Coastal Resource Use by Camel Pastoralists: A Case Study of Gathering and Fishing Activities among the Beja in Eastern Sudan

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This paper attempts to reconstruct subsistence activities among the Beja, camel pastoralists living along the Sudanese coast of the Red Sea, focusing on their coastal resource use.

I reveal, as a result of participant observation, that they target driftwood, mangroves, gastropods, and fish in gathering and fishing activities. The principal types and purposes of resource use are as a resource for food; a resource as a means of subsistence; and a resource for daily life materials.

I also show how the one-humped camel plays an invaluable role in the process of appropriating and carrying these resources, because it has an outstanding ability to walk on both soft substrates (mud and sand) and coral-rich hard substrates in littoral and sublittoral zones.

Key words: Beja, camel pastoralism, subsistence, coastal ecosystems, resource use.

1. INTRODUCTION

A variety of resources on many seashores throughout the world have been targets of human use, depending on particular circumstances of time and space. Hunter-gatherers, agriculturalists and fishermen have lived on the shore, a part of larger coastal ecosystem, which is an ecotone between the land and sea.

During the 1980s and 1990s, there was increasing recognition that management of subsistence activities is necessary for conservation or sustainable uses of natural resources, especially in mangrove and coral reef communities of tropical shores. We need to examine the ways in which human resource use affects coastal ecosystems, and in which environmental factors constrain human societies and cultures, in addition to biological productivity of the natural system itself (Tanaka 1986; Japan International Cooperation Agency 1990; Akimichi 1995; MaGinn 1999).

At the same time, pastoralist research also moved from a cultural ecology to a political ecology framework in the 1990s (Fratkin 1997). There is now a larger concern with the process of resource use as well as its outcomes. However, relatively little attention appears to be paid to how pastoral peoples interrelate with coastal ecosystems, and particularly what kinds of resources they use, except for a few pioneer studies (Chapman 1976; Takatsuki 1980). Examining the degree of multi-resource exploitation and the degree of dependence on non-pastoral products offers the possibility of within-group and between-

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group comparisons of pastoral production systems (Salzman 1972; Dyson-Hudson & Dyson-Hudson 1980).

I focus on coastal areas as living ranges from diversified points of view, in attempting to reconsider the subsistence economies of camel pastoralists[1] who have survived in arid lands. In this paper, as a first step, I try to analyze their gathering[2] and fishing activities, and to point out the considerable importance of the camel's role in the process of coastal resource use.

2. STUDY PEOPLE

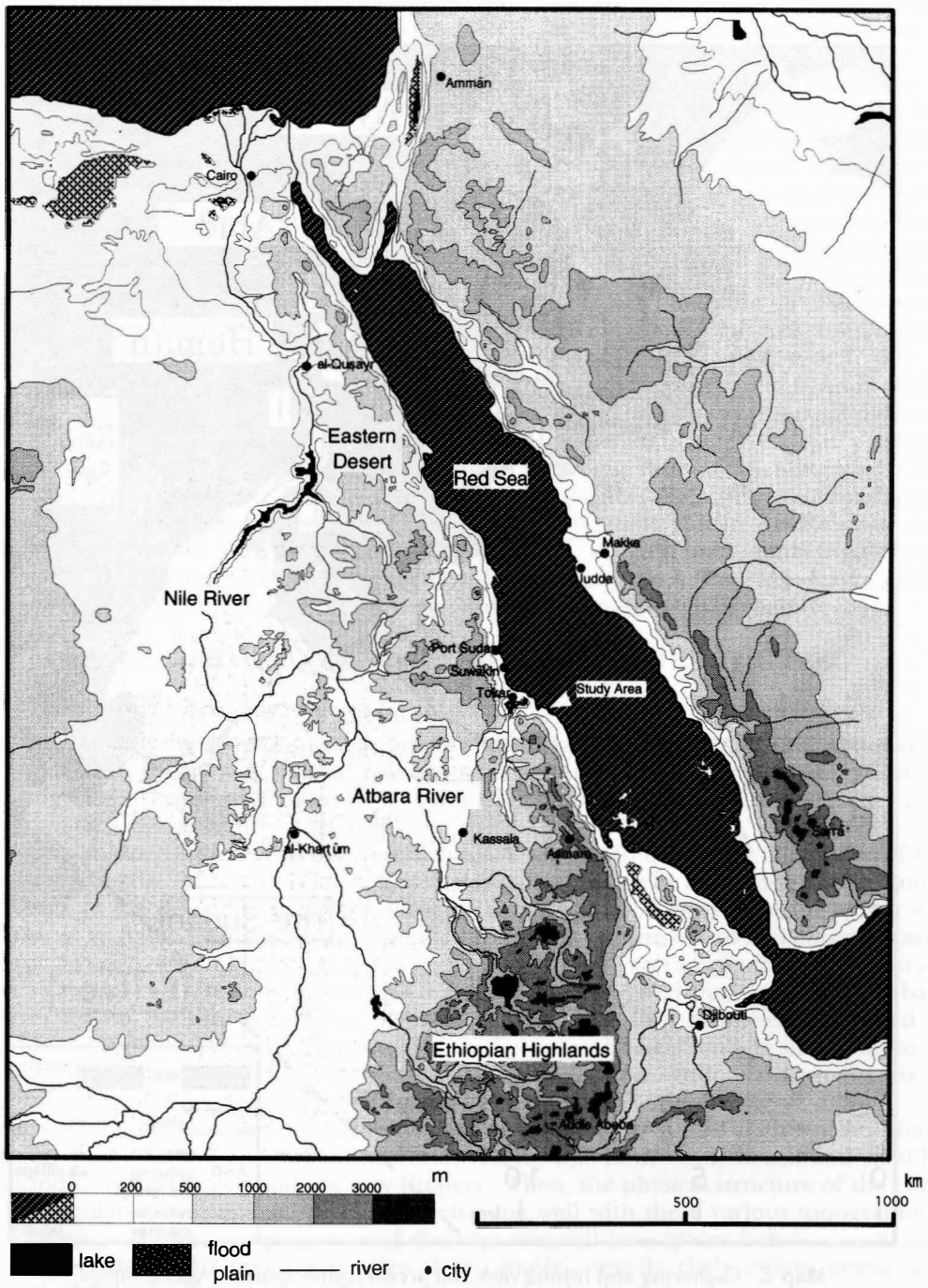
The Beja live in an area surrounded by the Red Sea, the River Nile, the Ethiopian highlands and Eastern Desert of Egypt, stretching over three countries (nation-states): Egypt, the Sudan, and Eritrea. The population was estimated as 620,000 in 1970 (Paul 1954; Holt 1960; Morton 1993). It was first mentioned in Arabic as *al-Bujat* by al-Wāqidī in the seventh century, and *al-Bujat* is also written as *al-Bujāt, Bujāh, al-Bujā* or *al-Bujāwat* in other Arabic sources. This name actually would have historical connection with *Bega* in Gəʿəz, *Blemmyes* in Greek, and *Medjay* in Egyptian (Nawata 1997). Either Tibḍaawẏe (the northern branch of Cushitic) or Tigre (the north Ethiopic branch of Ethiopic Semitic) is spoken as a first language by most of the Beja, and Arabic (Egyptian or Sudanese dialects) is also widely used (Moseley & Asher eds. 1994)[3].

Economic production of the Beja depends mainly on their herds of camels, cattle, sheep, and goats. High frequencies of lactase persistence are observed in large populations. Although many people practice some cultivation of sorghum (*Sorghum* spp.) and pearl millet (*Pennisetum typhoideum* (Burm. f.) Rich.), some also engage in fishing on the seashore. It is estimated that 75%–90% of the animal wealth of the people was totally lost through death in the drought of 1984–86. This caused extensive migration to urban centers, and raised the dependency on the market economy and relief food supplies (Crossland 1913; Bayoumi *et al.* 1982; Bakhit 1984; Cutler 1986; OXFAM 1990; Hjort & Dahl 1991).

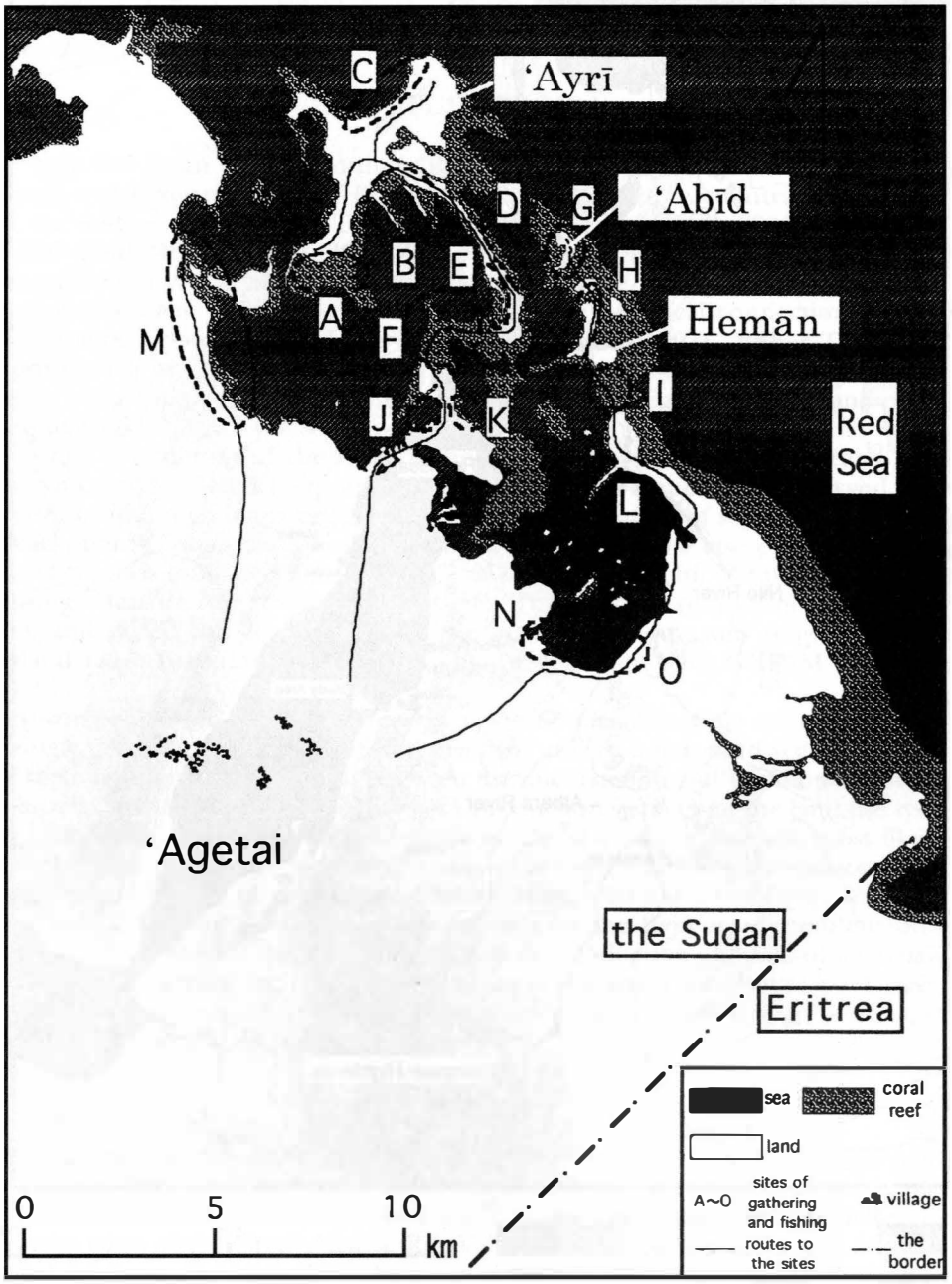
In spite such harsh circumstances in recent years, the Beja seem to have been surprisingly persistent in the same living areas for at least a thousand years. Accordingly, one of the main themes of research has been the understanding of traditional pastoral and agricultural subsistence economies (livestock production system and the land use system in particular). Even within a context of urbanization and modernization, most likely as a result of drought and famine, systematic analysis has been limited to agro-pastoral products as the dominant source of subsistence (Bakhit 1988; OXFAM 1990; Hjort & Dahl 1991; Morton 1993). Recent studies, however, show how the Beja are dependent on extra income generated outside the agro-pastoral system (production and sale of charcoal, *dum* palm tree mats and hides etc.), and pay attention to the totality of resources (Manger *et al.* 1996: 120–40). This case study may also shed a light on an overlooked aspect of subsistence activities among the Beja.

3. STUDY AREA

The Beja living area considered as a home range includes the Red Sea coastal region in eastern Sudan. The Red Sea region can be classified into three general physical units: the coastal plain, the Red Sea Hills, and the western plain. The Red Sea Hills, which represent the western edge of the Great African Rift Valley, extend for approximately 500 km in a northwest-southeast direction along the coast of the Red Sea. The altitude ranges between 900 and 1200 m above sea level. The western plain is located on the western side of the Red Sea Hills and the coastal plain on its eastern side. The coastal plain is a narrow strip ranging between 20 and 50 km in width, and extending from the shore to the foot of the Red Sea Hills (Hassan *et al.* 1996: 37–8, 205). The very small freshwater input from rivers or rainfall permits well-developed fringing reefs, which are found semi-continuously along both coasts of the Red Sea (IUCN 1988: xvii), and particularly in the Sudan the seaward



Map 1. Beja living areas and study location



Map 2. Gathering and fishing sites and access routes around 'Agetai village

edge of the fringing reef may be over 1 km from the shore, with a substantial 10 m deep lagoon in between. The Red Sea shores also contain sandy beaches, mudflats, and mangrove swamps (Head ed. 1987a: 9; 1987b, 131–2).

The survey area is around 'Agetai village on the coastal plain (Map 1)[4]. The village covers an area of about 3 km long by 5 km wide (Map 2). The estimated population is about 2000. Fieldwork was carried out during the period 1992–97[5].

Climatically the area exhibits a semi-arid subtropical Mediterranean type of climate in general (Bakhit 1988: 144). Annual rainfall means changed from over 400 mm in the late nineteenth century to less than 150 mm after the 1970s as a process of aridification intensified (Kassas 1957: 191; Abu Sin 1991: 9; Salah 1991: 2, 5). The mean temperature of the area is around 30° Celsius. Strong winds blow, especially during the summer season (Abdel Karim & Babiker 1991: 4–6). The vegetation is classified as the semi-desert grassland and shrubland that forms the eastern fringe of the Sahelian transition zone. Some data suggest that aridification has caused considerable ecological degradational changes in the vegetation. Thus, in fact, the present-day vegetation of this area seems to be the coastal desert that is said to cover the area north of Port Sudan. The coastal vegetation is characterized by drought-resistant halophytes (White 1983; Manger *et al.* 1996: 37–58).

The majority of the inhabitants of 'Agetai are the 'Ejīlāb clan of the Banī 'Āmir of the Beja. The Banī 'Āmir is less a tribe than a loosely knit confederation of groups of different origins (Paul 1954: 17–18). There are 'Ejīlāb, Aflanda and some other clans of the Banī 'Āmir in 'Agetai village. The 'Ejīlāb is thought to be ruling caste of Aflanda (Paul 1954: 83–4, 138). Other than the Banī 'Āmir of the Beja, the Rashāyda, who are immigrants from the Arabian peninsula (Young 1996), own small boats to fish in the Red Sea, and herd camels and other livestock. The Danākil (or Afar), who are immigrants from the so-called Afar Triangle in the Horn of Africa (Lewis 1955), engage in the same kind of work as the Rashāyda. All inhabitants are Muslims, and speak the Arabic language.

4. ACCESS TO GATHERING AND FISHING SITES BY CAMEL

4.1 The camel's usefulness in the littoral zone

I suggest that the camel plays a unique and significant role in the process of appropriating and carrying coastal resources, as a result of participant observation on gathering and fishing among the Beja (Photo 1). People make use of the camel as a supplementary means in these activities.

The one-humped camel (*Camelus dromedarius* L.) belongs to the family Camelidae of the order Artiodactyla. It is well known that the camel is excellent at moving on the loose sandy soils of the desert. One of the most striking anatomical feature of the camel is a structure of its foot. The front foot is about 19 cm long by 16 cm broad and covers an area of about 300 cm^2, which is twice as big as the human foot. The camel's foot splays out on taking the weight of the body, about 450–550 kg at maturity, and thus acts as a firm base for levering the weight forward to the next stride. The foot has been described as resembling a tire but filled with fat instead of air, because a fibrous rubbery sheath up to 10 mm thick covers the fatty pads. The camel, therefore, can move forward on deserts in which human and other animals would become stuck (Wilson 1984: 1–2, 65–6, 153–4).

Such well-adapted abilities are demonstrated on the bad terrain of both soft and hard substrates in the littoral and sublittoral zones (Photo 2). Both sandy beach and mudflat are periodically submerged and are very slippery. Then, the physical structure of the coral reef is irregular and complicated. But camels cope well with these various topographies. Other livestock (cattle, sheep, goat, and donkey) may fall into spaces between coral reef colonies, because their feet are smaller than camels', despite their weight being less. Although the donkey is used for riding and carrying water bags for short distances in land zones, it is not suitable for use in the littoral zone (Fig. 1). In sum, any other livestock than the camel will not serve to facilitate the human need to utilize the resources of both rocky and sediment shores in the littoral and sublittoral zones[6].

Photo 1. A view from a camel's back: camel silhouette with waves on a sandy beach, showing the clear contrast between the blue of the Red Sea and the white of the desert

Photo 2. Moving forward with a camel on slippery mudflats in the littoral zone

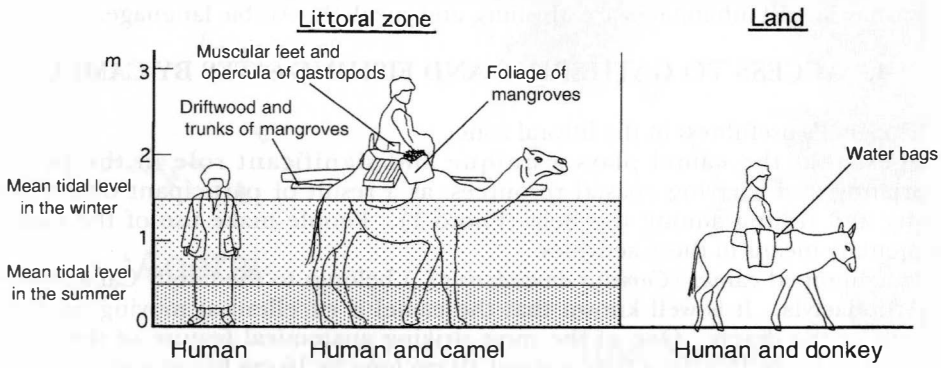


Fig. 1. The camel's ability in the littoral zone

4.2 Access to sites

Territorial rights and property rights in areas around 'Agetai village are claimed customarily and collectively by the inhabitants, with 'Ejīlāb as the majority[7]. Though members of other ethnic groups, the Rashāyda and the Danākil, can also use these resources it is only with permission from the 'Ejīlāb. I identify 15 sites, from A to O, of gathering and fishing activities under their management. Table 1 specifies the targets of resources site by site[8].

These sites of gathering and fishing activities exist on shores of both mainland and islands, including shallow-water reef tables. Normally sites can be approached only by foot, but are easily accessible by camel. Groups of people engage in the activities together (it is rarely a solitary pursuit).

The raised coral reef islands, such as 'Ayrī, 'Abīd, and Hemān, have heights of less than 10 m. It is possible to reach them without a boat by riding on a camel. For example, it is easy to cross to Hemān island, because the coral reef flat between the mainland and the

Site \ Activity / Target	Gathering			Fishing
	Driftwood	Mangroves	Gastropods	Fish
A	–	○	○	○
B	–	○	○	○
C	○	–	–	○
D	○	–	–	○
E	–	–	○	–
F	–	–	○	–
G	○	–	○	○
H	○	–	○	○
I	–	–	○	–
J	–	○	–	○
K	–	○	○	–
L	–	–	–	○
M	–	○	○	○
N	–	○	○	○
O	–	○	–	○

Table 1. Targets of gathering and fishing activities by site

island is either exposed or below 1 m depth even at high tide. 'Abīd island, however, can be reached only on windless days at low tide, because of very fast water movement due to tides, wave action and currents, passing through constrictions between Hemān and 'Abīd islands[9].

The seasonal sea level regularly moves up and down throughout the year, being at its highest in winter and at its lowest in summer (Fishelson 1973: 184–6; Taylor & Reid 1984: 176). In winter the mean water level is nearly a meter higher than in summer in the central Red Sea (Abdel Karim & Babiker 1991: 4). The mechanism causing the seasonal tide is driven partly by greater evaporation in the summer, but is mainly the result of wind-driven currents in the entrance to the Red Sea. The surface current in the Bab el Mandeb flows into the Red Sea in the winter, while in the summer strong winds blow the surface part of this outward, and this appears to be the main factor in determining the seasonal rise and fall (Sheppard *et al.* 1992: 52–3).

The upper parts of the reef flats between the mainland and 'Ayrī island are found 0.5 to 1.5 m below mean-water level. The deepest part has an approximate depth of 2 m in the winter season. The platform of coral reef flats provides an occasional corridor between the mainland and this island, and it takes about one hour to cross the distance of 2 km. Therefore, camel teams start to cross early in the morning, the time when the sea wind stops and before the tide comes in. The water goes up almost to the shoulder of the camel (Fig. 1)[10]. However, they are sturdy and brave enough to walk on the narrow ridge of coral reefs, a stony path where it is hard for them to retain their footing (Photo 3). The camel pastoralists accurately assess whether they can cross the sea under prevailing circumstances.

Photo 3. Heading for 'Ayrī island with a camel, crossing the distance of 2 km on coral reef flats

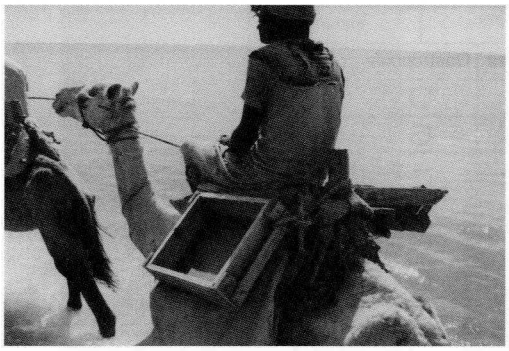


Photo 4. Loading driftwood and a wooden box on a camel, and bringing them to the village

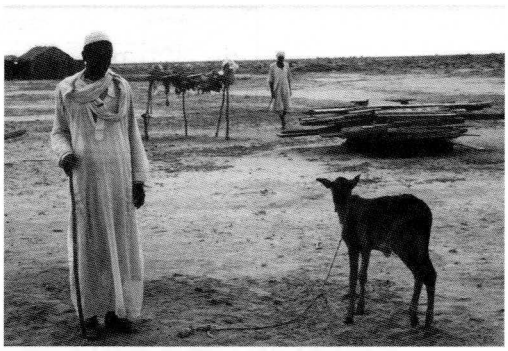


Photo 5. Piling up driftwood and raising a calf for a marriage gift

It also needs to be noted that the activities on coastal areas are exclusively a male task. Females do not participate in gathering and fishing, even though their village is located just 5 km from the shore. The camel riders are mainly young males, whose age is between teenage and thirties. I heard that almost none of them could swim adequately.

There is a life-passage reason why young males take part in these activities, related to the time when they become independent of their parents. They learn to manage a riding camel in later teenage, before which they must work with adult males, except for herding flock of sheep and goats, which they can do by themselves.

Gathering and fishing trips allow them to be away from their village for one week until their drinking water runs out. The young males, who know each other well, chat about all kinds of things, not only on their camel's back in daytime, but also around the fire at night. They may sometimes joke and make fun of each other, and sometimes argue and quarrel seriously. Talk about girls is a frequent topic. Heading for coastal areas, then, is a kind of passage of independence at an age between boyhood and youth.

5. DRIFTWOOD

Arriving at the islands, the young males run and try to get first to the beaches, because priority and ownership go to the one who finds driftwood. There is a good possibility of finding it, especially after strong sea winds.

Driftwood, in this case, does not mean natural wood but processed wood, as used for palettes or packing cargo. Shapes can be long, reaching a few meters, or heavy boxes nailed up together, or even a neat wooden box (Photo 4). However, these can be found only on islands facing the sea (such as sites C, D, G, H). The young males put this material on a camel's back and return to their village, piling up or standing the boxes against a wall of their house (Photo 5).

The boxes can be used as materials for building settlements, and for new houses after marriage in particular. In urban centers such as Port Sudan and Suakin, cargo wood is traded and used secondly for building materials. A rectangular parallelepiped house made of such wood is called *beit sandaqa*. In 'Agetai, this type of house is popular among people who have some relationship with urban areas, such as an owner of a shop selling daily necessities. In *beit hashīsh*, a more traditional type of house is made from the trunk of a mangrove as the chief pillar, strengthened by driftwood.

6. MANGROVES

Mangroves (mangrove plants) are the constituent plants of tropical intertidal forest communities (Tomlinson 1986: 3). At the survey area, I found only one species, *Avicennia marina* (Forsk.) Vierh. (vernacular name: *shāwara'*)[11]. A eurythermal and euryhaline mangrove species, *Avicennia marina* has the ability to adjust to low winter temperatures and

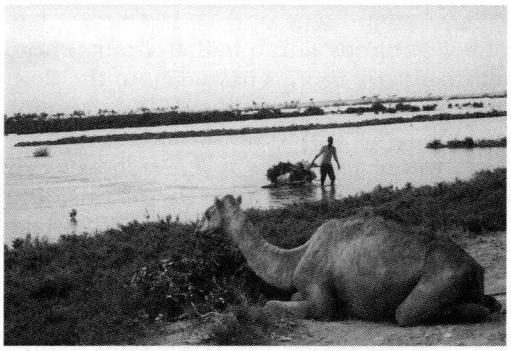


Photo 6. Cutting down young foliage of mangrove, and feeding a camel

high salinity, and is dominant in the Red Sea (Tomlinson 1986: 199–202; Sheppard *et al.* 1992: 162–3, 173, 255).

The outer wall of a *beit hashīsh* house is made of a combination of *Calotropis procera* (Ait.) R. Br. (vernacular name: *genṭe*) and the trunk of *Avicennia marina*, with a final coat of paint with cattle excrement. Most houses in 'Agetai are of this type.

When cutting down mangrove trees, builders are careful to leave a stump of several tens of centimeters above the surface. A principal aim of their activities is the systematic preparation of a new house for the time of marriage. Simple shades made of these building materials are also erected at some of the gathering and fishing sites.

As far as I could observe, there is no longer large-scale cutting of trunks for firewood and charcoal. Only dead branches are used for fuel, with camel excrement, while men are engaged in gathering and fishing along the coast. Fuel in everyday life at the village consists of dead herbage such as *Panicum turgidum* Forsk. (vernacular name: *sarra'*).

The most important aim of mangrove use is to collect branches and foliage for camel forage. The evergreen foliage of *Avicennia marina* contains less tannin than other mangroves, and is suitable for camels (Chapman 1976: 378). It is known that a mangrove community located in less than 2 m of water is invariably browsed by camels all year round[12]. In addition to this use, evergreen foliage is cut by humans and used for forage (such as at sites A, B, J, K, M, N, O). This helps in maintaining a regular supply of forage for the camels.

People go into the mangrove stands, which cannot be approached by camels alone because of poor footing. They cut down mainly young foliage with an ax, then pack it into hemp bags and carry it to the shore (Photo 6). Some is given to camels that come to the shore, and the balance is loaded on camel back and brought for other pack/riding camels. The amount of foliage gathered in an hour will be the amount of main (not supplementary) feeding for one pack/riding camel for one week.

7. GASTROPODS

The coastal communities of mangals, seagrass beds, and coral reefs are highly interdependent (Head 1987a: 9–10). Seagrass beds hold an ecological significance as primary producers in coastal environments (Sheppard *et al.* 1992: 143) and coral reefs provide shelter for many fishes as well as various species of polychaetes, crustaceans, molluscs, and echinoderms (Loya 1972: 100).

The third target of the gatherers' activities is gastropods. There are two species: Three-knobbed conch, *Strombus (Tricornis) tricornis* (Lightfoot, 1786) and Virgin murex, *Chicoreus virgineus* (Roding, 1798). I observed that the murex is comparatively numerous on the seaward fringe of coral reef flats facing the open sea (such as sites F and I), while the stromb occurs at the landward edge of the coral reef flat adjoining the lagoon (such as sites A, B, E, K, M, N)[13]. Gathering areas at sites are located in the sublittoral zone of shallow waters that are not deep enough to approach by boat, but not close enough to reach by foot. The best way for gathering the maximum harvest of gastropods is to ride on camels and go to the coral reef flats.

The principal reasons why gastropods are prized are to use the muscular feet as bait for fishing; to eat the feet as food; and to obtain opercula for incense and perfume.

7.1 As bait for fishing

At site A, three men can collect approximately 20 gastropods within half an hour (Photo 7). Then they smash the shells by ax on a piece of mangrove root. They take out the flesh from inside and remove opercula out of the flesh. After that they put the flesh on a hook at the end of nylon handline, which is rolled up around a piece of wood.

To fish they go on foot about 40–50 m offshore, where the water reaches above their waist. Two of them drop a handline with hook and bait. Stretching their arms, and sometimes bringing up a line, they wait for a fish to bite. When they catch a fish, they take it from the hook and hand it to another man (Photo 8). He puts his fingers into its gill, and breaks the backbone to kill it. After that he removes the scales from the fish. An internal organ of the fish is used as bait for the next fish. Within one hour they often capture 10 fish. Dory snapper, *Lutjanus fulviflamma* (Forsskål, 1775) (vernacular name: *maharūb*), Yellowfin bream, *Rhabdosargus sarba* (Forsskål, 1775) (vernacular name: *sho'ūla*), and Red Sea houndfish, *Tylosurus choram* (Rüpell, 1837) (vernacular name: *shunbrūr*) are the species most frequently caught[14].

After bringing these reef-associated fishes to land, the men make a fire of dead branches of mangrove with camel excrement. They chop onions into fine pieces, and fry these with oil in a pan on the fire. They hack up the fish into pieces with an ax using some mangrove roots as a chopping block, and put these pieces into the pan and boil with salt. When the fish taste penetrates into the soup, the pan will be removed from the fire.

At the same time, they knead dough that they bring from their village, and roll it out dough into a circle about 20 cm across. A kind of bread can be baked in the ashes. After tasting a cup of fish soup, they soak the bread in the soup and eat it with pieces of fish. They drink a cup of coffee with ginger or cloves at the end of the meal.

This meal on the coastal areas is different from the ordinary meals in a village (*asīda*: a kneaded and hardened lump made of sorghum or millet powder mixed with cow milk). Coral reef fish provides the main food resource for men engaging in activities on the coast.

Fishing time is typically either between sunrise and noon or between evening and night. Fishing lines and hooks are also left out overnight, and I observed once that the men caught a kind of manta 1 m long and released it without eating.

7.2 As food

The muscular feet of gastropods, both *Chicoreus virgineus* and *Strombus tricornis*, are consumed as animal protein for the diet[15]. The men put the shells on a fire, and pull out the grilled flesh with a knife or twig (Photo 9). This method of eating, though, is practiced only in the winter season.

As described earlier, the sea level is higher in the winter, and it is difficult to cross to the island and collect gastropods in abundance. In the summer, it is very windy, hot and humid. A strong wind blows up and the temperature goes as high as 45° Celsius. Yet, despite such conditions, more people go to camp on the shore and collect gastropods

Photo 7. Young male collecting gastropods on fringing reef flat, and shells left on the shore

Photo 8. Catching fish with hook and line, using gastropod feet as bait

Photo 9. Putting shells of gastropods on a fire, and eating the fleshy feet

Photo 10. Sun-dried gastropod flesh as preserved food

during summer than in winter.

In summer drying out the gastropods takes about one hour under the hot sunshine on a sandy beach. Operculum is removed, washed with seawater, and left again in the sun. People bring this sun-dried gastropod flesh to their village and keep it as preserved food for all members of their families (Photo 10).

7.3 As incense and perfume

The operculum is used for incense and perfume (Photo 11)[16]. The operculum of gastropods of molluscs is a horny or calcareous structure attached to the foot (Abbott & Dance 1982: 2).

One man, for example, took one *ukīya* (approximately 40 g) of opercula within a week in June, usually the peak period[17]. Most opercula are from *Strombus tricornis* (Photo 12).

Opercula is brought back to 'Agetai village, then village merchants go to urban centers in the coastal plain, such as Port Sudan and Suakin, to sell this produce. In the summer, when many opercula are harvested, outsiders come to the village to purchase them from the villagers. These are often merchants of the Beja or Takarīr, West African immigrants, from Port Sudan or Suakin. They bring opercula to Port Sudan and Suakin on the Red Sea coast, then to inland cities such as Kassala and Khartoum where Sudanese merchants or Indian merchants, Hunūd, distribute to other parts of the Sudan and also outside the country.

Prices in Kassala and Khartoum are twice as much as those in 'Agetai village[18]. Income from opercula is the only cash resource for the villagers other than selling their livestock.

I researched the kinds and prices of opercula in Port Sudan, Suakin, and Khartoum. I saw six kinds of opercula, and identified two of them as the same kinds as found around 'Agetai village. Based on an interview with some fishermen in Suakin, I ascertained that

Photo 11. Removing opercula from flesh of gastropods

Photo 12. Muscular feet at right and opercula at left

Species of gastropod			*Strombus tricornis*	*Lambis truncata sebae*	*Chicoreus ramosus*	*Chicoreus virgineus*
Shell	Morphological feature					
		Length (cm)	8.0 ~ 12.0	27.0	13.0 ~ 17.0	8.0 ~ 10.0
		Width (cm)	6.0 ~ 11.5	17.0	9.5 ~ 13.0	5.0 ~ 6.5
	Vernacular name	in Arabic in Tigre	ḥajar zurūmbāk ge'māi nūsh	ḥajar zurūmbāk ge'māi 'abi	ḥajar zurūmbāk ḥajar ghirjummatt	
	Price*		As ashtrays, ornamental objects and souvenirs: 100-300 £ S at Suakin			
Muscular foot	Vernacular name	in Arabic in Tigre	zurūmbāk alha'		zurūmbāk ghirjummatt	
	Price*		Sun-dried flesh of four species of gastropods (mainly conch): 1,400 £ S/kg at Suakin			
Operculum	Morphological feature					
		Long diameter (cm)	2.0 ~ 4.5	4.0 ~ 6.5	3.0 ~ 5.5	1.7 ~ 4.4
		Short diameter (cm)	0.5 ~ 1.0	1.5 ~ 2.0	1.7 ~ 3.1	1.2 ~ 3.1
		Thickness (cm)	0.05 ~ 0.1	0.1 ~ 0.3	0.25 ~ 0.5	0.1 ~ 0.3
	Vernacular name	in Arabic	ḍufra ḍufra saghīra ḍufra dankal rīsh	ḍufra ḍufra kabīra	ḍufra ḍufra dā'ira	
		in Tigre in Beja	echlāf nāf	echlāf nāf	ḍufra arfūb	
	Number of items	Per ukīya**	Approximately 400	Approximately 40	Approximately 25***	
	Price*	Per ukīya** at Port Sudan	4,000	3,000	2,000	

* 1 US $ equals 500 £S. Prices at March 1995
** 1 ukīya equals approximately 40 g
*** opercula of both *Chicoreus virgineus* and *Chicoreus ramosus* are mixed together (approximately 50:50) for sale

Table 2. Morphological features, vernacular names and prices for parts of a gastropod: shell, muscular foot, and operculum

Seba's spider conch, *Lambis (Lambis) truncata sebae* (Kiener, 1843), and Ramose murex, *Chicoreus ramosus* (Linné, 1758), are mainly caught by fishermen who engage in net fishing around islands a little way from the shore[19]. These four kinds are found in the Red Sea, but the other two are not from the Red Sea[20].

Perfumes are plentiful in the Sudan, including Beja living areas, and include incense, perfume ointment, and perfume oil[21]. These perfumes, a part of distinctive Sudanese culture, require opercula as a raw material. Opercula of *Strombus tricornis* are especially highly prized. Perfumes are made by women, and cannot be excluded from items of bridewealth from groom to bride for marriage. They have particular significance for the first night but also for the rest of married life. Table 2 shows the vernacular names and features of each usable part of the gastropods, and compares prices in detail.

I made an ethnographical observation on usage of opercula as incense and perfume by women, one at Port Sudan in eastern Sudan and another at Khartoum in central Sudan. There are differences in processing procedure, although two women emphasized the

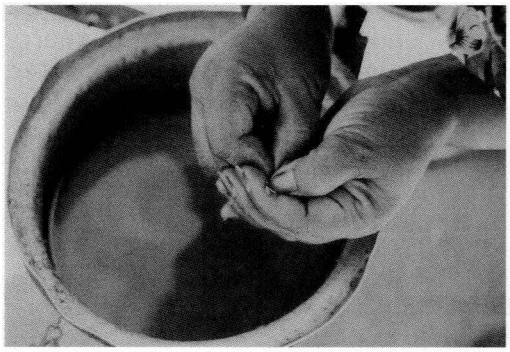


Photo 13. Removing sticky things from opercula that give off a foul smell

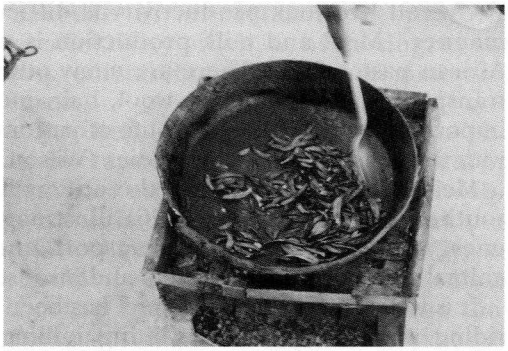


Photo 14. After being stir-fried on a pan, opercula must be ground into powder

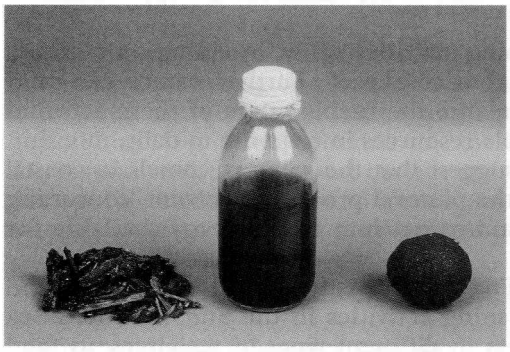


Photo 15. Incense, perfume oil, and perfume ointment include opercula of gastropods as a raw material

process of removing sticky things (seemingly a part of the muscular foot) that give off a bad smell.

They leave approximately one *ukīya* of opercula in hot water for a while in the sun, and removed the sticky parts directly one by one (Photo 13). These are stir-fried and mixed with sand, until the colors on the edges of the opercula change. The reason for using sand is to remove a foul smell and not to burn the opercula. Opercula are ground together into powders traditionally in a iron bowl with a stick, and in modern times with an electric mixer.

In another method, opercula are boiled with sorghum and washed with a piece of soap. This way seems to get rid of the smelly parts more readily. The opercula are dried for half a day, and stir-fried directly on a pan over a charcoal fire (Photo 14). Opercula, clove, misk, and *mahlab* (*Prunus mahaleb* Mill.) are ground together into powder, mixed with water and added to incense, perfume ointment, and perfume oil (Photo 15). Nonetheless, the smell of opercula, even after being stir-fried and ground, still seems fishy to me.

8. DISCUSSION

The goals of gathering and fishing activities with camels among the Beja are to find driftwood (processed woods); trunks, dead branches, and foliage of mangroves (*Avicennia marina*); the muscular feet and opercula of gastropods (*Strombus tricornis* and *Chicoreus virgineus*); and fish (*Lutjanus fulviflamma*, *Rhabdosargus sarba*, and *Tylosurus choram*, etc.).

The objectives of these activities, as drawn from this research, are:

- to find driftwood for use as building materials;
- to cut down trunks of mangroves for use as building materials;
- to collect dead branches for use as a fuel;
- to cut down foliage of mangroves for use as camel forage;
- to capture fish by using flesh of gastropods as bait for handline fishing;
- to collect gastropods to eat the flesh;
- to obtain opercula of gastropods for use as incense and perfume.

Overall livestock productivity is difficult to establish in a precise and quantitative manner. Meat and milk production is not the first and foremost goal and output of African pastoralists. There are many others, such as dung and manure, draught power, transport, hides and skins, wool, hair, etc. Although transport and draught power are important factors in the daily life of pastoralists, these are often overlooked by researchers, with the exception of a few studies (Wilson 1984: 164–70; Le Houérou 1989: 135–9).

Measuring and analyzing the energy-flow system in Nuñoa, the altiplano region of southern Peru, Thomas (1976) illustrated energetically that the llama reduces human energy expenditure-related transport, and its value lies in its multiple utility as a pack animal and as a secondary wool and meat source.

It is well known that the camel has been used for multiple purposes throughout history: riding, pack/baggage, water-lifting, milling, and cultivation, in addition to milk, meat and hide production (Bulliet 1975; Wilson 1984). However, the ecology of the highly topographically complex shores of the Red Sea, particularly the physical nature of fringing reef flats and shallow reef tops, demonstrates a hitherto unknown utilization of the camel. This paper reveals the invaluable specialized function of the camel for the exploitation of coastal resources.

People can access sites of gathering and fishing activities easily, by riding on a camel, which is capable of walking on flats of sand, mud or coral reef. Further, camels can carry very heavy and bulky loads. Pastoralists can enlarge the usable range of these activities even to islands without boats and exploit available resources in response to daily, monthly, and yearly cycles of tidal conditions. Thus, I suggest that the value of camels in coastal areas cannot be understood solely in terms of the pastoral production system: converting the energy in plant products that humans cannot eat into food energy available for humans as milk and meat.

Figure 2 is an attempt, based on this field data, to classify the principal types and purposes of resource use by gathering and fishing activities in the Sudanese Red Sea coastal area. The camel gives pastoralists access to different types of resources: as food (animal protein for the diet); as a means of subsistence (vegetable forage for livestock; bait for fishing); and as daily life materials (building materials; fuel; incense and perfume). Providing a direct source of food for humans is only an aspect of the important attributes of the camel in coastal environments. This fact illustrates the multiple dimensions of camel utilization.

If we look at the Beja subsistence system as a whole, the value of gathering and fishing activities on coastal areas would not be higher than that of the pastoral economy[22]. At the same time, however, it would seem that its supplementary role should not be taken lightly,

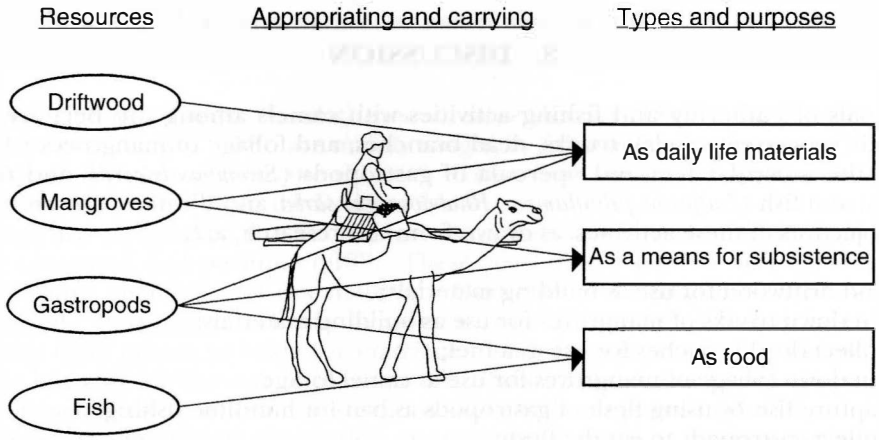


Fig. 2. Principal types and purposes of resource use by gathering and fishing activities on the Sudanese Red Sea coastal area

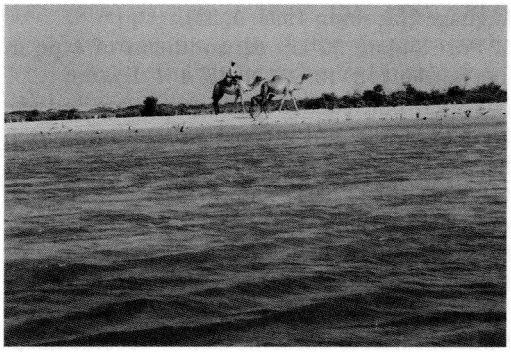


Photo 16. We should reconsider subsistence economies of camel pastoralists who have survived in arid lands, focusing on resource use on the coast

because of uncertainty in pastoral productivity, with a high degree of unpredictability of rainfall in time and space.

Further, it is necessary to place the importance of gathering and fishing activities on the coastal area within the dynamic between food-collecting and non-food-collecting purposes. Especially, we should not overlook the use of opercula as incense and perfume in the sense that these have been traded in broader networks[23], and provide cash income to a people who are suffering from hunger under recent drought conditions. To conclude, this field research among the Beja on the Red Sea coast presents a new perspective on aspects of the subsistence economy of camel pastoralists who have survived in arid lands, focusing on resource uses on the coast. Gathering and fishing activities have to be taken into account in understanding the totality of subsistence economies among the Beja (Photo 16). I will continue to examine the relationship between certain features of the natural environment and certain traits of human adaptation that directly depend on that specific environment, and investigate the adaptive strategies and survival mechanisms among pastoral societies from diversified points of view[24].

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NOTES

(1) I use the term "camel pastoralists" to refer to people who are not exclusively but principally dependent for their subsistence on pastoral products, and have a higher degree of dependence on the camel than any other livestock in terms of both productivity and social/cultural values. The Sudan has the second largest number of camels in the world and almost 1.5 million km^2 of territory suitable primarily or solely for their use (Wilson 1984: 39–41).

(2) In general, the term "gathering" refers to human foraging activities as a mode of production: to collect plants, shellfish, insects, eggs or small animals as food resources. Here, I extend this usage to non-food-collecting activities.

(3) "Beja" has been a term used largely by outsiders, and is not necessarily the most important ethnic category for the Beja themselves (Morton 1993: 32). According to Jacobsen, the term "Beja" is a non-native term not used by Beja themselves, who will usually refer to themselves as Bedawiét. The Beja do not at present exist as a political entity and are perhaps better labeled as

a linguistic unit, as speakers of the Tu Bedawie language (Jacobsen 1998: 5, 23).

(4) This area is situated about 210 km southeast of Port Sudan; 30 km eastsoutheast of Aqiq in South Tokar District; 20 km from the Sudan-Eritrea border (18° 19' 95" N, 38° 4' 4" E).

(5) Data on gathering and fishing activities were collected particularly at the following periods: February 1994; June 1994; February 1996; data on perfume and incense processing: March 1995. I identified species using the following reference books: *mangroves*: Kassas 1957; Chapman 1976; Babiker 1984; Tomlinson 1986; *gastropods*: Vokes 1964, 1971; Radwin & D'Attilio 1976; Abbott 1960, 1961; Mastaller 1979, 1987; Abbott & Dance 1982; Dance 1992; *fish*: Reed 1964; Randall 1983; Dor 1984; Ormond & Edwards 1987.

(6) According to Wilson (1984: 66), the camel's foot is less suitable for traversing stony desert although some hardening occurs in animals habituated to this kind of terrain. It is equally unsuitable, in principle, for travel on slippery or muddy surfaces but some camels become adept at traversing even this kind of terrain.

(7) In general, the Beja are divided into five groups: 'Abābda, Bishārīn, 'Amarar, Hadanduwa, and Banī 'Āmir. Among Hadanduwa, their minimal lineage group is called *diwāb*. The *diwāb* is the corporate group proper by which one, through shared descent, is entitled to share rights to a piece of land and all its productive resources. The main efforts of Hadanduwa in socio-economic terms are directed toward their own *diwāb* (Jacobsen 1998: 25). Hadanduwa are patrilineal with uxorilocal residence, and no social relations can be explained solely by unilineal descent. All social relations can therefore be said to have been molded equally by descent and residence ties (Hassan 1987: 18). Ideally, each tribal and subtribal group is affiliated with a piece of land in such a way that one's closest neighbors tend to be one's closest relatives from the perspective of patrilineal descent. However, the most important herding and land-using group, the lower-level *diwāb*, is ambilineal in its recruitment. This is the only effective corporate group claiming customary rights to a grazing territory (Jacobsen 1998: 24). In this sense, the 'Ejīlāb clan of the Banī 'Āmir of the Beja seems to share this socio-economic system, too.

(8) Here I use the term "site" to mean a walking range of subsistence activities, including the point at which people unload to camp or rest for a while.

(9) I heard that in the 1970s a man tried to cross to 'Abīd island for gathering and fishing activities, but he was washed away by strong currents with his camel. His corpse drifted ashore on 'Ayrī island.

(10) The camel is as tall as 2.00 m at the shoulder in this area.

(11) *Rhizophora mucronata* Poir and *Bruguiera gymnorhiza* (L.) Lam., along with *Avicennia marina*, are also reported on the Sudanese Red Sea coasts south of Suakin in which the research area is included (Anders 1950: 211). Some people of the village recognize another kind of mangrove that is excellent for building material. I myself observed something that looked like viviparous seedlings floating on the surface of the seawater, though I could not identify the species.

(12) The leaves and shoots of *Avicennia marina* are invariably browsed by camel (Kassas 1957: 196; Manger *et al.* 1996: 66). Babiker (1984) classified mangrove vegetation in the Red Sea shores of the Sudan, according to the particulars of the habitat, degree of compactness of aggregation, and the morphological behavior of its individuals. He pointed out that one of the main elements of disturbance is the accessibility of the camel. Hjort & Dahl reported that the shallageea type of camel among the Atmaan Beja is also very skillful at walking into the sea and browsing the leaves and fruits of mangrove (Hjort & Dahl 1991: 137).

(13) The typical habitat of *Strombus tricornis* is the vast seagrass beds formed by the spermatophytes *Halodule* and *Halphila* (Mastaller 1987: 204). *Strombus tricornis*, a browsing herbivore, grazes upon a variety of algae, with *Sphacelaria* a major item, but also *Ulva, Enteromorpha, Caulerpa,* and *Polysiphonia,* as well as blue-greens (Taylor & Reid 1984: 188). Although the detailed feeding behavior of *Chicoreus virgineus* is not known, most of the mureicid gastropods are predators (Taylor & Reid 1984: 190–2).

(14) *Lutjanus fulviflamma* is common throughout the year and usually found around the inner edge of the fringing reefs (Reed 1964: 3). It shelters near overhangs or in gullies near the reef crest, often where there is some surf, and wave surge (Ormond & Edwards 1987: 266). For snappers (Lutjanidae), migratory feeding on an alternating basis is common between coral reefs and seagrass beds. Mangroves also provide a nursery or feeding ground and protection for snappers

(Sheppard *et al.* 1992: 155, 168). *Rhabdosargus sarba* is also a predator of medium-sized invertebrates, principally crustacea and molluscs, which it crushes with molar-like teeth. It inhabits the shallow channel inside the fringing reef and most of the *marsas* along the coast (Reed 1964: 86; Ormond & Edwards 1987: 267). The fringing reefs of the Red Sea are penetrated at intervals by narrow channels, called *marsas*. These are interpreted as drowned river valleys cut during the Pleistocene (Berry *et al.* 1966), and they generally connect to wadis or seasonal rivers (Head 1987b: 133). *Tylosurus choram* is the surface-swimming species that can be seen in the fringing reefs and *marsas* (Reed 1964: 21). See Roberts & Ormond 1987 for habitat complexity and coral reef fish diversity and abundance on the Red Sea fringing reef.

(15) It has been already known that *Strombus tricornis*, *Lambis truncata sebae* and *Chicoreus ramosus* are collected for drying the flesh (Mastaller 1978: 125; 1987: 198).

(16) Opercula have been used as incense and perfume historically not only in the Sudan but also in many areas in the Middle East and India (Nawata 1997). The Japanese scholar of incense and perfume history, Kentaro Yamada, examined mixed incenses and perfumes from Chinese and Japanese historical sources, and concluded that "opercula are added in order to make odor fixed, mixed, harmonized, and stabilized" (Yamada 1976: 175–6, 211).

(17) Schroeder (1981: 254) reported that one pound of opercula may contain 1000–2000 pieces, and sales in the Port Sudan market average 13 pounds per day. Further, most probably based on the above-mentioned report, average sales in the Sudan markets were estimated at the production of perhaps 18,000 shells per day (Sheppard *et al.* 1992: 281). But this number seems an overestimate to me.

(18) It cost about 14,000 Sudanese pounds in 'Agetai; 17,000–18,000 in Suakin and Port Sudan; 25,000 in Kassala and Khartoum for 1 raṭl, about 450 g, of opercula of *Strombus tricornis* in March 1995.

(19) Although only *Strombus tricornis* is thought to be the source for opercula (Mastaller 1987: 198), *Lambis truncata sebae* and *Chicoreus ramosus* are collected only for food (Mastaller 1978: 125). This field research would be the first observation indicating that opercula of *Chicoreus virgineus*, *Lambis truncata sebae* and *Chicoreus ramosus* are also obtained.

(20) One is called *ḍufra khalīǰīya* (operculum of the Gulf), and another is *ḍufra hindīya* (operculum of India). Although it is thought that most opercula are imported from the Gulf countries or from India (Schroeder 1981: 254) or that some of the gastropods are imported, there is some local collecting (IUCN 1988: 335). These two kinds are circulated very little in the Sudan, as far as I could establish. The merchants told me that these were imported a few years ago when Sudanese opercula were not in abundance. It remains an unresolved question from which gastropods of molluscs these two kinds of opercula are obtained. Informants also told me of opercula of *Strombus tricornis* not only from the Sudan, but also from the coast of Eritrea and Yemen facing the Red Sea.

(21) Some ethnographers have reported on types and usage of Beja and other Sudanese perfumes (Keimer 1953; Kennedy 1978; Cloudsley 1983; Boddy 1989; Hjort & Dahl 1991; Kenyon 1991). It differs slightly depending on area, but many types seem to be shared in the Sudan.

(22) In this paper, I do not specify to what degree the pastoralists of the Beja depend on marine products and to what degree their camels depend on mangrove foliage as forage in terms of nutritional value. Therefore, in terms of total values of the use of coastal resources in subsistence economies, many issues remain to be analyzed further. I recognize that more research needs to be done on a local community's relationships to resource management. I also intend to move in future from descriptive methods and qualitative observation to quantitative analysis in order to measure the impacts of human exploitation on shore communities.

(23) It is known that, according to Arabic sources, operculum as incense and perfume was exported from Bāḍi', which is located on the southern tip of the starfish-shaped area of 'Ayrī island, in the eighth century (Nawata 1997). Bāḍi' had been the port connecting sea networks and the interior of Ethiopia and the Sudan in the period from the 7th to the 11th century (Kawatoko 1993a, b).

(24) I am preparing further papers concerning grazing lands and watering places in order to illustrate the camel's adaptation to a coastal environment. The camel favors salt-tolerant plants of coastal vegetation, and is able to drink well water containing high salinity caused by seawater

intrusion. The coastal area is a suitable habitat for the camel morphologically, behaviorally and physiologically. I will demonstrate that one of the most striking features of the adaptive strategies of the camel pastoralists living on the coastal areas is that pastoral activities are strongly connected with gathering and fishing activities as represented in this paper.

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