *Dina* is often added to fish names such as *kawakawa dina* for the popular tasty grouper *Epinephelus polyphekadion.* In the parrotfish survey, out of 346 binomials, the only use of *dina* was by two people referring to the bright green and blue TP of *Scarus frenatus* as *kakarawa dina*, which has a maximum size of 47 centimetres. Two other people advised that *kamotu* was the correct name for the taxon of *kakarawa*, *kamotu*, ulavi and similar fish, while one person advised that the name *ulavi* served this purpose. Does the monotypic status of the larger *kalia* and *sovi ni kie* / *kurokurolase* preclude them from prototype status? Is there a prototypical parrotfish and if so what identifies it?

v) <u>The Parameter of Shape</u>

Body shape is the other significant factor alongside colour and size given by people to identify parrotfish. Shape is represented in the binomial attributives recorded. The comparison to *kaka*, or parrots, is appropriate for these fish, given their beak shaped head and mouth for rasping filamentous algae from dead coral (Allen et al 2003:174). The prominent protruding teeth and jaw distinguish parrotfish from most other fishes. The most unifying factor of the Scaridae family according to Randall (2005:443-444) is the fusion of the teeth into dental plates, which keep growing like a parrot beak. This feature differentiates the ten genera and 90 species of parrotfish from the related 68 genera wrasse or Labridae family. Other distinguishing features of the Scaridae are unique pharyngeal dentition structures for grinding, a lack of the predorsal or supraneural bones, no true stomach, a long intestine, and an herbivorous diet. The scientific genera of *Bolbometopon, Cetoscarus*, and *Chlorurus* have stronger jaws and remove coral or limestone during feeding and are termed *excavators*, versus other members of the Scaridae genera grouped as *scrapers* (Randall 2005:444). While the first two excavator genera are monotypic in Latin and Fijian categorization as mentioned, several members of the excavator *Chlorurus* genus are identified in my survey as *kakarawa* or *kamotu*, ruling out the use of this feeding behaviour as a clear folkbiological parameter. Ichthyologists struggle to differentiate among parrotfish species using pectoral fin ray counts, dentition, and in some cases only colour patterns, which may change upon removal of the fish from the water. As shown in Pictures 3.6 to 3.8, body shapes tend to be bullet shaped with shape and size variation between kinds, but parrotfish share a common primary reliance for movement on the pectoral fins, positioned astern of the gills. One might think of normal parrotfish movement as that of a helicopter, as compared to most other pelagic fishes as airplanes. The tail is used when high speed is needed to chase or escape (Randall 2005:444).

Picture 3.6: Streamlined bullet shape

Picture 3.7: Tapered bullet shape

Pictures 3.8 and 3.9: Humphead shape

People spoke of distinguishing different types of parrotfish by the shape of the head and horizontal profile body curves as shown in Pictures 3.6 to 3.8. Beyond the term [*baji*] *batilumi* which may be a uninomial, there were few binomial attributives referring to shape and with little consensus. Barnett (1978:53) proposes morphology and behaviour as the key tools for folkbiological fish categorization. It would seem that these factors apply to forming the covert category of parrotfish in Ono Channel villages, but further surveys would be required to determine whether the distinct feeding habits and dental structure are sufficient to demarcate parrotfish from wrasses in the local folkbiology. The names recorded for parrotfish include very few uses of attributives such as *ni takali*, of the deep; *ni cakau*, of the reef; *ni vanua*, of the inshore reef; and none of the term *nawa*, meaning to float, but used to describe schooling fish, like the surgeonfish kinds known as *ta*, discussed in Chapter 5.

vi) <u>Summary</u>

I have established the value of considering a new approach to considering colour perception models for classification studies, which considers at the very least a comparison with contextualized colour perceptions using biological organisms, rather than a complete reliance upon de-contextualized technological society constructed colour chips. This is even more topical for colour perception studies that relate to folkbiology, given the interest in understanding people's perceptions of their natural environment. Using biological organisms does add context, but it also adds new variables that may cloud results to some degree. However, the variables are a natural part of colour perception and need to be taken into account rather than excluded. Developing appropriate methods will require a trial and error approach to identify effective methodologies. This may require more sophisticated data management tools such as the soft computing model considered below for sorting out multiple prototypes.

Is there a parrotfish prototype for this complex category of fishes with variant body shapes, sizes, feeding habits, colours, habitats, and application of names? I suggest that there are at least two and arguably four possible prototypes representing a blend of too many factors to express in a typical linear fashion. Certainly, the beak similarity between parrots and parrotfish as embodied in the names *kaka* and *kakarawa* is significant and illustrated in the animal story recorded by Buell Quain (1942) in an inland village of Bua province in Vanua Levu, Fiji, where Flying-Fox has tricked Parrot into a long flight across the ocean to another island.

> "Now Parrot falls helplessly, hurtles into the sea. Now straightaway the parrot fish eat him. The beak of the parrot and the beak of the parrot fish are just alike; likewise their fangs (Quain 1942:215)

It would be interesting to know the Fijian term given to Quain in this story to describe parrot fish, which Quain writes as two words. However, this study has shown significant variation in term use for parrotfish that is not just attributable to morphology and demands more complex analysis.

Lakoff (1987:288-289) provides a useful review of possible prototype models that reflect various category structures. These models include a metaphoric or metonymic prototype that stands for a category, a radial model where the prototype contains the category's most common properties, a prototype generated by rule of best example from a category member, and a prototype with the highest degree of a given property such as height within a graded category. Another model is a classical category prototype, which has all of the properties of a feature bundle that best defines the category. However as Lakoff (1987) notes, these are pure cases of prototype definition and while mixed cases exist, Lakoff states that no theory or serious study of competing prototype precedence has been done.

Given, that prototypicality effects are critical to understanding the structure of ethnobiological classification (Berlin 1992:70), what are the options for understanding multiple prototype categories? A complex prototype model such as parrotfish categorization may mix together Lakoff's prototype models listed above, as individual people process by varying degrees the salient features, metonymic representations, and cultural values thus associated with the fish image or fish. During fish identification interviews, many people were concerned that they might not know the correct name for a given fish, assuming that there was a single right answer. My interpreters and I had quite an epiphany when we began to grasp the reality of categorization variation within these small communities, where I suspect people think they have a good idea of what others think and know, as they spend a lot of time communicating.

Linguistic description has limitations on communicating degrees of intensity of concepts as we have seen in the discussion of colour perception categorization. As Lakoff (1987:26-30) notes, Kay and McDaniel (1978) applied Lofti Zadeh's (1965) fuzzy set theory to people's variant perceptions of the colour spectrum. Thus, neighbouring categories of primary colours overlap to create intermediate memberships, which are the non-primary colours. These intermediate categories can be broken down almost indefinitely, as a trip to the local hardware store's paint mixing department will demonstrate. The fuzzy set model is suited for linear categorization. Parrotfish categorization in Fiji is anything but linear. Minimum first choice name consensus (FCNC) agreement rates of the less than 20%, shown in Figure 3.9 for some common fishes, within small long established close-knit communities, suggests diversity in metonymic and cognitive reasoning that is worth looking into.

What is required to understand this variation is a model capable of measuring finer degrees of variation such as fuzzy set theory offers, but on multiple trajectories. Lakoff (1987:454-455) gives an example of fuzzy categories in his example of possible variant image schemas communicated in the phrase "the plane is flying over the hill," as options abound as to precisely what the phrase means. Suppose we were to turn this into "a certain kind of plane is flying over the hill?" Now the listener must not only choose from various schemas about how far above the hill the plane is, and if it is directly overhead, or flying around the hill to some degree, but they must also consider how big the plane is, the shape, what kind of engines it uses and so on. This variation introduces a different vector of thought.

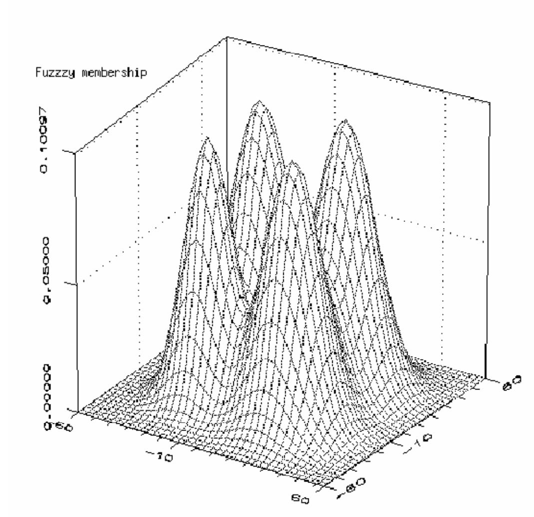
People identifying parrotfish in Fiji are drawing on multiple schemas in constructing this covert category and show more consistency in the unspoken qualifiers of shape and size than the colour dominated linguistic terms built into uninomials and used as attributives. Thus, to look for any order in this category we need a three dimensional multiple prototype model that can incorporate intersecting categorization schemas of colour, size, shape, metonymic representation, and cultural values.

This reflects an understanding of the perceptual process of recognizing an animal as a gestalt of features that one does not mentally list. Rodney Needham (1975) discusses the concept of polythetic classification, originally drawn from taxonomic studies, which allows category members to share a majority of common features, but not necessarily the same common features. This model allows for overlap between categories, such as in Ono Channel parrotfish taxonomy. Roy Ellen (2006:46-48) discusses polythetic classification to consider the problems of reducing a complex network of associations into a linear order, which can be represented on piece of paper. Ellen stresses that classification is more the sum of what Maclean and Ivimey-Cook (1956:2121) term 'qualitative sense data' that presents a person with a distinct entity rather than a certain number of features that relate to a prototype.

However, I suggest that when asking someone to name and by inference categorize an animal that they are not in the habit of frequently identifying by name, perhaps this request drives different cognitive processes that do pay more attention to parts than the whole, which could explain the variation in names and attributives for a given fish. The person may not consciously be aware of the parts as will be discussed further in Chapter 5. In this study I must question whether my Fijian language limitations, limit my ability to learn more of what Gregory Forth (2004:28) describes as 'simple distinctive features,' which Nage people bring up when talking about particular birds. Terms for these features, may not translate well and were not the focus for my interpreters. A further input in this equation is the emotional desire of interviewees to provide the 'right' answer. While I agree with Ellen (2006:47) that we must selectively reject attributes to make folk classifications manageable, perhaps we could establish a model that is more qualitatively and quantitatively selective.

Considering that the recognition of an organism belonging to a covert category with multiple parameters is going to involve multiple fuzzy sets, we might consider a recent conceptual advance in mathematics and soft computing known as *fuzzy prototype theory*. In soft computer science, fuzzy prototype theory attempts a more intuitive categorization model to group diverse data that belong together in less obvious ways. This method uses three dimensional multiple prototype models based on assessing and grouping typicality degrees around clusters and prototypes (Lesot et al 2005:128). Thus, a multiple prototype model utilizes three dimensions as in Figure 3.15 to shape information with more inclusive softer boundaries. The application of fuzzy prototype theory to ethnobiology studies is worth further consideration.

Figure 3.15: Infinite support fuzzy sets (Burdsall and Giraud-Carrier 1997:218)



Picture 3.10: Multiple parrotfish kinds, genders, and development phases

Chapter 4: The Naming and Classification of Sea Cucumbers in Kadavu and Ono

i) Introduction

The folkbiological analysis of sea cucumbers should be of particular interest to anthropologists interested in the South Pacific region, given the complex and lasting effects that the bêche-de-mer trade has had on Pacific Island societies and their natural environments. In Fiji the early 19th century acquisition of trade goods such as muskets, iron, and prestige goods by local people facilitated life style and social changes. Significant environmental change occurred upon the abrupt removal of large populations of algae consuming and filter feeding sea cucumbers from coral reefs for boiling and drying at length over wood fires. The consumption of firewood in the curing process resulted in considerable deforestation on some islands that is still in evidence today. I will review the folk taxonomy of sea cucumbers in the Kadavu Island Group in comparison to scientific taxonomy and some common trade names, but also consider the unique role that fluctuating human interest in these animals has had in shaping Fijian society. I will consider the role of utility in animal naming practices. Following conventional terminology I will use the term bêche-de-mer to refer to dead animals processed for commercial trade and, for live animals, use the terms sea cucumbers, holothurians (Kinch et al 2008), or a Fijian term *sasalu*. In this report I use the term *sasalu* for any kind of live sea cucumber, which is the usage definition of many Ono Channel villagers, ignoring for now the wider definition of *sasalu* by Calamia et al (2008).

The Pacific trade in sea cucumbers, or bêche-de-mer, had a significant affect on the exploration and early contact with Central and Western Pacific Island peoples by Western and East Asian traders seeking new sources of supply for Chinese markets. Bêche-de-mer is valued in Asia as a medicine, food, and soup item, as well as for supposed aphrodisiac properties, all of which continue to drive Asian demand today. Fiji proved to be a viable source of supply for this resource, previously little used by Fijians. Buyers in Canton and Manila set quality standards that demanded cooperation for extraction between British, French, and American traders, often shipping multinational crews, and the Fijians doing the collecting and much of the preparation of sea cucumbers for shipping. The early Fiji trade focused on northern Vanua Levu and south eastern Viti Levu Islands. The latter region's chiefs demanded regular patronage from Kadavu people (Thornley (2005), connecting them economically and socially.

There are 22 scientific species and one subspecies of sea cucumbers harvested commercially in Fiji (Kinch 2008:21). Some types are widely found, others have specific ranges. A number of other kinds exist, but have no trade or local value. The variety of sea cucumber kinds found in Fiji provide an interesting topic for ethnobiological analysis, when one considers: the complex Linnaean taxonomy of Class Holothuroidea, a Fijian nomenclature that reflects two hundred years of harvesting and export, and a set of widely used English trade names.

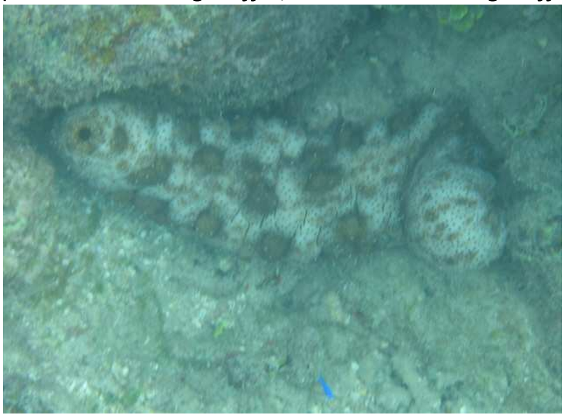
I will discuss the classification of sea cucumbers in the Kadavu Island Group and their economic, historic, and symbolic importance for people who draw much of their living from the sea. In my research in the Kadavu region, the identification of sea cucumbers during interviews consistently generated the most enthusiasm, in particular from women and children. A few older men showed less interest in sea cucumbers, but often people sitting on the sidelines of an interview would draw in closer to look at the pictures and express opinions. We most often covered the sea cucumbers last, but when people were losing interest in fish picture identification, we would switch to the sea cucumbers, before reviewing the last group of fish to better maintain people's enthusiasm. These animals are of great interest to people of all ages in the villages.

ii) <u>Taxonomy Overview</u>

In the Linnaean classification system, sea cucumbers, or Class Holothuroidae, are grouped in the 6000 scientific species strong Phylum Echinoderm, along with three Classes of sea stars, and the Class of sea urchins and sand dollars. Holothurians typically lay on their sides, using tube feet on their bottom side to get around, and tube feet modified as tentacles to feed off the bottom or filter feed (Colin and

Arneson 1995:237-238). Linnaean classification and identification of some kinds of sea cucumbers is challenging given their changeable body shapes, sizes, colours, and other adaptations to local environments. Colin and Arneson (1995) illustrate 26 members of the families Holothuridae and Stichopididae in the order Aspidochirotida, identifying four of these images only to the level of genus. Pictures 4.1 to 4.4 illustrate several Ono Channel sea cucumber types to demonstrate the effectiveness of their camouflage and amorphous body structure. My image naming identifications are estimates.

Picture 4.1: *melamela* / tigerfish? (*Pearsonothuria graeffei,* was *Bohadschia graeffei*)



Picture 4.2: A feeding melamela / tigerfish? (*Pearsonothuria graeffei,* was *Bohadschia graeffei*)

Picture 4.3: An unidentified type (*tarasea*?)

Picture 4.4: *vula* (*Bohadschia argus*)

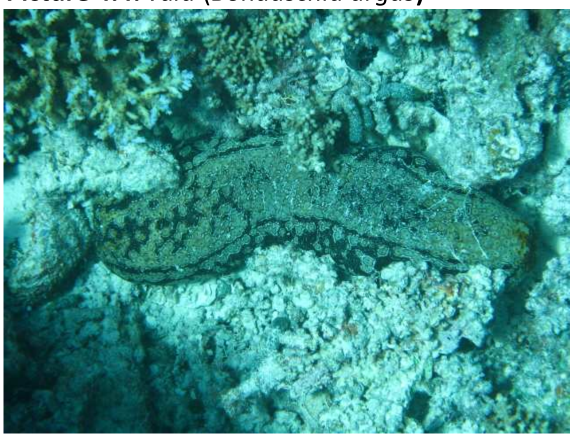
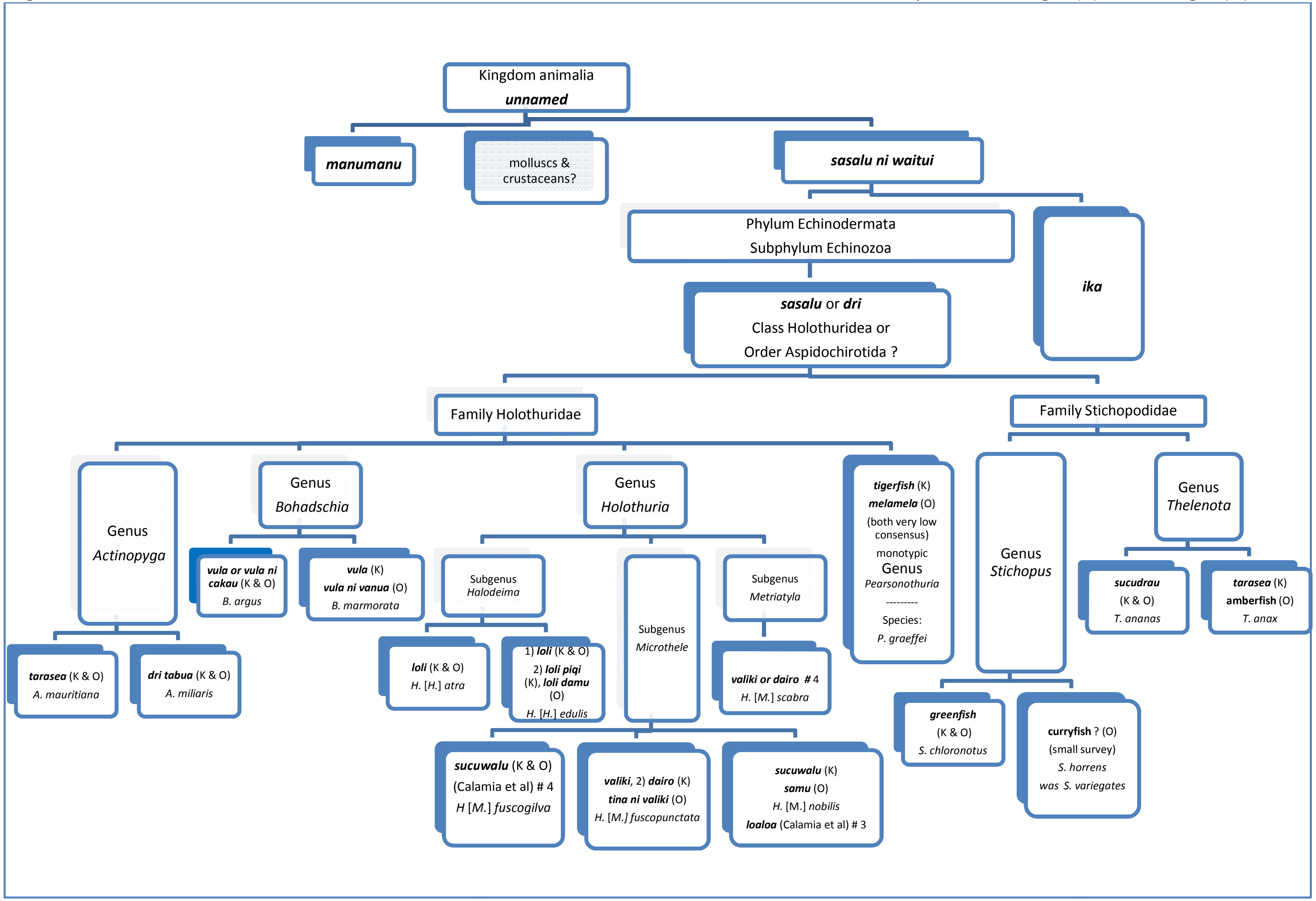


Figure 4.1 is a master chart of scientific and folk taxonomies for the sea cucumber kinds relevant to this study for use as a navigational chart and reference for the many names discussed.

Figure 4.1: Scientific and **folk taxonomies** of sea cucumbers or ***sasalu*** found on the Astrolabe Reef. Key: Kadavu villages (K). Ono villages (O).



For the present survey, nine of the 26 images are selected on confirmation of their local presence by Astrolabe Reef underwater transect survey identifications of Obura and Mangubhai (2003). Four other images of sea cucumber kinds known to be in the area are also used. An additional question used in the Ono interviews encouraged people to identify any other images that they recognized among other related field guide pictures. This led to people naming several other sea cucumbers, and sea urchin kinds, such as *cawaki*, which are popular snacks. Two of my own photos of sea cucumbers taken on reefs near Kadavu were shown for identification. I provide a list of images and names in chapter section 4.v. All images of dried animals are the author's, taken at the conclusion of the fieldwork. These images were not used for survey identification, but were identified upon shooting by a knowledgeable person, as captioned.

Certain types of sea cucumbers are in demand in the Orient for both their gonads and their dried body wall, the latter often known by the Malay term *trepang*. The term bêche-de-mer is well established to refer to dried sea cucumbers harvested for trade (Osborn 1833: 612, Kinch et al 2008:8), but the term bêche-de-mer was not familiar to many Kadavu area people, and only one person used it to describe a sea cucumber image. Many of the 45 Fijian names for holothurians collected in this research reflect a perceived relation between sea cucumber physiological processes of the extrusion of white mucus or other body tissues with human nursing or birthing, such as in the terms *sucuwalu* or *sucudrau*, meaning eight or 100 breasts. These sea cucumber physiological processes are actually the animal's defensive mechanisms, which include exuding bad tasting sticky tubules and expulsion of internal organs such as gonads, which holothurians can regenerate (Colin and Arneson 1995:237-238). Several small reef creatures live in the safe internal water filled cavity of some kinds of adult sea cucumbers at times, thus giving rise to further perceptions of birthing properties by local people. The hole visible in the end of the sea cucumber shown in Picture 4.1 can expand considerably.

iii) <u>Local Terminology Overview</u>

I will begin with an overview of where sea cucumbers fit into the Kadavu Island Group folk taxonomy in which local names roughly correspond to Linnaean species as shown in Figure 4.2, before moving on to some name usage models, along with background on the trade to provide context. Interview participants in this study identified 15 images of sea cucumbers with their Fijian names. English or trade names were recorded only when people did not know a Fijian name. People in these villages choose to speak Fijian exclusively regardless of their English language skills. For the sea cucumber category, the roughly 112 people comprising the 80 core interview groups often involved extra people, but my interpreters and I still recorded the name that the person or group settled upon. In addition, we asked people in 20 Ono interviews for a collective term that they would apply to all sea cucumbers, yielding 17 responses of *sasalu* and three of *dri*. What I did not clarify sufficiently in many of these responses was whether any other animals belong in this category.

Sasalu is an interesting term in that it applies to sea cucumbers as a group, but it appeared only once for an individual sea cucumber kind in the 936 sea cucumber name responses recorded and this was for an unrecognized image. *Sasalu* also forms a component of the broader term *sasalu ni waitui*, which several people confirmed as the encompassing category for "all things of flesh in the sea" including *ika* or fish. The 11 village study by Mark Calamia et al (2008:41-46), overlapping with two of the same Ono villages as this study, uses the term *sasalu* to describe a category of invertebrates, which includes anemones, echinoderms, jellyfish, octopus, squid, and worms of the sea, but excludes molluscs, *vivili*, crustaceans, *qa,* and fish, *ika*. People in Kadavu told me that the term *manumanu* does not encompass *ika* and *sasalu*, but is restricted to birds and terrestrial animals; nevertheless, some people now classify whales and dolphins as *manumanu*, as I will discuss. My reports from Kadavu conflict with Andrew Pawley's (1994A) report on the Western Fijian Wayan dialect, which establishes *manumanu* as a general term for all animals or creatures, subsuming a group of what Brent Berlin (1992) calls life-form and second order categories: *ika* or fish and fish like animals, which include whales, porpoises, turtles, and cephalopods; *manumanu qwāqwā* or crustaceans; *cici* or molluscs; *dri* or sea cucumbers; and *baya* or worms. In Wayan, *manumanu* is used to describe fish as in the statement "*Na ika na manumanu ni waitaci*," "fish are animals of the sea" (Pawley 1994A:5).

Capell (1968:184, 130) defines *sasalu* as "flesh food served with *magiti,"* defining *magiti* as feast food served for ceremonial events to important visitors only. The concept of flesh is an important distinction in Fiji. Fijians distinguish food types that describe root vegetables such as breadfruit, cassava, taro, potatoes, or yams, as *kākana* in Bauan or standard Fijian. Flesh food, which includes meat or fish, often served with a green vegetable, is known in Bauan as *icoi* (Geraghty 2008:100). Flesh is considered a relish and Wallace Deane (1921:212) uses the term *ai dhói* for the category in Kadavu, where it includes bats, flying foxes, plover, pigeons, parrots, ducks, goats, dogs, cats, wild pigs, shrimps, shellfish of all kinds, snakes, eels, and turtle, along with the leaves of various greens boiled to serve with food. In a study of eating habits in eastern Fijian villages in Lau, Sharyn Jones (2009) recounts that a dinner of starch alone is considered a poor dinner, but to eat only flesh without a starch for dinner is rare. My experiences were consistent with this. Poor weather days where fishing was difficult often meant a trip to the store for tinned mackerel in tomato sauce to supplement the ever-present taro or cassava.

Considering the term *sasalu ni waitui*, the word *wai* is broadly used for water, or as a component term for different kinds of liquids, such as *wai-ni-niu* for coconut milk, or as *waitui* for salt water or the sea (Osborn 1833; Hazelwood 1872; Capell 1968; Geraghty 2008). Jones (2009:53) translates *waitui* as the 'noble sea' to describe the offshore area outside of the fringe reef. The terms *sasalu* and *sasalu ni waitui* do not occur in the early 19 century word lists compiled by Schütz (1985), in Hazelwood's 1872 dictionary, or Geraghty's 2008 phrasebook. The term *dri* is recorded for *bêche-de-mer* by Endicott (1831:602), Osborn (1833:612), Hazelwood (1872:271), and Capell (1968:59) and is used in the term *sili dri*, recorded in Kadavu and translated as "to dive for bêche-de-mer*"* (Calamia 2008:47).

Most of the old word lists were compiled by *bêche-de-mer* traders in Vanua Levu, at some physical and linguistic distance from my research site in Kadavu, where *sasulu* is used in conversation to refer to sea cucumbers in general.

Sea cucumbers are of economic importance in the South Pacific. 18 of 21 people responded to our request to pick their favourite *sasalu* with a choice that they substantiated in economic terms, such as a high price, large size, or fast drying to allow quick sale for best return. The exceptions were the two people who chose *loaloa* for its good eating and one person who choose *tarasea*, as they liked the red colour. These responses contrast with the same people's responses regarding their favourite fish, which focus on good eating and taste.

To establish the importance of sea cucumbers in recent Fijian history, I will provide a brief review of the background of the Fijian trade along with a contextualization of *sasalu* in modern Kadavu Island Group society. Gerard Ward (1972) provides a comprehensive summary of the history of the trade. The collection of bêche-de-mer in Fiji for large scale shipment to the Orient dates back to 1813 (Ward 1972:97). Early word lists such as Lockerby (1809:568-570) contain a high percentage of terms relating to sandalwood, which was in high demand in Canton ports. As sandalwood supplies ran out, the bêche-de-mer trade expanded, building upon sandalwood trading relationships between Western traders and Fijians (Ward 1972:95).

As mentioned above, the term *dri* is found in several 1830s word lists, recorded as *andre,* but corrected by Schütz (1985) as *dri*, reflecting the usual Fijian unwritten *n* sound before *d* as shown in Figure 1.5 in Chapter 1. The 1825 castaway William Cary (1972) provides accounts of various ships visiting Fiji between 1825 and 1832 to trade for sandalwood and bêche-de-mer. Ship captains would arrange to have a bêche-de-mer curing and storage house built on a beach and dispatch a couple of men to stay on shore and trade with the local people. With the exception of a visit to Bau in 1831 where "the bêche-de-mer were scarce," Cary (1972:68) often describes excess availability of bêche-de-mer, with women and children bringing them in to trade "from morning until night" (Cary:1972:49). Collecting 16 hogsheads of bêche-de-mer took five or six days work, I presume for the people of a village, and was worth a highly valued musket. Ward (1972:108) refers to ship logs which describe 30 men and 30 boys working to cure the ongoing sea cucumber harvesting by 200 people, with a further 100 people employed cutting wood to boil and dry the sea cucumbers. As noted, extensive deforestation was a significant long term effect of this trade; wood in dryer areas was easier to obtain, but forest regeneration is slower and extreme erosion during seasonal heavy rains negatively affects soil quality.

600 tonnes of bêche-de-mer were exported from Fiji from 1828 to 1835 (Ward 1972:108). A kilogram of the small but popular *greenfish* requires 60 animals, requiring 60,000 *greenfish* to make a tonne (Picture 4.13). At times, traders sold bêche-de-mer in Manila for a tenfold profit (Lavuka website). All accounts suggest that local people were pleased to participate in this trade in order to acquire valued trade goods; at least until the sea cucumbers became scarce. Ward (1972:104) describes a period in the late 1830s where several local groups decided it was more expedient to just attack the ships of the traders to appropriate the trade goods. This strategy met with some success for a time, until a few punitive visits to Fiji by British and American warships discouraged these local entrepreneurial efforts.

This trade had a significant affect on initiating Western and Eastern contact with Fijians, but the trade waned as supplies diminished in the 1850s, although export statistics from Fiji for 1876 to 1879 list bêche-de-mer from Fiji as the distant fifth largest export product behind copra, cotton, sugar, and maize (Committee 1880:40). The closing of Chinese and Japanese markets to the West in the 1930s diminished the trade until it recommenced on a large scale in the early 1980s, peaking at over 800 tonnes in 1988 (Kinch et al 2008:20). A Chinese trader now established in Narikosa village on Ono Island will purchase *sasulu* wet or dry, whenever people show up with it. Other people dry *sasalu* and ship it to Suva to get a better price, but this requires a broker in Suva and involves delay in payment.

Sea cucumber prices for the Asian market have increased steadily since the 1980s as prime species such as *Actinopyga miliaris,* known as *dri tabua* in Kadavu, have become scarce across the Pacific, shifting pressure onto other kinds, and resulting in people working harder to catch ever smaller animals to make up a kilogram. Animal kind and quality of curing affects Asian market pricing; hence buyers prefer to buy the animals wet and control the drying process to prevent spoiling (Kinch et al 2008). *Tabua* is the Fijian word for a sperm whale tooth, which is a key item exchanged in Fiji as a gift of great value and significance; hence the term *dri tabua* indicates the high value of this animal kind.

iv) <u>The collection of *sasalu* in Fiji today</u>

"We need to sell them to get some money," a fisherwoman told me one day as we chatted and walked along the beach in Kadavu. Another day on Ono Island, I met up with five men returning from over six hours of spear fishing work on the reef using an open boat as a base to dive from in the 23 degree Celsius open ocean waters. This may sound like warm water, but after a couple of hours it is a cold business on a cloudy windy day, often without quality wetsuits, if any. The mood in the boat was sombre as the spear fishing had been unsuccessful, so these men had turned to gathering some *sasalu* to sell in Narikosa for some money, but retained a 30 centimetre long *vasua,* or clam*,* and a large *drumani,* or anemone for dinner. On neighbouring Buliya Island, where, like Ono, the soil is too poor for significant agricultural production, the young men must fish and gather sea cucumbers everyday and bring home 30 to 100 *sasalu* to be dried for shipping to Suva. Free diving is hard on the body and becomes more difficult with age. Edvard Hviding (1996:217) confirms that in the Solomon Islands people consider spear fishing as hard work with high knowledge requirements of fish behaviour, tidal and lunar cycles, and spawning aggregations.

In Kadavu Province, *sasalu* are gathered by hand in shallows, often at low tide, or by diving from boats into deeper waters, which was the best place to find high value kinds even in 1830 (Cary 1972:50). Sea cucumbers contain considerable water, so the dried weight is a fraction of the mass of the live animals. Cary's 1830 record (1972:50) confirms harvests of five to six different sea cucumber kinds that vary in value. Hazelwood (1872:271) defines the term *dri* as bêche-de-mer and lists nine kinds as binomials built upon the term *dri*, including the modern Kadavu uninomial *tarasea,* suggesting *dri* as the prototype kind and term in Bauan or standard Fijian. As mentioned, three of 20 interviews offered *dri* as a general term for sea cucumbers in Ono, where Bauan word use is higher than in Kadavu. Kinch et al (2008:21) report that 22 scientific species and a subspecies of holothurians, with minimum animal size restrictions of 7.6 centimetres, are exported from Fiji, which must be gathered only by Fijian nationals. A ban on the export of *Holothuria scabra* is meant to protect it as a domestic food source (Laws of Fiji website).

In a report from a Viti Levu Island village, women glean *driloli* at low tide for household consumption. Lilian Fay-Sauni et al (2008:28) identifies *driloli* scientifically as *Stichopus chloronotus* and *Holothuria scabra*. However, in the Kadavu Group, people told me that only a few people eat one or two kinds of sea cucumbers, as "we don't like the taste." Kinch et al (2008:15) state that only *H. scabra* and *Bohadaschia vitiensis* are eaten in Fiji, in contrast with the seven species eaten in the Cook Islands and eight species eaten in Samoa, where they are important dietary items. Specific cooking and preparation knowledge for each kind is required to remove toxins. Fijian people do eat other types of *sasalu ni waitui* such as octopus and squid, known as *sulua* and *suluanū* in Kadavu and Ono, and use them for fish bait (Calamia et al 2008:45). Octopus has special status in Kadavu. On at least two occasions I heard the tale of the octopus god of Kadavu defeating the Fijian shark god in battle, with the release of the shark god as provisional upon the condition that no Kadavu man would ever be eaten by sharks, which story tellers assured me is in fact the case. A tourist guide book recounts this tale, claiming that octopus have totemic status and are not eaten by locals in Kadavu (Starnes et al 2009:216). Matt Tomlinson (2009:212) clarifies that the octopus god is Bakaliceva, from Naceva on Kadavu's south coast, and that it is Naceva men who are protected from shark attack. The fierce shark god is Dakuwaqa, who plays key roles in many Fijian legends throughout the islands (St. Johnston 1918, Deane 1921). Tomlinson recalls being served sea cucumber at meals, but not octopus or shark during extensive research stints in Kadavu (personal email March 14, 2010).

v) **Summary of sea cucumber study results**

In this section I will highlight some key results from the study, provide details on the naming and identification of several kinds of sea cucumbers, and discuss categorization issues. The reader may wish to refer again to Figure 4.1 as needed for taxonomic or nomenclature overviews or details.

A key point of folk biological interest about sea cucumbers in the Kadavu Island Group is the use of the term *sasalu*, as a component of the broader term *sasalu ni waitui*, the representational name for all flesh covered animals that live in the ocean. My interview experiences demonstrate that an interest in sea cucumbers is high across age and gender, as people enjoyed identifying the animals; even toddlers would point at the pictures and say *loli* for many pictures. The linguistic category dominance of *sasalu* at very least, must be representative of the high ecological salience of *sasalu*. Whether in Kadavu Province, *sasalu ni watui* represents all creatures of flesh in the ocean, or as Calamia et al (2008) state *sasalu* used alone represents only marine invertebrates without shells, this smaller category still includes much more iconic, active, salient, and often edible creatures, such as jellyfish, starfish, urchins, squid, and octopus. Why would people use the name of a lowly sea slug that is not good to eat for a larger category of important animals? In Kadavu, *sulua* or octopus do have special status; a well known set of stories explains how the men of Kadavu have special protection from shark attack based on a promise made by another island's shark god after losing a battle with Kadavu's octopus god. Yet a category of 20-40 centimetre long, often bland coloured, amorphous shaped and slow moving sea slugs have prototypical status in their category, rather than octopus or other more dynamic animals.

Figure 4.2 provides a summary of what I term as First Choice Name Consensus (FCNC), or Second Choice Name Consensus (SCNC) for *sasalu*. This term reflects the percentage of interview groups from Kadavu or Ono Islands who identified an image with the name listed here.

Figure 4.2: **Sasalu First and Second Choice Name Consensus** (FCNC, SCNC) by island with the percentage of responses given to Colin and Arneson's (1995) field guide live specimen images. Captioned scientific names are included to refer to. Figure 4.1 shows any reclassifications. The "# found" column lists Obura and Mangubhai's (2003) total number of specimens found in the 10 of 17 transect sites with sea cucumbers on the Astrolabe Reef near Ono and Buliya. The far right column gives depth range in metres listed by Kinch et al (2008) from Secretariat of the Pacific Community 2003 ID cards.

Genus	**Species**	**Kadavu FCNC**	**%**	**Kadavu SCNC**	**%**	**ONO FCNC**	**%**	**ONO SCNC**	**%**	**# found**	**depth rge. (m)**
Actinopyga	*mauritiana*	*tarasea*	80		0	*tarasea*	96		0	0	0-20
Actinopyga	*miliaris*	*dri tabua*	31	*loaloa*	15	*dri tabua*	36	*dri*	20	0	0-10
Bohadschia	*argus*	*vula*	76	*vula ni cakau*	7	*vula*	68	*vula ni cakau*	32	14	0-30
Bohadschia	*graeffei*	*tigerfish*	18	*katavila*	11	*melamela*	32	*vula*	12	1	0-25
Bohadschia	*marmorata*	*vula*	22	*dri vatu*	11	*vula ni vanua*	20	*vula*	16	1	n/a
Holothuria	*atra*	*loli*	73		0	*loli*	80		0	7	0-20
Holothuria	*edulis*	*loli*	53	*loli piqi*	9	*loli*	40	*loli damu*	24	1	0-30
Holothuria	*nobilis*	*sucuwalu*	22	*samu*	7	*samu*	32		0	1	n/a
Stichopus	*chloronotus*	*greenfish*	89		0	*greenfish*	100		0	12	0-15
Thelenota	*ananas*	*sucu drau*	64	*sucu i drau*	15	*sucu drau*	88		0	4	0-25
Thelenota	*anax*	*tarasea*	15		0	*amberfish*	40	*tarasea*	16	3	10-30
Holothuria	*fuscopunctata*	*valiki*	84	*dairo*	9	*tina ni valiki*	72	*valiki*	24	0	0-25
Bohadschia	*Sp.*	*vula*	86	*vula ni vanua*	11	*vula ni vanua*	44	*vula*	36	0	n/a
Holothuria	*scabra*	not	---	shown	---	not	---	shown	---	2	0-15
Holothuria	*atra* * Pic. 4.5	*loli*	80			*loli*	88				0-20
Bohadschia?	Unkown *Pic. 4.16	*tenatena*	16	*melamela*	9	*amberfish*	36	*melamela*	8		

*local supplementary pictures shown that were taken by Gordon 2009 in the Ono Channel (Pictures [Pic.] 4.5 and 4.16).

There does not appear to be a clear relationship between name consensus and maximum depth ranges. *T. anax* has the only minimum range and very low FCNC in Kadavu. Figure 4.2 gives only part of the story, as some sea cucumber images had low FCNC or SCNC rates where people use other less popular names to identify images. Figure 4.3 lists all the names collected for sea cucumbers for all images in this study and clearly illustrates the resiliency of the local names against trade names.

Figure 4.3: Summary of all *sasalu* or sea cucumber names collected

name	#	name	#	name	#
amberfish	27	*nai dri*	3	*ura ta kelekele*	1
basi	1	*pinfish*	2	*valiki*	58
beche-de-mere	1	*piqi*	1	*veata*	1
curryfish	14	*purplefish*	1	*vila civicivi*	1
dairo	7	*queenfish*	1	*vola*	1
drega ni dawa	2	*samu*	12	*vula*	129
dri	16	*sandfish*	1	*vula civicivi*	2
dri: loa, loli, togo, voli	10	*sasalu*	1	*vula ni batina*	2
dri tabua	2	*senikau*	1	*vula ni cakau*	18
dri vatu	14	*seniloli*	1	*vula ni nuku rama*	1
greenfish	75	*sucu beyara*	1	*vula ni valiki*	1
katavila	12	*sucudrau, sucuidrau*	71	*vula ni vanua*	23
loaloa	11	*sucuwalu, sucuiwalu*	14	*vula ni varani*	2
lokoloko	3	*taitai*	1	*vula ni vutia*	1
loli, lolilolі	177	*tarasea*	83	*vula niu*	9
loli damu, piqi	12	*tenatena*	20	*vula wadra*	1
loli ni cakau, ni vanua	7	*tigerfish*	12	# of terms recorded	936
madrai togo	1	*tina ni loli*	1	# of unique terms	63
medru	9	*tina ni tarasea*	1	# of unique uninomials	30
melamela	27	*tina ni valiki*	24	# of unique attributives	18
mudra	1	*togo*	4	# of uses of 8 unique trade names	133

To provide context for this classification system, I will discuss the results and the naming of some individual kinds of *sasalu*. Pictures of drying *sasalu* shown here are not images used in the survey. All survey images were of live animals from a field guide, except for the use of Pictures 4.5 and 4.16. I photographed most of the live *sasalu* shown here late in my 2009 visit to Kadavu.

Picture 4.5: A live specimen at about 40 cm. of *loli* (*Holothuria atra*), or lollyfish in the trade.

Picture 4.6: a drying specimen at about 15 cm. of *loli,* (*Holothuria atra*), or lollyfish in the trade.

The term *loli* is a long established loan word from the English word lolly (Schütz 1978:46); the 'ee' sound of the 'i' representing the 'y' fits Fijian language structure well. Lollyfish is an established bêche-de-mer trade name, but I recorded only *loli* or *loliloli* (Conand 1994). Few other names from the trade seem to have substantially penetrated Kadavu Island Group terminology. Figure 4.3 shows that 133 uses of eight trade terms such as curryfish, or amberfish, were recorded within the 936 names, and 75 of these were *greenfish*. I did not include established loan words such as *loli* in the eight trade terms. *Loli* is a common and well known sea cucumber, but it has a low commercial value as is shown in Figure 4.4. I saw *H. atra* at a depth of about four metres of water as shown in Picture 4.5. Figure 4.2 shows that *loli* is a high percentage first choice name consensus (FCNC) for two scientific species. For *H. edulis*, the second choice name consensus (SCNC) adds terms for red or pink to *loli* to differentiate it from *H. atra*. *Damu* is the Fijian word for red and *piqi* is a loanword for pink, as discussed in Chapter 3. *Loli* is the most common *sasalu* identification kind with 177 uses and 19 more as the first word in a binomial, reflecting the familiarity of this animal, but also my use of three different pictures of these two sea cucumber kinds in the study. Calamia (2008 et al:40) recorded the fishing method term *kari loli,* as poisoning with *loli,* implying a use for this animal that Hocart (1929:115) and Ward (1972:96) describe as grinding *loli* with coral or sand to extrude a liquid toxin. Pouring this toxin into shallow water drives fish into the open for spearing or netting, but fish poisoning is an illegal practice in Fiji now (Laws of Fiji website). Kinch et al (2008) confirm that *H. atra* possess a defensive toxin that interferes with the function of fish branchiae, confirming the mechanism of this item of practical Fijian folk biological knowledge.

Picture 4.7: Live *vula* or *vula ni cakau* (much bigger than P.4.8)

Picture 4.8: *Vula* or *vula ni cakau* drying

Vula (*Bohadschia argus*) is a common sea cucumber, easily identified by the markings illustrated in Pictures 4.7 and 4.8. The term *vula* is an old Fijian word for moon and the colour white. This was the most common scientific species found by Obura and Mangubhai (2003) in their reef transect surveys conducted well offshore, supporting the second choice name consensus of *vula ni cakau*, meaning *vula* of the reef. Every interviewee on Ono knew this animal as *vula* or *vula ni cakou*, as did all but eight people in Kadavu. No one used the term *vula ni vanua* for the image of *B. argus*.

Picture 4.9: Live *vula* or *vula ni vanua* (*Bohadschia marmorata*?)

The term *vula* is also applied to *Bohadschia marmorata* with a low FCNC, but with the inclusion of binomials with *vula* attributives such as *vula ni vanua* and *vula niu*, there is a 54% first choice name consensus (FCNC) average across both groups of villages. *Vanua* means land which extends into the ocean and *niu* means a coconut tree, so I will make an assumption that this kind is more common to find closer to shore and named accordingly. The undescribed *Bohadaschia* species listed in Figure 4.2 also has strong consensus as *vula* and *vula ni vanua*, again suggesting a ecological zone differentiation between *vula ni cakau*. Here we have a match in folk and scientific taxonomy in a more typical fashion under Berlin's (1992) model where binomials differentiate kinds at the folk specific level.

Picture 4.10: Live *melamela* / tigerfish? (*Pearsonothuria graeffei*?)

Bohadschia graeffei, the other member of scientific genus *Bohadschia* presented for identification using Colin and Arneson (1995:261), was reclassified for the second time at the genus level in 1984 as *Pearsonothuria graeffei* based on chemical analysis of body tissue (Bolland 2004, WoRMS website). There are 20 unique survey responses to this image with only 8% using *vula* or a *vula* compound. The highest consensus was among the 32% of interviewees on Ono who choose the term *melamela*, and the 10 interviewees from only the village of Tiliva on Kadavu who gave the term *tigerfish* used only in this village in a total of 12 interviews. Although the naming consensus for this animal is low, the consensus that it is not a *vula* is high, so the folk biologists were ahead of the scientists on this one.

Picture 4.11: *Valiki* or *tina ni valiki* drying in the sun

The use of the term *valiki* for an image of a live *Holothuria fuscopunctata* also had high name consensus with alternate related responses of *tina ni valiki* and *dairo.* I added a picture of this kind because everyone had a name for it, although I had no record of its presence in Kadavu. However, I did not have or show a picture of the similar *Holothuria scabra,* which is common in Fiji and found in the area by Obura and Mangubhai (2003), being known to the trade as *sandfish* and confirmed as *valiki* or *dairo* by Calamia et al (2008). I suspect that the similar shape and cross-body creases led to the consistent *valiki* identification, which should apply to *H. scabra*, and *H. fuscopunctata*. Some local people confirmed that *valiki* and *dairo* are names used in different regions of Fiji for the same animal. Conand (1994:47-48) uses *dairo* for the sandfish and *dairo-ni-cakau* for the elephant's trunk fish, a common name applied to *H. fuscopunctata* elsewhere. The word *tina* means ten in Fijian. These two species may receive one of either *dairo* or *valiki* as names depending on regional linguistic differences. If *H. fuscopunctata* is present near Kadavu, and these assumptions are correct, there are two linguistic group options of one folk name, applied to two scientific species in separate scientific subgenera and also given two trade names. Verification of *H. fuscopunctata* presence would make this an exception to the general parallel terminal taxonomy pattern for sea cucumbers in Kadavu Province.

Picture 4.12: *Sucudrau* drying in the sun (15 cm.)

The term *sucudrau,* meaning one hundred breasts, is applied to the image of *Thelenota ananas* or prickly redfish with high consensus in all villages. Obura and Mangubhai (2003) found this kind in several locations on the Astrolabe Reef. The animal's many papillae aid identification. Catching these and other *sasalu* that range into 20 to 30 metre deep waters may be challenging for fishermen, as the animals may be in cracks and fissures on the reef. The depth limit for recreational SCUBA divers is 30 metres, although free divers do go this deep and beyond. I was not aware of anyone in these villages using SCUBA gear to harvest sea cucumbers, a banned practice in some South Pacific countries. SCUBA gear and air compressors are costly and generally not accessible to local people in Kadavu and Ono.

Picture 4.13: *Greenfish* drying in the sun (10 cm.).

Greenfish or *S. chloronotus* had the highest consensus rate of any sea cucumber with 100 % FCNC on Ono and most people agreed on Kadavu, except four interviewees who did not know a name and one who used *melamela*. No other terms were given for this animal and people used this term whether they spoke Fijian or English. Colin and Arneson (1995:262) confirm that the black colour and rows of pointed papillae make *S. chloronotus* easy to recognize, and in this survey's case, from a very poor quality photograph of the live animal. The use of the term *greenfish* represents 56% of the total number of the eight different English trade name responses recorded as in Figure 4.3. It is curious that the animal is black, and many people on Kadavu do not use a separate colour term for green as discussed in Chapter 3. There is some evidence that people in Viti Levu eat this animal (Fay-Sauni et al 2008:28). This was the only member of the scientific *Stichopus* genus formally shown; eight interviewees in Ono identified a light green coloured image of *Stichopus variegatus* as curryfish. I have no explanation for the exceptional level of consensus on the term *greenfi*sh, but it highlights the resiliency of the rest of the Fijian language terms in a centuries-old large international business with its standard common English terms such as *tigerfish*, *sandfish*, and *greenfish* that seem to be the *lingua fraca* of the trade.

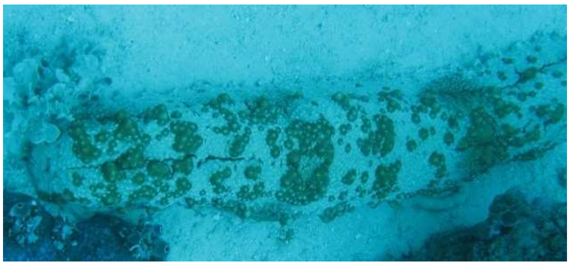
Picture 4.14: *Loaloa* drying in the sun (12-15 cm.).

Loaloa, (*Holothuria* [*Microthele*] *nobillis*)*,* or the black teatfish is eaten in Fiji and in demand to the trade. No image of a live specimen was available for identification, but this is a familiar animal to most people as the name came up in identification discussions. This specimen along with about a dozen other *sasalu* specimens of various kinds were set out to dry on sheets of corrugated metal to reflect the sunlight and aid drying. The vertical spike is splinter of wood opening the carcass to dry. I suspect this was a day's harvest for the household doing the drying. I expect that *loaloa* would have a high level of consensus as a name for this animal that parallels the scientific name *Holothuria* [*Microthele*] *nobillis* and the common black teatfish. The term *Microthele* scientifically classifies this animal in a subgenus of genus *Holothuria*.

Picture 4.15: *Dri* drying in the sun (15-20 cm).

Dri is a traditional broad name for sea cucumbers in Fiji and is used in the term *dri tabua*, recorded in this survey as matching the scientific category of *Actinopyga miliaris.* I regret not asking for more detail for the term *dri* as given to the specimen in this picture by my informant. The term was applied specifically to this drying animal. The term '*dri*' has a long history of use in Fiji's main islands of Vanua Levu and Vitu Levu as a broad term for sea cucumbers in general as noted elsewhere in this chapter.

Picture 4.16: Unconfirmed *sasalu* type photographed by Gordon near the Naigoro Passage.



The *sasalu* image 4.16, which I photographed on a Kadavu reef received low consensus responses with over 16 different names recorded from 51 people who named the image. Ono interviewees had the highest first choice name consensus (FCNC) of 36% for *amberfish* on Ono, with a (FCNC) high of only 16% for the term *tenatena* in Kadavu. I have not identified a scientific species match yet either. I suspect that taking the photograph from directly overhead was a mistake and a shot taken from a 45 degree angle would add dimension as Colin and Arneson (1995) often do.

vi) *Sasalu* folk taxonomy context

We can see then that Kadavu Group folk taxonomy names identify sea cucumbers with consistency to the scientific specific level. This is a complex taxonomy; I expect that in 1758 when Linnaeus established the Holothuria genus he did not anticipate the 151 species grouped into 21 subgenera and the further 84 species that comprise the genus today (WoRMS website). This highly differentiated class of animals seems to have held little interest for Fijians until the traders exhausted the sandalwood supply. The estimated sixty million US dollar per year worldwide trade in bêche-de-mer that includes Fiji as a source must affect the demonstrated naming consistency. However, this is a folkbiology system that uses a number of uninomial names at the scientific species level of identification, rather than Berlin's (1992) proposed genus level identification, as Figure 4.1 clearly shows. I suspect that there is a bit more going on here than what we might call simple economic utility. Kadavu Island Group people can always use a few extra dollars, as we all do, but few people choose to live in small rural villages with limited economic prospects if making money is their primary life focus. What village life does provide is a rich and interactive social life. One must also consider the strong identification in many *sasalu* names with nursing, birthing, giving of life and the regeneration abilities associated with the expelling of gonads and organs by these animals, whose healing systems are now attracting the research attention of bio-scientists.

Figure 4.4: ***Sasalu* / Holothurian market values paid by a Suva buyer to some Kadavu fishers.** This is not a comprehensive list. The January 2010 exchange rate is 0.55 cents Canadian to one Fiji Dollar. Minimum wage in Fiji is $1.86 an hour as of September 2009 and one gallon of boat fuel costs $13.50 FJ$ in Kadavu. A trip to the outer reef and back requires one to two gallons of fuel depending on the village, the boat, and the seas. Further out of pocket costs include boat transfer to the ferry and ferry freight charges.

Genus	species	Kadavu/Ono name	Market value in FJ$	English tradename (Conand 1994:47)
Actinopyga	*miliaris*	*dri tabua*	$$ high - rare?	deep water redfish
Bohadschia	*graeffei*	*melamela*	$30/kg	
Holothuria	*atra*	*loli*	$12/kg	lollyfish
Holothuria	*edulis*	*loli*	$12/kg	lollyfish / pinkfish
H. Microthele	*fuscogilva*	*sucuwalu*	$55/kg	white teatfish
Stichopus	*chloronotus*	*greenfish*	$50/kg	*greenfish*

This analysis raises several questions for future investigation. Given historical gaps in the trade demand for sea cucumbers, how did the use of these names survive, or was usage re-established in the 1980s after 45 years of a theoretically closed Chinese market and the small demand levels of the early twentieth century. In some places, by various accounts, sea cucumber harvesting was so thorough that one wonders how many animals were left on the reef to look at and identify. If only two or three kinds of sea cucumbers held any interest for Kadavu Group people, would elders pass along the use of all of these names for *sasalu* that held little local interest? Furthermore what are we to make of the use of the term *sasalu* as the key component of *sasalu ni waitui.*

Folk taxonomy may be resilient but it does not stay still. I asked people in the villages whether whales and dolphins were *ika,* and their reasons. Age estimates are approximate, but it is clear from the results in Figure 4.5 that the folkbiology of young people is shifting from a traditional resemblance basis to anatomy based classifications in this example of high salience animals that frequent the region. I saw both a whale and a school of dolphins in the Ono Channel in 2009.

Figure 4.5: Are whales and dolphins *ika* (fish)?

People	no	Why are they not ika?	yes	Why are they ika?
Under 30 yrs. with some fish knowledge	4	They are *manumanu*. They give birth like humans. They breathe on the surface. They have warm blood. They are mammals and nurse.	1	They live in the sea.
Under 30 yrs. with expert fish knowledge	4		0	
Over 30 yrs. with some fish knowledge	3	They are *manumanu*. They breathe on the surface. We do not eat them. They are warm blooded *manumanu.*	9	They stay in the sea. We refer to *tabua* as fish teeth.
Over 30 yrs. with expert fish knowledge	2		8	
Total responses	13		18	

The age-skewed results in Figure 4.5 suggest that modern education is affecting local folkbiology, as most younger people did not consider whales and dolphins to be fish, using modern science reasoning concepts, such as ‘warm blood’ to link whales with mammals. For older people, religious training may also enter into perceptions of whales as fish, based on particular bible interpretations of terms used for the creature that swallowed Jonah, which may include a whale, a great fish, and a sea monster in the Book of Jonah, also referred to in Matthew 12:40 (Holy Bible). Given the mixed results of this small survey, the topic deserves further study, which could include categorization questions regarding traditional members of the *ika* category, which are anatomically distinct from fish, such as sharks, rays, and turtles. This represents a significant shift in folkbiology perspective. Graham Burnett (2007) describes the pivotal role of whale re-categorization as representative of the late 19th century transition to acceptance of anatomy based classification in Western science and public opinion. However, this question still attracts debate. A web search for the keywords: Bible, whale, and fish yields links to many websites where people in North America argue about the distinctions between whales and fishes and the practicalities of a man surviving inside one or the other for three days.

Nevertheless, in Ono Channel village responses, I did not see strong age related patterns in *sasalu* naming patterns. The unique use of the term *tigerfish* in a single village spans age, gender, and households of interviewees. *Greenfish* use for a single kind is universal, but its high percentage of use is closely followed by much older names for single kinds like *vula* or *vula ni cakua*, and *valiki* or *dairo*. Is there a special resiliency attached to terms for sea cucumbers in Kadavu?

In his important essay *"The Economics of Developman in the Pacific"* Marshall Sahlins (1992) coined the term *developman,* to describe the resilience of local cultures to change driven by influxes of trade goods and Westerners. One of Sahlins' key points is how we in Western societies focus on personal consumption and accumulation, but are simultaneously intimidated and awed by our own technologies, as we accept prescribed ways to use and perceive them. Pacific people are keen to acquire Western trade goods, but fit them into their own categories and absorb these goods into kinship and tribal based societies to enhance the exchanges of goods, which shape social bonds. Sahlins goes on to point out how quickly Pacific people adapted to new bargaining systems, as occurred with the Fijian bêche-de-mer trade, but takes issue with the accepted theory that acquiring muskets was the primary trade goal (Ward 1972). In a critique of the idea that this trade in muskets generated warfare, Sahlins makes the point that muskets used by poorly trained users were more likely to cause damage to the user than the target, whereas Fijian war clubs for honourable killing became more decorative and much more numerous during the same period of extensive trade. Reinforcing the difficulties and limited use of muskets is castaway William Cary's (1972) record of being called a *kalou* or god for his musket cleaning abilities in the 1820s by his patron Fijian chief of the time.

The more important input item from the bêche-de-mer trade, according to Sahlins were the *tabua* or sperm whale teeth that were valued exchange items, within Fijian society as detailed below, and traditionally hard to acquire. However 19th century whaling ships generated an ongoing supply of *tabua* that traders could convert into bêche-de-mer in Fiji. Increased supplies of prestige goods such as *tabua* and fancy war clubs were critical in structuring alliances and become empire building tools for ambitious chiefs, thus increasing the amount of power in Fijian society (Sahlins 1992:17-20). Muskets were valued and delivered a limited utility; in contrast *tabua* delivered a type of unlimited social utility in a highly social and stratified society.

Deane (1921:77-89) describes the role of the *tabua* to embody power and meaning in Fijian society as socially potent and unique in the South Pacific Islands. Deane quotes Dr. B. Seemann (1862) on the origins of the item and term *tabua*, as carved and polished wood shapes like whale's teeth from the Fijian *Mbúa* tree coupled with the term *ta* for "cut" to create *ta-mbúa.* The *m* is sounded, but not written today, as shown in Figure 1.5. Fijians did not hunt whales, so sperm whale teeth were obtained from beached whales on rare occasions until the whaling industry generated a large supply. Within Fiji, circumstances determine the value of a *tabua,* such as the social status of the exchange parties, or the ceremony involved. *Tabua* were used for acquiring goods, property, women, at births, deaths, house building and chief installation ceremonies, for diplomacy, atonements, propitiation, and in earlier days, requests of someone to kill an enemy. Refusal of a *tabua* is considered rude and means trouble for the refusing party, unless one returns a larger gift termed as "pressing down," which creates demands on original giver (Deane 1921:77-89). The longer a *tabua* had circulated the greater its value; people would stain and polish *tabua* to make them look older and well used (Sahlins 1992:32). Much as in the ideas that Marcel Mauss expanded upon in *The Gift* (1990), *tabua* are vehicles of obligations to give and receive. Sahlins (1992) demonstrates how people accumulate social bonds through exchange, evidenced by Deane (1921), who observed people buying expensive pigs with *tabua* purchased in stores for the purpose, at less than a tenth of the market value of the pigs.

vii) Summary

What does all this have to do with folk biology, other than the obvious connection of naming of the most valuable *sasalu* as *dri tabua?* I discussed utility in fish naming in a 2009 discussion with Fijian language expert and experienced recorder of Fijian fish names, Paul Geraghty at the University of the South Pacific (USP) in Suva. Geraghty suggested that the differentiation and detail level of Fijian fish names reflects the degree of utilization of the given fish kinds and lumping of types occurs with low utility of the fish kinds. Berlin (1992:287) acknowledges the role of utility, viewed as potential human consumption, in differentiating organisms at the folk species and folk varietal level, but points out folkbiology sub-folk generic differentiation patterns based upon both non-materialistic uses such as adornments, which I would argue are a form of utility and people paying attention to the natural expressions of nature's plan. Geraghty gave examples of plants that have many uses, thus utility, and consequent name transfers between an item like an arrow and a component plant. Following the utility model, *sasalu* have little or no lumping and are thus high utility animals. In some cases, Fijian folk differentiation of *sasalu* exceeded Linnaean classification. The well established terms *sucuwalu* and *loaloa*, for the white and black teatfish, long preceded the parallel 1980 differentiation by scientists, as *Holothuria (Microthele) fuscopunctata* was reclassified from within the 1867 description of *Holothuria (Microthele) nobillis*.

The diversity of uninomial and binomial names used in Kadavu and Ono is in sharp contrast with a list of names for ten scientific Holothuridae species recorded in Maluku (Monk et al 1997:579), five of which are species queried in this study in Fiji. All of the Maluku names are binomials with *teripang* as the primary term, suggesting a folk generic of *teripang*, for the category, and a secondary term to define the folk species in a format that fits Berlin's (1992) scheme.

There is no question that utility plays a significant role in the detailed identification system used in Ono Channel sea cucumber names. Several kinds of sea cucumbers can be converted to cash for fuel and store bought goods, with a few kinds used for food by some people. Most ethnobiological work on utility has focused on plants and animals subject to domestication (Berlin 1992:288). There is no history of the farming of sea cucumbers in Ono Channel villages. However, we have a folkbiological naming system that is highly differentiated beyond expected levels for sea cucumbers, whose utility level and population presence in Fiji has undergone dramatic fluctuations over the last 190 years with many more years of low levels than high. We also have the use of the term *sasalu ni waitui* for a large group of animals, thus represented by a large sea slug that is not very good to eat. Today, *sasalu* represent cash money in a cash poor economy, so knowing what a given type is worth is of interest, but in the short time that I spent in Kadavu and Ono, I observed that just as in Canada, economic utility is often not the main value of an object. In Kadavu, if you do have surplus goods you may soon be sharing them with relatives anyway through *kerekere*, as discussed in Chapter 1. In my interviews, conversations about *sasalu* identification consistently drew people together into a closer circle on the pandemus mat covered floor of someone's home for animated conversations in Fijian, using Fijian *sasalu* terminology, often as a toddler or two struck their fingers on various *sasalu* images, all the while repeating the words *loli, loli, loli*.

Sahlins (1992:17) cautions us on the use of the terminologies of utilitarian and prestige goods that imply objects which exist discretely from human social ties, and to avoid smuggling in the simplistic Western dichotomy of needs and luxuries. In a similar vein we often use the word utility for electricity, natural gas, or other suppliers of what we deem essential services, which provide a defined mechanical service for cash where the responsibility of each party in the transaction concludes upon delivery of service and payment. No exchanges in a Fijian village are devoid of human interaction and structured relationships. Utility may be an inappropriate term to describe the relative usefulness of an animal to humans living in societies where exchanges of goods define sociality. Should we use terms such as social utility, *sociotility*, or a graded range known as a kula score?

Did *sasalu* then achieve some folk biological status at a time when Fijian society was expanding and stratifying through empire-building? In another work, Sahlins (2004) compares the sophisticated and complex 19th century Fijian political empire building machinations, fed to a great extent by the fruits of the bêche-de-mer trade, to the much more ancient struggle between Athens and Sparta in the Peloponnesian Wars that fuelled many myths, stories, and perceptions woven into modern Western culture. If we follow the well supported ideas of Sahlins regarding the fundamental importance of prestige goods in structuring Fijian society, then we should consider the humble animals that made it all happen. Based on the evidence reviewed here, I suggest a certain prestige is associated with *sasalu* in Kadavu that provides special status and leads to conflicts with Berlin's (1992) folk taxonomic scheme by paralleling many uninomial folk end taxonomic terms at the scientific specific level, and positioning the animals in a key prototypical taxonomic position in Kadavu Island Group societies.

Chapter 5: Fish parts that matter and poisonous things

i) Introduction

In this chapter, I review folkbiological identification, categorization, and classification of a covert group of fish, which make up a considerable proportion of the fish mass on the Great Astrolabe Reef near Kadavu and Ono Islands in Fiji. Scientific classification of Acanthuridae family members differentiates subfamily, genus, and species on some very salient features, but in other cases upon much finer differences, such as the tiny bristle teeth determining the genus *Ctenochaetus*. The following analysis will put the First Choice Name Consensus method to work and extend it into what I term as 'key name analysis' and 'detailed term analysis' to consider organisms which receive a variety of names within village populations, and consider if and what patterns affect the variations. Many kinds of fish in the scientific Acanthuridae family are important food fish for local consumption in Ono Channel villages, as in other Pacific reef-dependent communities. The sharp and often venomous spines of many of these fish add an element of danger to catching them. I will consider what affect this may have upon identification terms. I will extend this discussion into a number of other venomous marine animals with which local people come into contact in Kadavu and Ono waters.

ii) Fish of the scientific Acanthuridae family

The scientific Acanthuridae family of fish, known in English as surgeonfish, share the distinctive feature of sharp spines in their caudal peduncle, or base of the tail. There are two subfamilies. The scientific subfamily Acanthurinae fish have blades laid flat against their skin and project the spines horizontally through an arch of the back, when the fish is threatened or takes aggressive action (Ryan 2000:145); much like a switchblade is used in a knife fight. Fish of the scientific subfamily Nasinae and its single genus *Naso,* the Latin for 'nose', have fixed horizontal blades. Some types commonly known as 'unicornfish' in English have additional weaponry of a single horn protruding from their forehead. Most fish of both subfamilies are popular food fish in Fiji, comprising a considerable component of inshore and reef fishermen's catch, with the use of nets or spears. The fish of the scientific Acanthuridae family are the most common fish kind on the Astrolabe Reef near the Ono Channel (Obura and Mangubhai 2003:71). The caudal peduncle blades on types, such as *Acanthurus lineatus,* and the primary dorsal, anal, and pectoral spines on some types are venomous at various growth stages. People fishing must handle them with care as the fish erect the blades and spines under stress and often upon death (Debelius and Baensch 1994, Randall 2005), for example, when fish caught with nets are removed by hand.

Ethnoarchaeologist and ethnographer Sharyn Jones, (2009:98-105) determined that fish of the Acanthuridae family represent the largest component of people's fish diet in central Lau, Fiji, in both the prehistoric to pre-contact periods and in the present time. A study by Kuster et al (2003) in southern Lau supports this; Acanthurids composed 24% of fish consumed by weight. My interpreters and I asked many Ono Channel people to name their favourite fish, and Acanthuridae fish represent a number of the responses, as they did in the favourite fish list compiled from current Lau residents by Jones (2009:77).

Many surgeonfish kinds fill an essential ecological role on coral reefs, grazing on algae that would otherwise overcome coral polyps, thus allowing corals to flourish. These fish act as primary consumers of vegetation, much as rabbits or deer do in terrestrial environments. Some kinds use schooling behaviour to overcome the defenses of territorial damselfish, which inadvertently protect what consists of islands of algae on the reef, although many surgeonfish kinds, including those that school, may feed on their own and in pairs or small groups. Some surgeonfish, in particular the scientific subfamily Nasinae, feed on zooplankton and often school in open water.

Surgeonfish fossil dates of both Acanthurinae and Nasinae Linnaean subfamilies go back more than 50 million years (Debelius and Baensch 1994:686-687). Randall (2005:573) recognizes 80 scientific species with 73 of these in the Indo-Pacific and seven in the Atlantic. Obura and Mangubhai (2003:55) identified 31 scientific species in the Acanthuridae family in transect studies on the Astrolabe Reef near the Ono Channel, along with the closely related and distinctive single species Zanclidae family, represented by *Zanclus cornutus*, as shown in Section 5.vi. For the present identification study, drawing upon the 2003 transect study list, I chose 21 images of Acanthuridae scientific species, along with five images of juveniles or alternate colour phases, one of *Z. cornutus*, and two images from the closely related Siganus single genus family. I added three photographs that I took of local Acanthurinae subfamily kinds and found comparable responses with the same scientific species shown in the field guide images. Given the unique caudal peduncle spines of these fish, it is not surprising that people conceptualize the broad covert category of surgeonfish, unnamed in Fijian. However, the results in Figures 5.1 and 5.2 show a clear distinction in local folkbiology between the scientific subfamilies, given salient morphological differences of spines, skin texture, and shape between the *ta* and other kinds.

iii) <u>Terminology</u>

The historic research project of Proto-Oceanic languages assembled by Meredith Osmond (in press) has found more reconstructions for Acanthuridae than any other lexicon of fishes. The research I conducted in Fiji found a relatively small number of 21 unique names in the 2,167 responses recorded for 32 images, although uses of attributives applied to common base terms such as *balagi*, *jila*, *ikaloa*, and *ta* expand this number. Figure 5.1 provides a summary of what I term as First Choice Name Consensus (FCNC), or Second Choice Name Consensus (SCNC). These terms reflect the percentage of interview groups from Kadavu or Ono Islands who identified the images shown with the names listed here. Background information on villages and interview groupings were given in Chapter 1. In general, the consensus levels are quite high for some kinds of fish in the group, but low for others where different people provided various primary terms for a given fish kind. Images where three or four terms show similar FCNC percentages within the sample require further key name analysis as provided in the Figure 5.2 comparison of common uninomial terms and the detailed term analysis in Figure 5.4. For simplicity, the response numbers for uninomial or primary terms in the Figure 5.2 graph include all binomial responses with attributives added into the totals for appropriate prominent primary terms.

Figure 5.1: Acanthuridae and Zanclidae scientific family First and Second Choice Name Consensus (FCNC, SCNC) by island with percentage of interviewee responses recorded using the Allen et al (2003) field guide images and this author's photographs.

Genus	**species**	**Kadavu FCNC**	**%**	**Kadavu SCNC**	**%**	**Ono FCNC**	**%**	**Ono SCNC**	**%**
Acanthurus	*olivaceous*	*jila*	82			*jila*	92		
Acanthurus	*olivaceous juv*	*jila*	49	*ikaloa*	18	*jila dromodromo*	60	*ikaloa*	16
Acanthurus	*achilles*	*jila*	29	*balagi*	24	*balagi*	48		
Acanthurus	*pyroferus*	*ikaloa*	40			*ikaloa*	48		
Acanthurus	*pyroferus JP*	*ikaloa*	20			*guru*	16		
Acanthurus	*pyroferus JY*	*ikaloa*	25			*ikaloa*	16		
Acanthurus	*nigicans*	*balagi*	25	*ikaloa*	25	*balagi*	36	*balagi lailai*	12
Acanthurus	*xanthopterus*	*balagi*	38	*balagi nawa*	20	*balagi nawa*	44	*balagi*	40
Acanthurus	*thompsoni*	*balagi*	55	*balagi nawa*	16	*balagi*	68	*balagi nawa*	12
Acanthurus	*bariene*	*balagi*	53	*ikaloa*	13	*balagi*	44	*balgi nawa*	16
Acanthurus	*lineatus*	*jila*	65	*ikaloa*	11	*jila*	76		
Acanthurus	*nigricaudas*	*jila*	27	*balagi*	24	*balagi*	44	*jila*	24
Acanthurus	*blochii*	*balagi*	38	*jila*	24	*balagi*	84		
Acanthurus	*triostegus*	*tabace*	76			*tabace*	44	*bisikete*	24
Zebrasoma	*scopas*	*tivitivi*	18	*ikaloa*	16	*ikaloa*	44	*bebe*	12
Zebrasoma	*veliferum*	*via*	38			*via*	48		
Zebrasoma	*veliferum juv*	*tivitivi*	27	*via*	25	*via*	28	*via dromodromo*	12
Ctenochaetus	*striatus*	*ikaloa*	85			*ikaloa*	80	*ikaloa dina*	12
Ctenochaetus	*binotatus*	*ikaloa*	69			*ikaloa*	76		
Naso	*caesius*	*ta*	60	*ta masimasi*	15	*ta*	72	*ta masimasi*	12
Naso	*unicornis*	*ta*	76			*ta*	92		
Naso	*brevirostris*	*ta*	69	*ta penikau*	9	*ta*	68	*ta qio*	24
Naso	*annulatus*	*ta*	69	*ta qio*	11	*ta*	76	*ta qio*	12
Naso	*viamingi*	*ta*	60			*ta*	92		
Naso	*viamingi*: dark	*ta*	49			*ta*	68		
Naso	*literatus*	*ta*	55	*ta bui dromodromo*	7	*ta*	44	*ta bui dromodromo*	7
Zanclus	*cornutus*	*tivitivi*	58			*tivitivi*	48		
from photographs									
Acanthurus	*nigricans*	*balagi*	20	*ikaloa/jila*	20	*balagi*	40		
Naso	*caesius*	*ta*	58			*ta*	56	*balagi nawa*	20
Naso	*brevirostris*	*ta*	60	*ta penikau*	11	*ta*	64	*ta qio*	28

Figure 5.2: Key names people used for images of the scientific families of Acanthuridea and Zanclidae.

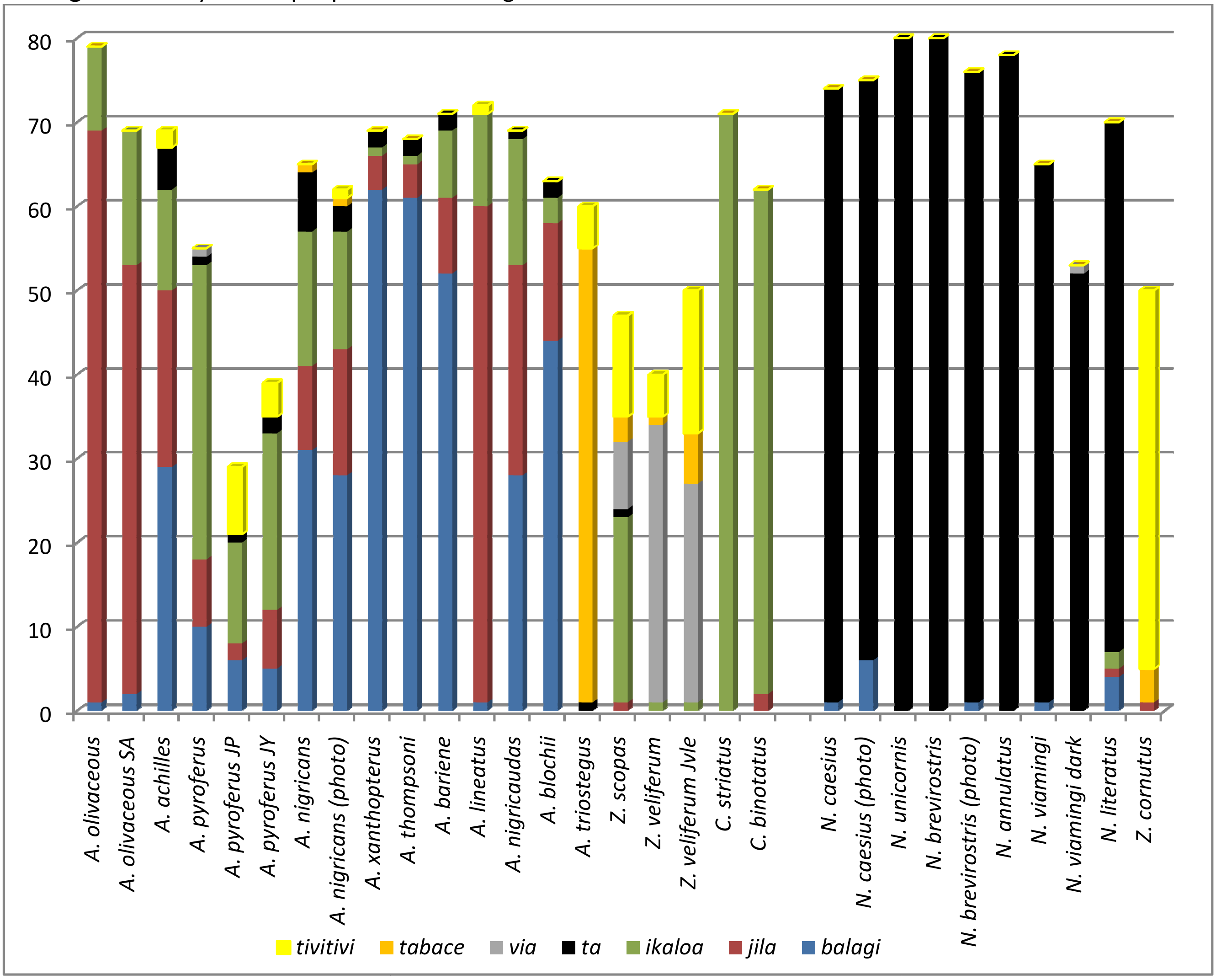
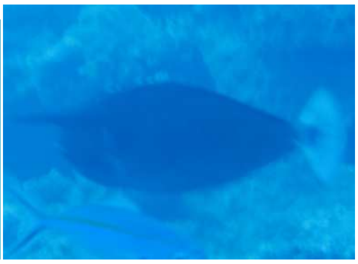


Figure 5.2 clearly shows consistency between photos and field guide images, and differentiation in folk names between the scientific genera, but with overlap between *ikaloa*, *jila*, and *balagi*.

iv) <u>The fish: *ta*, *balagi*, and *jila*</u>

The use of the term *ta* for fish of the scientific *Naso* genus is clear, despite the fact that various kinds of these fish have long horns, short horns, or none at all. A photo sorting exercise performed with Kadavu elders isolated pictures of *ta* with and without horns from other Acanthuridae fish. The following pictures illustrate obvious morphological similarities and differences between different kinds of *ta*. The double spines are visible in Picture 5.1 along with a small horn if one looks closely. Some local people think that the colour variances of the fish visible in Picture 5.4 differentiate males from females.

Picture 5.1: *Ta* (*Naso unicornis*) **Picture 5.2** *Ta qio* (*Naso annulatus*) **Picture 5.3** *Ta masimasi* (*Naso caesius*)


Picture 5.4 *Ta masimasi* (*Naso caesius*) schooling in the open sea and showing colour variances.

At mature size, most types of *ta* are 50 to 70 centimetres long and have meaty bodies with "plenty of tasty fat," according to several people who like to eat this fish best. As SCNC choices in Figure 5.1 show, the long horns of *N. brevirostris* and *N. annulatus* attract attributives of *qio* or shark-like, and *penikau* that refers to the pencil-like horn. *Peni* is an introduced word, Fijianized from the English term 'pencil' (Hazelwood 1872:229). The only uses of the term *ta dina*, meaning the true or real *ta*, occurred five times for *N. unicornis* and once for *N. brevirostris,* which may suggest *N. unicornis* as the prototype for the group, aligning with the common English name of unicornfish for many *Naso* genus types. These two field guide images were the only images of fish or other marine animals identified by interviewees 100% of the time of the 130 images used in the entire study. Other common attributives for *ta* are: *masimasi*, describing their rough skin referred to in the English common name of leatherjacket; *nawa*, translated as floating, but used to describe open water schooling fish as in Picture 5.4; *ni takali*, or of the open sea; and *bui dromodromo*, or tail yellow.

Several people referred to the long horned kinds of *ta* as *ta tagane*, which means male ta; although one man explained with a serious demeanor, amidst much laughter from the people sitting around us, that the *ta yalewa,* or female *ta*, had the longer noses for fighting. This may have been humour rather than folk knowledge, as most males in this fish group have longer horns than females (Debelius and Baensch 1994; Randall 2005), and no one else gave the name *ta yalewa*. People did mention seeing these fish fight using their horns.

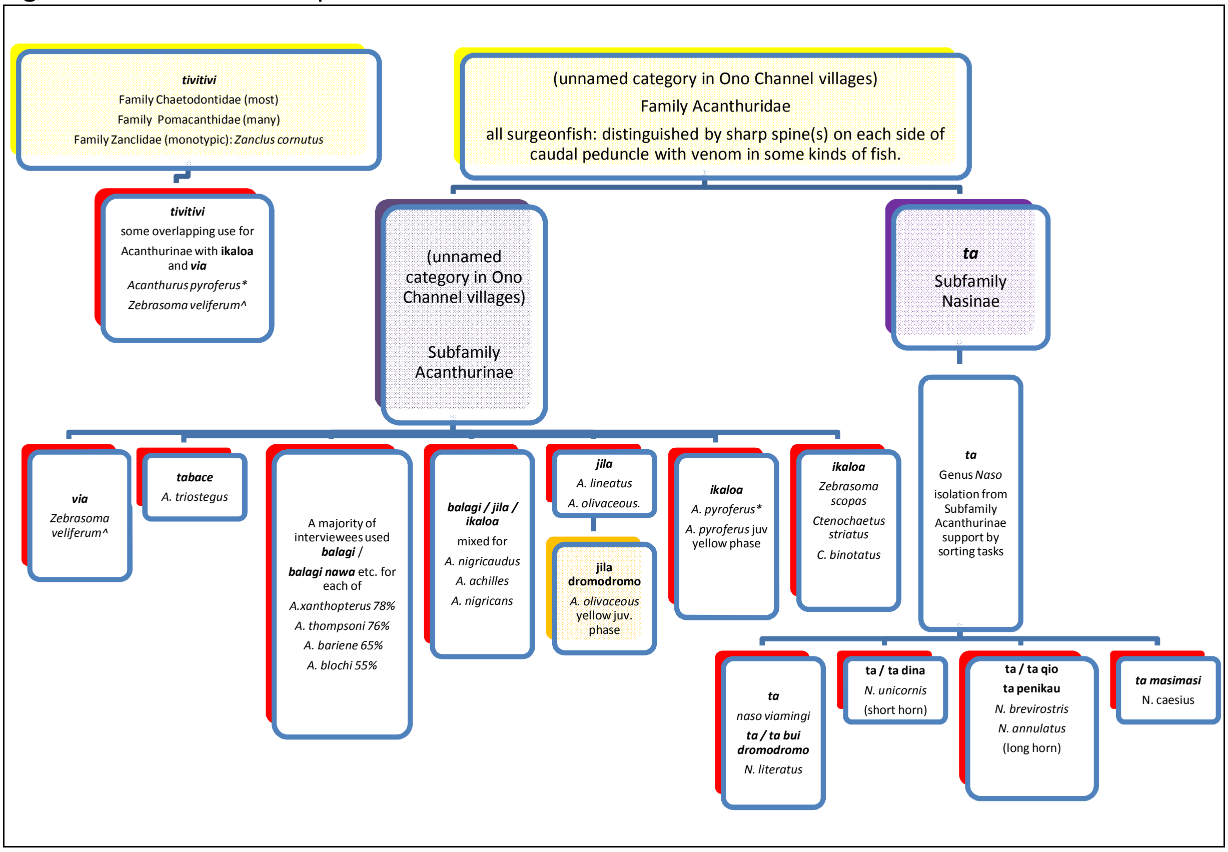
Despite information from Southern Kadavu gathered by Ritsuko Kikusawa (1995) and used by Osmond (in press:74), Figure 5.2 shows that the term *balagi* does not have significant use for members of the scientific *Naso* genus, although there is an argument for application to much of the *Acanthurus* genus. Calamia et al (2008:33) and Geraghty (1994:163) identify *ta* as *Naso unicornis*. Osmond (in press:70) confirms the use of *ta* for unicornfish in Bauan and Wayan Fijian dialects, and nonexclusive use in Tokelauan, Tikopia, and Tahitian, but not in neighbouring Samoa and Tonga where the term *ume* with deeper proto Oceanic language roots is used. Geraghty (1994:163) suggests the term *ta* originates from a proto eastern oceanic term *taRa*, or to cut, to refer to the fixed caudal peduncle spines. Gregory Forth confirms a similar use of *ta*, *tara*, and *taya* for the spur of a fighting cock or a branch of a tree in Indonesian languages, such as Nage (personal communication 2010).

I found it interesting that the smaller, 20 to 30 centimetre, bright orange and yellow trimmed scientific species *Naso literatus,* or orangespine unicornfish (Allen et al 2003), commonly known in the Canadian pet trade as the Naso Tang was included as *ta. Ta* on its own or with an attributive was applied 78% of the time for this fish, including a 12.5% usage of *ta bui dromodromo*, or 'yellow tailed *ta*'. Figure 5.2 shows seven uses of *balagi*, *jila*, and *ikaloa* for this type of *ta*, suggesting some variable categorization. As a side note, the common English term 'tang' is used for fish in the scientific genus *Zebrasoma*, *Paracanthurus* and some *Acanthurus* according to Randall (2005:573). It is clear that the Fijian term *ta* and the scientific genus *Naso* taxonomically fit Berlin's (1992) model of the primacy of generic taxa, with attributives classifying folk species, prototypical types, and broader than average community agreement upon terminology. However, as Figures 5.2 and 5.3 show, other fish kinds in the Acanthuridae family are not as clearly demarcated as is the *ta.*

Balagi

Figure 5.3 shows broad use of the term *balagi* in Ono Channel villages for many fish kinds in the scientific Subfamily Acanthurinae, but not so broadly as indicated in Osmond (in press:74-75) for Wayan and Southern Kadavuan. Figure 5.2 shows usage of the three terms *balagi*, *jila*, and *ikaloa* to some extent for most fish in the group, with several exceptions for discussion below. I asked many people what the differences, known in Kadavu as *duidui*, are between the three types. Most people described *balagi* as the biggest and widest fish, but the consensus is split between *ikaloa* being smaller than *jila* or equal to *jila* in size.

Figure 5.3: Taxonomic comparison between Ono Channel names and scientific names



Picture 5.5: *balangi* (*Acanthurus blochii*)

Picture 5.6: schooling *balagi* (*A. blochii*)

People spoke of the *balagi's* distinctive white tail markings as seen in Picture 5.5. Schooling habits shown in Picture 5.6 and habitat differences are referred to by the use of *balagi nawa* for certain kinds, representing 63 of the 373 uses of *balagi* in uninomial or binomial form, in contrast to a single application of the attributive term *nawa* to *jila* and no applications of *nawa* to the more solitary *ikaloa.*

<u>Jila</u>

People consistently describe *jila* as a more colourful and often striped fish, and give high levels of consensus to the scientific species *Acanthurus olivaceous* and *Acanthurus lineatus*. The terms *volavola* and *oriori* are used to describe stripes and patterns for *jila*, such as the territorially aggressive *A. lineatus* shown in Picture 5.7, whose unmarked venomous toxic caudal peduncle spines require careful handling in a net (Randall 2005:577). These fish are common on shallower reefs in the Ono Channel and may form schools at times, facilitating productive net fishing by local people.

Picture 5.7: *jila* (*A. lineatus*)

Picture 5.8: *balagi*? (*A. nigricans*)

v) <u>A fish of many parts, or 'aggregate features'</u>

People struggled to identify both a field guide image and a photograph of the scientific species *A. nigricans*, shown in Picture 5.8. This results in low FCNC consensus levels, and multiple names as shown in Figures 5.1, 5.2, and 5.4. For these images, substantial numbers of people applied, in diminishing order, the terms *balangi*, *jila*, *ikaloa*, and even *ta*, to this type of smaller than average, 15 to 20 centimetre, *Acanthurus* scientific species, as they also did to the similar *A. achilles* scientific species, which is known to hybridize with *A. nigricans* (Randall 2005:579). I am unsure how common these types of fish are in the Ono Channel, as I saw relatively few of them while diving and snorkeling. These fish kinds represent an aggregate of key identification features with the white tail and round body shape of *balagi,* the small size and pointed nose of *ikaloa*, and the dark base colours of *balagi* and *ikaloa*, but with bright multiple colour accents that people stressed as more definitive of *jila.* This kind of fish, spanning category boundaries, demonstrates the value of recording responses from more people than just a few experts to begin to understand classifying processes and provide insights into who uses which components of the animal for identification.

Investigating the categorization of aggregate featured fish, such as these, extends the goals of a folkbiological study beyond the butterfly collecting model (Leach 1961:21 from Ellen 2006:28), or simple reification schemes that Roy Ellen (1996:27) cautions against. When people attempt to identify a fish with discrete familiar features bundled in an unfamiliar construction, anthropologists may gain insight into classificatory practices and prehension models as distinct from rote responses. People struggled to identify the images of the scientific species *A. nigicans* and *A. achilles*, turning the photograph upside down and seeking advice from other people observing the interview. There are substantial differences in responses between village groups as shown in Figure 5.4.

Figure 5.4: Detailed analysis of terms chosen by interviewees to identify one image of the scientific species *Acanthurus achilles* and two images of the similar *Acanthurus nigricans*. Percentages of total responses are based on totals of 163 identifications in Kadavu villages and 75 in Ono villages.

term chosen **(attributive translation)**	**Kadavu**	**Ono**	**Total**		**term chosen**	**Kadavu**	**Ono**	**Total**
balagi	38	31	69		*ta*	6	3	9
balagi bui dromodromo (tail yellow)	0	2	2		*ta bui dromodromo*	0	2	2
balagi dina (real)	1	0	1		*ta cumu* (sm.triggerfish)	2	0	2
balagi lailai (small)	0	4	4		*ta loaloa* (black)	0	1	1
balagi nawa (schooling)	3	5	8		*ta masimasi* (rough)	1	0	1

term chosen (attributive translation)	**Kadavu**	**Ono**	**Total**		**term chosen**	**Kadavu**	**Ono**	**Total**
balagi ni takali (of the open sea)	1	0	1		***Total ta***	**9**	**6**	**15**
balagi qau (lg. triggerfish/*Balistoides*)	1	0	1		**% of total responses**	**6%**	**8%**	**6%**
balagi soro (fish that runs away)	0	1	1					
balagi volavola (pattern / stripes)	1	0	1		*bebe* (butterflyfish)	1	1	2
Total *balagi*	**45**	**43**	**88**		*bebe vola kosa*	1	0	1
% of total responses	**28%**	**57%**	**37%**		*cumu*	2	1	3
					dridridri	1	0	1
ikaloa	36	5	41		*lati ni daveta*	1	0	1
ikaloa ni dakunituba	1	0	1		*meto*	0	1	1
Total *ikaloa*	**37**	**5**	**42**		*pone*	0	2	2
% of total responses	**23%**	**7%**	**18%**		*qau*	1	0	1
					rijilase	1	0	1
jila	36	4	40		*tabace*	0	1	1
jila bui dromodromo	0	2	2		*tabace nu nuba*	0	2	2
jila loa (black)	1	0	1		*tivitivi* (butterflyfish)	3	0	3
jila nawa	1	0	1		***Total other***	**11**	**8**	**19**
jila ni vanua (inshore reef)	1	0	1		**% of total responses**	**7%**	**11%**	**8%**
jila volavola	0	1	1					
Total jila	**39**	**7**	**46**		no ID	22	6	28
% of total responses	**24%**	**9%**	**19%**			13%	8%	12%

In Ono where interviewees are more involved in subsistence fishing and people tend to live and work closer together, 57% of interviewees identified these fish images as *balagi*, in sharp contrast to the 28% consensus level in Kadavu villages. The majority of people in Kadavu villages who did not respond with *balagi* evenly divided their identifications between *ikaloa* and *jila* for these fish images. Both fish kinds shown have a shorter and rounder body shape than many surgeonfish, which likely generated the terminology links to similarly shaped *cumu* and *qau* as attributives for *balagi* and *ta*, or as uninomials. *Cumu* and *qau* refer, respectively, to small and large members of the scientific genus of *Balistoides*, also known as triggerfish for their distinctive dorsal and anal fin spines that lock erect in moments of stress.

This example, profiled in Figure 5.4, provides a clear demonstration of what Roy Ellen (1996:29) refers to as the interplay between a person's informal and formal socialization, the world in general, and earlier classifying experiences, blending what they know and have experienced with the context of the perceptual event. Although there are contextual limitations of using images instead of live fish, the fish do exist in the local area and people identifying these fish images are working from a framework of knowledge of related fish types that turn up on dinner plates with regularity. The fact that the features are somewhat scrambled from several prototypes generates a novel pattern of what Ellen (1996) terms as ‘prehension’ by the interviewee.

Prehension, or to grasp, for Ellen (2006:27-29), is a way to understand identification, categorization, and classification of an organism as a web of interactional processes, rather than as an action. These processes occur at a nexus of relevant knowledge, context, purpose, and cognitive architecture to place the organism in question into a framework in the mind of the viewer. For example, ‘giss’ is a term used by experienced bird watchers to describe how a fleeting glimpse of a just a few features of a bird is often enough for a confident identification (Petrak 2008). I suggest that people looking at images of the scientific species *A. nigricans*, and *A. achilles* use a sort of ‘giss’ to pick the features most salient to them from the aggregate feature mix, to group the fish kind into a familiar category.

In most interviews people tried hard to provide accurate answers and in some cases saw the exercise as a test that they wanted to perform well on. A challenge for an ethnobiologist interested in prehension patterns is determining which features of an animal are important to whom. My questions on the differences between *balagi*, *jila*, and *ikaloa* were of a general nature. Comparing the results of Figure 5.4 with those for FCNC fish images provides a clearer insight into how different people perceive fish features, and provides useful tools to select appropriate images for a future study to gain more in-depth understandings of how people perceive their biological world.

vi) The fish: *ikaloa, tabace, via, and tivitivi*

Pictures 5.9 to 5.12 show three scientific species of fish termed *ikaloa*, as listed in Figures 5.1 to 5.3. Three of these images show adult fish displaying the typical muted colouring of *ikaloa* reflected in the name's translation as 'blackfish'. The exception is the juvenile form of *A. pyroferus* shown in Picture 5.10, a mimic colouration of a local non-herbivorous angelfish, allowing juvenile *A. pyroferus* temporary feeding access to algae growing within damselfish territories. 50 of 80 interviewees identified this fish with diverse terms including 18 uses of *ikaloa*, three of *ikaloa dromdromo*, seven of *jila*, one of *jila dromodromo*, five of *balagi*, and a few other names. This variety of responses reflects people's use of varied identification tools within their local folkbiology. Most examples of attributive uses of *dromo* or *dromodromo*, 'yellow,' for this image came from the 25 Ono interviews, as did 47 of the 68 total uses of these terms for 'yellow' across all surgeonfish images through all 80 interviews. Therefore, for many people an *ikaloa* is not necessarily a black fish.

Picture 5.9: *ikaloa* (*A. pyroferus*) adult

Picture 5.10: *ikaloa dromodromo* (*A. pyroferus*) juv.

Picture 5.11: *ikaloa* (*Ctenochaetus striatus*)

Picture 5.12: *ikaloa* (*Zebrasoma scopas*)

On the whole, Ono Channel folk names for surgeonfish make little use of colour terms with the exception of *dromodromo* for 'yellow,' with much more use in Ono where the Bauan dialect is more prevalent. This supports a proposal of Chapter 3 that *dromodromo* is a loan word also used for 'orange,' as mentioned for *ta bui dromdromo* above, but with much less usage in Kadavu to date. Other colour terms used as attributives to describe any surgeonfish, not including the term *ikaloa*, in this study are nine uses of the term *loa*, 'black,' and one use of *damu*, 'red.' In Chapter 3, Figure 3.4 provides a breakdown of all colour term attributive uses in this study showing that *damu, loa,* and *vula* for 'white' are common terms, and that *dromodromo* or *dromo* represents 'orange.'

Figure 5.3 shows that people use the term *ikaloa* for individual scientific species in three different scientific genera. People in these communities use different names than *ikaloa* for other members of the *Acanthurus* and *Zebrasoma* genera. Thus, the category of *ikaloa* is irregular under Berlin's (1992) scheme, as it should compare more closely to a single scientific genus.

However, people's use of *ikaloa* as a uninomial or in a binomial yielded a FCNC of 89% for images of *Ctenochaetus striatus*, and 75% for *Ctenochaetus binotatus*, with three uses of *ikaloa dina*, or *ikaloa* real, for *C. striatus*. This result suggests that the term *ikaloa* does fit the primacy of generic taxa rule of Berlin's (1992) model for the scientific genus *Ctenochaetus*, but with quite fuzzy boundaries. Bristletooth is the English common name for *Ctenochaetus* fishes, to refer to their unique dentition. I found that all of these small *ikaloa* fish, shown in Pictures 5.9 to 5.12, shared a property of being very hard to photograph, with their rapid direction changes and movements in and out of cracks in the reef. I am unhappy with the photos included here for *A. pyroferus* and *C. striatus*, but I took at least 100 shots of lower quality, as these fish tend to be in constant motion, moving towards or away from you and allowing only the briefest of side-on views. This photographic challenge exists despite the fact that *C. striatus* along with *Zebrasoma scopas* are the most common surgeonfish on the Astrolabe Reef (Obura and Mangubhai 2003), and *A. pyroferus* adults were also common. Shared body shape, feeding habits, and swimming deportment are all physiologically interrelated factors, which may be more salient features than tooth structures for non-scientific ichthyologists. Although the nose and front body shape of *Z. scopas* resembles *Ctenochaetus* species and *A. pyroferus*, the body height-to-length ratio and tail shapes are significantly different. Thus, the affect of certain morphology features may be greater than others. The notion of 'simple distinctive features' may be applicable for this group of fish (Forth 2004:28). This category of *ikaloa* illustrates the essential difference between internal anatomy based scientific classification and the more observable function approach of folkbiologists whom I now understand have good reasons to group these fish kinds together.

Several people mentioned tail shape as a distinguishing factor between *balagi*, *jila*, *ikaloa*, and *ta*. As a very general rule, longer caudal peduncles with defined tails spaced well back from rear rays of small dorsal and anal fins provide strong locomotion of streamlined bodies in the open ocean, as is shown in Pictures 5.1 to 5.4 of *ta*. In contrast, Pictures 5.9 to 5.12 of *ikaloa* types with their proportionately larger dorsal and anal fins positioned closer to wide and rounder caudal or tail fins matched with large active pectoral fins provide quick braking and turning mechanisms for maneuvering around coral heads and through recesses in the reef. In general, *balagi* and *jila* are bigger and freer swimming than *ikaloa*, but stay closer to reefs and bottoms as they graze on algae, in contrast with many *ta,* which often feed on open-water zooplankton. Pictures 5.5 to 5.9 of *balagi* and *jila* demonstrate intermediate versions of these body shapes and fin structures between the typical *ta* and *ikaloa* morphology. On the whole, the Acanthuridae fishes all have well defined and muscular caudal peduncles with broad tails for the rapid acceleration necessary for browsers in any environment to escape predators. People out fishing would take extra notice of these tails to avoid injury and potential venom. Children helping with fishing activities would learn early to be careful. Cuts and wounds take a long time to heal in humid environments when you are in and out of the ocean all day.

Tabace

Picture 5.13: *tabace* (*A. triostegus*)

The kind of fish known as *tabace* (*Acanthurus triostegus*) in Kadavu, with some uses of the loanword *bisikete* in Ono, has an exceptionally small tail spine (Randall 2005:583), which is perceived not to exist at all by some interviewees. This distinctively marked fish kind shown in Picture 5.13 is common in shallow waters where it forms feeding and spawning aggregations harvested enthusiastically by Ono Channel people using nets each December. Sharyn Jones (2009:105) recorded total consumption of 707 *tabace* during one week in the village of Liku in Lau, Fiji, of their total consumption of 4,045 fish, confirming these fish as salient components of inshore fishing people's diets in Fiji. In Ono Channel villages, even young children know the name of this distinctively coloured fish.

Often poisonous or dangerous fish and animals have unique short names such as *novu* for stonefish from the proposed Proto-Oceanic language term of (*ñ/n*)*opuq* (Osmond in press:85). Given the size and density of the surgeonfish population on the Astrolabe Reef, the distinct naming of *tabace* may reflect some combination of unique colour, food value, convenient inshore schooling habits, and safe handling attributes. Since many kinds of surgeonfish have venomous spines at varying life stages and colour patterns, the distinctive term *tabace* may indicate safety, where the 'safe to handle fish' is the exception in a group of 'risky to handle fish.' A more common naming system approach is to focus attention on highlighting dangerous organisms apart from non-threatening organisms. I will further discuss other venomous fish and sea snakes further on.

<u>Via</u>

Another named surgeonfish category is that of the monotypic *via*, applied to the scientific species *Zebrasoma veliferum* by 41% of interviewees, with a further 39% unable to identify the image. This kind has a similar body shape to the long-nosed, 15 to 20 centimetre, *Zebrasoma scopas* known as *ikaloa,* but *via* is wider and twice the size, with blue, brown, and cream vertical bands extending into large dorsal and anal fins that earn it the common English name of 'sailfin tang.' While grouped together in a single Linnaean category, *Z. veliferum* in real life has many differences from the more common *Z. scopas.* Geraghty (1994:161) traces the name *via* from a proto-Fijian term *viRa* for a swamp taro with unpalatable skin. Capell (1968:263) defines *via* as a broad fish with large breast fins.

<u>Tivitivi</u>

One of the most striking fishes on the Astrolabe Reef and found on Indo-Pacific coral reefs from East Africa to Hawaii and the Galapagos is the single member scientific family Zanclidae and species *Zanclus cornatus* or Moorish idol, shown in Picture 5.14. This fish type in Linnaean taxonomy is classified in the suborder Acanthuroidei with surgeonfish and other fish kinds. It is quite common to see this fish browsing in pairs on inshore and offshore reefs in the Ono Channel; the fish's sharp colour contrasts and distinct shape make it hard to miss.

Picture 5.14: *tivitivi* (*Zanclus cornutus*)

The grace and colour of this laterally compressed 20 centimetre long fish with a sweeping first dorsal fin ray often captivate divers and snorkelers, but locals are not so impressed. 24% of interviewees could not name the image, although several people supplied the name Dive Kadavu Fish in jest, for the Kadavu Island dive shop that uses this fish kind as their logo. Captured in nets along with *tabace* and *nuqa*, this fish kind is consumed by people in the Eastern Fijian island of Lakeba (Jones 2009 and personal email: March 2010).

55% of interviewees gave the term *tivitivi* for this image. *Tivitivi* is a catch-all term for all members of the scientific family Chaetodontidae, or butterflyfish and many Pomacanthidae, or angelfishes. This is a large group of fish kinds; I have identified 27 scientific Chaetodontidae species on the Astrolabe Reef alone. An image shown to people of the locally common *Chaetodon vagabundus* attracted a 78% FCNC for the term *tivitivi*, with little hesitation by interviewees. This lumping of Chaetodontidae and others into *tivitivi* or *bebe* is well known in Pacific languages (Osmond in press: 59; Hviding 1996: 192; Hooper 1994:215). This helps to explain the use of the term by some people for *Zebrasoma* species and a few *Acanthurus* species as shown in Figures 5.1 to 5.3. The contrast with the quickly named *C. vagabundus* 78% result, suggests that the scientific species *Zanclus cornutus*, at a 55% FCNC, is not a prototypical *tivitivi*. In fact, the hesitation or inability of many people to name this highly salient fish suggest Gregory Forth's (2004:41) description of a "covert generic," where Nage informants were unable to name a brilliantly coloured bird, but assumed that it might have a name or possessed an unknown name. For the people that did name this fish after some consideration, their use of *tivitivi* as a default may represent a way of pleasing the interviewer on a fish that ought to have a name.

Geraghty (1994:156) confirms *tivitivi* as a proto-Fijian term for Chaetodontidae fish. Fijian dictionaries define the term *tivitivi* as sitting sideways in profile, and as a hatchet shaped like the fish (Capell 1968:234; Hazelwood 1872:133). In Kadavu, the term *tivi* means ‘to cut.’ Local folk knowledge warns pregnant women not to eat *tivitivi* fish to avoid having babies born with cuts behind their ears.

vii) General folkbiology knowledge and section summary

In response to a question about what *balagi*, *jila*, and *ikaloa* eat, 56 of the interviewees offered information, often listing two or three things. The most common answer is *nuku*, or sand, which came up 49 times, followed by 22 answers of *lase*, or coral, and seven of *ni cakau*, meaning the reef. 17 responses included the terms *vutia* and *lumi*, translated to me as seaweeds, sea plants, or moss. Given that these fish are grazers and possess very long intestines (Randall 2005:573), these responses have empirical validity. As Eugene Anderson (1996:103-104) explains, environmental knowledge by folkbiologists and scientists alike that seems odd is often based upon accurate observations “described in a culturally unique way”. People observe these fish picking at the bottom or the reef. People cleaning fish must remove intestines filled with decomposing plant material mingled with sand consumed as a grazing by-product. Fish guts are popular food and certain parrotfish with edible livers are given the special name *vasoso*. Surgeonfish intestines with a sand component would not be good to eat by people, so the *nuku* component may have high salience. However, local people may not perceive these fish as primary converters of vegetation into flesh as a scientific ecologist might. Other responses that people made to *ta* and some *balagi* eating floating dirt, I suspect, refer to zooplankton consumption. I will discuss issues of discrepancies between folkbiological and scientific biological knowledge further in Chapter 6, including people’s perceptions of fish eating sand.

This section has provided in-depth analysis of the folk identification and categorization of a large and diverse group of fishes that include the most common fish on the Astrolabe Reef, which fulfill critical ecological roles as primary consumers of algae. The detailed term analysis of Figure 5.4 provide useful methods for sorting out the folk identification of fish, when people have low consensus levels for terms and provide multiple names for the same organism, as shown in Figures 5.1 and 5.2. The method allows isolation of groups to determine how well they fit with Berlin's (1992) folk biological principles and ways of considering the components of prehensive identification. The spines that create risks of injury and toxin exposure from handling surgeonfish provide a natural grouping mechanism for folkbiologists and ichthyologists alike, with distinctively named *tabace* posing a tasty exception by folkbiologists. I will go on to provide a review of some other venomous fish and sea snakes found in the Ono Channel area.

Nuqu / sarika

Related to surgeonfish within the scientific suborder of Acanthuroidei is the family Siganidae and its only genus of *Siganus*, another common group of fish with venomous spines that cause painful but shorter term injury than stonefish (Randall 2005:598). Field guide images of the scientific species *Siganus spinus* and *Siganus uspi* shown to people had high FCNC levels as shown in Figure 5.5.

Figure 5.5: Siganidae scientific family First and Second Choice Name Consensus (FCNC, SCNC) by island with percentage of interviewee responses recorded using the Allen et al (2003) field guide images.

Genus	**species**	**Kadavu FCNC**	**%**	**Kadavu SCNC**	**%**	**Ono FCNC**	**%**	**Ono SCNC**	**%**
Siganus	*spinus*	*sarika*	91	*nuqa*	4	*sarika*	84	*nuqa*	8
Siganus	*uspi*	*nuqa tabanicau*	42	*nuqa*	31	*nuqa tabanicau*	56	*nuqa*	12

S. spinus is known as *sarika* by 89% of interviewees in this study with four uses of *nuqa* and five unknowns. This was another fish well known by the children observing interviews. This fish type forms large schools on inshore reefs at times, grows quickly, and is considered good to eat. *Nuqa* as a general term for scientific *Siganus* species ranks high on the favourite fish list compiled by Jones (2009:77) in Lau. The *sarika's* light camouflage colour blends well with shallow bottoms and also makes them difficult to photograph. People in Ono Channel villages identified images of other similar silver and green mottled *Siganus* species from the field guide as *sarika*, such as *Siganus vermiculatus*. Calamia et al

(2008:28) shows broad multi-village support for the use of both *sarika* and *nuqa* as names for the scientific species *S. vermiculatus*. Ryan (2000:145) has observed *S. vermiculatus* for sale in Fijian fish markets as *nuqu*. The common English name for fish of the Siganus family is 'rabbitfish,' for their rabbit-like profile. Rabbits are not native to Fiji, but two people identified *Nuqu tabanicau* as *ravete,* 'rabbit.'

Picture 5.15: *nuqu tabanicau* (*Siganus uspi*)

Distinctively coloured *Nuqu tabanicau* (*Siganus uspi*), shown in Picture 5.15, is unique to Fiji, and possibly New Caledonia (Randall 205:602). It is common offshore on the Astrolabe Reef. This fish kind is well known to 75% of interviewees as either the uninomial *nuqu*, or the binomial *nuqu tabanicau*, with 15% of people unable to identify the image. Many people mentioned that these fish live in pairs, as shown in Picture 5.15, and that they are man and wife. I observed many pairs and a few trios. I am told that the meaning of *tabanicau,* or likely *taba ni cau* is a branch of a tree. Dictionaries define *taba* as bark, skin, arms, or wings, and *cau* is a type of ironwood tree among other things (Geraghty 1983:475; Capell 1968:208, 26). I have not found a clear meaning for *tabanicau* as an attributive term for *nuqu*, despite asking a number of local people. Calamia et al (2008:28) also records *nuqu* for the silver coloured scientific species *Siganus doliatus.* Calamia et al (2008) do not provide a folk name for the locally common *S. uspi,* although the scientific species of *Siganus argenteus* is identified as *mayawa.* Several people identified *mayawa* as *S. argenteus*, a favourite fish to eat for its high fat content. Neither *sarika* nor *nuqu* are listed in the language reconstruction lists of Osmond (in press) or Geraghty (1994). Ono Channel people have knowledge and interest in this group of fish, requiring further study, as Andrew Pawley records 10 unique names for scientific *Siganus* species in Wayan Fijian.

viii) <u>More venomous organisms</u>

I discussed other dangerous fish in Kadavu seas with people in random conversations over the field guide, such as *novu,* or stonefish, and *toa* for the more spectacular *Pterois volitans* lionfish. Picture

5.16 shows a small *toa* from above. Both *novu* and *toa* fish have extended venomous spines capable of delivering painful injuries to people. *Toa* is the Fijian name for a chicken, and denotes the resemblance between a rooster's crest and the fish's sweeping dorsal fins. While, I did not spot any of the camouflaged stonefish and only a few small lionfish, fishermen were well aware of these fish, as they are a danger when sorting fish out of nets and walking on the reef. Paul Geraghty (1983:84-85) suggests that the term *toa* is a loanword into Fijian, possibly from Tongan.

Picture 5.16: *toa*
(*Pterois volitans*?)

Picture 5.17: *bula*
(*Acanthaster planci*)

Picture 5.18: *dadakulaci*
(*Laticauda* sp.)

Bula (*Acanthaster planci),* known in English as the Crown-of-thorns starfish, is a dangerous creature with an interesting Fijian name. *Bula*, a common greeting, spoken with emphasis on the b, is the first word anyone learns when they visit Fiji and is used with gusto in many ways. Hazelwood (1872:16) and Capell (1968:18) translate *bula* as life, with alternate meanings that refer to recovering from sickness, escaping death, and being in good health. 71 out of 80 interviewees used the term *bula* to describe a photo of *A. planci.* This large animal, growing up to 50 or 60 centimetres in diameter, is unpopular with conservation minded people for its aggressive consumption of stony corals. It is argued that fishing pressures on *bula's* key predators, the Trumpet triton shell (*Charonia tritonis*) and the Humphead wrasse (*Cheilinus undulatus*), have led to massive stony coral kills related to *bula* overpopulations in many Pacific reefs (Colin and Arneson 1995:230, Ryan 2000:65). Kadavu residents recall several years of regular Saturday public hunting efforts to spear *bula* and bury them on land to reduce human danger and save the local coral reefs. In my 2009 dives and snorkels on the reef and offshore from Kadavu, I saw only the one large *bula* specimen shown in the Picture 5.17. This eradication program has been effective in the Ono Channel area and I expect raised local recognition of the animal. Only one person used a different name for *bula,* namely *gasagasa*, but I suspect this to be a misidentification, as other people used this term for a much smaller sea urchin. However, Capell (1968:18) defines *bula* as a red, round, and flat kind of echinus also known as *gasagasau* and *cawaki*, which are terms I recorded for several sea urchins. Only six interviewees did not know a name for *bula*.

Many children identified the photograph of *bula*. One man who seldom fished and had a limited vocabulary of fish names knew *bula* well, after having stepped on the poisonous spines of a *bula* a few years previously. This man described a reaction of excruciating pain and a badly swollen leg with no mobility for several weeks. While it is common to have short names for poisonous creatures, I found it a curious use of the term *bula*, so often used to denote life and vitality with enthusiasm, for such a dangerous creature. People explained that the use of *bula* for the only poisonous starfish meant that the spines were upright and visible, indicating it to be alive and dangerous if contacted, as opposed to an upside down dead one. I will inquire in the future whether there is a different name for dead ones.

Dadakulaci (*Laticauda colubrine and L. laticaudata*), or the banded sea krait, is one of the most venomous snakes in the world and very common in Fijian waters (Ryan 2000:181). Separation of these two very similar scientific species made by scale counts is inconsequential for folkbiologists. 73 out of 75 interviewees quickly identified a photograph of this animal as *dadakulaci*; one person called it *gateaniwai* and another did not know a name. The *dadakulaci* image drew special attention from people, with many parents taking the time to show the picture to young children and warn them of its danger, as its venom is three times more toxic to humans than the Indian cobra (Ryan 2000:181). Ryan discounts the common myth, which I heard around the dive shop, that this snake cannot open its jaws wide enough to bite people. They are not generally aggressive to humans, but trapped or threatened snakes may bite. I observed these snakes on a number of occasions on small inshore reefs and on the outer reefs. A *dadakulaci* approached me one day while I was snorkeling, investigating me with fleeting curiousity, and allowing a good photo opportunity by a very still photographer. One person mentioned that *dadakulaci* are good to eat. The name *dadakulaci* is long and complex, for a dangerous creature. On Viti Levu where the term *dadakulaci* is also used, the term *dadaru* translates as slippery to refer to the freshwater eel *dadarikai*, which seems related to the sea krait name (Waqaniu and Rogers 1991:171).

ix) <u>Summary</u>

The bulk of this chapter has been devoted to the twin purposes of examining the Ono Channel folk taxonomy of the surgeonfish and allies, and developing a methodology to consider how and why people identify, categorize, and classify coral reef fish when consensus levels for these activities are low. On the first count, the Acanthuridae taxonomy survey has been a success with 21 unique names recorded. This compares well with Andrew Pawley's (2008:14) 20 terms collected for Acanthuridae fish in a comprehensive study of Wayan Fijian fish names and marine animals. On the second count, the analytical methodologies clearly isolated fish kinds with high consensus rates in the communities, but also established some models for considering how people perceive fish types where there are low levels of agreement about sorting less familiar animals. However, I do not consider these results to be an end point, as this leaves us still too close to the static butterfly collection that Leach and Ellen caution against. In order to have insightful conversations with people and learn from them, one needs grounding in the subject matter. Poisonous animals are good conversation items that yield memorable stories and experiences, as exemplified by the man who apologized throughout the interview for how little he knew about fish, but had a lot to say about his painful experience with the *bula.*

This chapter then provides a starting point for more in-depth folkbiological studies of local knowledge, not only of the main fish groups considered, but also the neighbouring categories, such as the triggerfish and other kinds spanning the fuzzy category boundaries. Analysis of the category *ikaloa*, where observable behaviour linked with the morphology that facilitates the behaviour shapes the category and demonstrates differences in categorization prerequisites between folkbiologists and ichthyologists. Edvard Hviding (1996:192) pointed out that in fishing-dependant Marovo villages, local knowledge of fish and fishing focuses on fish and marine animal behaviour patterns, so that predicting these patterns determines success. This knowledge is not static; Marovo fishermen learn from older generations, but must test the knowledge themselves for accuracy. This is an adaptive strategy to cope with fluxes in complex and high biological diversity coral reef environments. In Ono Channel villages investigated in the current study, we see people thinking about the same fish type in different logical ways, such as the aggregate feature fish types discussed in this chapter. Perhaps these low consensus levels reflect adaptive strategies in action.

Chapter 6: *Kawakawa dina* as a Cultural Keystone Species

i) Introduction

In this chapter I will consider people's interaction with their marine environment through folkbiological identification, classification, and traditional knowledge of people living near the Ono Channel in Fiji about local grouper fish in the scientific Family Serranidae. Here on Kadavu and Ono Islands, these kinds of fish, known in general as *kawakawa* and *drodrouwa,* are in demand for local and commercial consumption, but are vulnerable to overfishing during their seasonal spawning aggregations. Local fisheries sustainability programs known as Marine Protected Areas (MPAs) limit fishing in certain areas. Establishing MPAs is a broad strategy, but given their popularity, certain high demand kinds of fish such as *kawakawa* may require specific attention to prevent overfishing. Eugene Anderson (1994:155) notes that the kinds of fish in highest demand generate higher emotional responses in most situations, which I suggest includes detailed taxonomic recognition by fish experts and novices alike.

I will demonstrate that an in-depth taxonomic survey of a broad section of a population can identify fish kinds suitable for what Ann Garibaldi and Nancy Turner (2004) term as cultural keystone species (CKS). I will consider the applicability of the CKS model to coral reef environments, whether certain cultural keystone species can also be ecological keystone species, and consider how the CKS model can connect with the emotions of local decision making to support sustainable fisheries. I propose the use of rapidly deployed cultural keystone species models, built on local knowledge for coral reef sustainability projects, such as protecting grouper aggregations as complementary methods to Marine Protected Areas. This follows R. E. Johannes' (1998) call for less focus on exhaustive fisheries studies with minimal attention to human behaviour, in favour of more emphasis on encouraging near term practical actions, such as the current work of the Society for the Conservation of Reef Fish Aggregations in Kadavu (SCRFA website).

I will begin with a definition for traditional knowledge. There is some debate about the usefulness and accuracy of terms to describe what people know about their physical and biological environment. Andrew Pawley (2001:228) provides a useful definition of knowledge as "a subjective thing, encompassing 'perceptions', beliefs', and 'understandings.'" To find an English term to precede the word 'knowledge' that defines what people know about their physical and biological environment is difficult when one accepts that each language develops unique concepts and mechanisms for creating ideas (Pawley 2001:230). Furthermore, one must consider not just what people know, but what the social processes are that construct how people come to know what they know about their environment, and the practical use of the knowledge. Terms like indigenous, local, and traditional knowledge all generate different built-in meanings that can be found discordant with how people understand their environments (Sillitoe and Bicker 2004:1). In many cases where these issues come up, the people under discussion by anthropologists are living in a richer interactional relationship with their biological environment than the people doing the discussing. This further widens the perception variance. In this paper, I will use the term traditional knowledge, drawing upon Dana Lepofsky (2009:161), to mean an actively changing range of knowledge and practice accumulated and passed down inter-generationally that gives people explanations for why and how things have come to be as they are, and how to deal with the current situation (Stewart and Strathern 2004:54).

ii) *Na ika* / The fish

In Ono Channel villages, *kawakawa* and *drodrouwa,* the grouper fish and coral trout of the scientific family Serranidae, provide a substantial component of the fish caught for local consumption by handline and spear fishermen in the area. Pictures 6.1 and 6.2 shows the eight fish caught in an unsatisfactory morning of fishing by a handline fisherman working from an outboard motorboat inside the barrier reef; seven of these fish are *drodrouwa* and *kawakawa*. Picture 6.3 shows a sink of fish caught by handline from a dinghy a few hundred metres off shore; the largest specimen is a *kawakawa*.

Picture 6.1: *drodrouwa (Plectropomous leopardus)* **Picture 6.2:** *drodouwa and teiteimolo*

Picture 6.3: Local consumption
Top right: *kawakawa (Epinephelus ongus*)

Picture 6.4: Loading fish on the ferry to Suva

Picture 6.5: *kawakawa dina (Epinephulus polyphekadion)* (40-50 cm.) **Picture 6.6:** *kawakawa dina*

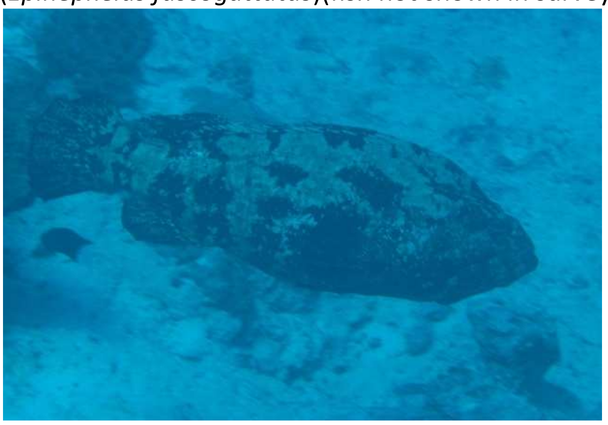
Picture 6.7: *donu / drodrouwa* (*Plectropomus laevis*)
Note: dark colour phase, well over one metre in length.

Picture 6.8: *senigaragara* (*Epinephelus merra*)
Note: less than 20 centimetres.

Picture 6.9: *drodrouwa*? *(Plectropomous oliganthus)*
An image of this fish was not shown. This image shows what is described as the *drodrouwa* shape.

Picture 6.10: *teiteimolo (Cephalopholis argus)*
More than half of interviewees identified this image without a profile, relying more on colour.

Picture 6.11: *orooro*? / *seravua*? (one metre long) (*Epinephelus fuscoguttatus*)(fish not shown in survey)



Picture 6.12: *drodrouwa* (*damu*) top and *kawakawa* (*P. leopardus* and *E. polyphekadion*)

Please note: All photos by Gordon, as are any errors in folkbiological or scientific identification.

Responses to questions about favourite fish kinds often include members of the *kawakawa* / *drodrouwa* fish group, described as tasty with hard flesh, which keeps better. In general, these fish kinds are quite meaty, easy to cook and have large heads, considered a special delicacy in Fiji. People readily identified most of the fish in the category. Figure 6.1 lists the names given to the 21 images of 14 scientific species in this survey and the names with first and second highest consensus levels in villages on each side of the channel.

iii) Taxonomic analysis

The analytical tool developed in this study of 'first choice name consensus' (FCNC) is the percentage of consensus for a name used to identify the kind of fish shown in a picture to each of the 80 interviewees or interviewee groups. The consensus percentages are divided into the results from 55 Kadavu interviews and 25 Ono interviews to highlight differences and similarities in traditional knowledge and language use between the neighbouring islands. The second choice name consensus (SCNC) is included when a significant number of people chose another name than the FCNC name.

Figure 6.1: First and second choice name consensus for grouper fish. A summary of the most common names provided for field guide images shown to people for fish identification (Allen et al 2003).

Scientific genus	**scientific species**	**Kadavu FCNC**	**%**	**Kadavu SCNC**	**%**	**Ono FCNC**	**%**	**Ono SCNC**	**%**
	field guide images								
Cephalopholis	*argus*	*teitei molo*	56	*kawakawa*	18	*teitei molo*	36	*kawakawa*	24
Cephalopholis	*argus* (pale phase)	*teitei molo*	38	*kawakawa*	29	*teitei molo*	40	*kawakawa*	24
Cephalopholis	*urodeta*	*kawakawa*	15	*drodrouwa*	11	*kawakawa damu*	40	*kawakawa*	20
Cephalopholis	*miniata*	*droudrouwa*	29	*kawakawa /varaniu*	16	*kawakawa damu*	40	*kawakawa*	28
Epinephelus	*chlorostigma*	*kawakawa*	51	*drodrouwa*	25	*kawakawa*	52	*kawakawa dravu*	16
Epinephelus	*corallicola*	*kawakawa*	53	*senigaragara*	13	*kawakawa*	44	*kawakawa matanisiga*	16
Epinephelus	*areolatus*	*senigaragara*	56	*kawakawa*	27	*senigaragara*	32	*kawakawa*	32
Epinephelus	*merra*	*senigaragara*	95	*kawakawa*	5	*senigaragara*	92	*senikawakawa*	8
Epinephelus	***polyphekadion***	***kawakawa***	**65**	***kawakawa dina***	**25**	***kawakawa***	**64**	***kawakawa dina***	**32**
Epinephelus	*caeruleopuntactus*	*kawakawa*	60	*kawakawa balotu*	11	*kawakawa*	72	*kawakawa loa*	12
Epinephelus	*ongus*	*kawakawa*	75			*kawakawa*	92		
Epinephelus	*ongus* (juv)	*kawakawa*	73			*kawakawa*	68		
Epinephelus	*malabaricus*	*seravua*	51	*orooro*	20	*seravua*	24	*orooro*	16

Scientific genus	scientific species	Kadavu FCNC	%	Kadavu SCNC	%	Ono FCNC	%	Ono SCNC	%
Variola	*louti*	*drodruwa*	27	*varaniu*	24	*varaniu*	20	*lauwi / jago*	16
Plectropomus	*leopardus*	*drodrouwa*	55	*drodouwa damu*	35	*drodrouwa damu*	68	*drodrouwa/varaniu*	8
Plectropomus	*laevis* (light / juv? type)	*drodrouwa vokai*	64	*drodrouwa*	16	*drodrouwa vokai*	52	*drodrouwa*	20
Plectropomus	*laevis* (dark type)	*drodrouwa*	27	*donu*	22	*droudrouwa*	40	*donu*	24
	author's photos								
Plectropomous	*laevis* (dark type)	*drodrouwa*	44	*donu*	25	*donu*	44	*droudrouwa*	24
Cephalopholis	*argus*	*teitei molo*	53			*teitei molo*	48	*kawakawa*	28
Cephalopholis	*argus*	*teitei molo*	53			*teitei molo*	52		
Epinephalus	*polyphekadion*	*kawakawa*	85			*kawakawa*	84		

Of the three fish categories covered, the grouper section was the most interesting for people reflecting their higher emotional engagement. The 17 field guide images of 14 scientific species of groupers generated an identification response 94% of the time on average, much higher than the parrotfish response rate of 70% over 36 images, and the 63 % averaged over 29 images of surgeonfish and rabbitfish. Some people apply the term *kawakawa* to most grouper members of the scientific Serranidae family category, but primary use is for members of the scientific genus *Epinephelus* with their distinctive large heads in proportion to their bodies, and a jaw rounding upwards towards the mouth. The coral groupers of the scientific *Plectropomus* genus and *Variola* genus belong to the *drodrouwa* group. Most types have a distinctive flat planed body underside extending straight forwards into a protruding lower jaw as shown in Picture 6.9. A number of people confirmed this as the distinguishing characteristic used to differentiate between *kawakawa* and *drodrouwa*.

The members of the scientific genus *Cephalopholis* blur the line between *kawakawa* and *drodrouwa* as shown in Figure 6.2. Many people confirmed that the well known *teiteimolo* (*C. argus)* is a type of *kawakawa*, but the *teiteimolo's* body profile resembles that of *drodrouwa.* Identification of *C. urodeta* caused identification confusion that shows up in the many different names people gave this fish, although the image used may be a factor. Identification responses on *C. miniata* were mixed, with

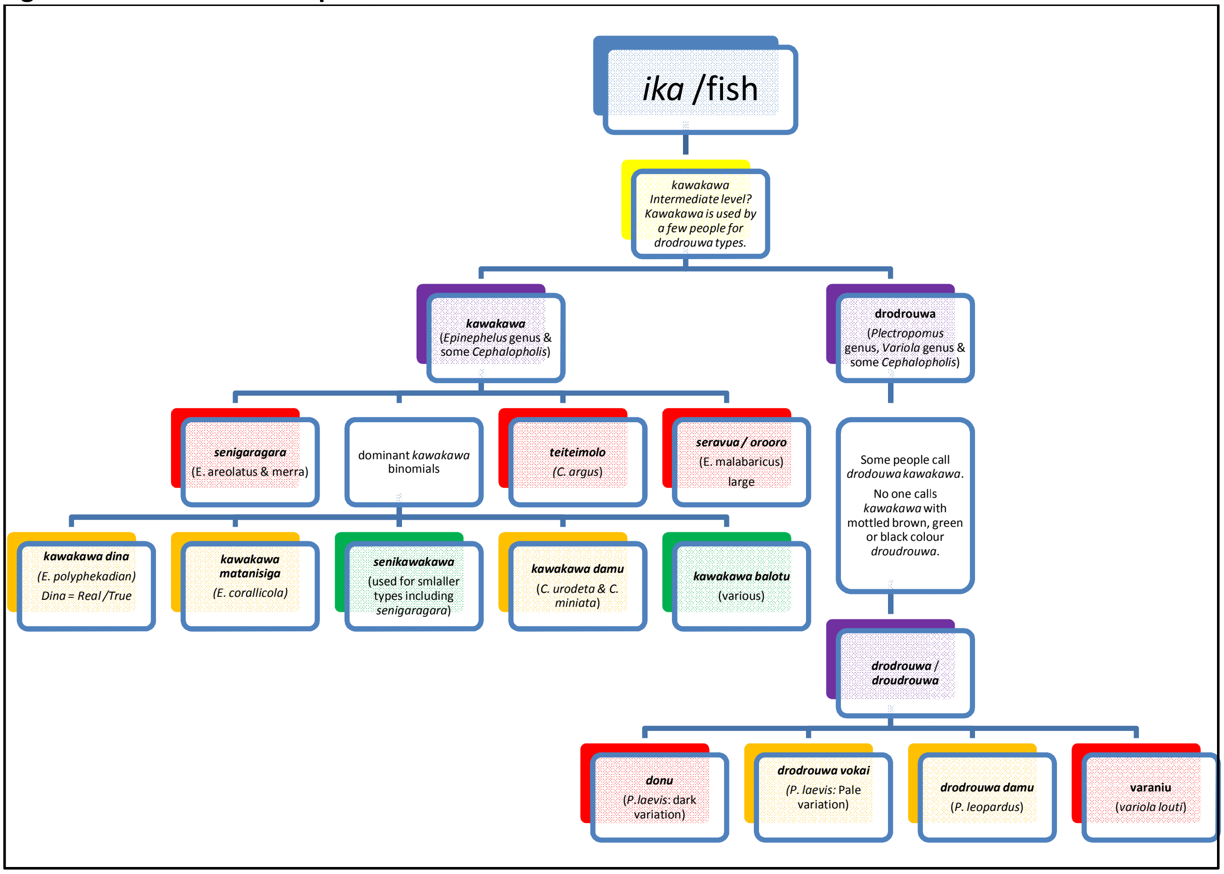
Kadavu people favouring *drodrouwa* by a small margin, in contrast to Ono people who had high consensus levels on *kawakawa damu* or *kawakawa*.

We presented eight images of seven scientific *Epinephelus* species, which all share camouflage-like mottled colours of brown, green, white, or black; no one identified any of these as *drodrouwa*. The fish kinds identified as *drodrouwa* in FCNC and SCNC results did attract at least a few identifications as *kawakawa*. This result suggests that body shape, head shape, and colour distinguish *kawakawa* from *drodrouwa*. The comparative image of these two types shown in Picture 6.12 is somewhat deceiving due to distended bellies resulting from the rapid pressure change for the fish when pulled to the ocean surface. Furthermore, although people told me that *kawakawa* and *drodrouwa* are distinct kinds, the term *kawakawa* may name a taxon at the 'intermediate' taxonomic level in Berlin's (1992) scheme, equating with the scientific Serranidae family. I assume this excludes the distinct Serranidae subfamily of soapfishes on which I have no information.

Different people pronounce the term *drodrouwa* in different ways, but this does not seem to reflect variation in identification. My interpreters recorded *drodrouwa*, *droudrouwa*, and infrequently *drudruwa*. I will use *drodrouwa* as representative of all pronunciations within this discussion. *Teiteimolo* also has an alternate pronunciation of *taitaimolo*.

The two scientific species named *senigaragara* in Figure 6.2 are small, common in lagoon areas, and sport similar colour patterns of white with brown spots (Picture 6.8). The word *seni* in this context means small. Another distinctively named *kawakawa* is the large *seravua* (*E. malabaricus*) of which I observed several upon the outer reef at a size of about 130 centimetres; Allen et al (2003) give a 234 centimetre maximum for this kind. In retrospect, the similar one metre long *Epinephelus fuscoguttatus,* shown in Picture 6.11, should also have been included in the survey for comparison, as the Society for the Conservation of Reef Fish Aggregations (SCRFA) considers this an 'at risk' kind of fish. *Kawakawa* fish kinds in the mid-size range of 34-65 centimetres are known as *kawakawa* or *kawakawa* with an attributive, which may relate to a single scientific species or several as in Figures 6.1 and 6.2.

Figure 6.2: Taxonomic comparison between Ono Channel names and scientific names



Droudrowa is applied to several scientific *Plectropomus* and *Variola* species with individual names provided by many people for each of the four images presented, two of which are distinct primary lexemes. The scientific species *P. laevis* may receive separate names for each colour phase. The name *donu* describes the larger phase of this fish eater, as shown in Picture 6.7, which may have more toxicity risk as discussed later on. However, 60% of responses to this image chose *drodrouwa* as a uninomial, or with an attributive. The bands of the light phase of *P. laevis* identified as *drodrouwa* often attract the attributive *vokai,* which is the Fijian word for the similarly banded Fijian iguana. *Varaniu* is a distinctive uninomial name given to the fish identified scientifically as *Variola louti,* with few attributives used. Future inquiries could determine if the term *varaniu* is applied to another member of this small scientific genus, *V. albimarginata,* if it is present in the Kadavu area. The scientific species *P. leopardus* is often identified as *drodrouwa damu* or simply *drodrouwa*. This kind of fish makes up the bulk of the fishermen's catch in Pictures 6.1 and 6.2.

This *kawakawa* and *drodrouwa* category of fish fits Berlin's (1992) taxonomic proposal in some respects and in others somewhat unevenly. Fish identified at the scientific species level with uninomial names, as shown in the red boxes in Figure 6.2 do not fit well in this system that predicts species level names as binomials. The relationship of the broad term *kawakawa* to the scientific genus *Epinephelus* fits, but the relationship with the *Cephalopholis* genus is awkward. The term *drodrouwa* relates to the genera *Plectropomus* and *Variola. Varaniu* as a uninomial name for a scientific species does not fit. The term *kawakawa* is the predominate name used for the scientific Serranidae family with at least one use for every picture shown and a total of 609 uses as a uninomial or in a binomial for the 17 field guide images shown. This implies a named intermediate category, which is not the norm in the Berlin (1992) system. *Kawakawa* turns up at equivalent taxonomic levels to scientific family, genus, and species.

iv) <u>*Kawakawa dina*, the 'real' or 'true' *kawakawa*</u>

Of particular interest to conservationists, Fijians, and Asian epicureans alike is the kind of fish shown in Pictures 6.5 and 6.6, listed in Figure 6.2 on the far left, and known in Ono Channel villages as *kawakawa or kawakawa dina*, meaning the true or real *kawakawa,* matching the scientific species known as *Epinephelus polyphakadian,* or the camouflage grouper shown in Pictures 6.5 and 6.6. This Fijian identification is a classic example of Berlin's principle 4.a, which allows for the prototypical taxon to be polysemous with the superordinate taxon name, along with the use of a secondary name such as 'genuine,' 'real,' or 'true' to indicate prototypical status and differentiate it from congeneric taxa (Berlin 1992:29). In other words, the name *kawakawa* is applied to a number of similar groupers, but this kind is the ideal and focal type of *kawakawa.* 28% of interviewees used *kawakawa dina* and 65% used only *kawakawa* for this fish image with consistency on both sides of the Ono Channel for a total consensus level of 93%. The term *kawakawa dina* was applied to *E. polypheakdion* images 28 times and of all the other images in the group, was given only four times in total to describe one of three different kinds of *kawakawa*.

The *kawakawa dina* (*E. polyphekadion*) is a solitary medium size grouper under 61 centimetres, which is found throughout the Indo-Pacific region as far east as French Polynesia (Allan et al 2003:160). These fish live both inside the Ono Channel and on the outer reef and are caught with hand-lines from boats and underwater by spear fishermen. Local people like to eat this fish for its firm flesh and good taste, to which I can attest, in particular when steamed with papaya in coconut milk. *Kawakawa dina* may be perceived locally as a safer fish to eat than others. A number of people commented that eating certain larger groupers such as *seravua* and *donu* could poison humans, referring to the ciguatera toxin accumulation associated with some large piscavores, which accumulate ciguatera through eating small fish that graze upon human-toxic algae. Hazelwood's (1855) dictionary also warns of the toxicity of *donu.* According to Randall (2005:161) the primary diet of *E. polyphekadian* is crabs, with some fish and other prey, although the Society for the Conservation of Reef Fish Aggregations (SCRFA) website refers to a number of ciguatera incidents with this fish kind. SCRFA reports that in Fiji, this fish is a species at risk, vulnerable to overfishing, in particular during spawning aggregations. It is also one of the most popular fishes in the Life Reef Fish Trade (LRFT); restaurants in Asian markets such as Hong Kong have high demands for fish caught and transported alive for fresh pre-meal killing to command higher prices from diners (Colin et al 2003).

Kawakawa dina is a popular fish for all the wrong reasons from the perspective of the fish kind. Although I saw no evidence of local commercial harvesting by specialized LRFT boats, these fish are popular catches for local consumption and resale. A main concern of the people at SCRFA is to minimize harvesting during aggregations when the fish are vulnerable to capture and may not reproduce. However, local people work hard to catch fish in what are often difficult conditions and each day risk spending money on fuel and boats with little return. Conservation focused NGOs run education and tagging programs and local people listen to presentations, but people must balance their short term needs against long term risks of fish stock depletion. SCRFA reports their best results from working with older fishermen who have observed longer term declines in fish stocks.

The Astrolabe Reef is a biological hotspot with significant diversity and like other coral reefs hosting significant and diverse fish populations it contains sites visited by seasonal fish spawning aggregations. The SCRFA identifies a number of scientific species of groupers among the over 110 known species of marine fish that use aggregation spawning to maintain species diversity. A spawning aggregation consists of groups of a certain kind of fish assembling in a given location on a seasonal basis for egg-laying and fertilization in schools numbering from dozens to thousands of fish. In the Indo-Pacific region several otherwise solitary kinds of *kawakawa* or groupers may travel considerable distances to congregate in certain outer reef passages on a falling tide for spawning events, at specific times of year and lunar cycles. The concentration of fertilized eggs in high water flow locations ensures survival of some young and wide distribution of the larvae. Immature fish often follow adults to the sites to learn the travel and spawning pattern. Given some predictability of these events, they become attractive opportunities for fishers to harvest the abnormal high density fish population, but with significant risk to fish population sustainability. Researchers are uncertain as to the distance that the fish travel to aggregate. To investigate this, tagging projects have been underway on the Astrolabe Reef for several years to tag fish during aggregations and request fishermen to report where they catch tagged fish (SCRFA website).

Established marine protected areas provide safe havens for fishes. During several dives in no fishing zones I saw large 100 plus centimetre specimens of groupers known as *droudrouwa* or *donu* (*P. laevis*), and *seravua* or *orooro* (*E. malabaricus*) just floating without fear a few metres off the reef wall at 15 to 30 metres of depth. Spear fishermen told me that they seldom see this bold behaviour outside

Marine Protected Areas (MPAs) where this exposure would make the groupers easy targets. The same kinds of large groupers in other areas of the reef are much more careful, often slipping into crevices upon a diver's approach and they are particularly reactive to the arm movements of raising a camera, which is a similar movement to raising a spear gun for action.

The Fiji Local Marine Managed Area Network (FLMMA) works effectively with local communities to manage their fisheries, providing tools and training for MPA management. They have had considerable success in Kadavu Province given the 12 MPA sites listed on their website. The twin objectives of this program are marine environment health and human well being. Tools such as surveys and discussion points allow facilitators help people assess their own levels of well being and relate this to the benefits of sustainable fishing practices. Their materials present the important question of the affect of formal education on the success of LMMAs (FLMMA website).

- LMMA success can increase with higher formal education levels, as people will have greater awareness of environmental issues and jobs that are not dependent on fishing.
- Higher formal education levels can produce negative outcomes with reduced connectedness and knowledge of the marine environment, marine issues, and consequent support for LMMAs.

I found that a few people not involved with fisheries felt themselves to be more diverse and sophisticated people than those who fished full time. Perhaps the piece that is missing in this puzzle is a model capable of engaging all members of a community in sustainable fishing practices, even those with limited knowledge and interest levels. In order to begin this process effectively one needs to connect with the more limited folk biological knowledge of non-experts using methods such as the first choice name consensus (FCNC) taxonomic method developed in this study to determine kinds of fishes that everyone in a community knows and can potentially identify with.

v) **<u>Bridging genres of biological knowledge with the cultural keystone species model</u>**

Ann Garibaldi and Nancy Turner (2004) link cultural and ecological knowledge together in their novel proposal of using what they term as *cultural keystone species* (CKS) to focus attention on particular organisms, which play extraordinary ecosystem roles and have high cultural significance for local people. The authors integrated Roy Ellen's (2006A), unpublished at the time, description of the concept of ethnobiological keystone species, which relates the bioactivity of useful species to taxonomy and cultural significance. Garibaldi (2009) sets out to establish practical synthesized mechanisms for ecological and cultural conservation or reclamation. In the field of ecology the concept of keystone species, as proposed by Robert Paine (1966, 1969), is well established for important species playing essential roles in diversity maintenance and organization within their ecological communities, often as predators.

Linking cultural values and conservation together is not a new idea. As mentioned above, Fiji LMMA has developed a detailed handbook for working with villages to educate people on sustainable fishing practices, as has SCRFA, which does considerable work explaining the importance of not fishing from vulnerable fish aggregations. Garibaldi and Turner (2004) are taking this approach to a micro-level in trying to find important organism types that many people will identify with. They define these locality and context dependant cultural keystone species as:

> "culturally salient species that shape in a major way the cultural identity of a people. Their importance is reflected in the fundamental roles these species play in diet, materials, medicine, and/or spiritual practices."

The use of the cultural keystone species (CKS) concept for ecological conservation projects is not without its detractors, who criticise the mixing of ecological terms with cultural matters on the grounds that culturally significant species could well be ecologically harmful invasive species, which exploit new environments in ways that decrease species diversity. The introduction of periwinkles to New England shores and *Eucalyptus* trees in California are examples of now culturally popular organisms dominating ecological environments to the detriment of indigenous species (Nuñez and Simberloff 2005).

Garibaldi (2009:334) demonstrates the practical use of the CKS concept in working with Fort Mackay indigenous people on an oil sands land reclamation project where specific animals and plants provide a focus for ideological and ecological reclamation of lands transformed by bitumen extraction. A key point made in their study is the fiscal and logistical practicality of choosing just five plant and two animal kinds to focus on as starting points to re-establish a totally disrupted ecosystem, rather than assuming the daunting task of attempting to imagine and recreate a complete ecosystem all at once. Using interviews and literature reviews, Garibaldi developed a list of species to present to community members for further input in establishing the seven CKS and their values to the local community. This is an innovative approach incorporating quantitative and qualitative methodologies to draw on internal community knowledge and perceptions to connect community members with specific kinds of organisms that should act as ecosystem building blocks.

The important step that the CKS model accomplishes is building opportunities to forge defined links between formal scientific ecosystem models and local folk biological cognition models. Just as the LMMAN methods manual notes, formal education can create a certain disconnect between people and their biological environment with misconceptions arising on both sides of the education variance. For example, a key categorization boundary in Western science is the division between things that are alive and things that are not. A cross-cultural study of six year-old children demonstrated cultural support for variant applications of the properties of living things onto ontological categories of plants, and inanimate things. Japanese children were more likely than Israeli children to perceive plants and inanimate things with properties shared by all living things. A comparison of Buddhist and Old Testament teachings supports this cultural variation (Hatano and Inagaki 1999:147-148). This particular definition between organic life forms and inorganic substances is a fundamental concept of scientific biology and ecology that plays out in popular culture. Greenpeace promotes pictures of baby seal clubbing to generate emotional reactions, not pictures of gold miners smashing rocks with jackhammers. Wearing gold jewelry is socially acceptable for most people.

Biology and geology are separate subjects in most schools and categorization systems of organic and inorganic substances use different classification terminologies and principles. This is not the case in the folkbiology of many small scale indigenous societies, where conflation of the organic and inorganic is routine, but outsiders may perceive it as a symptom of backwards and uneducated thinking. Although, I recently listened to a stock market analyst describe the stock market's behaviour as if it is a grumpy erratic person, and a weatherperson's similar description of a storm. Storms even get human names if they are harmful enough to people.

In my efforts to learn more about people's knowledge of local reef fishes, I asked people what they thought different groups of fishes ate. Response times varied a lot and some people had no idea. A common answer across all categories was "*nuku*" or sand, which surprised me, in particular for the *kawakawa*, as these fish are commonly caught on hand lines with bits of fish or artificial squid-like plugs that, as I was instructed while learning to handline fish, must be made to look alive at all times. Most surprising was the expert fisherman who explained how cleaner wrasses delivered food into the mouth of *kawakawa*. Cleaner wrasses are fish that make their living by cleaning tiny parasites from inside mouths, gills, and external surfaces of larger fish.

However, Darrel Posey (2004:65), advises us to consider carefully which traditional knowledge is taken at face value and what researchers reject as not believable, since this may reflect the researcher's inability to grasp traditional reality. For example, questions about what *kawakawa* or groupers eat yields insights into traditional ecological knowledge about an important food fish.

Figure 6.3: What do *kawakawa* eat? Many people gave two or three responses and all are listed here.

Fijian	*ikalailai*	*sulua*	*vivili*	*nuku*	*lase*	*vutia*	*bulewa*	*misc*
English	small fish	shrimp/squid	crabs	sand	coral	seaweed	a	b
# responses	30	5	5	12	19	9	3	5

a) *Bulewa* is a broad term to describe various small animals crawling or living on the reef.
b) Miscellaneous includes dirt floating in the sea, dead fish, and food from cleaner wrasses.

Of the people who told me that various fishes ate sand, no one except for me seemed surprised that fishes can flourish on what I perceive as an inorganic non-food source. There may be micro-organisms living in ocean sand that do contain nutrients, but these are not easily visible to the naked eye, and to my knowledge most groupers will not have the functionality to filter them out for consumption as some fish might. After some thought, I started asking myself why I found this surprising.

My point here is that the lack of science structured knowledge among local marine environment experts about what these common fish eat, reveals a very different and more diverse understanding of the local biological environment than I learned about in biology or ecology classes. What the cultural keystone species model can do is focus attention on a few specific organisms in order for cross-cultural conceptualization between scientific ecology and folkbiology to occur. Individuals confronted with a whole new worldview may retreat, but learning how to see one organism differently is more manageable if the interest in that organism, a function of emotional engagement, is present.

vi) <u>Application of the cultural keystone species model for coral reefs</u>

A key question about the effectiveness of the CKS methodology put forward by Garibaldi and Turner (2006), as noted in a critique, is whether the kinds of organisms chosen as significant from a community's cultural storehouse fulfill the role of keystone species in the local environment and are capable of supporting biological diversity in the given ecosystem (Nuñez and Simberloff 2005). Rather than critiquing the use or bastardization of the keystone species concept in new ways outside of ecology (Davic 2004), the important issue is to determine the relative levels of cultural and ecological importance of a given species. Highly disrupted environments such as oil sands lands or ecosystems overrun by invasive species present great challenges in determining what fits where, and which organisms will act as agents for diversity by allowing others to integrate into the environment over time. Garibaldi (2009) makes a good case for the use of the cultural keystone species model in Fort Mackay, but questions remain about CKS model use in other environments.

Coral reef environments, while complex and extremely diverse, provide good places to put the cultural keystone species model to work. Given the continual distribution of larvae in ocean currents, coral reefs may have more resilience to invasive species issues than land masses or shorelines where the oceans form natural barriers to organism migration. Recent coral reef ecology studies demonstrate broad reproductive ocean current dispersal models that often support bio-diversity in spatially isolated habitats (Salomon et al 2010). Marine environments have been more resistant to high levels of human driven modifications than applied to terrestrial environments through fire, disease, and domestication of plants and animals (Erlandson and Torben 2008:13). However, coral reef environments at their very foundation continually change as ongoing reef growth, waves, and storms alter reef dependant ecosystems, but not necessarily in a stable cyclical manner such as the circle of life models portrayed in Disney movies and other popular culture outlets.

Humans affect coral reefs in changing ways, which in turn then change how people think about the reef. Jon Erlandson and Torben Rick (2008:2) demonstrate this by drawing upon the ideas of Jackson et al (2001) that human affects of coral reef interaction with marine fish populations pass through three general overlapping stages. The authors make the point that humans have been fishing and hunting in marine environments for much longer than often thought with significant affects upon reef ecology. Beginning with near shore coastal fisheries for subsistence purposes using basic boats and fishing tools, societies move to higher exploitation levels with greater technologies allowing fishing farther from shore and facilitating commercial export, which links a society into globalized networks of resource consumption, thus generating the third stage of intense exploitation of coastal zones and deep ocean species within a global pattern of resource consumption. This example serves first to illustrate the fact that all marine environments are in a state of continual change and people are an ongoing part of this matrix, and second that as people gain access to tools and markets that allow more intense exploitation of the environment, their view of the environment may not change as quickly as do their methods of exploitation.

The term ‘trophic cascade’ in ecology refers to the removal of apex predators that allow unchecked expansion of certain prey species and a reduction in species diversity. As one man told me in Kadavu, “*kawakawa* eat anything that they can get in their mouths.” If we consider *kawakawa dina* as an apex predator, which spreads out across the reef establishing territories and feeding on whatever is available, one can justify this kind of fish as an ecological keystone species pivotal to a guild as a stabilizer upon population spikes of *kawakawa* edible organisms. Robert Paine (1966:73, 1969:92-93) showed that apex predators maintain species diversity. *Kawakawa dina* is desired as a food fish both locally and abroad. The spawning aggregation practice, which the fish evolved over millennia to ensure genetic mixing, larval survival and distribution, makes this fish kind vulnerable to high levels of human predation and consequent scarcity. *Kawakawa dina* is a good candidate for a cultural keystone species, given its recognized linguistic and prototypical status and its ecological keystone status. The extinction of this fish kind would have direct and indirect human social consequences. I agree with Eugene Anderson (1994:155) that all other factors being equal, the fish in highest demand are those that generate the emotion of interest. This would seem to be the case with *kawakawa dina* in Ono Channel villages.

The SCRFA website provides methods manuals, brochures, and videos in multiple languages to educate the scientific community and local communities about the importance of allowing spawning aggregations to proceed unmolested. Working with local communities to establish Marine Protected Areas (MPAs) and educating people on the ecological importance of aggregations is admirable and of great importance. However, if people are used to seeing and harvesting aggregations of one kind of fish or another through much of the year (Veitayaki 1995:72-73), how much affect will these education methods have on long term patterns of fishing choices. Fisheries biologists are recognizing the need to pay more attention to local human and social dimensions in fisheries management using what is termed the *ecosystem approach*, which recognizes the need to identify local social and cultural conditions along with the ecological analysis to harmonize ecosystem sustainability with human needs (Bianchi et al 2008:15-19).

While these approaches to integrate community concerns into sustainability programs are admirable, program terminologies of cost benefit analysis, stakeholder involvements, and defining bounded ecosystems (Bianchi et al 2008:17-19), may structure sustainability programs in a manner that is discordant with the conceptions and worldviews of the very people that the program hopes to engage. In other words these programs may make fundamentally inaccurate assumptions of local motivations. Eugene Anderson (1996:175) proposes that resource management must anticipate local emotional response, as knowledge, emotion, and social institutions form an inseparable and interactional triad for people's decision making, where each of the three elements acts upon the others to produce a result. Furthermore, assumptions that people will act in rational self interest, if appropriate cost benefit ratios are presented, may be a bit naïve in any social setting, let alone in a small-scale society, which has not spent the last 500 years trying to convince itself that it is completely rational. Anderson (1996:176) presents the important idea that the survival of a society or what is termed as a "resource managing institution" is dependent upon people deploying correct knowledge, securing the emotional engagement of the people involved, and providing relevant education to children. In other words, science based sustainability programs documented in hundreds of pages of academic language buttressed by calculus, impressive flow charts, and analytical pathways must still engage local people at an emotional level and this may be a challenge.

In a diverse biological environment such as a coral reef, where local folkbiology identifies hundreds of kinds of animals, complex notions of bounded ecological zones may not translate well. For example in Fiji, the reef in front of a village territory is considered to be *vanua*, or part of the village owned land that extends to the outer edge of the barrier reef. Figure 6:4 demonstrates taxonomic use of the term *vanua* as a differentiating attributive for the fish kind termed *ta.* Similar use occurs with other fish names.

Figure 6.4: The use of the term *vanua* which describes a village's lands for near shore ocean regions.

Kadavu terms for kinds of fish known as *ta*	English translations *ta* = various scientific species of unicornfish as discussed in Chapter 5.
ta ni takali	*ta* of deep sea
ta ni vanua	*ta* of shallow water
ta ni vanua nubu	*ta* of deep water place

Careful selection of a few cultural keystone species does provide a starting place in a high diversity environment to establish sustainability programs that people can and will engage with. My question is whether people can adopt a popular and prototypical kind of fish such as *kawakawa dina* as representative and emblematic of their biological environment and home, so that *kawakawa dina* spawning aggregations become occasions of celebration of the health of the environment rather than fishing bonanzas? Following Anderson's model, the required steps would be to obtain institutional support from community leaders for further community discussions on traditional knowledge of *kawakawa dina,* and reciprocal explanations for local people on reproduction cycles of the fish kind. The first step to emotional engagement with *kawakawa dina* is a broad consensus on its identification, as has been established with the FCNC model in this study. The second step involves forging emblematic identification links between the health and stability of the population of the given kind of fish with that of the local community, building upon the FLMMA ideological approach. This requires the use of tools such as the distribution of images of the fish in photographs, t-shirts, sulas, life cycle charts, fish pins to wear, children's story booklets, and stickers for children. It works for Disney; several children in Kadavu volunteered the term “Nemo” to identify clownfish for this study. The third step extends these ideas into education of children and young people both in school and out of school, as the young men who do considerable fishing have often stopped going to school.

The core challenge for developing successful sustainable fisheries management programs is to go beyond understanding what people know, and to incorporate what they know to make decisions. In any community, the decisions that people make reflect the knowledge and values of their neighbours. Taxonomic studies such as this one, where many people in a community respond to similar questions to determine knowledge consensus, are good first steps. People able to provide detailed descriptions of an animal reflect knowledge accumulation stimulated by some emotional engagement with the given animal. Politicians have long known that engaging people upon an emotional issue, even if they do not agree with you, creates interest and opportunities for persuasion that are unavailable with less stimulating issues (Anderson 1996:5).

Successful local resource management requires a community with a good flow of relevant information within the community, tight social organization that allows broad participation, sharing of benefits, and strong emotional involvement by community members with a self-renewing motivational system (Anderson 1994). Religion once served this purpose in many small scale societies, and encouraged respect for the fish. Overarching ideologies do not necessarily relate directly to fish conservation, but still reflect people negotiating scarcity in some area of their needs (Anderson 1994). As societies become secularized or shift religious practices away from direct associations with animals, emotional engagement with the biological environment lessens and a fish become just another a thing rather than a fellow organism.

Leaders in fisheries management science are recognizing the need to address social incentives that create peer pressure along with legal, institutional, and economic or market based incentives (De Young and Charles 2008), but developing effective social incentives may be counter-intuitive to the approach of intense statistical analysis often used to develop fisheries management strategies. R. E. Johannes (1998) addresses this issue with specific examples from Oceania to demonstrate that fisheries management projects can be successful without detailed scientific studies of an area, by utilizing the knowledge gained from studies in similar areas, local folk biological knowledge, and a little common sense in what is termed adaptive management or trial and error. Johannes provides an example of a community driven closure of grouper spawning aggregation sites in Palau where action taken based upon local recognition of stock declines proved just as effective as statistical monitoring (Sadovy 2007 provides more details on Palau aggregations).

vii) <u>Summary</u>

There is a philosophical problem for the scientist or social scientist going into a small rural community, near a biodiversity hotspot, to encourage sustainable environmental programs that may be unattractive in the short term. I agree with Anderson (1996:4) that people everywhere often value a small present benefit over a future large benefit, so the problem with promoting a sustainability program is that the scientist in most cases does not have to experience the loss of the present good, but can feel good about the preservation of the future larger benefit. The counter argument is that as people acquire new technologies to better exploit their environments, scientists and social scientists have a responsibility to provide knowledge of mistakes and over-exploitation elsewhere in a manner that local people can relate to. Thus, if one is going to promote a sustainability program that yields long term success, it must be organic and build upon existing biological environmental conceptions.

My goal in this chapter has been to blend the established principles of taxonomic prototype analysis with in-depth cross community surveys to establish first and second choice name consensus patterns that will confirm the breadth and depth of folk biological knowledge in the community. We know that elders have deep traditional knowledge levels and may be more attentive to declining fish stocks based on decades of observations. But what of the 14 year old who has quit school to become a fisherman or the studious young person who achieves tertiary education and returns to the village as a teacher. How will they negotiate the science – folkbiology divide? Young people in any society tend to get more enthusiastic about things faster than their elders and may be the best conduit to emotional engagement with their biological environment. Adults often read children's books with their children.

The cultural keystone species approach, as proposed by Garibaldi and Turner (2004), and demonstrated by Garibaldi (2009) has merit for sustainability projects with small scale marine dependent societies. This approach should focus attention on specific culturally and ecologically important organisms that can serve as communication conduits between world views and generate the emotional engagement required to allow that young spear fisherman to perceive the emblematic status of a culturally significant fish, and the wisdom of opting to catch a more plentiful and lower status fish. Suitable for a complex biological environment, this multi-pronged approach of folkbiological survey, prototype study with FCNC analysis, traditional knowledge, and community engagement, can help select appropriate cultural keystone species that will stimulate emotional engagement within the community to complement marine protected area programs.

Chapter 7: Study summary and the next steps

My approach to the work of this study has been to correlate what I see as the three parallel, but inter-mingling streams of ethnobiological work. The starting point for ethnobiology research is to determine what people know of their local animals and plants, the taxonomies they use, and what they do with the organisms. A second stream of work is to explain the taxonomies and their underlying principles (Pawley 1994:1). This stream includes comparative work relating to linguistic sub-groupings, biological classifications, and cultural symbolism (Forth 2000; Forth 2004:177). A third stream is to put this knowledge to use for the benefit of the local people who contribute to its acquisition, such as Andrew Pawley's Western Fijian Wayan dictionary project. Ethnobiological knowledge gained may assist other people to learn new ways, or relearn old ways, of perceiving and interacting with their own biological environments. I stress that these are concurrent streams of comparable importance, and are not evolutionary or sequential, as Eugene Hunn (2008) also clarifies in a summary of ethnobiology.

Eugene Hunn (2008:15-18) describes ethnobiology as a four complementary phase field. These phases include what Hunn terms as 'pre-theoretical ethnobiology' to describe the knowledge exchange engaged in by people from one culture who learn from another culture's understanding and interaction with their biological environment. Another phase is the cognitive ethnobiology approach triggered by Harold Conklin's (1954) study of Hanunóo ethnobiology, which inspired the analytical framework of Berlin's general principles (Berlin, Breedlove, and Raven 1973, Berlin 1992), used as comparative tools in this ethnobiology study and many others. Advocates of Hunn's third phase of 'ecological ethnobiology' seek to contextualize the knowledge termed as 'traditional ecological knowledge' (TEK) and put the knowledge to use for human survival using 'traditional resource management' (TRM), relating knowledge levels of biodiversity to sustainability issues or questions of personal profit. The fourth phase of Hunn's framework involves sorting out the relative positions of ethnobiologists and the people who provide the traditional knowledge being 'salvaged' or investigated. Hunn calls for this to be a positive model of collaboration between the growing body of indigenous scholars and the researchers from elsewhere who also seek to contribute their efforts to understand how humans relate to their environment through the study of what Atran and Medin (2009) term as this underlying "distinct module of the mind" for processing biological knowledge.

Given the limits of time and resources available for the current study and the educational goals of a Master's thesis project, I have addressed these diverse components to a certain degree, but in some cases they lack depth, and in this respect future research could be productive. In what follows, I will summarize some key points from the core chapters of this study.

The fish names used in the South Pacific Islands of Oceania have a wide and detailed nomenclature, as demonstrated by Meredith Osmond's work (in press). There is a high biological diversity of fish and marine animals available to human perception and interaction for people living in artisanal fishing villages. The diversity and distribution of Fijian language dialects, sub-divisible into village or village group communalects, combined with high local biological diversity, provides fertile ground for students of ethnobiology. Through comparison of the responses of two groups of people living six kilometers of ocean apart, this study demonstrates a wide range of variation of consensus on terms for fish and marine animals, reflecting the biological, cultural, and linguistic diversities in play.

At one extreme is a 100% cross-village group agreement on the term '*ta'* for the locally common scientific species *Naso unicornis* and *Naso brevirostris*, as discussed in Chapter 5. In contrast, there is a complete disagreement between Kadavu and Ono residents on terms used to name the locally common scientific species *Priacanthus hamrur*. As shown in Chapter 2, *P. hamrur* is named in Ono with the high consensus term *wainisu mei radanibau*, or 'broth fit for the queen of Bau, a cultural term symbolizing a respect for the Bauan Empire. Bauan leaders, notably Cakobau, dominated Fijian politics in colonial times, after overthrowing their relatives and neighbours who led the competing Rewan Empire on Viti Levu until the 1840s. Kadavu people were subjects of the Rewan Empire and key suppliers of food, boats, and natural resources (Thornley 2005). In this study, Kadavu people provided no uses of the Ono term for *P. hamrur*, but they do have high consensus use of the term *misijeke*, which was often repeated during interviews in a word play as 'Miss Jeke,' with much amusement. The contrast between respect and parody in different high consensus names for the same kind of fish is curious.

Even more curious is the fact that an extensive 11 village survey of fish and marine animal nomenclature carried out previously in the area using free recall and follow-up field guide identification includes neither of these fish names (Calamia et al 2008). This does not in any way diminish the value of this comprehensive survey, recently published in The Journal of the Fiji Museum, to create a valuable resource for the Fijian people. However, this discrepancy does demonstrate the complementary value of the present study and methods, and upon the recommendation of Mark Calamia, I plan to submit a summary of first and second choice name consensus to the same journal.

The covert category of parrotfish discussed in Chapter 3, proved to be a complex one, given the size of the family and the wide range in developmental phases, colour, morphology, and behaviour. The use of colour modifiers as attributives is more significant in this category than others, in particular for a possible category prototype of *kamotu.* The term *kakarawa*, another prototype term in this category attracts few attributives at all, but is related linguistically to '*karakarawa*,' the Fijian term for green-blue, and the Proto-Oceanic [*ma*]*karawa* for green-blue. This colour term merges with the onomatopoeic term for the endemic Fijian musk parrots, *kaka*, to form the fish name *kakarawa*.

People mentioned colour and size most frequently as differentiating factors within the parrotfish category. Background research into relevant colour-perception categorization studies led me to propose the use of colourful fish images in these types of studies alongside the standard Munsell chips. The use of fish images offering texture and context may engage the mind in a more natural manner, in particular for people living in less technologically developed societies who are less accustomed to sorting objects on the basis of colour alone.

The summary provided in Chapter 3 leaves an unresolved tension between perceiving animals as gestalts rather than a collection of parts, with ideas about people focusing on key features, such as some examples of the 'simple distinctive features' proposed for birds by Gregory Forth (2004:28). This topic comes up again in Chapter 5, where I consider the notion of 'fishes of aggregate features.'

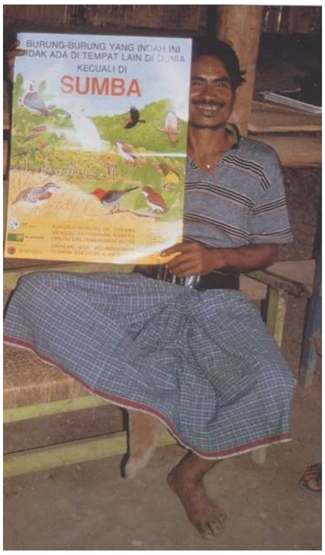
The responses and research presented in Chapter 4 raises interesting questions about the use of the term *sasalu* to describe sea cucumbers as a category, but not at the folk generic level. This term may also imply social prestige in relation to food. Under Berlin's scheme, the use of this term for sea cucumbers suggests that distinctly named *sasalu*, should be considered a life-form rather than an intermediate category. This notion is reinforced by some people's use of the term *sasalu ni waitui* to mean 'all things of flesh in the sea,' including *ika* or fish. I require more research on this topic to make any definitive statements, but Pawley (1994:14) also ponders the unusual position of sea cucumbers in Wayan folk taxonomy where they are named by the term *dri*, which the historical records reviewed in Chapter 4 show as a common Fijian term for the category of sea cucumbers. In Wayan Fijian, the term *dri* is a subtaxon of the term *manumanu* used for all animals and inclusive of *ika* (Pawley 1994:14).

The term *manu* is a Malayo-Polynesian proto-form used today as a general term for birds or in some cases specifically for domestic fowls in many Indonesian languages (Forth 2004:39). Several people in Kadavu tell me that *manumanu* are land animals, birds, and things that crawl in the sea, describing crabs and shelled animals. If the category of *sasalu ni waitui* is defined as creatures of flesh in the sea including fish, then this represents at least one additional taxonomic level above *sasalu* and possibly above *ika.* If *sasula* is a life form, and a subtaxon of *sasalu ni waitui,* then should we consider *sasalu ni waitui* to be a kingdom or unique beginner under Berlin's scheme, despite the overt name? In Chapter 4, I review contrasting folk taxonomic sea cucumber data from Moluku that is conventional with Berlin's system. Clearly, this category in Fiji challenges conventions of folk taxonomy, and I consider some cultural factors that may relate to these taxonomic aberrations, which may supersede the obvious economic importance of these animals.

In Chapter 5, the responses to inquiries about fish kinds of the scientific Acanthuridae family present a wide range of consensus levels that open opportunities to consider how people identify animals. Several different kinds of fish in this covert category, defined by their dangerous tail spines, were viewed as prototypical of their type, based on first choice name consensus results and descriptions recorded. However, two scientific species of these fish found locally, but less commonly than prototypical kinds, seem to have a confusing mix of features from inside and outside the distinct but covert tail-spine defined category. I term these as 'fish of aggregate features' that confuse the identifier's 'giss' or instant recognition ability. I consider the relative prominence of a number of different fish morphology features and their affect upon the interactive processes of identification, categorization, and classification. The diversity of fish kinds and range of responses recorded for the fish and animals discussed in Chapter 5 suggest future research options for several overlapping categories, such as the scientific Siganidae and Balistidae families.

In Chapter 6, I specifically address models for putting ethnobiological research to use, as described in my proposed third stream of ethnobiology, and in Eugene Hunn's third phase of ethnobiology, as reviewed at the beginning of this section. The key proposal of Chapter 6 is to establish appropriate methods for selecting what has been termed as 'cultural keystone species' (Garibaldi and Turner 2004; Garibaldi 2009), which play significant ecological roles, and in this case are under significant fishing pressure. Results from the first choice name consensus for the grouper fish category showed that *kawakawa dina*, one of the most desirable fish to catch and eat or sell, is the same kind of fish that conservation groups working in the area are most concerned about for its role in sustaining biological diversity on the reef. Patterns of fishing-related ecosystem collapse for coral reef ecosystems are well known. As groupers and other piscavores are depleted, more fishing emphasis is placed upon herbivores including Acanthuridae fish and urchins, which in turn leads to filamentous algae overgrowing the corals that sustain and build the reef (Helfman 2007:346). However, we must also consider the pressing wellness needs of the people who live proximate to the reef and are dependant upon it for their food and income.

Picture 7.1: Endemic birds of Sumba poster (Monk et al 1997:430)



My proposal in Chapter 6 to use ethnobiology research to contribute to sustainability and human wellness in artisanal fishing villages requires moving beyond education programs that put people in a situation of conflicting choices. A successful sustainability program must engage people at an emotional level, in particular younger people with growing needs, and less awareness of longer term declining fish stocks. Creating iconic perceptions of certain animals for conservation programs is not a new idea, as shown by the villager on Sumba holding a poster of endemic birds in Picture 7.1 to make the point that people enthusiastically support conservation when they feel engaged as custodians of the wildlife (Monk et al 1997:430). In the 1960s in Canada, campaigns to stop wolf and bear hunts repositioned wolves and bears in people's minds from threats and pests to become icons of Canadian nature. Change is a trial and error process in any situation, but emotional engagement is the key. As Eugene Anderson (1996:105) writes, "unemotionality is simply not humanly possible."

In conclusion, I believe this study has been productive in exploring approaches and methods to utilize ethnobiological research effectively in environments where local people are significant participants in high biological diversity coral reef environments. Like any interactional relationships, there are costs and benefits here that require consideration. However, to make headway, the workings of our 'module of the mind' (Atran and Medin 2008), which governs how people perceive and interact with our biological world, is important to think about.

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