Small cetaceans of Ghana are documented to suffer considerable pressure from frequent by-catches in mostly drift gillnet fisheries and perhaps also in industrial purse-seine fisheries although the latter remain largely unmonitored. While total mortality is unknown, it is significant and potentially increasing with intensifying fishing effort. Monitoring of landings over a few years has shown the presence of at least 17 different species of dolphins and small whales and all are affected to varying degrees. Researchers at the University of Ghana at Legon and the Wildlife Department have pressed for the adoption of conservation strategies for marine mammals offshore Ghana.

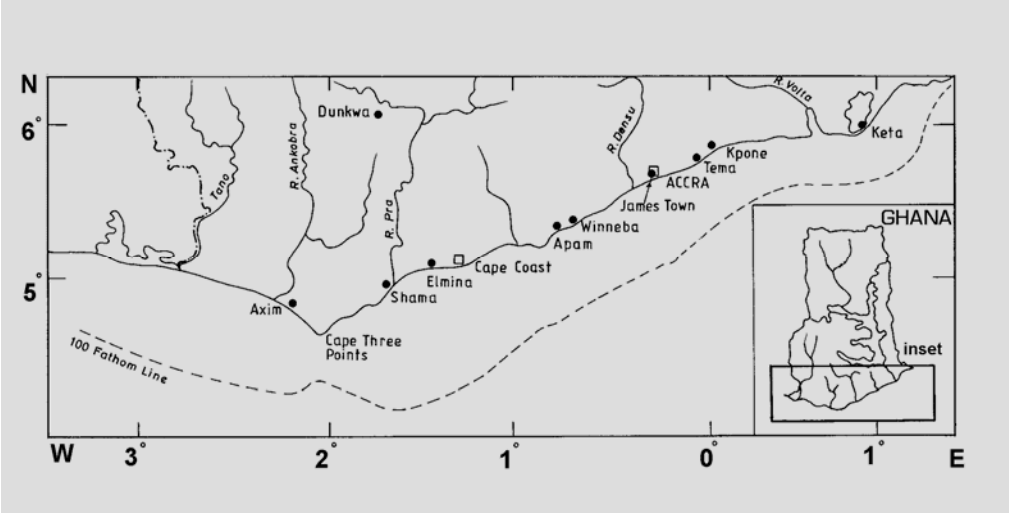
In 2008, the Conference of the Parties of the Convention for the Conservation of Migratory Species (CMS/UNEP) included the West African population of Clymene dolphin (*Stenella clymene*) (Ghana's principal dolphin species) on its Appendix II, thus formally recognising its vulnerable status. The Atlantic humpback dolphin, a species endemic to West Africa, has not yet been found in Ghana even though good habitat exists. Rudimentary knowledge of the presence of large whales in Ghana waters may result equally problematic as potential conservation issues may also go unrecognised. For instance, the Gulf of Guinea humpback whale population seasonally occupies Ghana's shelf zone as a calving and breeding area, ie during a period when they are most vulnerable to disturbance. The global threat of large ships colliding with whales and killing or injuring them is well-documented. Shipping is known to affect at least humpback whales and Bryde's whales worldwide but also in West Africa and especially near large ports. In West Africa, a number of unexplained whale deaths are suspected to be due to ship strikes.

Current knowledge of the distribution, natural history, population structure and ecology of dolphins and whales in the Gulf of Guinea is rudimentary and fragmentary in the scientific literature. All information on cetaceans in Ghana is the result of land-based field research, mainly monitoring of fishing port for landings of small cetacean by-catches as well as the study of stranded animals. Capture locations and thus habitat (neritic, slope, pelagic) are unknown, as fishermen may operate both shorewards and offshore of Ghana's continental shelf and operate at considerable distances to the east or west of the ports where they landed catches. No shipboard surveys for marine mammals have been implemented so far, therefore it is not presently possible to provide distribution maps for Ghana or adjacent states. Scientists who study aquatic mammals are based at the University of Ghana at Legon and the Faculty of Sciences at the University of Cape Coast.

Figure 4.28 shows artisanal fishing ports and fish landing beaches where cetaceans have been landed (Van Waerebeek *et al*, 2009). Specimens derived from by-catches and stranding shows that the cetacean fauna of Ghana is moderately diverse, essentially tropical and predominantly pelagic. It comprises 18 species belonging to 5 families: 14 species of Delphinidae (dolphins) and one species each of families Ziphiidae (beaked whales), Physeteridae (sperm whales), Kogiidae (pygmy sperm whales) and

Balaenopteridae (rorquals). Summary information on these species is contained in *Table 4.7*.

Figure 4.28 Fishing Ports on the Ghanaian Coast



Source: Van Waerebeek *et al*, 2009

References to cetaceans in West Africa include Wilson *et al* (1987) for a striped dolphin *Stenella coeruleoalba* record from Côte d'Ivoire, but no voucher material is identifiable. However, striped dolphins are not uncommon offshore Angola (Weir, 2007) and this delphinid and the short-snouted common dolphin *Delphinus delphis* are expected to occur in the Gulf in deep waters. Among beaked whales, the Gervais' beaked whale *Mesoplodon europaeus* has been documented from Ascension and Guinea-Bissau (Rice, 1998), so may also be present offshore, as well as Blainville's beaked whale *Mesoplodon densirostris* which is a pantropical cetacean. Another widely distributed (sub)tropical cetacean that may be present within the survey area is the pygmy sperm whale *Kogia breviceps*. All these species have a pelagic distribution in common and may be present in the Gulf. The presence of long-snouted common dolphin in Ghana, Côte d'Ivoire (Cadenat, 1959) and Gabon (Van Waerebeek, 1997) points to a wide distribution in the Gulf, perhaps partly related to the seasonal upwelling over the continental shelf (Adamec and O'Brien, 1978). The listing of *D. delphis* in Ofori-Danson *et al* (2003) was premature, but the species may be present offshore. The skull of a confirmed *D. delphis* was collected in Mayoumba, Gabon (van Bree and Purves, 1972; Van Waerebeek, 1997).

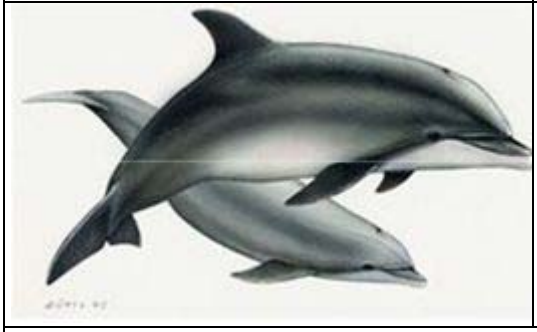
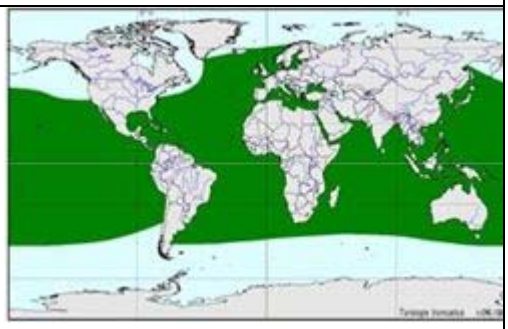
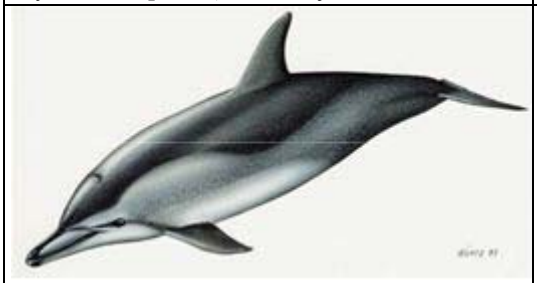
Among baleen whales, pictures of Bryde's whales *Balaenoptera brydei/edeni* were taken as far north as Gabon (Ruud,1952) and it is likely that Bryde's whale occurs in Ghana's Exclusive Economic Zone (EEZ) waters. *B. brydei* was originally described from South Africa (Olsen 1913) and is the most likely species involved. Other rorquals (*Balaenoptera spp.)* could also occur. No Atlantic humpback dolphins (*Sousa teuszii*) have so far been confirmed in Côte d'Ivoire, Ghana, Togo, Benin or Nigeria (Debrah, 2000; Ofori-Danson *et al*,

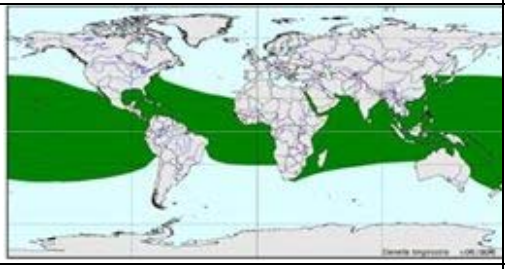
2003; Van Waerebeek *et al*, 2004, 2009; Perrin and Van Waerebeek, 2007), despite suitable coastal habitat. Also, since the holotype was collected in the port of Douala (Kükenthal, 1892), it has not been reported again from Cameroon. Possible explanations may include local extirpation through intense pressure from coastal fisheries (by-catch), disturbance and other habitat encroachment or insufficient research effort.

There are unconfirmed fishermen's reports that humpback dolphins may occasionally be seen between the Volta River delta and Lomé, Togo. In recent years, Atlantic humpback dolphins have been encountered with some regularity in Gabon (Schepers and Marteijn, 1993; Collins *et al*, 2004; Van Waerebeek *et al*, 2004). In 2008, the species was listed on Appendix I of CMS reflecting mounting international concern about its population status. Other rorquals such as minke whales (*Balaenoptera acutorostrata),* sei whales (*Balaenoptera borealis),* blue whales *(Balaenoptera musculus)* and fin whales *(Balaenoptera physalus)* have very wide distributions globally. Of these, the blue, fin and sei whales are classified as Endangered on the IUCN's Red Data List. The primary and secondary ranges of blue whales and the secondary ranges of fin whales potentially extend into the Gulf of Guinea, although there are no records of blue whales in Ghanaian waters. Sei whale are not generally found in equatorial waters as they occupy areas northern and southern oceans (Jefferson *et al*, 2008).

Regular landings in several Ghana ports of Clymene dolphin, pantropical spotted dolphin, common bottlenose dolphin and, to a lesser degree, short-finned pilot whale, Risso's dolphin, Atlantic spotted dolphin, rough-toothed dolphin and melon-headed whale suggest that these species are not rare in the northern Gulf of Guinea, although any estimate of population abundance is lacking. Rarely captured species may be characterised by a lower abundance in the areas that are near the continental shelf and slope. Landed cetaceans are often used as 'marine bush meat (Clapham and Van Waerebeek 2007), which is defined as meat and other edible parts derived from wild-caught marine mammals, sea turtles and seabirds.

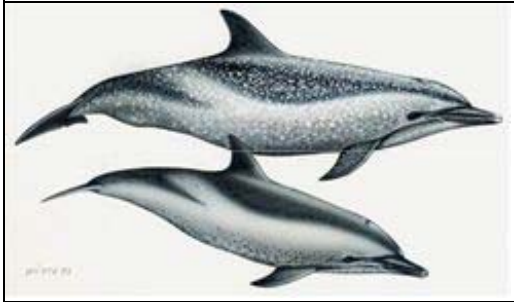
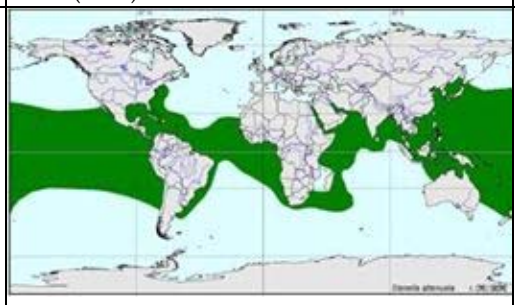
Table 4.7 Baseline Marine Mammal Information

Species	Baseline Information
Common bottlenose dolphin (*Tursiops truncatus*)	**Distribution** Inshore and offshore
	
Bottlenose dolphins have been recorded landed at Jamestown, Senya Beraku (05°23'N,00°29'W) and Tema. A small group has been recorded foraging around artisanal encircling gillnets set in nearshore waters west of Cotonou, Benin. Four bottlenose dolphins of an undetermined population, possibly offshore, were taken 10-16nm south of Vridi (ca. 05°14.5'N, 04°02.3'W), Ivory Coast, in 1957-1958 (Cadenat and Lassarat, 1959a). Both inshore and offshore populations occur off Angola year-round (Weir, 2007), as well as off western South Africa and Namibia (Ross,1977; Findlay *et al*, 1992). Bottlenose dolphin is the third-most frequently (15.5%) landed small cetacean in Ghana (Ofori-Danson *et al,* 2003). The location of the usual drift-gillnetting grounds suggests an offshore population, although this has not been confirmed. A total of 11 live-capture attempts were made in Walvis Bay, Namibia, in 1975, 1976 and 1983 (Findlay *et al,* 1992). Best and Ross (1984) warned against capture operations on small coastal populations on South Africa's west coast as 'potentially of more consequence'.	
Clymene dolphin (*Stenella clymene)*	Shelf (zone) and offshore
	
Robineau *et al* (1994) provided a first review of the presence of Clymene dolphin in West Africa, but did not indicate records for Ghana. Ghanaian fishermen however are most familiar with the Clymene dolphin, some calling it 'true dolphin' or 'Etsui Papa' because the species is so frequently found entangled in fishing gear. Many specimens have been landed at Keta (05°55' N, 00°59' E), Winneba, Apam and Dixcove (Debrah, 2000; Ofori-Danson *et al*, 2003). A sighting was registered in deep oceanic water at 02°10'N,02°30'W, some 160nm south of the Ghana coast (Perrin *et al,* 1981). From temporal distribution of captures, Clymene dolphins seem to be present year-round in Ghanaian waters. South of the Gulf, credible sightings were reported from Congo and Angola (Weir, 2006a, 2007). Being a tropical species, it is absent from the cool Benguela system off southwestern Africa (Findlay *et al,* 1992). Some 34.5 percent of captured cetaceans have been Clymene dolphins, more than of any other species (Ofori-Danson *et al*, 2003). Most catches were by drift-gillnet fishermen operating out of Apam and Dixcove. The COREWAM-Ghana database holds photographic evidence for at least 35 net-entangled specimens. In 2007, concern about the observed take led the CMS Scientific Council to unanimously endorse an Appendix II listing proposal for the West African population (Van Waerebeek, 2007). The population was added to Appendix II by the Conference of the Parties in December 2008.	

Spinner dolphin *(Stenella longirostris)*	Offshore
	

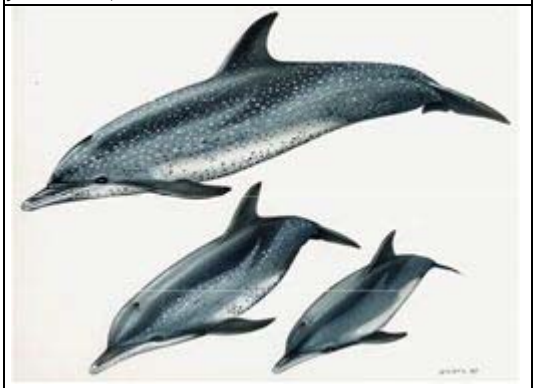
Spinner dolphins have been offloaded at Dixcove and Axim in 2000. Skulls exist from specimens collected at Abidjan, Côte d'Ivoire (van Bree, 1971) and in Liberia. (Broekema, 1983). Weir (2007) reported sightings in deep pelagic areas off Angola. Spinner dolphins, typically wide-ranging and oceanic, are likely to occur throughout the deeper waters of the study area and the entire eastern tropical Atlantic.

Morphology points to the pantropical subspecies *S. longirostris longirostris* (see Perrin, 1990). Conservation status is unknown. Spinner dolphins are only infrequently captured (3.5% of dolphin takes) by Ghana's artisanal fishermen (Ofori-Danson *et al*, 2003). The claim that tuna-dolphin associations are rare in this ocean province and tuna purse-seiners rarely set upon dolphins is not properly supported and stands in sharp contrast with the situation in the eastern tropical Pacific (e.g. Perrin, 2004). If the captures by small-scale drift-gillnet boats in Ghana are any indication, several species of tuna, billfish and sharks are habitually taken with dolphins in the same nets (Debrah, 2000; Ofori-Danson *et al*, 2003).

Pantropical spotted dolphin *(Stenella attenuata)*	Shelf (zone) and offshore
	

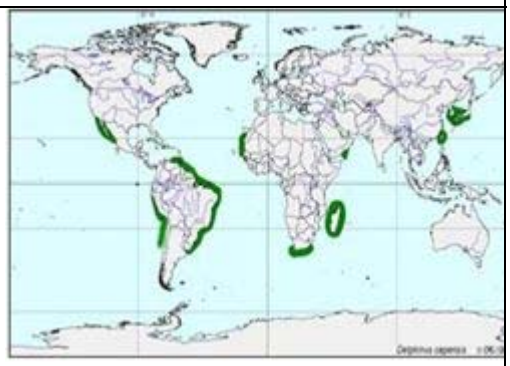
The first supported record in Ghana was a juvenile examined at Apam in 1998; since then many more have been collected from the main study sites. The species has been documented from Côte d'Ivoire (Cadenat and Lassarat, 1959b; van Bree, 1971), Gabon (Fraser, 1950a) and offshore waters of the eastern tropical Atlantic (Perrin *et al*, 1987). No records exist from the Atlantic coast of South Africa (Findlay *et al*, 1992). A group was encountered off Pointe Pongara, southern shore of the Gabon River estuary (Fraser, 1950a).

An high percentage (17.2%) of small cetaceans offloaded in Ghana ports were pantropical spotted dolphins, making it the second-most frequently captured species (Ofori-Danson *et al*, 2003). Spinner and pantropical spotted dolphins are the main marine mammal indicator species for the presence of tuna in the eastern tropical Pacific (Perrin, 2004). For tuna fisheries in the eastern Atlantic such associations have not yet been studied. Information on levels of incidental dolphin mortality in these fisheries is scarce and of questionable credibility.

Atlantic spotted dolphin (*Stenella frontalis*)	Shelf (zone) and offshore
	

Atlantic spotted dolphin is endemic to the eastern and western tropical Atlantic (Perrin *et al*, 1987). The earliest reports of Atlantic spotted dolphin in Ghana refer to two bycatch victims at Dixcove, one in 2000 and another in 2003. Two specimens were captured off Vridi, Côte d'Ivoire, in 1958 (Cadenat and Lassarat, 1959b). Off Benin, a group of 10 individuals was sighted in coastal waters (Van Waerebeek, 2003). Gabon has also been cited as a range state (Perrin and Van Waerebeek, 2007). Atlantic spotted dolphin is reported from Angola (Weir, 2008), but the species avoids the cold Benguela Current off Namibia and western South Africa (Findlay *et al*, 1992). As noted above, the spotted dolphin collected off Gabon and reported by Fraser (1950a) as *Stenella frontalis* was actually a pantropical spotted dolphin.

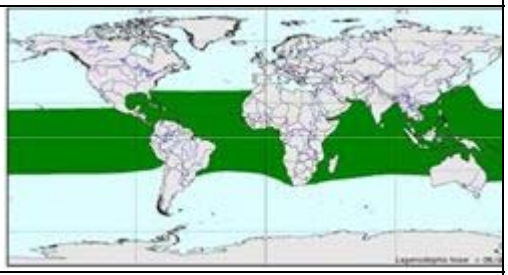
In Ghana in 1998-2000, Atlantic spotted dolphins accounted for 5.2 percent of the small cetacean bycatch (Ofori-Danson *et al*, 2003). Two specimens were captured for research in Côte d'Ivoire (Cadenat, 1959). The largest recorded mortality was attributed to fisheries in Mauritania involving 140 stranded dolphins of which at least 125 died (Nieri *et al*, 1999). Off Angola, Weir (2008) detected negative responses in Atlantic spotted dolphins to seismic surveying off Angola.

Long-beaked common dolphin (*Delphinus capensis*)	Shelf (zone) and offshore
	

This species is often confused with the short-beaked common dolphin *D. delphis*. Fishermen landed two long-beaked common dolphins at Dixcove in 1999 and a third was landed at Axim in 2000. For the Gulf, Cadenat (1959) provided body measurements for 24 long-beaked common dolphins from Côte d'Ivoire. Van Waerebeek (1997) re-examined nine West African dolphin skulls considered *D. delphis* (van Bree and Purves, 1972) but assigned only two specimens to *D. delphis*, one from Mayoumba, Gabon and another from Angola. Four skulls from Gabon, two from Angola and one from Congo were assigned to *D. capensis*. Most common dolphins occurring within the 200-m isobath shelf in South African waters are *D. capensis* (Samaai *et al*, 2005).

Common dolphin records, perhaps of both species, exist as far north as Walvis Bay, Namibia (Findlay *et al*, 1992). Photographs off Gabon (in Rosenbaum and Collins, 2004) show a colouration pattern consistent with that of *D. capensis*. It supports an earlier claim that long-beaked common dolphins are widely distributed in the Gulf of Guinea as well as off central Africa (Van Waerebeek, 1997).

Long-beaked common dolphins are avid bowriders and can easily be targeted with hand-held harpoons. However, so far only a few have been recorded landed in Ghana ports. Simmons (1968) reported the take of 'common dolphins' with tuna in the Gulf of Guinea.

Fraser's dolphin *(Lagenodelphis hosei*)	Offshore
	

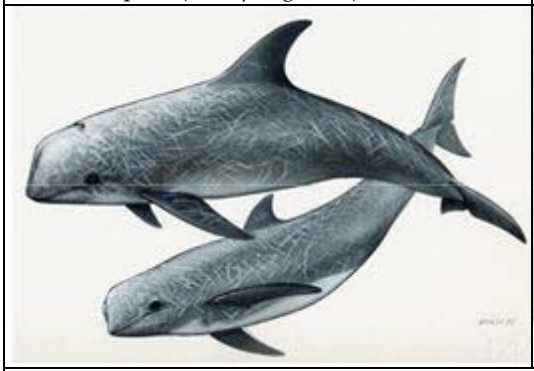
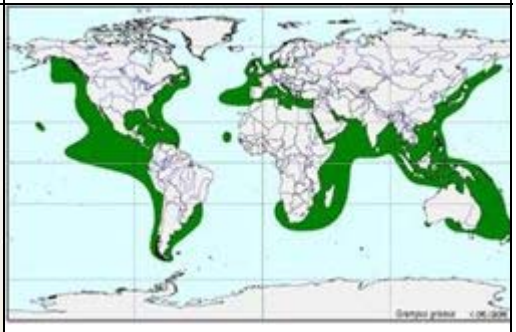
Records of Fraser's dolphin in West Africa were recently reviewed (Weir *et al*, 2008). For Ghana, only bycatch specimens are known: one in Axim in 2000 (Ofori-Danson *et al*, 2003), three at Dixcove and Axim in 2000 (Debrah, 2000). One probable sighting is known from Nigeria and two confirmed sightings from Angola (Weir *et al*, 2008). To the west, the closest record is Ile de Sangomar (13°50'N, 16°46'W), Senegal (Van Waerebeek *et al*, 2000). However, Fraser's dolphin may be widely distributed in deep waters of the Gulf and the tropical SE Atlantic Ocean. In South Africa all records are from the warm Agulhas Current-influenced SE coast (Ross, 1984; Findlay *et al*, 1992).

Of unknown status, Fraser's dolphin is only occasionally taken in Ghana's artisanal fisheries, explainable by its preference for far offshore waters. The potential of bycatches by large pelagic or foreign fishing vessels remains to be assessed.

Rough-toothed dolphin (*Steno bredanensis*)	Offshore
	

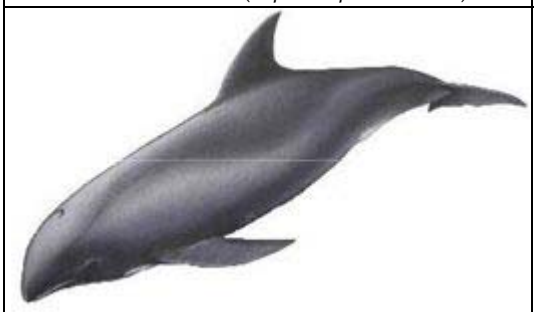
Jefferson *et al* (1997) reported two undocumented sightings 'off Ghana' in 1972. At least four catches are recorded in Ghana at Apam: one in 1999, two in 1998, and another one in 2002 (Debrah, 2000; Van Waerebeek *et al*, 1999). Rough-toothed dolphins are confirmed from Côte d'Ivoire when 3 were taken 15-18nm south of Vridi in 1958 (Cadenat, 1959), a fourth (a skull) with reported origin 'Abidjan' is at the US National Museum of Natural History. Only one specimen record exists for Namibia (Möwe Bay, 19°20S,12°35'E) in 1986 (Findlay *et al*, 1992). Rough-toothed dolphins plausibly range in deep waters throughout the eastern tropical Atlantic.

In Ghana, rough-toothed dolphins are occasional victims of gillnet entanglement (3.5% of cetacean catches). Apparently the Vridi specimens (Cadenat, 1959) were taken for research purposes. Little else is known on the species' status in the eastern tropical Atlantic.

Risso's dolphin (*Grampus griseus*)	Offshore
	

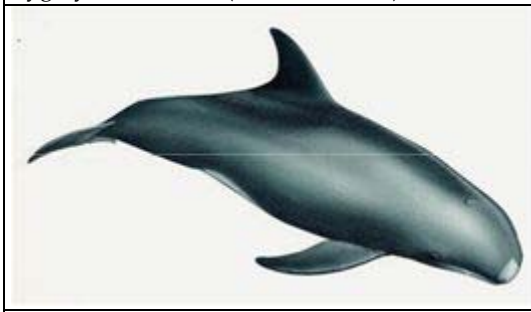
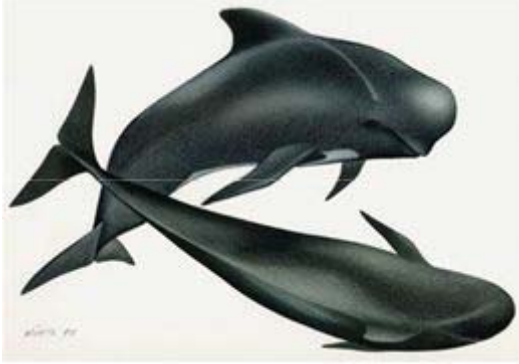
Ghana's Fante fishermen have long been familiar with the Risso's dolphin and call it 'Eko tui', the parrot dolphin, in reference to its peculiar head shape. Confirmed landings are known at Apam in 1999, at Dixcove in 2000, and one at Axim in 2000 (Ofori-Danson *et al* , 2003). A crew chased a small group of Risso's dolphins ca. 25nm off Côte d'Ivoire in 1958, in a failed harpooning attempt (Cadenat, 1959). The species almost certainly occurs throughout the Gulf, but Ghana and Côte d'Ivoire are the only confirmed range states.
The Risso's dolphin inhabits tropical to cool-temperate waters which is in concordance with its presence off Angola (Weir, 2007), Namibia and South Africa where it is associated with the shelf edge and pelagic waters (Findlay *et al*, 1992).

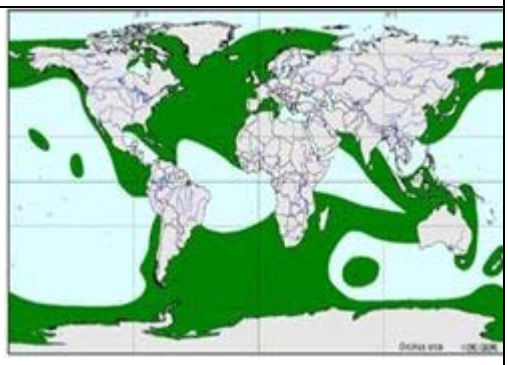
Risso's dolphins are regularly captured (6.9% of catches) in Ghana's artisanal fisheries (Ofori-Danson *et al*, 2003), but we know little else on the species' status.

Melon-headed whale (*Peponocephala electra*)	Offshore
	

The melon-headed whale is known in the Gulf solely from bycatches in Ghana. Geographically most adjacent records are, to the northwest, a skull from Guinea-Bissau (van Bree and Cadenat, 1968) and, to the south, three sightings in deep oceanic waters off Angola (Weir, 2007) plus a stranding at Hout Bay (34°03' S,18°21'E), South Africa (Best and Shaughnessy, 1981). Nonetheless, melon-headed whale may be widely distributed in the eastern tropical Atlantic but it is probably fairly rare.

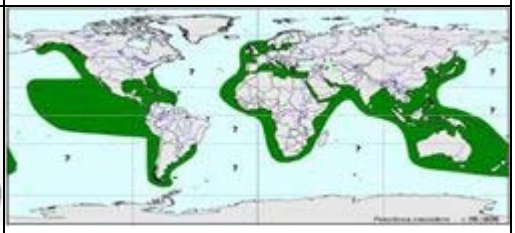
Melon-headed whales are accidentally netted with some regularity in Ghana waters. Specimens have been landed in Shama in 1994 and at least four in Dixcove in 2000 and 2002. No other information is available.

Pygmy killer whale (*Feresa attenuata*)	Offshore
	
An adult-sized pygmy killer whale landed at Dixcove in 2007 is the first and only documented record in the Gulf of Guinea. Records to the south from Annobon Island (01°24.2'S,05°36.8' E) were reported by Tormosov *et al* (1980) however there is no voucher information and the records cannot be verified. Indeed, confusion with melon-headed whales is very common. Off southwestern Africa, pygmy killer whales have stranded in Cape Town and as far north as 23°S, Namibia (Best, 1970; Findlay *et al*, 1992). Best (1970) documented in great detail four animals stranded at Lüderitz Lagoon, but little other information is published. An adult-sized pygmy killer whale was landed at Dixcove in December 2007, the only case detected during our port monitoring (Van Waerebeek *et al*, 2009). Status is unknown but, as elsewhere, pygmy killer whales are probably rare.	
Short-finned pilot whale (*Globicephala macrorhynchus*)	Offshore
	
Short-finned pilot whales seem to be fairly common in Ghana waters, and also occur off Côte d'Ivoire (Cadenat, 1959). Pilot whales are also reported off Cap López, Gabon (Walsh *et al*, 2000). Fraser (1950b) summarized the morphology of pilot whales in NW Africa. Distribution boundaries to the south and SE are unclear. On South Africa's Atlantic coast the cool-water-adapted long-finned pilot whale *G. melas edwardii* is found but no short-finned pilot whales have been recorded (van Bree *et al*, 1978; Findlay *et al*, 1992). Short-finned pilot whales are irregular bycatch victims in drift gillnets off Ghana (3.5% of cetacean catches, Ofori-Danson *et al*, 2003) and have been landed at Shama, Axim and Dixcove. Most specimens are too big to haul onboard artisanal fishing boats and are towed to port. The Vridi specimen was harpooned for research purposes (Cadenat, 1959). A significant conservation problem exists around the Canary Islands where animals are frequently hit by small boat propellers during whale-watching (Heimlich-Boran,1990; Carwardine, 1994; Van Waerebeek *et al*, 2007).	

Killer whale (*Orcinus orca*)	Inshore and offshore
	

A single skeletal specimen is known for Ghana, possibly collected in 1956. A killer whale was harpooned some 15-20nm south of Abidjan in 1958 but the animal sank. Cadenat (1959) claimed that killer whales are regularly present in the region. Observers on industrial tuna purse-seiners reported a few sightings off the coast of Liberia, Ivory Coast and Ghana (Hammond and Lockyer, 1988). Other sighting reports exist for Gabon (Reeves and Mitchell, 1988; Jefferson *et al*, 1997; Rosenbaum and Collins, 2004). The presence of humpback whales with calves in many areas of the Gulf may attract killer whales to prey on them.

The status in the region is unknown but no conservation problems have been identified. The only killer whale reported taken in the Gulf was in 1958 (Cadenat, 1959).

False killer whale (*Pseudorca crassidens*)	Offshore
	

The first record in Ghana comprises three false killer whales landed at Apam in 2003. Skulls were collected from a false killer whale stranded near Assini (05°07'25"N, 03°06'40"W), Côte d'Ivoire, in 1970 (van Bree, 1972) and from a specimen in Benin (Van Waerebeek *et al*, 2001; Tchibozo and Van Waerebeek, 2007). An animal live-stranded at Cap Esterias (00°37'N, 09°29'E), Gabon, in 1992 (Van Waerebeek and De Smet, 1996). Mörzer-Bruyns (1969) described a group of 30 off Liberia at 04°48'N,11°24'W in 1961.
Nine sightings off Angola, in eight months of the year, were all located over deep-water areas seaward of 1467m (Weir, 2007) in accordance with the species' usual habitat elsewhere. Findlay *et al* (1992) reported a mass stranding near Lüderitz, Namibia.

The conservation status of false killer whale in the Gulf is unknown. In Ghana, the species is infrequently captured in drift gillnets. The animal that live-stranded in Gabon was butchered for food (Van Waerebeek and De Smet, 1996).

Cuvier's beaked whale (*Ziphius cavirostris*)	Offshore
	
Cuvier's beaked whale is a cosmopolitan ziphiid found in pelagic tropical to warm temperate waters. A juvenile landed at Axim in 1994 is the first documented beaked whale in the Gulf of Guinea. Weir (2006b) described a group of 3 Cuvier's beaked whales SW of Luanda, Angola, at 07°15.84'S,11°07.79'E, and reported a group of 3-4 'likely Cuvier's beaked whales' NW of Luanda. Four other beaked whale sightings off Angola were not identified, but Cuvier's beaked whale was possible in three cases. The fourth was a Mesoplodon sp. All encounters were over deep water seaward of the continental shelf (Weir, 2006b). Three stranded Cuvier's beaked whales are known from Namibia (21°-23°S) and another two from the Atlantic coast of South Africa (Findlay *et al*, 1992). The status of Cuvier's beaked whale is unknown, but no threats are identified. The single capture in Ghana among hundreds of other small cetaceans (Debrah, 2000; Ofori-Danson *et al*, 2003) suggests that impact from bycatch is probably negligible.	

Dwarf sperm whale (*Kogia sima*)	Offshore
	
In Ghana, a dwarf sperm whale was taken by fishermen from Apam in 1998. Two unidentified Kogia sp. were landed, one at Shama in 1994 and another at Apam in 2003. No sightings exist for the Gulf. In South Africa dwarf sperm whale distribution is limited to the South Coast between Cape Columbine and c. 28°E. Stranded dwarf sperm whale specimens are recorded north to at least 22°S at Cape Cross, Namibia (Ross 1984, Findlay et al 1992). Maigret and Robineau (1981) reviewed the genus Kogia in Senegal and West Africa. Although all three kogiid specimens, one K. sima and two Kogia sp. were captured in drift gillnets, impact of fisheries cannot yet be evaluated. While entanglement rate seems low, populations may also be small.	

Sperm whale (*Physeter macrocephalus*)	Offshore
	Found in all worlds oceans

Hardly any information is available on sperm whales in the Gulf of Guinea, however at least females and juveniles are thought to be present year-round beyond the continental shelf. In Ghana, two dead sperm whales washed ashore, one near Accra in 1994 and a second at Dixcove in 2002. Off Gabon, sperm whales were hunted from August till October (Slijper *et al*, 1964). Off Angola, their density peaked between January and May (Weir, 2007a). As expected, sperm whales were sighted exclusively seaward of the shelf break.

A notable cluster occurred west of the Congo River mouth. Natural history information is available only for sperm whales off the southwest coast of South Africa (e.g. Best 1967, 1969, 1970). Sperm whales are 'Vulnerable' according to the 2008 IUCN Red List and are listed in Appendix I of CMS. Long-line fishermen targeting tuna and sharks in equatorial waters of the Gulf and farther south complain about regular predation of hooked fish by sperm whales.

Humpback whale (*Megaptera novaeangliae)*	Offshore and inshore
	Found in all worlds oceans

Irvine (1947) recorded a possible humpback whale at Prampram in September 1938. Van Waerebeek and Ofori-Danson (1999) first confirmed the species from Ghana based on a fresh neonate stranded at Ada (05°48.5'N,00°38'E) in September 1997. An adult-sized humpback whale stranded at Ada Foah (05°46'33"N,0°36'58"E) in October 2006. Humpback whales are regularly sighted inshore, e.g. from the Dixcove castle, from September till December. A neonate stranded in Lomé, Togo, in August 2005 (Tchibozo and Van Waerebeek, 2007). Rasmussen *et al* (2007) encountered several pods including a mother and possible newborn calf in Ghanaian waters in October 2006.

From the presence of humpback whales exclusively from early August till late November, and the frequent observations of neonates and 'competitive groups', it is evident that the continental shelf of Benin, Togo, Ghana, and western Nigeria hosts a breeding/calving population with a Southern Hemisphere seasonality (Van Waerebeek *et al*, 2001; Van Waerebeek, 2003), referred to as the 'Gulf of Guinea stock'. Its parapatric distribution suggests it may be related to the IWC-defined breeding stock 'B' from central-west Africa (IWC, 1997, 2006). Mother/calf pairs have been sighted exclusively nearshore in Benin, sometimes just beyond the surf-zone. The westernmost authenticated record is a stranding at Assini Mafia (05°7'25"N, 03°16'40"W), eastern Côte d'Ivoire in August 2007 (Van Waerebeek *et al*, 2007). For many years, small-scale, seasonal humpback whale-watching sorties have been conducted from the ports of Sekondi-Takoradi, Lomé and Cotonou (Van Waerebeek *et al*, 2001). The breeding stock off Gabon and Angola is the subject of long-tem dedicated studies (e.g. Best *et al*, 1999; Walsh *et al* 2000; Rosenbaum and Collins, 2004).

No abundance estimate is available for the Bight of Benin population, but encounter rate in October 2000 was 0.109 humpback whales/nautical mile surveyed (Van Waerebeek *et al*, 2001). The reported neonates stranded in unknown circumstances, both natural and anthropogenic causes are possible. At least some humpback whale strandings in the area are thought to be animals killed in vessel collisions, which may be far more common in African waters than scarce reports suggest (Félix and Van Waerebeek, 2005; Van Waerebeek *et al*, 2007). Humpback whales near Cotonou's harbour entrance and crossing the main shipping lanes, incur obvious risk. The individual that stranded at Assini Mafia was reported with external trauma consistent with a propeller hit (see Van Waerebeek *et al*, 2007).	
West African manatee (*Trichechus senegalensis*)	Fluviatile/inshore
In Ghana as in the rest of the Gulf, manatees are present almost exclusively in continental waters, including freshwater or brackish environments. In Ghana this includes Abi, Tano and Ehy Lagoons (Roth and Waitkuwait, 1986, Powell, 1996), Volta River and in the Volta lake above the Akosomba Dam and Digya National Park (Ofori-Danson, 1995). Manatees also seem to occur in Keta Lagoon and associated waterways. Powell (1996) referred to 'Happold, 1975' who claimed that manatees were present along the coast, but Nishiwaki *et al* (1982) found no evidence of their occurrence. Powell (1996) indicates that manatees require sheltered water with access to food and freshwater. They may transit areas of unsheltered coast, but they are usually rare in these areas. There are no reports of West African manatee offshore, and it is very unlikely that they occur in deep pelagic waters.	

Main source: Van Waerebeek *et al*, 2009

4.2.10 Turtles

The Gulf of Guinea serves as an important migration route, feeding ground, and nesting site for sea turtles. Five species of sea turtles have been confirmed for Ghana, namely the loggerhead (*Caretta caretta*), the olive ridley (*Lepidochelys olivacea*), the hawksbill (*Erectmochelys imbricata*), the green turtle (*Chelonia mydas*), and the leatherback (*Dermochelys coriacea*) (Armah *et al*, 1997, Fretey, 2001). Summaries of the biology of these turtles, including distribution, size and reproduction are provided in *Tables 4.9* to *4.13*. All five species of sea turtles are listed by the CITES and National Wildlife Conservation Regulations under Schedule I. The olive ridley is listed by the World Conservation Union (IUCN) as vulnerable while the loggerhead and green turtles are listed as endangered. The hawksbill and the leatherback are listed as critically endangered.

All species except the hawksbill are captured with some regularity in fishing nets set off Ghana. Although fully protected by national and international legislation, sea turtles that are landed are sold locally for human consumption. The EEZ waters of Ghana constitute a known feeding area for at least the green turtle. However, there is no published information on the spatial and temporal distribution of turtles in both nearshore and offshore waters. Recent sea turtle telemetry tagging undertaken by a team from the Department of Oceanography and Fisheries, University of Ghana and Galathea II team from Denmark indicated that sea turtles from Ghana migrate as far west as the inshore areas of Liberia.

Marine turtles spend most of their life at sea, but during the breeding season they go ashore and lay their eggs on sandy beaches. The beaches of Ghana from Keta to Half-Assini are important nesting areas for sea turtle species.

Approximately 70 percent of Ghana's coastline is found suitable as nesting habitat for sea turtles, and three species; the green turtle, olive ridley and leatherback turtles are actually known to nest (Armah *et al*, 1997; Amiteye, 2002). The olive ridley is the most abundant turtle species in Ghana. Population estimates from four previous surveys of these turtle species are provided in *Table 4.8*. The nesting period stretches from July to December, with a peak in November (Armah *et al*, 1997). In Ghana, the majority nests observed (86.3 percent) are those of the olive ridley.

Table 4.8 Population of the three sea turtle species that nest on the beaches of Ghana

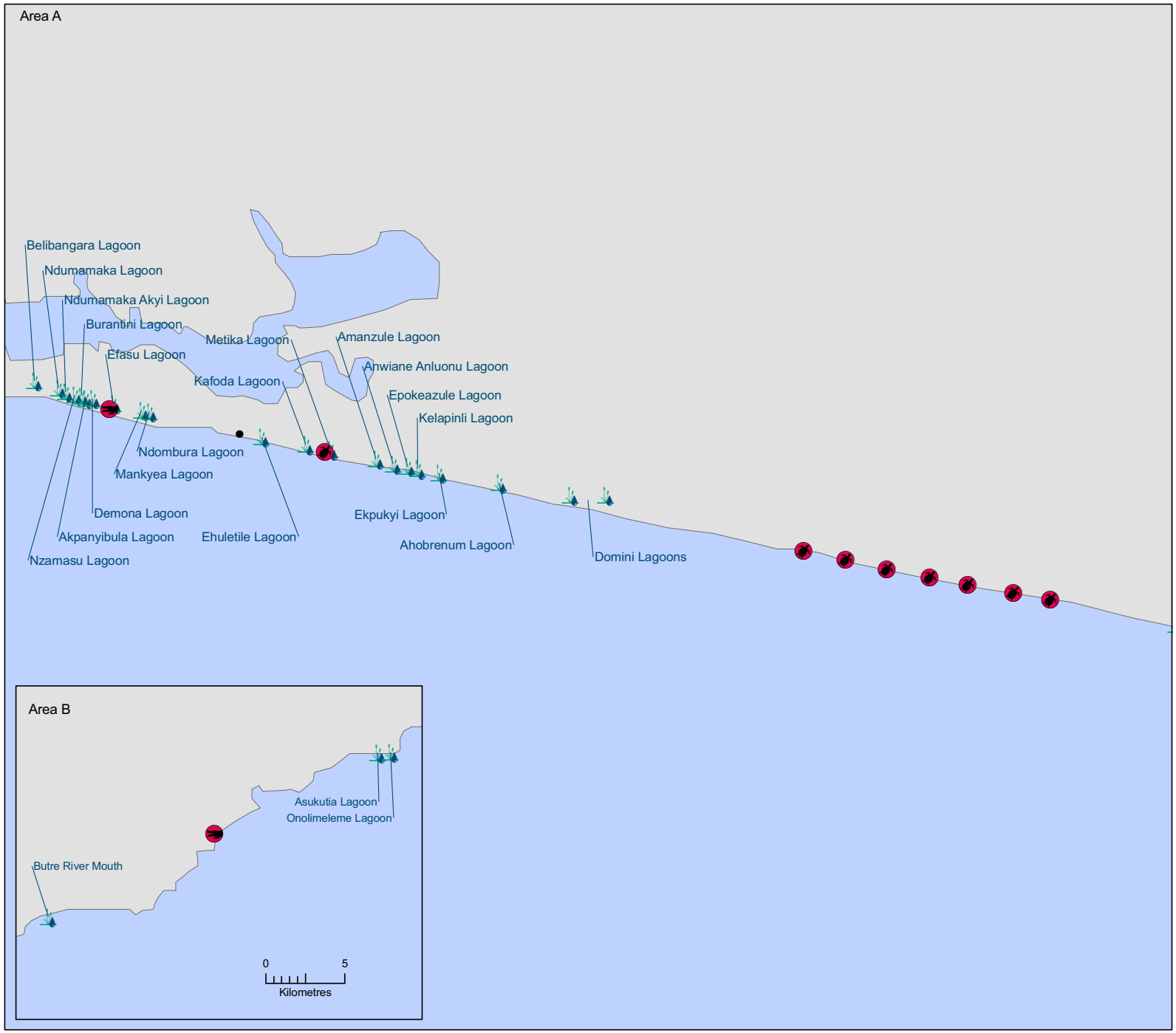
Author, year	Leatherback	Olive ridley	Green Turtle
Amiteye, 2002	46	412	32
Agyemang, 2005	30	190	10
Allman, 2007	418	134	0
Agyekumhene, 2009	74	103	0
Average	**142**	**210**	**21**

Source: Armah *et al*, 1997

In the Western region, the beaches at Kengen, Metika Lagoon, Elonyi, Anochi, Atuabo and Benyin are important nesting sites for sea turtles. The locations of these nesting beaches are shown in *Figure 4.29*. The prime nesting sites have been identified as the coastline from Prampram (about 10 to 15 km east of Tema) to Ada and the areas beyond the Volta estuary to Denu, in the Volta region. It is also evident that moderate nesting occurs from Winneba through Bortianor and on some beaches around Accra such as Gbegbeyise and Sakumono (Amiteye, 2002). These nesting sites are located along the eastern coast of Ghana away from the Jubilee Field.

Despite their protected status, marine turtles continue to face various forms of threat on Ghanaian beaches. The major threat to marine turtle population in Ghana is predation on eggs and juveniles by domestic animals especially pigs and dogs (Billes, 2003). Human exploitation also contributes significantly to the decline in turtle population in Ghana. Female turtles which come to the beaches to lay eggs are normally ambushed and killed as soon as they start laying because they become weak and hence easy to capture. Where the female succeeds to complete laying the eggs, the local people walk the beaches at dawn to look for the tracks and dig up the eggs. Special fishing nets are used by local fishermen for capturing the turtles. The turtle meat and eggs obtained by the above methods are eaten or traded for cash income.

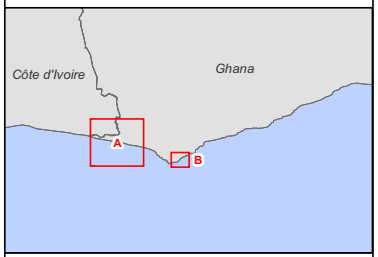
The Ghana Wildlife Society has been carrying out sea turtle research and monitoring activities, conservation education and enforcement of legislation since 1995. The marine turtle conservation project is a contribution towards the achievement of Ghana's national goal of sustainable management of coastal resources and wetland habitats. The objective of the project is to promote the socio-economic development of coastal communities through marine turtle conservation.



KEY:

- Crocodiles
- Turtles
- Lagoon, River Mouth or Estuary
- Cities and Towns

N
W E
S
0 5
Kilometres



TITLE:
Figure 4.29
Marine Turtle Nesting Beaches
along the Western Coastline of Ghana

CLIENT:	SIZE:
Tullow Ghana	A4

DATE: 06/08/2009	CHECKED: MI	PROJECT: 0096867
DRAWN: CO	APPROVED: MI	SCALE: As Scale Bar

DRAWING:	REV:
EnvSnstvs_TurtlesandCrocs_remargind.mxd	0

ERM
Norloch House
36 King's Stables Road
Edinburgh, EH1 2EU
Tel: 0131 478 6000
Fax: 0131 487 3636

SOURCE: EPA Ghana: Environmental Sensitivity Map for Coastal Areas of Ghana, Volume 1, Atlas
PROJECTION: GCS WGS 1984

File: 0096867\Ghana_CO_MXD\PS\EnvSnstvs_TurtlesandCrocs_remargind.mxd

Table 4.9 Loggerhead Turtle

Scientific name	*Caretta caretta*
Status:	Endangered
Size:	Adults Length 70-100 cm Mass up to 200 kg Hatchlings Length 25 mm Mass 15-20 g

Distribution:

- Nesting areas in tropical to sub-tropical regions; Non-nesting range extends to temperate regions
- Loggerheads exhibit trans-oceanic developmental migrations from nesting beaches to immature foraging areas on opposite sides of ocean basins.

Reproduction:

- Reproduce every 2-4 years
- Lay 2-5 clutches of eggs per season
- Lay 80-120 eggs per clutch
- Large ping-pong ball size eggs weigh 30-40 grams
- Can take 20-30 years to reach sexual maturity

Nesting Sites and Distribution of Loggerhead Turtles

Source: http://seaturtlestatus.org/

Table 4.10 Olive Ridley Turtle

Scientific name: *Lepidochelys olivacea*

Status: Vulnerable

Size: *Adults*
Length 60-70 cm
Mass up to 70 kg

Hatchlings
Length 25 mm
Mass 15-20 g

Distribution: Circumglobal
Nesting areas in tropical to sub-tropical regions
Non-nesting range extends to temperate regions

Reproduction: Reproduce every 1-3 years
Lay 1-3 clutches of eggs per season
Lay 90-130 eggs per clutch; ~
Ping-pong ball size eggs weigh approximately 30 grams each
Incubation period approximately 60 days long

Nesting Sites and Distribution of Olive Ridley's Turtles

Source: http://seaturtlestatus.org/

Table 4.11 Hawksbill Sea Turtle

Scientific name: *Eretmochelys imbricata*

Status: Critically Endangered

Size: *Adults*
Length 75-90 cm
Mass up to 150 kg

Hatchlings
Length 30 mm
Mass 5 g

Distribution: Nesting areas in tropics
Non-nesting range is generally restricted to tropical regions, although during immature stages it extends to sub-tropical regions

Reproduction: Reproduce every 2-4 years
Lay 2-5 clutches of eggs per season
Lay 120-200 eggs per clutch
Ping-pong ball size eggs with approximately 25-30
Incubation period is approximately 60 days long

Native/Resident Range of Olive Ridley Turtles (IUCN, 2009)

Source: http://seaturtlestatus.org/

Table 4.12 Green Turtle

Scientific name: *Chelonia mydas*

Status: Endangered

Size: *Adults*
Length 80-120 cm
Mass up to 300 kg

Hatchlings
Length 30-40 mm
Mass 25-30 g

Distribution: Nesting areas throughout tropical regions are often on islands and coral atolls in addition to mainland beaches
Non-nesting range extends to temperate regions during immature stages

Reproduction: Reproduce every 2-4 years
Lay 2-5 clutches of eggs per season
Lay 80-120 eggs per clutch
Large ball size eggs weigh approximately 40-50 grams
Incubation period approximately 60 days long
Can take 20-40 years to reach sexual maturity

Nesting sites and distribution of Green Turtle

Source: http://seaturtlestatus.org/

Table 4.13 Leatherback Turtle

Scientific name:	*Dermochelys coriacea*
Status:	Critically Endangered
Size:	*Adult* Length 140-160 cm Mass 300-1000 kg *Hatchling* Length 50 mm Mass 40-50 g
Distribution:	Present in all world's oceans except Arctic and Antarctic Nesting areas in tropics Non-nesting range extends to sub-polar regions
Reproduction:	Reproduce every 2-4 years Lay 4-7 clutches of eggs per season Lay 50-90 eggs per clutch Billiard ball size eggs weigh roughly 80 grams Incubation period is approximately 60 days long

Nesting sites of the Leatherback Turtle

Source: http://seaturtlestatus.org/

4.2.11 Birds

The west coast of Africa forms an important section of the East Atlantic Flyway, an internationally-important migration route for a range of bird species, especially shore birds and seabirds (Boere *et al*, 2006, Flegg 2004). A number of species breed in higher northern latitudes winter along the West African coast and many fly along the coast on migration. Seabirds known to follow this migration route include a number of tern species (*Sterna* sp.), skuas (*Stercorarius and Catharacta* spp.) and petrels (Hydrobatidae).

The distance of the migration routes of these species from the shore depends on prey distribution and availability (eg the abundance and distribution of shoals of anchovies or sardines) (Flegg 2004). Species of waders known to migrate along the flyway include sanderling (*Calidris alba*) and knott (*Calidris canuta*). The highest concentrations of seabirds are experienced during the spring and autumn migrations, around March and April, and September and October. Waders are present during the winter months between October and

March. The marine birds of Ghana include storm petrels (*Oceanodroma castro*) and Ascension frigatebirds (*Fregata aquila*). Records dating back to the 1960s reveal only limited sightings of a few species (Elgood *et al*, 1994). The rarity of oceanic birds may be attributable to the absence of suitable breeding sites (eg remote islands and rocky cliffs) off the Ghana coast and in the Gulf of Guinea.

During the environmental baseline studies research cruse for the West African Gas Pipeline (WAGP, 2004) in 2002/2003, the survey crew recorded several sightings of black tern (*Chlidonias niger*), White winged black tern (*Chlidonias leucopterus*), royal tern (*Sterna maxima*), common tern (*Sterna hirundo*), sandwich tern (*Sterna sandvicensis*), great black-back gull (*Larus marinus*), lesser black-back gull (*Larus fuscus*), pomarine skua (*Stercorarius pomarinus*) and great skua (*Catharacta skua*). The two species of skua are predominant in the Western offshore environment. Black terns were mainly recorded at nearshore locations close to estuaries and/or lagoons. These species leave the onshore areas to feed at sea during the afternoon. The general low diversity of marine birds may be ascribed to lack of suitable habitats and availability of food resources in the offshore area. There are 40 Important Bird Areas (IBAs) designated by Birdlife International within Ghana (Birdlife International, 2009). Six IBAs are located along the coastline of Ghana, namely:

- Amansuri wetland;
- Densu Delta Ramsar Site;
- Keta Lagoon Complex Ramsar Site;
- Muni-Pomadze Ramsar Site;
- Sakumo Ramsar Site; and
- Songor Ramsar Site.

A map showing the locations of these IBAs is provided in *Figure 4.30*. Five of these are designated Ramsar sites, however, only one, the Amansuri wetland, is located along the western coastline within the project sphere of influence. Further information on this IBA is provided in *Box 4.1*.

KEY:

- IBAs
- Lagoon, River Mouth or Estuary
- SensitivePlacenames
- Cities and Towns

N
W E
S

0 50

Kilometres

CLIENT: Tullow Ghana

SIZE: A4

TITLE: Figure 4.30 Important Bird Areas along the Coast of Ghana

ERM
Norloch House
36 King's Stables Road
Edinburgh, EH1 2EU
Tel: 0131 478 6000
Fax: 0131 487 3636

SOURCE: Data obtained from www.birdlife.org 15/06/09
PROJECTION: GCS WGS 1984

DATE: 06/08/2009	CHECKED: MI	PROJECT: 0096867
DRAWN: CO	APPROVED: MI	SCALE: As Scale Bar

DRAWING: IBAs_labelId_remargnd.mxd

REV: 0

File: 0096867\Shared_CO_MXD\FIGS\IBAs_labelId_remargnd.mxd

Box 4.1 Amansuri Wetland Important Bird Area

Location: 4deg 55' N 2o 15' W

Extent: 38,050 ha

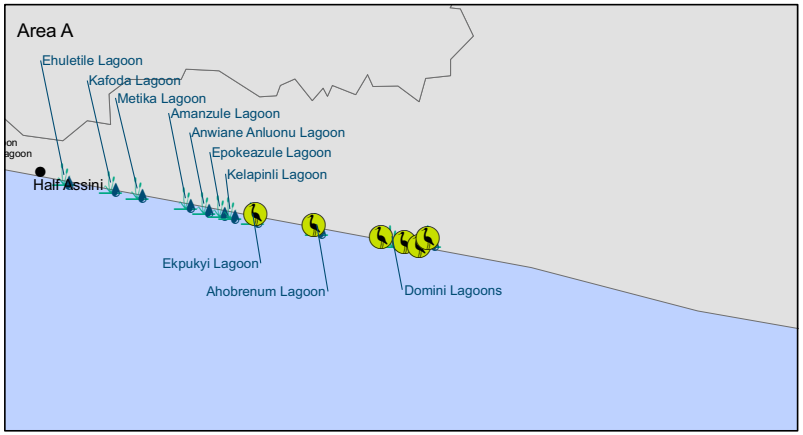
Site description: The site lies c.360 km west of Accra, near the town of Axim. It includes the freshwater Amansuri lagoon (including the village of Nzulenso which is built on stilts in the lagoon), the flood-plains of the Amansuri River, the coastal Amansuri lagoon and estuary, and the sandy Esiama beach, between the Amansuri and Ankobra Rivers. The site covers c.40 percent of the total catchment of the Amansuri River. The wetland is a blackwater system. The vegetation in the catchment is Wet Evergreen Forest, with swamp-forest in wetter parts. The most common tree in the swamps is the Raffia Palm *Raphia vinifera*, which grows in almost pure stands. The large spiny aroid *Cyrtosperma senegalense* grows along the edge of the raffia while the drier patches support mainly sedges and grasses. The area is subject to seasonal flooding and the nature of the terrain is such that access is very difficult and, as a consequence, large areas are largely untouched.

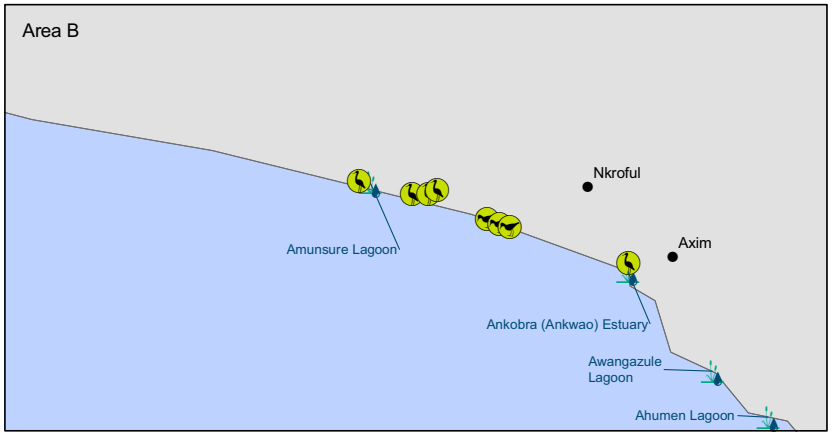
Birds: Key bird species include the Sanderling (*Calidris alba*) and Royal Tern (*Sterna maxima*). The coastal areas of the Amansuri catchment, including the coastal lagoon, estuary and Esiama beach, support appreciable numbers of waterbirds. Other common species occurring at the site include *Pluvialis squatarola*, *Charadrius hiaticula*, *Tringa hypoleucos* and *Arenaria interpres*. Up to 30 *Haematopus ostralegus* are regularly seen on the beach, the only site along the Ghana coast where the species is seen with any degree of frequency. In addition to *Sterna maxima*, small flocks of *S. sandvicensis*, *S. hirundo* and *Chlidonias niger* also regularly roost on sandbanks in the estuary. Species occurring in the inland freshwater lagoon and swamp areas include gallinules, crakes and jacanas. The avifauna of the rest of the catchment has not been studied.

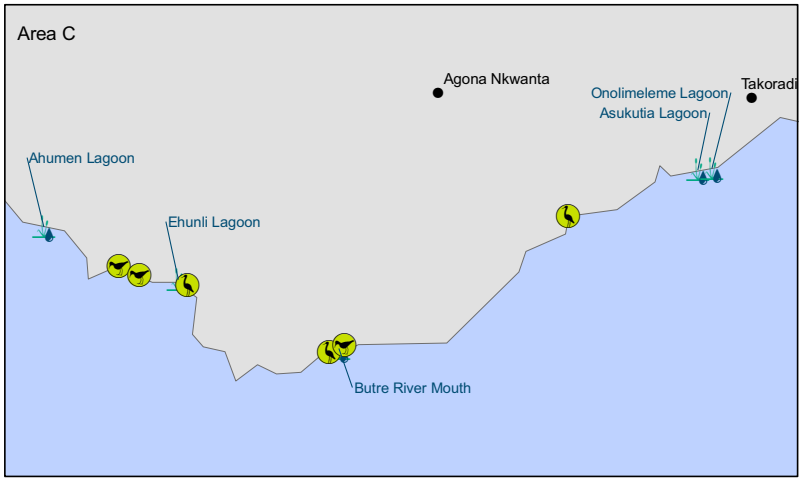
Conservation issues: Amansuri wetland is the largest stand of intact swamp-forest in Ghana and its value is further enhanced by the fact that large areas are still in a relatively pristine condition. The fauna of the site, as with most blackwater areas, is species-poor; however, the communities present are distinctive. With current rates of population growth and development, unless action is taken now to safeguard this unique area, it is likely to suffer the fate of numerous other coastal wetlands, which have become completely degraded. The area is being considered as a Community Nature Reserve, with the possibility of Ramsar designation, under a project being implemented by the Ghana Wildlife Society, with funding from the Netherlands Government. Because of the large size of the catchment and the high population density in some parts, a zonation system will be necessary to focus conservation action on the most biologically important and intact areas. The freshwater lagoon is fished by the Nzulenso community; the fishing is regulated by a wide range of well-enforced taboos, aimed at ensuring sustainability and preventing pollution of the lagoon waters.

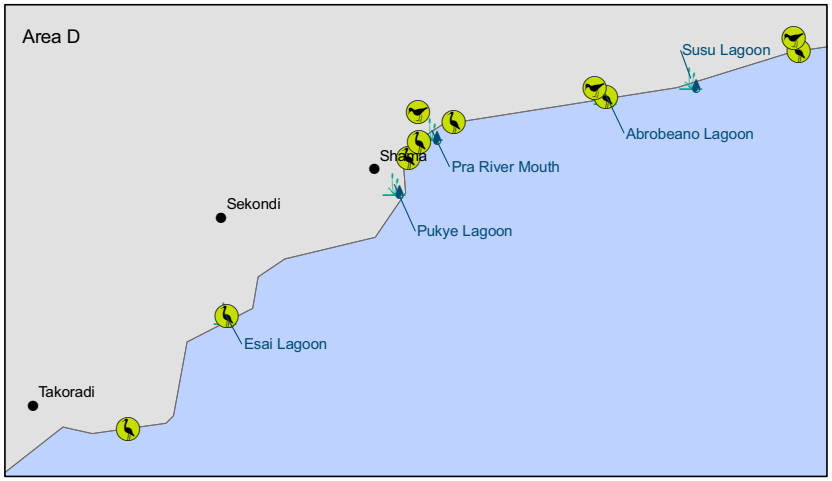
Source: Birdlife International, 2009

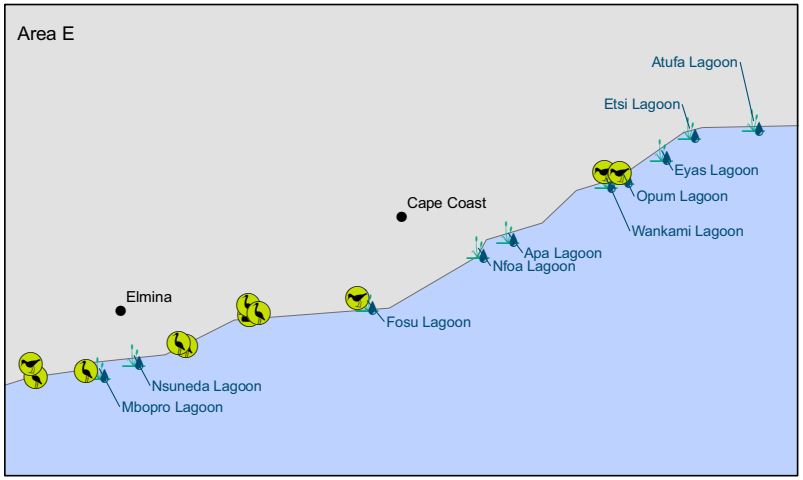
In addition to designated IBAs, there are a number of estuaries, lagoons and wetland along the western coastline that are importation habitats for shore birds, gulls and terns, waders and waterfowl. These locations are shown in *Figure 4.31*.

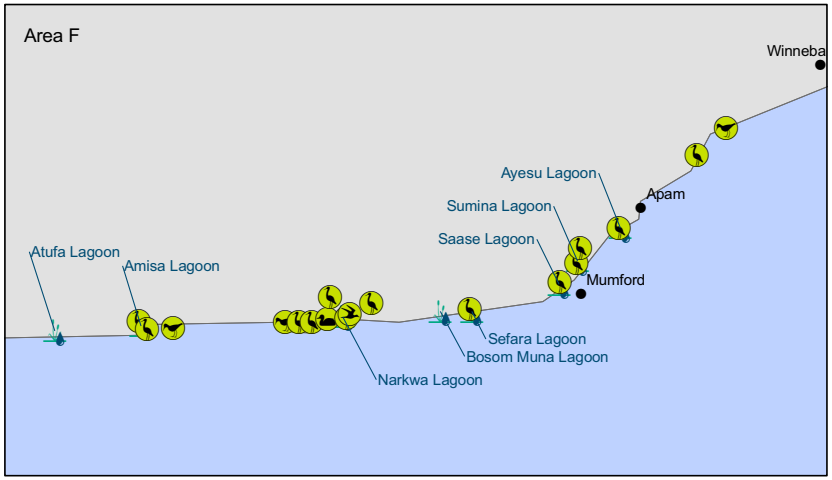












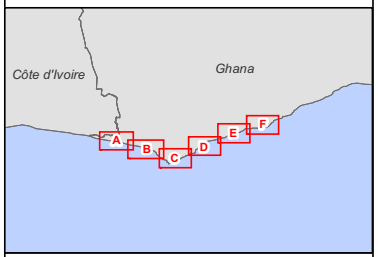
KEY:

Birds

- Shorebirds
- Gulls and Terns
- Waders
- Waterfowl
- Lagoon, River Mouth or Estuary
- Cities and Towns

N
W E
S

0 10
Kilometres



TITLE:
Figure 4.31
Sensitive Bird Habitats along the Western Coastline of Ghana

CLIENT: Tullow Ghana		SIZE: A4
DATE: 06/08/2009	CHECKED: MI	PROJECT: 0096867
DRAWN: CO	APPROVED: MI	SCALE: As Scale Bar
DRAWING: EnvSensitivites_Birds_remargnd.mxd		REV: 0

ERM
Norloch House
36 King's Stables Road
Edinburgh, EH1 2EU
Tel: 0131 478 6000
Fax: 0131 487 3636

SOURCE: EPA Ghana: Environmental Sensitivity Map for Coastal Areas of Ghana, Volume 1, Atlas
PROJECTION: GCS WGS 1984

File: 0096867\Ghana_CO_MXD\MXD\EnvSensitivities_Birds_remargnd.mxd

4.2.12 Habitat Types

The coastal area of Ghana is situated at latitude 5.5° north. The coastline is approximately 550 km long and is generally low-lying, with a maximum elevation of 200 m above sea level. It has a narrow continental shelf extending outwards to between 20 and 35 km, except off Takoradi where it extends up to 90 km.

In 2004, the UNDP with financial assistance from the Fund for Danish Consultancy Services, supported the EPA to compile environmental sensitivity maps for the coastal area of Ghana. The coastal sensitivity map is a Geographic Information System (GIS) based environmental planning tool for coastal zone management use in planning and implementation of oil spill response. This section draws largely on information from this document.

Approximately 70 percent of the coastline consists of sandy beaches. Over 90 coastal lagoons are located in the back-shore areas, most of which are small and less than 5 km^2 in surface area (Armah *et al,* 2004). The Ghanaian coastal zone can be divided into the following three geomorphic zones according to Ly, 1980. The locations of these zones are shown in *Figure 4.32* and a brief outline is provided below.

- **The Western Coast.** Covers 95 km of stable shoreline and extends from the Cote d'Ivoire border to the estuary of the Ankobra River. These are basically composed of fine sand with gentle beaches backed by coastal lagoons.

- **The Central Coast**. Extends approximately 321 km from the estuary of the Ankobra River near Axim to Prampram, located to the east of Accra. It represents an embayment coast of rocky headland, rocky shores and littoral sand barriers enclosing coastal lagoons.

- **The Eastern Coast**. Extends approximately 149 km of shoreline from Prampram, eastwards to Aflao at the border with Togo. It is characterised by sandy beaches with the deltaic estuary of the Volta River situated halfway in-between.

Major rivers draining the coastal zone are the Tano, Ankobra, Butre, Pra, Kakum, Amisa, Nakwa, Ayensu, Densu and the Volta (*Figure 4.33*).

This section focuses on the habitat types within the immediate sphere of influence of the Phase 1 Jubilee project (mainly the western coast) but includes descriptions for other areas along the Ghana coast, where information is lacking for the western coast.

Figure 4.32 Western, Central and Eastern Coastlines of Ghana

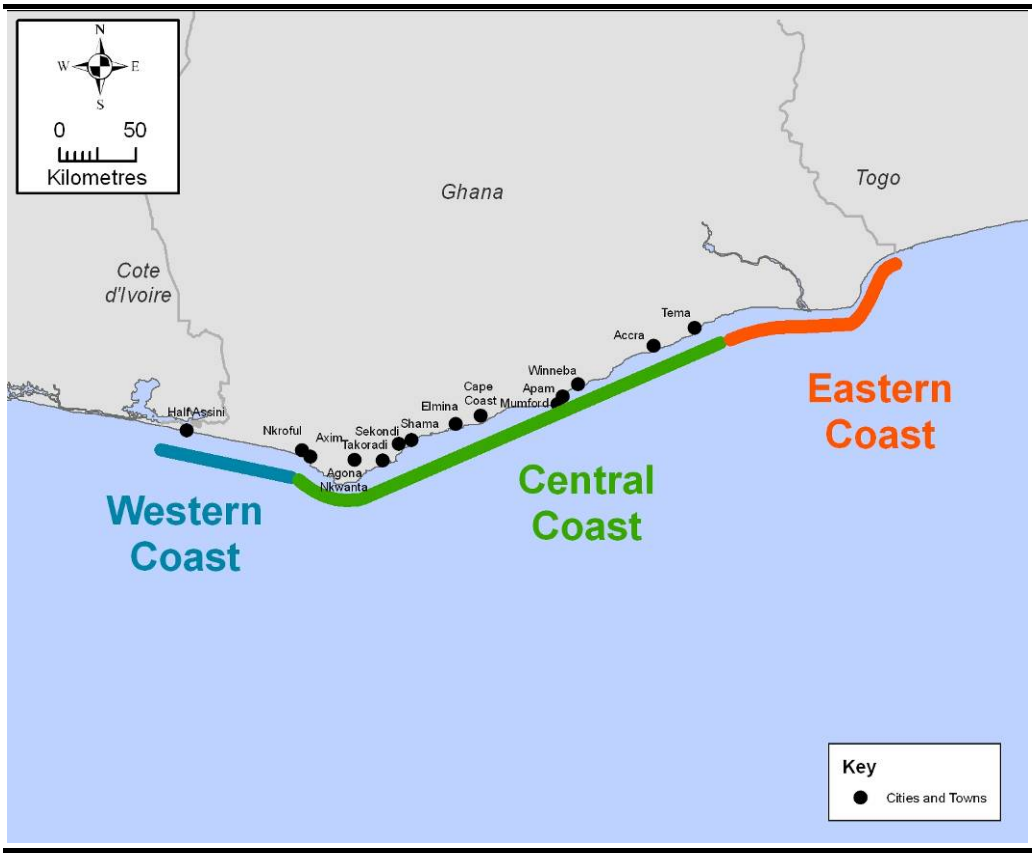
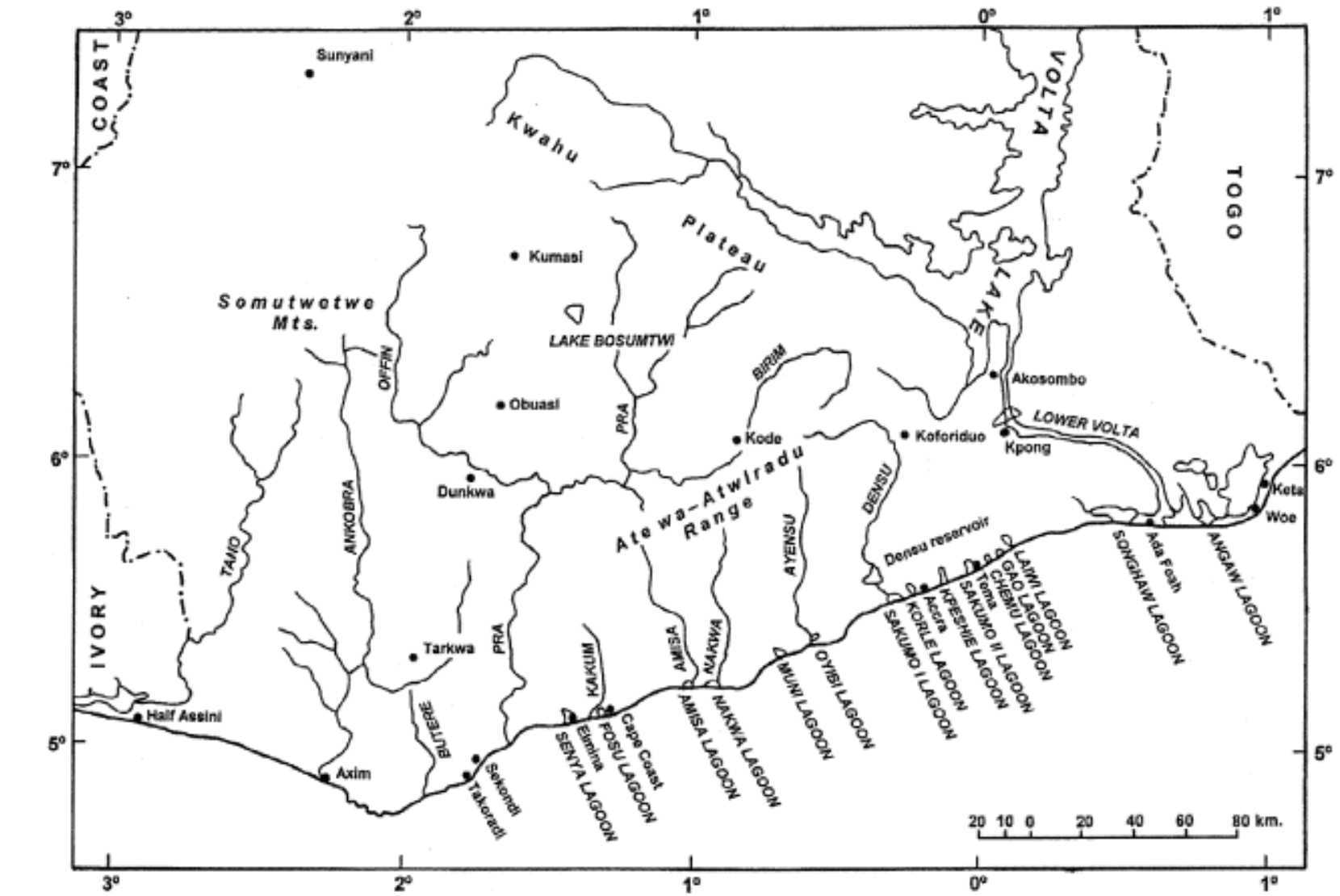


Figure 4.33 Major Rivers and Lagoons along the Coast of Ghana



Source: Biney, 1986

Sandy Shores

Sandy shores are the most prominent coast type in Ghana and most of the West Coast coastline comprises sandy beaches. Limited detailed ecological studies have been undertaken for the sandy shores along the western coast of Ghana. Generally, species diversity on the sandy beaches is low, especially on beaches with coarse sand and a steep profile. *Figure 4.34* shows a typical sandy shore with fine-grained sand gentle profile.

Figure 4.34 Sandy Beach with Fine-Grained Sand and Low Slope (Near Essia-mah)

Source: Environmental Sensitivity Atlas, 2004

Species diversity is higher on fine grained sandy beaches with a gentle profile, which are predominant along the western coastline. The dominant species along such beaches are summarised in *Table 4.14* (Gauld and Buchanan, 1956, E. Lamptey, pers. comm., 2009).

The sandy shores along the western coast also serve as important nesting sites for marine turtles (Armah *et al*, 2004). Epifauna on the sandy shores along the West Coast are literally non-existent. However, strand vegetation occurs above the high tide mark and typically comprises creepers (*Canavalia rosea* and *Ipomea pes-caprae*) in association with some grasses (*Cyperus maritimus* and *Diodia vaginalis*). The prickly cactus (*Opuntia vulgaris*) is occasionally found (Armah *et al*, 2004) in this zone. The back shore vegetation is generally characterised by coconut palms, the dwarf palm *Phoenix reclinata* and the shrubs *Baphia nitida, Grewia* spp., *Sophora occidetalis, Thespesia populnea* and *Triumfetta rhombaidea* (Taylor, 1960).

Table 4.14 Common Species on Fine Grained Sandy Beaches

Common name	Species
Ghost crab	*Ocypoda cursa*
Isopods	*Excirolana latipes*
Amphipods	*Urothoe grimaldi* *Pontharpinia intermedia*
Mysids	*Gastrosuccus spinifer*
Mole crabs	*Hippa cubensi*
Polychaetes	*Narine cirratulus* *Glycera convolut*
Bivalves	*Lumbrinereis impatiense* *Donax pulchellus* *Donax rogusus*
Gastropods	*Terebra micans* *Olivancilaria hiatula* *Olivia sp.*

Rocky Shores

Rocky shores within the potentially affected coastline occur primarily at Axim. Along the western coastline, other significant sections of rocky shoreline occur at Eqyembra, Cape Three Points, west of Busua, west of Takoradi Port and at Abuesi. The rocky shore in this area occurs as rocky outcrops alternating with sandy bays (Lawson, 1956). A steep exposed rocky coastline is shown in *Figure 4.35*. Rocky outcrops serve as suitable substrate for a wide variety of macroalgae, barnacles, littorinid snails (Armah *et al*, 2004) and limpets. The algal mat on the rocks serves as important micro-habitat for several species of epifauna and fish. Common algal species include *Sargassum vulgare, Dictyopteris delicatula, Ulva fasciata, Chaetomorpha* sp. and *Lithothamnia* sp. (Evans *et al*, 1993; Lawson, 2003, 1956).

Fauna along the rocky coast include barnacles (*Chthamalus dentate, Balanus tintinnabulum*), snails (*Echinolittorina pulchella* - formally *Littorina puctata, Nodolittorina meleagis, Nerita senengalensis*), the whelk *Thais haemastoma* and limpets (*Siphonaria pectinata, Fissurella nuecula* and *Patella safiana*), *Thais nodosa*, and *Palythos sp* (Evans *et al*, 1993; Lawson 2003, 1956).

Tidal pools occurring on rocky coasts also serve as important micro-habitats for fauna and flora. Important tidepool flora on Ghanaian rocky coasts includes *Sargassum vulgare*, *Dictyopteris delicatula, Dictyotta* spp. *Pardina durvillei* and *Galaxaura marginata* (Lawson, 1956). The fauna include the damselfish *Microspathodon frontatus, Rupescartes atlanticus* and juveniles of

Abdefduf hamyi, the seargent major fish *Abdefduf saxatilis* and the parrot fish *Pseudoscarus hoefler* (Armah *et al*, 2004).

Figure 4.35 Steep Exposed Rock

Source: Environmental Sensitivity Atlas, 2004

Coastal Lagoons

Coastal lagoons along the Ghanaian coastline range from brackish to hypersaline and are separated from the sea by barriers of sand that run parallel to the shore. They are important ecosystems, housing a wide variety of fish, shrimp, crabs, mollusc and other benthic form. They are important nursery areas for juveniles of marine fish and shrimp and may serve as wintering sites for Palaearctic birds as well as roosting sites for local waterfowls.

Five of the lagoons along the Ghanaian coastline are designated as Ramsar sites (Sakumo, Densu, Muni-Pomadze, Keta and Songor), however, none of these occur within the immediate sphere of influence of the Phase 1 Jubilee project. Fourty coastal lagoons are located along the western coast between New Town (on the border of Cote d'Ivoire) and Winneba(1). The locations of these lagoons are shown in *Figure 4.36*.

The coastal lagoons along the coastline of Ghana may be designated as open, closed or semi-closed depending on their connectivity with the adjacent sea.

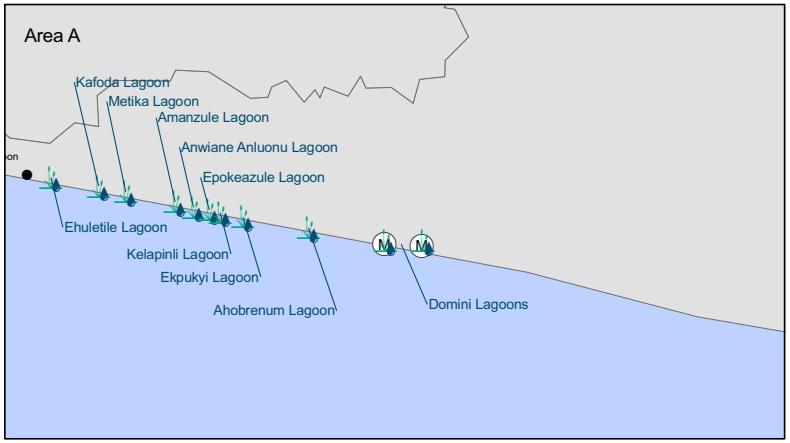
(1) Ehuletile, Kafoda, Metika, Amanzule, Anwiane, Epokeazule, Kelapinili, Ekpukyi, Ahbrenum, Domini, Amunsure, Awangazule, Ahumen, Ehulni, Butre, Asukutia, Onolimeleme, Esai, Pukye, Abrobeano, Susu, Mbopro, Nsuneda, Fosu, Nfoa, Apa, Wankami, Opum, Eyas, Etsi, Atufa, Amisa, Narkwa, Bosom Muna, Sefara, Saase, Sumina, Ayesu.

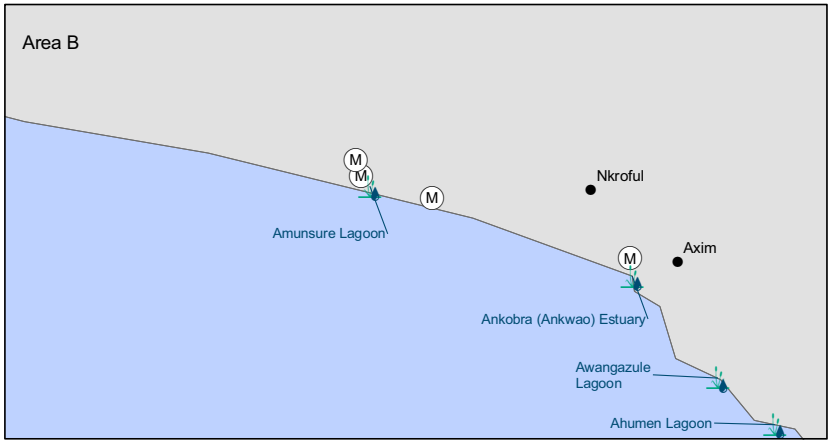
The hydrology and hence the ecology of the lagoons depend on inflow of freshwater into the lagoon and its connectivity with the adjacent ocean (ie whether it is closed or otherwise). Ecological studies on two coastal lagoon in Ghana (Muni and Sakumo (*Figure 4.37*)), which are not within the immediate sphere of influence of the project, indicate that the fauna is dominated by tilapine species with *Sarotherodon melanotheron* dominating catch (Koranteng, 1995a; 1995b). The open lagoons generally tend to have a higher diversity than the closed lagoons. Invertebrate species found in the closed lagoons (Muni) include the crustaceans *Uca tangeri, Callinectes latimanus, Cardiosoma armatum* and the molluscs *Tympanotonus fuscatus, Macoma cumana* and *Turitella meta*. The fish species were *S. melanotheron, Tilapia zillii* and *Liza falcipinnis* (Koranteng, 1995a; 1995b).

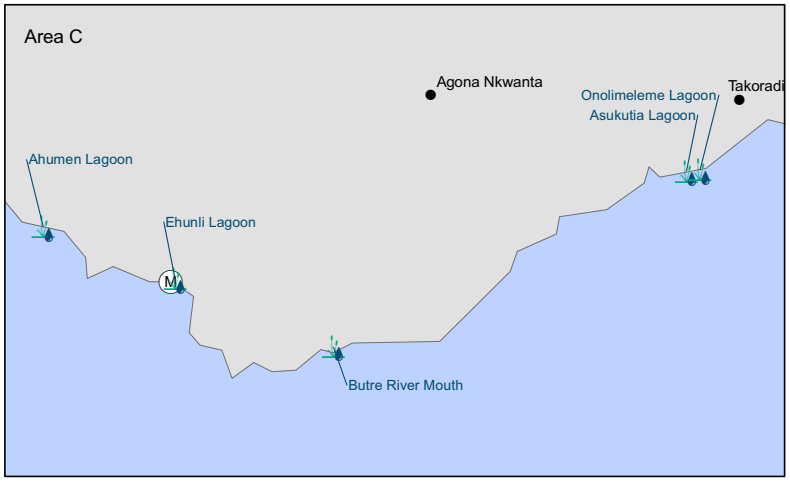
Species found in the open lagoon (Sakumo II) were the crabs *Uca tangerii, Callinectes latimanus, Cardiosoma armatum, Sesarmia africana*, juveniles of the shrimps *Parapenenaeopsis atlantica* and *Penaeus duorarum*, and the molluscs *Tympanotons fuscatus, Macoma cumana, Semifusis morio, Turritella ungulina, Turitella meta, Tivela tripla, Anadara senilis* and *Crassostrea tulipa*. Fish species in the open lagoons include brackish water species *Sarotherondon melanotheron, Tilapia zillii, Gobious ansorgii, Periothalmus* spp., the freshwater species *Oreochromis niloticus, Claria anguillaris, Hemichromis bimaculatus*, marine forms *Gerres melanopterus, Lethrinus atlanticus, Lutjanus fulgens, Albula vulpes* and the juvenile forms of *Liza falcipinnis* and *Mugil* sp. Pauly (1975) defined the following four groups of fish and shrimps encountered in open coastal lagoons in Ghana.

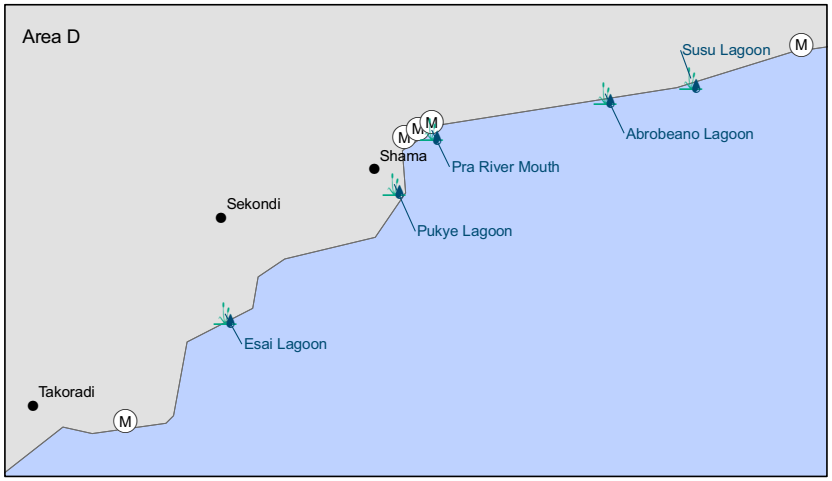
1. Freshwater fish which swim into the lagoon during the rainy season (e.g. *Clarias anguillaris, Hemichromis bimaculatus, Oreochromis niloticus, Tilapia zillii*).
2. Fish species that spend all or most of their lives in the lagoon (e.g. *Sarotherodon melanotheron, Priopthalms kaelruti* and some gobid species).
3. Marine fish species that come into the lagoon for short incursions (e.g. *Albula vulpes, Lutjanus fulgens, Lethrinus* sp.).
4. Species that spawn at sea but have their juvenile forms washed into the lagoon just after the rainy seasons (e.g. *Mugil* sp. *Gerres melanopterus, Penaeus duorarum, Parapenaepsis atlantica*).

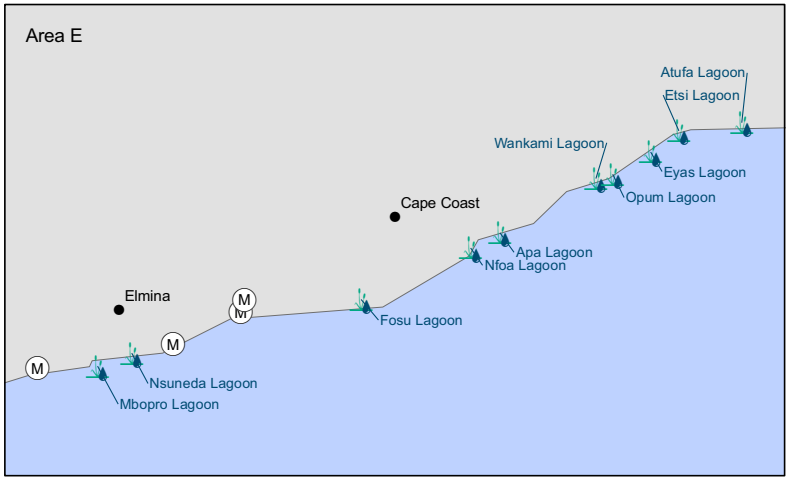
Other important biota of the coastal lagoon ecosystem include the avifaunal population, small mammal and reptile populations and lagoon flora including mangrove stands and associated vegetation.

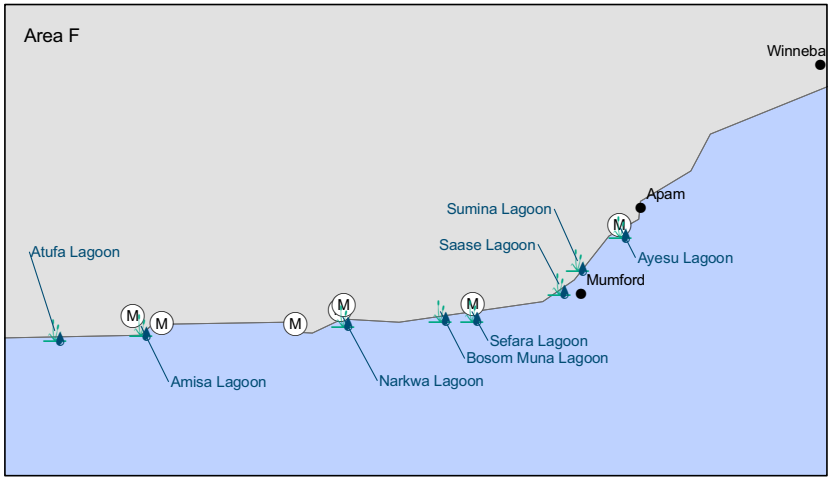










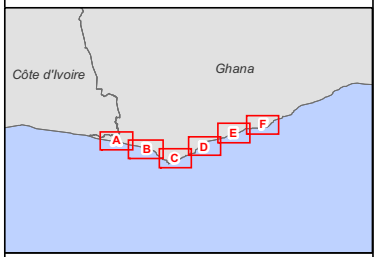


KEY:

- Lagoon, River Mouth or Estuary
- (M) Mangrove
- Cities and Towns

N
W E
S

0 10
Kilometres



TITLE:
Figure 4.36
Sensitive Habitats along the Western Coastline of Ghana – Lagoons, River Mouths, Estuaries and Mangroves

CLIENT:	SIZE:
Tullow Ghana	A4

DATE: 06/08/2009	CHECKED: MI	PROJECT: 0096867
DRAWN: CO	APPROVED: MI	SCALE: As Scale Bar

DRAWING: EnvSnstvs_Mangroves.mxd
REV: 0

ERM
Norloch House
36 King's Stables Road
Edinburgh, EH1 2EU
Tel: 0131 478 6000
Fax: 0131 487 3636

SOURCE: EPA Ghana: Environmental Sensitivity Map for Coastal Areas of Ghana, Volume 1, Atlas
PROJECTION: GCS WGS 1984

File: 0096867\Ghana_CO_MXD\MXD\EnvSnstvs_Mangroves.mxd

Figure 4.37 ***Open coastal Lagoon (Sakumo Lagoon West of Tema). The lagoon is Cnnected to the sea via a Culvert***

Source: Environmental Sensitivity Atlas, 2004

Mangrove and Tidal Forests

Mangroves along the coastline of Ghana tend to be associated with coastal lagoons and estuaries (see *Figure 4.38*). The distribution is sparse and mangrove populations have also been degraded through over-cutting and conversion of mangrove areas to salt pans. The total area of land occupied by mangroves along the Ghanaian coastline in 1995 was estimated to be around 10,000 ha (Saenager and Bellan, 1995). Most of these mangroves occur along the eastern coast of Ghana out of the sphere of influence of the Phase 1 Jubilee project. A few smaller mangrove areas occur along the western coastline and are shown in *Figure 4.39* above.

The species of mangrove found along the Ghana coast are the red mangroves *Rhizophora racemosa*, *Rhizophora mangle* and *Rhizophora harrisonii*, the white mangroves *Avicennia germinans* and *Laguncularia racemosa*. The mangrove species show zonation within the lagoons with the red mangroves being the primary colonists in open lagoons with regular tidal exchange, and the white mangroves being the primary colonists in closed lagoons (Sackey *et al*, 1993). Other associated vegetation found within mangrove habitats includes *Conocarpus erectus, Thespeia populnea, Acrostichum aureum, Phoenix reclinata, Sessuvium portulacrastrum* and *Phylloxerus vermicularis* (Armah *et al*, 2004). The drier areas of mangrove habitats with less saline or normal soils may have other species such as *Dahlbergia escastophyllum, Drepanocarpus lunatus, Hibiscus tiliaceous* and *Terminalia catappa* (Armah *et al*, 2004).

Mangrove habitats along the Ghana coast also tend to host a wide variety of fauna species such as oysters, gastropods, crabs, invertebrates, birds and fish.

They also play an important role as nursery areas for many species of fish and crustaceans.

Figure 4.38 Mangroves

Source: Environmental Sensitivity Atlas, 2004

Estuarine and Depression Wetlands

Armah *et al* (2004) defined estuarine wetlands as all wetlands which are exposed when the tide is out, as well as plains of estuaries, which are seasonally inundated during the rainy season. They define depression wetlands as those wetlands not linked to any significant watercourse, but are small in size and confined mostly to low-lying areas.

There is a paucity of information on the wetland types, especially along the western coast of Ghana. However, it is known that depression wetlands predominate along the western coast as a result of high rainfall and poor drainage. Examples of estuarine wetlands along the western coast include Butre, Ankrobra, Kpani-Nyila and Hwin while depression wetlands include Belibangara, Ndumakaka, Efasu and Ehuli (Armah *et al*, 2004). Estuaries and river mouths along the western coastline are shown in *Figure 4.39* above.

According to Armah *et al* (2004), the wetlands have diverse and extensive vegetation with mangrove stands and species of swamp forest vegetation. Several species of fish, crustaceans and other invertebrates also occur in these habitats.

4.2.13 Nature Conservation and Protected Areas

Several coastal habitats are important for their biodiversity as well as for rare and endangered species. However, only five coastal protected areas currently

exist within the country. These areas are all located onshore and are protected under the Ramsar convention. They are the Muni-Pomadze, Densu Delta, Sakumo Lagoon, Songor Lagoon and the Anglo-Keta Lagoon complex Ramsar sites (*Table 4.15*). None of these protected areas occur along the western coast, which is within the sphere of influence of the Jubilee field project (1). The locations of these Ramsar sites are shown in *Figure 4.33* above along with the International Bird Areas.

Table 4.15 Coastal Ramsar Sites in Ghana

Name and Site Number	Location	Area (km^2)	Comments
Muni-Pomadze (563)	5°23′N, 0°40′E	94.6	Sand dunes, open lagoon, degraded forest and scrubland. Lagoon opens into the sea during the rainy season.
Densu Delta (564)	5°30′N, 0°15′E	58.9	Sand dunes, lagoons, salt pans, marsh, and scrub. Scattered stands of mangrove with extensive areas of open water.
Sakumo (565)	5°30′N, 0°08′E	13.6	Brackish lagoon with narrow connection to the sea. Main habitats are the open lagoon, surrounding flood plains, freshwater marsh, and coastal savannah grasslands.
Songor (566)	5°45′N– 6°00N, 0°20′E–0°35′E	511.33	Closed lagoon with high salinity, and a large mudflat with scattered mangroves.
Keta Lagoon Complex (567)	5°55′N, 0°50′E	1,010.22	Open lagoon with brackish water influx from Volta River. Coastal savannah grasses with patches of trees and shrubs. Largest seabird populations of all coastal wetlands of Ghana.

Ghana has not declared any marine protected area with the exception of the Ramsar sites. Currently, coastal lagoons and mangrove stands are identified as breeding and nursery areas for a wide variety of marine species. However, none of these are under any protection by state legislation, with the exception of the Ramsar designated areas.

Traditional methods of conservation exist for a number of lagoons and wetlands within the country. These methods (mainly taboos), however are poorly documented and lack legislative backing. The traditional methods include days, periods and seasons of closed fishing, and restrictions on fishing methods and gear, and fishers.

(1) Oil spill modelling undertaken as part of this EIA showed that for a very large spill (ie 20,000 tonnes) oil would beach on the stretch of coastline (40 to 50%) approximately 100 km west of Cape Three Points. Although the analysis shows that it is possible that a larger area of coastline east of Cape Three Points would be exposed to oil beaching it is noted that in the event of a spill of this size the probability of this area being affected is in the range 1 to 10%.. It is therefore unlikely that any of these protected areas would be affected even in a worse case oil spill scenario. Oil spill impacts are assessed in detail in *Chapter 5, Section 5.6.*

4.3 FISHERIES

Ghana is located in the western Gulf of Guinea sub-region, about 750 km north off the equator between latitudes 4° and 12° N and longitudes 3° W and 1° E. The fishing industry in Ghana is based on resources from both marine and inland (freshwater) waters and from coastal lagoons and aquaculture (Quaatey, 1997; NAFAG, 2007). Within the marine sector target species include pelagic, demersal and shellfish resources.

The agricultural Gross Domestic Product (GDP) contributes about 45-50 percent of Ghanaian GDP and about 75 percent of export earnings. The fisheries sector accounts for approximately 5 percent of the agricultural GDP. Fish and fish products provide the greatest proportion of animal protein in Ghana and contribute approximately 60 percent of the total animal protein intake. About 75 percent of the total domestic production of fish is consumed locally and the per capita consumption is estimated to be about 25 kg annually. Fish is the country's most important non-traditional export commodity. In 2002, export earnings from fish and fishery products amounted to over $95 million.

There is a long tradition of both artisanal and distant-water fishing fleets, the latter a unique feature amongst West African countries (Alder and Sumaila 2004). Ghana has a coastline of 550 km and relatively narrow continental shelf to a depth of 75–120 m with a total area of approximately 24,300 km^2. Most commercial marine fishing undertaken by Ghanaian vessels takes place within the Ghanaian 200 miles Exclusive Economic Zones (EEZ).

The traditional artisanal inshore fishery in Ghana is well developed and provides about 70 percent of the total marine fisheries production in the country. Fishing occurs year round but shows some seasonality, with periods of higher landings and periods of reduced catches through the year. The fish landings from coastal lagoons or estuaries, although comparatively small, provide reasonable quantities of fish products for subsistence purposes. Fishing in lagoons and estuaries involves substantial number of fishers using small scale gear such as gill nets, throw nets and weirs.

Marine fishing activity in Ghana is strongly linked with the seasonal upwellings (1) that occur in coastal waters. Two upwelling seasons (major and minor) occur annually in Ghanaian coastal waters. The major upwelling begins between late June or early July when sea surface temperatures fall below 25°C and ends between late September or early October. The minor upwelling occurs either in December, January or February and rarely lasts for more than three weeks. During the upwelling periods, biological activity is increased due to greater concentrations of nutrients in the water column that have been drawn up from deeper waters. Most fish spawn during this period

(1) An upwelling involves wind-driven motion of dense, cooler, and usually nutrient-rich water towards the ocean surface, replacing the warmer, usually nutrient-depleted surface water.

and stocks are more readily available to the fishers. For the rest of the year, catches are lower and more sporadic.

The fishing industry in Ghana consists of three main sectors:

- small scale (or artisanal);
- semi-industrial (or inshore); and
- industrial fisheries.

Table 4.16 shows the number of operational vessels in each fleet between 1997 and 2007.

Table 4.16 Number of Vessels Operating in Ghanaian Fleets

Fleet	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Canoe *	8,895				9,981			11,219			
Inshore	241	239	239	236	244	230	233	253	240	235	230
Industrial	48	47	38	46	45	34	47	56	48	61	73
Shrimpers	14	11	6	3	3	2	2	2	2	2	2
Tuna baitboats	36	35	39	34	33	33	28	28	26	25	23
Tuna Purse seiners	5	6	8	10	10	10	9	9	10	10	10

*Numbers enumerated during canoe frame surveys in the indicated years.
Source: FAO 2007

4.3.1 Fisheries Regulatory Framework

The fishing Industry of Ghana is regulated by the Fisheries Act 2002 (Act 625 of 2002). The Act provides for the regulation and management of fisheries, development of the fishing industry and the sustainable exploitation of fisheries resources. The development of fisheries policy has generally followed the development of the industry, as new methods and fishing strategies have appeared the legislation has generally followed.

The legal basis for fisheries management in Ghana involves ordinances, laws and regulations. Over the years, these have been consolidated, improved upon and revised to meet the challenges of the fast-developing and changing fishing industry into the Fisheries Act (2002). The law was continuously reformed to:

- improve regulation of and sustain the national fishery resource;
- improve Ghana's access to international markets within the domain of the international fish trade;
- obtain optimum benefits for Ghanaians as owners of fish-related enterprises, as employers, as consumers of fish products and as beneficiaries of foreign exchange earnings from fish trade;
- enhance investment in a private sector-driven industry; and
- improve the fishery management system.

With reference to fish production and fisheries management, it is important to note that the *Fisheries Act (2002)* conforms to the relevant sectors of the United Nations Food and Agriculture Organisation (FAO) Code of Conduct for

Responsible Fisheries with particular emphasis on gear selectivity and an effective institutional framework. The *Fisheries Act (2002)* also gives legislative backing to the recently established Monitoring, Control and Surveillance Division with clearly defined legal powers to regulate fishing operations. The membership of the Division includes the Ghanaian Navy.

The Directorate of Fisheries under the Ministry of Food and Agriculture has also developed fishery management plans for marine fisheries. A new set of Fisheries Regulations to give effect to the *Fisheries Act (2002)* is currently being developed. Some of the management measures and policies in use include the following.

- ***Minimum Mesh Size Regulation.*** It is illegal to use the following:

    - gill nets with a mesh size of less than 50 mm for multifilament nets or 75 mm for monofilament nets when fishing in marine waters;
    - seine nets with a mesh size of less than 25 mm when fishing in marine waters;
    - bottom trawl nets with a mesh size of less than 60 mm when fishing in marine waters; and
    - shrimp trawl nets with a mesh size of less than 40 mm when shrimp fishing in marine waters.

- ***Regulation on Crustaceans.*** The Fisheries Law prohibits the catching of gravid lobsters and/or young lobsters or any other gravid crustaceans and/or young crustaceans during fishing operations. Where any such gravid lobsters and/or young lobsters or gravid crustaceans and/or young lobsters are accidentally caught, they shall be immediately returned into the sea.

- ***Regulation on Fishing with Explosives and Chemicals***. The Fisheries Law prohibits the use of dynamite and/or any other explosive substances or poisonous substances to fish.

- ***Restriction on the Size and Area of Operation of Vessels***. The Fisheries Law prohibits the use of fishing vessel of 50 Gross Registered Tonnage (GRT) or more to use bottom trawls in waters of depth less than 30 m. Bottom trawlers and shrimpers are restricted to sizes of GRT 450 or less.

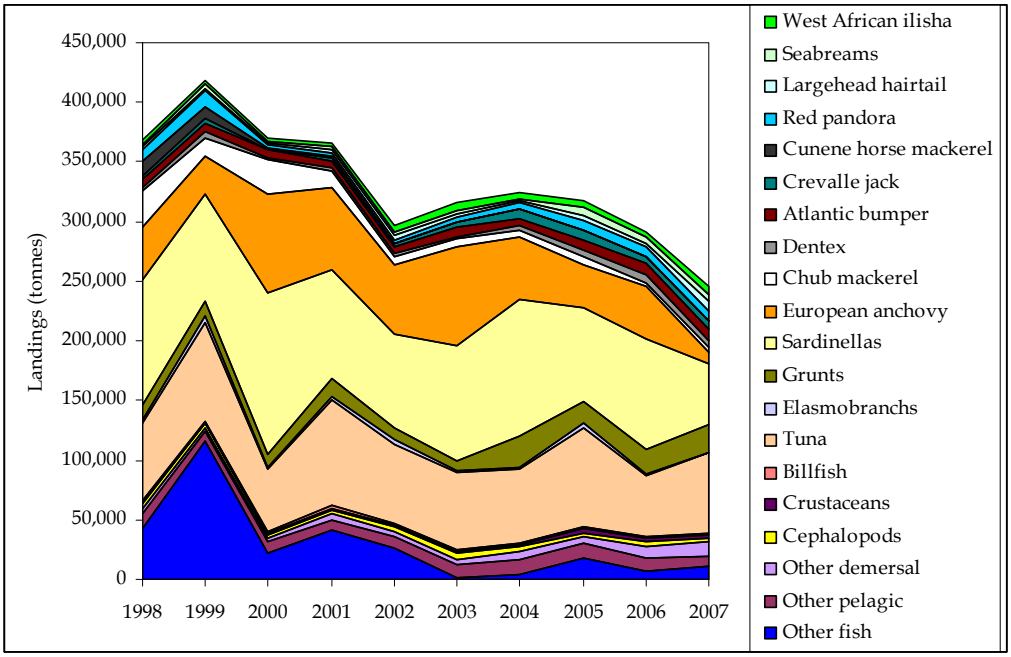
- ***Limited Entry for Industrial Trawlers***. A ban on licensing of new bottom trawlers due to the current high levels of exploitation of the demersal resources is now in force.

4.3.2 Fish Landings

Overall landings in the last decade (1998 to 2007) have shown a declining trend with a number of the most important species showing particularly marked declines particularly the main pelagic resources such as anchovies and sardinellas (*Figure 4.39*). Declines in less important pelagic resources,

as chub mackerel, Cunene horse mackerel and crevelle jack have also contributed to the overall downward trend. However, demersal species show some increases, with grunts, Atlantic bumper, Red Pandora, crustaceans and demersal resources in general showing marked increases over the last ten years. Tuna and billfish landings have remained fairly stable, showing some interannual variability but no continuous trends.

Figure 4.39 Total Landings of Major Target Groups by Ghanaian Fisheries 1998 to 2007



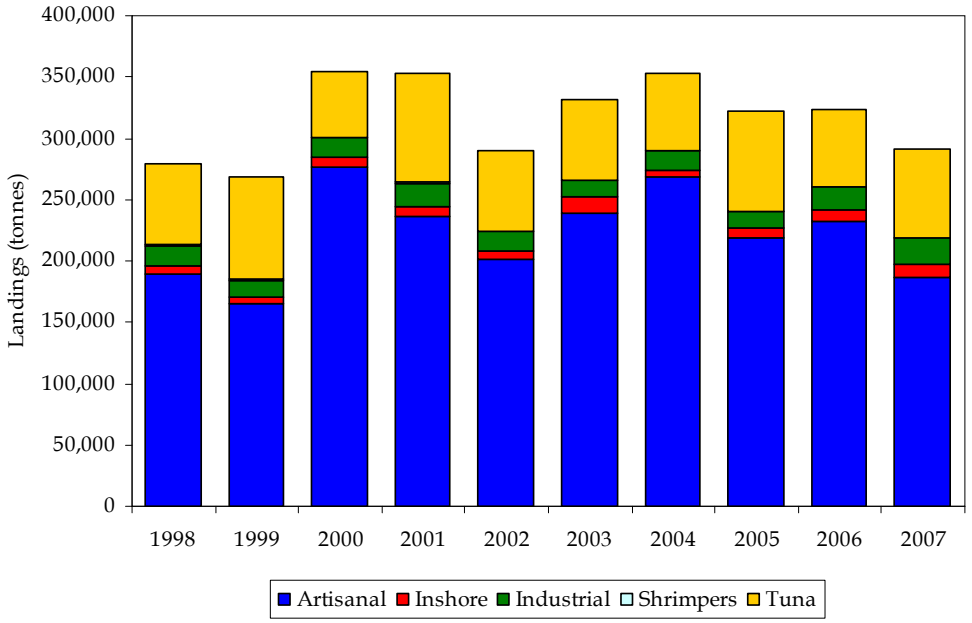
Source: FAO 2007

Fish landings for each fleet in the Ghanaian fishing industry over the last ten years are shown in *Figure 4.40*. The artisanal sector on average land 221,000 tonnes of fish annually, approximately 70 percent of the total annual marine fish catch. This is made up of mainly small pelagic fish species such as sardinellas, mackerels and anchovy.

The semi-industrial fleet exploits sardinellas, mackerels and a number of different demersal species. The average annual total landing from this fleet over this period was about 8,200 tonnes, representing less than 3 percent of the total annual marine fish catch from Ghanaian waters.

The industrial fleet (including trawlers, shrimpers and pair trawls) lands an average of 16,300 tonnes each year, 5 percent of the total annual marine fish catch. About 60 percent of the fish landed by the industrial vessels are demersal species such as seabream, cuttlefish and cassava croakers. Shrimp catches during the last ten years have been a relatively minimal proportion of the total catch (0.16 percent). The majority of shrimp landings are exported to Europe and the Far East. Shrimp production has recently declined and some of the shrimping companies are now converting their vessels into trawlers.

Figure 4.40 Total Landings for Ghanaian Fleets 1998 to 2007 (Tonnes)



Source: FAO 2007

On average tuna landings in the past decade have been in the region of 70,000 tonnes each year. This represents 22 percent of the total annual marine fish catch. The *Fisheries Act (2002)* stipulates that at least 10 percent of landings of commercial tuna vessels must be sold on the local market (ie not to be exported). About 70 percent of the landed tuna is processed into loins or canned for export.

4.3.3 *Fisheries Infrastructure*

Landing Facilities

There are three deep-water ports and harbours in Ghana at Tema, Sekondi and Takoradi that provide berthing facilities for both industrial fishing vessels and inshore vessels. There are four other ports at Apam, Mumford, Elmina and Axim that provide reasonably good landing facilities for inshore vessels. The Ghana Ports and Harbours Authority manages all ports and harbours in Ghana and provides facilities for bunkering, stevedoring and handling, electricity and water supplies.

Physical landing facilities for artisanal fishing crafts are not as well developed. Canoes usually operate from open beaches. Occasionally canoes have to move through violent surf which may result in damage to canoes or injuries to fishermen. There are about 300 landing centres along the coast for marine canoes. Each landing site is under the control of a Chief Fisherman. Fish landing sites along the western coastline of Ghana is shown in *Figure 4.41.*