



Folk taxonomy of reef fish and the value of participatory monitoring in Wakatobi National Park, southeast Sulawesi, Indonesia

Duncan May¹

Introduction

This study presents an etymological examination of folk taxa of nearshore fish caught around Kaledupa Island, in Wakatobi National Park (WNP), Indonesia. Translations of Bajo and Palo fish taxa presented here provide a basis for fisheries studies in WNP, and have already assisted participatory monitoring (PM) by trained fishers. The suitability of folk taxa for monitoring and analysis, and the ability of PM to stimulate appropriate fisheries management are discussed in the context of Indonesia.

The value of folk taxa knowledge and participatory monitoring

As a prerequisite to fisheries surveys, ethnographic data need to be collected — a process that can unearth a wealth of local knowledge on the biology and ecology of species, and technical fishing details (Johannes 1978, 1981; Ruddle 1994; McClanahan et al. 1997; Poizat and Baran 1997; Foale 1998; Neis et al. 1999; Johannes et al. 2000; Obura 2001; Sabetian 2002). Before studies of local knowledge can proceed, a working knowledge of folk taxa must be obtained (Foale 1998). This is particularly challenging in Indonesia where there are an estimated 583 languages spoken, often with highly divergent dialects. Though Bahasa Indonesian is the national language, in most rural locations a local language is used in everyday life and specifically to discuss fishing practices or fish taxa.

As well as aiding in the collection of local knowledge, identification of folk taxa can facilitate PM of fisheries by resource users. The primary benefit of

PM is its ability to address complexity vs cost issues inherent to most fisheries surveys (Wilson et al. 1994) and specifically tropical nearshore fisheries (Poizat and Baran 1997; Johannes 1998). Participatory monitoring can take the form of log books or creel surveys, which offer a low cost alternative to fisheries-independent methods such as underwater visual censuses. Log books require a high level of literacy, which is not present among Indonesian artisanal fishers. However, creel surveys utilising key members of the community who can interact with all fishers, can generate data on effort, technique, total catch and length frequency of folk taxa.

Participatory monitoring, in association with other management actions, can engender a strong commitment to conservation and co-management. It also places coral reef management within the cultural framework of fisher communities, addressing community requirements by creating a demand for resource use education, local investment and community-level decision making. Furthermore, PM can generate awareness and encourage independent proactive evaluation of trends by user groups (Davos 1998; Obura 2001).

Wakatobi National Park

The Wakatobi National Park (WNP) marine protected area (13,900 km²) was formed in 1996, and includes the atolls and islands of the Tukang Besi Archipelago (Fig. 1). The support for the formation of WNP was based on the park's position in the centre of the Wallace Region — a biodiversity "hot spot"^{2,3,4}, and the relatively low level of subsistence and commercial fishing on the 50,000 ha

1. Head Fisheries Scientist, Operation Wallacea, Hope House, Old Bolingbroke, Spilsby, Lincolnshire. PE23 4EX. UK. Email: duncan_rmay@yahoo.co.uk
2. <http://www.gefweb.org/COUNCIL/council9/workprog/indonesi.pdf> (Indonesia: Coral Reef Rehabilitation and Management Project – COREMAP)
3. <http://international.nos.noaa.gov/heritage/pdfs/seasia.pdf> (Chou L.M. World heritage biodiversity: Filling critical gaps and promoting multi-site approaches to new nominations of tropical coastal, marine and small island ecosystems. Potential tropical coastal, marine and small island world heritage sites in Southeast Asia)
4. <http://www.biodiversityhotspots.org/xp/Hotspots/wallacea/?showpage=Biodiversity>

of coral reef within the park. Since its well-intended start, WNP languished as a paper park, suffering from a lack of funding, continued destructive fishing practices, and complacent park rangers and management (Elliott et al. 2001; Clifton 2003). Furthermore, there has been limited success in addressing the dipolar needs of expanding local resource use and centralised WNP management objectives. In 2003 a new Head of WNP was appointed and WNP was

selected for the Indonesian government's Coral Reef Rehabilitation and Management Program (COREMAP), which aims to develop co-management of reef fisheries in Indonesia. Since 2001, Operation Wallacea has examined various aspects of fisheries around Kaledupa, as part of volunteer programmes, and as ongoing monitoring studies. This work is being put forward as part of a fisheries co-management programme evolving from the WNP, COREMAP and TNC/WWF.



Figure 1. Wakatobi National Park, Tukang Besi archipelago, southeast Sulawesi, Indonesia.

Social background

Within WNP there are two socially-segregated ethnic groups: the Orang Bajo (Bajo People), who speak Bahasa Sama, and the Orang Palo (Island People), who speak Bahasa Pulo. Originally, the Bajo were sea nomads living on boats throughout the Malay Archipelago, whose livelihoods and culture were based on subsistence fishing (Djohani 1996; Sather 1997). The Palo are descendants of nearby ethnic Butonese and were predominantly land dwellers, practicing both fishing and farming. In addition the Palo have a strong maritime history as sea traders and pirates, possessing many large wooden sail boats called *sopes* (Schoorl 1986), which traditionally formed the bulk of the Sultan of Buton's fleet. However, these seemingly unassociated ethnic groups appear to have cohabited the area, as flood stories in both folk histories tell of a split in one people, the Bajo travelling far out to the sea and the Palo climbing the highest peaks.

Increasing enforcement of national borders from the early 1900s and strong political pressure during the 1950s forced nearby Bajo to settle in permanent communities on coral platforms on the reef flats, and the Palo to sell most of their boats and adopt a new centralised government. These changes have caused the loss of important Bajo and Palo maritime history, which had been a way of life for centuries. Now the Bajo are embracing commercialisation and material aspirations, which has caused a shift from subsistence to small-scale commercial fishing and has led to many men seeking work outside fisheries, particularly in Malaysia. The Palo continue to farm as they always have but have now become less active fishers, dominating the developing infrastructure and government.

Of the 87,953 inhabitants of WNP in 2000, 6.1% were ethnic Bajo and 93.9% were ethnic Palo (BPS Statistics of Kec. Wangi-Wangi, Kaledupa, Tomia and Binongko 2000). However, the equal importance of both Palo and Sama languages for fisheries monitoring is indicated by comparable numbers of Bajo (58.6%) and Palo (41.4%) nearshore fishers around Kaledupa in 2003 (May, in prep.). This skewed demography is due to the total reliance of the Wakatobi Bajo on marine resources for subsistence and commerce, and the dominance of farming and administration by the Palo.

Methods

Bajo and Palo fish folk taxa were collected during creel and onboard surveys of all fishing tech-

niques used on the reef flat, crest and wall in the waters around Kaledupa Island between 2001 and 2004. Fish names were re-corrected for misidentification and pronunciation initially, and where confusion arose, fishers were interviewed for clarification. All interviews were conducted in fishers' respective languages with experienced interpreters. During all interviews, folk taxa were checked using the illustrations in Allen (2000) and Lieske and Myers (1996), and photographs in Allen et al. (2003). If there was no general consensus for a species-specific folk taxon, only well known folk taxa for the generic groups were recorded. Most common English names were taken from Allen (2000), as it was found to be very comprehensive for WNP, good for identification of most species, and easy to use for referencing. Etymological translations were obtained from local Bajo and Palo translators who worked closely on fisheries surveys between 2001 and 2004.

Results

During creel and onboard surveys, 313 species of bony fish (*dayah_b: kenta_p*)⁵ were recorded, for which 229 individual Bajo and 199 individual Palo folk taxa were identified (Appendix I). There were around 40 commonly caught species that most fishers could readily identify, beyond which identification became ambiguous. Consequently, the folk taxa displayed in Appendix I represent the collective knowledge of fishers, not the general ability of fishers to identify folk taxa, which improved with age and fishing experience. It was also evident that few Bajo and Palo fishers knew folk names in the other's respective language, which is reflected in the lack of similarity between folk taxa. Similar names only extend to: *pogo_{bp}*, the generic name for triggerfish; *ruma-ruma_{bp}*, the generic name for scad; and *bebet_b/bete-bete_p*, *Leiognathus smithursti*. Within folk taxa there are no variations in names assigned to fish around Kaledupa, with the exception of *Cheilenuus chlorurus* in Palo, which is *tai pere_p* on the east coast and *tai repe_p* on the west coast.

Both Bajo and Palo folk taxa use either a species-identifying primary lexeme, which may have a secondary lexeme of descriptive qualifiers, or a primary lexeme relating to a generic group. A generic group lexeme is often followed by secondary lexemes of descriptive qualifiers, which may make the whole folk taxon species-specific. Generic group lexemes were defined as those identified by fishers to have an appreciated generic value, though not necessarily with a known translation. There are 53 and 54 generic group lexemes that represent 43%

5. Words with the subscript _b and _p indicate Bajo and Palo languages, respectively.

and 40% of the caught species in Bajo and Palo, respectively. A further 8% and 3%, respectively, of caught species appeared to have generic values that were not identified by fishers. The use of species-identifying primary lexemes generally corresponds to species with clearly identifying features and does not appear to be related to locally desirable species. However, identification of infrequently caught non-target species (i.e. damselfish), was not possible below generic groups, mostly because fishers' appeared to have little interest in such species.

Even with a substantial number of species-identifying primary lexemes (41% of Bajo and 47% of Palo taxa) and many generic groups with species-indicating secondary lexemes, both Bajo and Palo taxa fail to distinguish 48% and 55% respectively, of caught species to a species level. Though this percentage seems high, the generic groupings found normally correspond to family, sub-family and genus, sometimes with descriptive qualifiers which identify species to sub-genus generic groups.

The similarity between Linnean and folk taxonomic systems can be seen by the synchrony of generic groupings within Linnean family and genus groupings, with the exception of only 2 Palo and 1 Bajo groupings: *jarah gigi_b* and *bicara_p* (*Synodus variegatus* and *Saurida gracilis*); and *randa moruta_p* (*Gnathodentex aurolineatus* and *Scolopsis auratus*). However, a Linnean system does not apply to Scaridae, where both Bajo and Palo identify Scaridae into colour types, apparently unaware of sexual dimorphism. Interviews revealed that these groupings, as well as other folk taxa which fail to identify species to a species level, are at the level to which identification was important for both Bajo and Palo fishers, and are viewed by fishers as essentially "folk species". These folk species can consist of a generic group lexeme, with or without a descriptive qualifier. For example: snappers with similar appearance, *Lutjanus quinquelineatus*, *L. kasmira*, *L. lutjanus* and *L. rufolineatus*, are *sasageh_b* "folk species" to Bajo fishers; or black parrotfish, *Scarus niger*, *S. viridifucatus*, and *Chlorurus bleekeri* are *lehe biru_p* "folk species" to Palo fishers. The only exception of identifications below species level are due to colour morphs of *Plectropomus laevis* and a Palo name for small grouper (*tulareke_p*).

Table 1 presents etymologies of Bajo and Palo taxa together with etymologies of West Nggela (Solomon Islands) folk taxa, as the percentage of

species described by that category. Over half the species caught have untranslatable primary lexemes in Bajo and Palo, with many primary lexemes for generic groups having lost their meaning to almost all fishers. For example, the meanings of *pogo_{bp}* (triggerfish) and *mogoh_b* (parrotfish) are hardly known, and the associated story indicating the meaning of *mbula_p* (soliderfish) is no longer fully understood. A few generic groups have retained their meanings, probably because of their direct association to the fish group. For example *kuu_p*, which translates as "smelly" and *sala_p*, which translates as "don't accidentally eat". Generally, the loss of the meaning of primary lexemes does not appear to be related to the importance of species to fishers. For example, Bajo and Palo folk taxa with untranslatable primary lexemes can be both important commercial or food species (*Herklotsich quadrimaculatus*, *Gerres oyena* and *Lethrinus olivaceus*) and species with little commercial or food value (*Ostracion cubicus* and *Scolopsis monogramma*).

Table 1. Percentage of 313 bony fish species caught around Kaledupa described by Bajo and Palo taxa categories, compared with West Nggela, Solomon Islands folk taxa for 350 cartilaginous and bony fish (Foale 1998). Percentages do not total to 100% as some categories overlap.

	Bajo	Palo	West Nggela
Untranslatable 1° lexeme	63%	56%	31%
Appearance only	33%	36%	39%
Habitat only	17%	8%	9%
Behaviour only	6%	6%	3%
Appearance & other	5%	1%	4%
Habitat & other	4%	1%	4%
Behaviour & other	3%	1%	4%
Taste or smell	3%	2%	1%
Fishing	1%	2%	5%
Other	1%	6%	4%
Untranslatable 2° lexeme	3%	2%	n/a
No name	1%	4%	n/a

Descriptive qualifiers, for both species identifying primary lexemes and secondary lexemes of generic groups, can be categorised into "appearance", "habitat", "behaviour", "taste and smell", "fishing", "other", and combinations thereof (Table 1). The category "other" tends to contain complicated explanations that identify the fish, but are not related to direct observations, for example: *mbula_p* (first), *tumolla_p* (bang), *meah_b* (pay) and *ruma-ruma_p* (small house). The use of "appearance" dominates descriptive qualifiers in both Bajo and Palo taxa to a similar degree as in West Nggela folk taxa.

Variations in the use of the remaining translatable etymological categories between Bajo and Palo taxa appear small, though when compared to those for West Nggela folk taxa, the relative importance of descriptive qualifiers can be gauged. Etymology of Bajo taxa are very strongly influenced by "habitat", strongly by "behaviour" and weakly by "fishing" and "other". Palo taxa are strongly influenced by "behaviour" and "other", and weakly by combined categories. While West Nggela taxa are strongly influenced by "other", "fishing" and combined categories.

Discussion

Linguistics

As well as aiding fisheries surveys within WNP, Bajo translations may be useful to fisheries scientists and anthropologists across Indonesia, as the Bahasa Sama spoken in WNP is spoken across most of Indonesia (Noorduyn 1991). The wider value of Wakatobi Bajo translations is supported by a strong similarity in Wakatobi Bajo fish names to a small list of Bajo fish translations from Indonesian Lesser Sunda Islands, at least 300 km to the south (Fig. 1a) (Verheijen 1986). Conversely, Palo translations are likely to have a limited value outside the national park, as Bahasa Pulo is a strongly divergent dialect of Bahasa Cia-Cia, one of five core languages on Buton Island. Furthermore, Palo fishers believed there are small island-specific differences in the pronunciation and names of some fish relating to island-specific dialects within the Wakatobi. Considerable differences between geographically close islands are not unusual, as Jennings and Polunin (1995) found between the Fiji islands. However, the differences within the Wakatobi are not thought to be extreme.

Etymological examination of Bajo and Palo folk taxa revealed a lack of meaning of the majority of words, with around twice the number of untranslatable primary lexemes in Bajo and Palo compared with that of West Nggela, Solomon Islands (Foale, 1998). Such a difference in the number of untranslatable primary lexemes suggests a loss of traditional understanding in Bajo and Palo, which may have arisen from cultural erosion due to recent shifts in both the Bajo and Palo lifestyles discussed previously. These changes in socio-economic factors appear to confirm the feared loss of fishers' knowledge identified by Sabetian (2002), as there has undoubtedly been a loss of marine tradition over the last two generations.

Translatable lexemes show a dominant use of "appearance" as a descriptive qualifier in Bajo and

Palo folk taxa, which together with size, habitat and spawning times used to discriminate folk species, tends to identify similar Linnean species. This is not unusual with folk taxa round the world (Poizat and Baran 1997; Foale 1998; Obura 2001), as both Linnean and folk taxa are primarily based on appearance. Of the remaining descriptive qualifiers, Bajo taxa uses "fishing" and "other" — which is usually related to folk law, with a surprisingly low frequency for a culture that depends on fishing. Conversely, Palo fishers tend to use less obvious visual identifiers, such as "behaviour" and "other", as well as less combined categories and more species-specific primary lexemes. The more frequent use of "habitat" by Bajo could indicate the Bajo's closer relationship to marine environment, though as recent folk history describes the Palo as highly skilled fishers. However, the Palo's more frequent use of "other" and more species-specific primary lexemes could be accounted for by a build up of folk laws among a non-transient island dwelling people, and the Bajo frequent use of "habitat" could reflect the practicality of "habitat" to converse within a previously transient and dispersed people.

Folk taxa and analytical resolution

One concern about using folk taxa for monitoring is the potential loss of analytical resolution caused by grouping species with a similar physical attributes within one folk taxon. However, Bajo and Palo folk taxa identify approximately half of the species individually, the remainder of which are identified at least to family level, and most to genus or sub-genus levels. These "folk species" normally consist of 2–10 species of similar body shapes, growth rates and feeding guilds/trophic levels, and are congruent with the Linnean system. Due to this, folk taxa are highly suited to complex fisheries analyses using multi-species and ecosystem models based on feeding guilds or trophic levels. Though Bajo or Palo folk taxonomy per se is unlikely to cause the loss of statistical resolution to fisheries analysis, the degree of rigor in community data collection and misidentification can reduce its value. However, trials of PM around Kaledupa suggest that rigorous data collection can easily be achieved using either Bajo or Palo folk taxa by effective training.

Importance of participatory monitoring in Indonesia and experience in WNP

Indonesia has one of the longest coastlines in the world, with over 17,000 islands and 51,020 km² of coral reef (17% of the world's total) (Spalding et al. 2001). This vast area is coming under increasing threat from the expanding (1.49% year⁻¹)

Indonesian population of over quarter of a billion in 2004⁶, who derive 60% of their protein from fisheries, 90% of which are artisanal (Spalding et al. 2001). The massive funding required for the development of sustainable reef fisheries in Indonesia, via expert based surveys and analysis, is an unrealistic prospect. The economic reality dictates low-cost, community-run fisheries monitoring, assessment and management.

The cost-effectiveness of PM using folk taxa has already been demonstrated in Kenya (Oburu, 2001) and the Takabonerate National Park, South Sulawesi (Malik and Kusen, 1997), where large areas were surveyed with minimal investment. Around Kaledupa the cost PM survey was substantially smaller than for underwater visual censuses (UVCs), with a substantial portion of PM cost being taken up by payments required to sample Bajo fishers who at present do not see aiding monitoring as a civic duty.

Within Indonesia, PM using folk taxa was found to permit meaningful community involvement in Takabonerate National Park (Malik and Kusen 1997) and it was felt that PM would have aided more effective management in three co-managed marine management programs in Maluku, North Sulawesi and South Sulawesi (Malik and Kusen, 1997). PM around Kaledupa proved to be socially rewarding in many subtle ways, and stimulated the assimilation of further fishers' knowledge. As expected, PM generated more questions from fishers than could be explained briefly during creel or on-water surveys, and forced an expanded explanation to an increasingly curious fishing community. The surveys around Kaledupa caused a degree of self analysis by some fishers on the existence of over fishing and its causes, culminating in quantitative interview surveys of anecdotal evidence. Awareness and self-evaluation of trends can incite a gradual step away from expert-based, paternalistic co-management and "rational analyses", as advocated persuasively by Davos (1998). Self supported community management, however "underdeveloped", should be the goal of sustainable development in Indonesia, as realistic long-term monitoring and management must be independent of external aid — which can breed corruption and community fragmentation. With analysis geared towards locally appropriate management issues and developing in complexity over time, such adaptive ad hoc management is perhaps more appropriate to near shore tropical fisheries and reflects the essence of reduced data management suggested by Johannes (1998).

Moreover, under recently formed political and legal framework in the wake of Indonesian government decentralisation (Crawford et al. 1998; Patlis et al. 2001), grass roots self-management is a real possibility.

Economics, achievable and locally appropriate analysis, and practical application of data, determines what type and how much data is required for individual situations. In the context of WNP, and perhaps Indonesia, PM using folk taxa is appropriate to the goals of nearshore fisheries monitoring and should aid skills transfer from scientists to the communities living in WNP, Indonesia's second largest marine national park.

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