An update on the catch composition and other aspects of cetacean exploitation in Ghana

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ABSTRACT
Photographs of 231 landed specimens (212 identifiable) were analysed to determine species composition of cetacean take in Ghana's artisanal fisheries in 1995-2010, the most comprehensive sample documented in West Africa. The three most commonly landed species are: 24.5% Clymene dolphin (*Stenella clymene),* 13.2% pantropical spotted dolphin *(Stenella attenuata),* 12.3% common bottlenose dolphin *(Tursiops truncatus).* Also regularly caught are: 10.4% melon-headed whale (*Peponocephala electra*), 9.4% short-finned pilot whale (*Globicephala macrorhynchus*), 9.4% long-beaked common dolphin (*Delphinus capensis).* Occasionally landed are: 6.1% rough-toothed dolphin *(Steno bredanensis),* 4.7% Risso's dolphin (*Grampus griseus),* 3.1% kogiids (including *Kogia sima*) and 2.8% spinner dolphin (*Stenella longirostris*). Rarely (<2%) landed are: Atlantic spotted dolphin (*Stenella frontalis*), Fraser's dolphin (*Lagenodelphis hosei),* false killer whale (*Pseudorca crassidens*) and pygmy killer whale (*Feresa attenuata*). One small sperm whale was recorded taken offshore.
Catch rate estimators, *cetaceans landed per month* (cpm) and *cetaceans landed per day* (cpd) were derived for 3 ports, but the national situation is unknown. At Axim, in 23 months, 130 cetaceans were observed landed (mean 5.65 ±SE 1.19 cpm); prorated per annum, 67.8 ±SE 14.28. During high-intensity surveying Jan-Nov 2003, 52 cetaceans were recorded in 192 days, with mean daily landings 0.271 cpd, prorated per annum 99.0. Reported landings at Axim in Aug-Dec 2007 were limited (0.087 cpd), prorated per annum 31.8 cetaceans, however a negative sampling bias was indicated making this cpd questionable. At Apam in 1995-99 mean monthly landings were a very low 1.117 (±SE 0.23 cpm); prorated per annum 13.40 (±SE 2.76) cetaceans. In Oct 2001-Oct 2003, 128 cetaceans were observed, ie mean monthly landings 5.57 ±SE 1.29 cpm (n= 23, range 1-25), prorated per annum 66.84 (±SE 15.48). Intensive surveying in Jan-Nov 2003 saw 87 cetaceans landed on 267days, or 0.362 cpd; prorated per annum 132.22. The cpm in 2001-03 increased very significantly compared to 1995-99. Highest catches occurred at Dixcove: in 25 months (Oct 2001-Oct 2003) 564 cetaceans were observed, mean monthly landings 22.56 ±SE 3.26 cpm (n=25, range 6-69), prorated per annum 270.72 ±SE 39.12 cetaceans. Mean daily landings rate 0.74 cpd. In 2009-10, daily landings became the norm with frequent multiple landings; highest one-day catch >20 dolphins. In April 2010, of 9 cetaceans landed in 7 days, 3 were butchered before a team could document them, supporting caveat that observed landings underestimate true landings. An intensive biological sampling programme and nation-wide recording of cetacean captures are needed immediately, to guide the formulation and implementation of effective management and conservation measures.

KEYWORDS: SMALL CETACEANS; LANDINGS; CATCH RATES; PORT MONITORING; GULF OF GUINEA

INTRODUCTION

In comparison with the low to moderate levels of information available on cetacean-fisheries interactions for some areas off northwest Africa (e.g. Maigret, 1994; Van Waerebeek *et al.*, 2000, 2003; Zeeberg *et al.*, 2006; Bamy *et al.*, 2010) and southwest Africa (e.g. Best and Ross, 1977; Findlay *et al.*, 1992; Peddemors, 1999; Peddemors *et al.*, 1997), the little what is known for the Gulf of Guinea[1] largely relates to incidental observations (Van Waerebeek and De Smet, 1996; Van Waerebeek *et al*., 2004; Uwagbae and Van Waerebeek, 2010; Segniagbeto and Van Waerebeek, 2010) with the exception of Ghana where small cetacean captures have been documented periodically, albeit on a limited scale, since 1995 (Ofori-Danson and Agbogah, 1995; Ofori-Danson and Odei, 1997; Van Waerebeek and Ofori-Danson, 1999; Debrah, 2001; Ofori-Danson *et al*., 2003; Van Waerebeek *et al*., 2009; this paper). Until 2000, 8 species (Debrah, 2000) were known to be taken in Ghana's artisanal fisheries, then updated to 14 and 15 species (Ofori-Danson *et al*., 2003; Van Waerebeek *et al.*, 2009). The first approximation of the species catch composition was derived from a relatively limited sample of 58 specimens examined in a 3-year period (1998-2000). Species were very unequally exploited, with three of them, Clymene dolphin *Stenella clymene*, pantropical spotted dolphin *Stenella attenuata* and common bottlenose dolphin *Tursiops truncatus*, representing 67.2% of all landings, while other species were much less commonly or even rarely taken (Ofori-Danson *et al*., 2003). This paper covers a partial

[1] definition as by the International Hydrographic Organization (1953)

analysis of aspects of Ghana port monitoring since 1995, in particular it provides a significantly improved estimate of the relative catch composition as well as explores apparent trends in cetacean catches. This preliminary evaluation should at least allow managers to focus on the most affected species and help define and implement appropriate management measures.

MATERIAL AND METHODS

As in many other maritime nations, no national scheme for the systematical data recording of cetacean landings is operating in Ghana. This may partly be a matter of limited resources, but it is also an awareness issue because captured cetaceans are still too often considered, equivocally, to constitute an unwanted by-catch, instead of a fully utilised marine living resource that begs proper management. Partial and periodical port surveying has, so far, mostly been co-ordinated by fisheries science academics (Universities of Ghana and Cape Coast) concerned with the scarcity of data despite high mortality levels.

In the field, cetacean landings were recorded (voluntarily) by fisheries officers or by one of the authors. Most information originates from the Western Region, mainly from three artisanal ports known for their regular catches, i.e. Dixcove (04°48'N,01°57'W), Apam (05°17'N,00°44'W) and Axim (04°51.3'N, 02°13.5'W). Numbers (without species data) landed at Apam in 1995-1997 are from Ofori-Adu (1998); 1998-99 data are from Debrah (2000). A survey period with optimal coverage stretched between October 2001 and October 2003.

Species composition was determined from a 15yr (1994-2010) pooled sample of photographed specimens (N=231, of which N_{pos} =212 positively identified). Photographic evidence is archived both at EcoLab, University of Ghana and at CEPEC. Estimators for relative capture rates were defined as *cetaceans landed per month* (cpm) and *cetaceans landed per diem* (cpd), the latter for periods with intensive (daily) surveying and reporting. Annual estimates are provided prorated from either cpm or cpd (365.24 days per annum-base) and, in the latter case, some limited bias from lack of stratification is acknowledged. However, we believe such bias would be negligible compared to the existing negative sampling bias from cetaceans landed but not reported/tallied.

Fisheries officers with an intimate knowledge of the local fishers communities agreed to count, and if time allowed, document, any cetaceans on the landing beaches during their customary controls of fishing activities. Periods of low or no effort alternated with periods of higher effort, depending on project activity/funding, the presence of biologists in the field, as well as the officers' personal interest. Data requested comprised: observer name, port, date, fishing gear (drift gillnet or purse-seine), daily fishing effort (number of boats landing), standard body length (SL), tooth counts and photographs. Due to understaffing, officers could not supervise the totality of landing operations that often occur simultaneously at different landing beaches of a port. An indeterminate number of landed animals are not observed. In addition, not all carcasses are landed as an unassessed percentage are used offshore for shark bait (Debrah, 2000). Our statistics reflect minimum values for actual removals.

Observers were asked to daily note entries including on off-effort days and days without cetaceans. Authors regularly visited stations, collected notes, replaced equipment and serviced stipendia. Compact cameras plus film, and in the later stages, digital cameras, were provided. Print photographs were digitized. Originally we attempted to use species identifications by observers but this was abandoned when cross-checks showed such IDs to be unreliable. All specimens were re-assessed and identified by at least two of the authors (including KVW), exclusively based on photographs. If unclear, they were assigned to 'unidentified small cetacean'. Recently skin samples were collected opportunistically. Dolphin heads were acquired and deposited in a cranial reference collection at the University of Ghana, but much larger samples of both skulls and tissues will be needed for in-depth population studies.

RESULTS

Nation-wide cetacean takes

Video evidence recorded from a drilling platform in Ghana's Jubilee Field shows an apparently deliberate capture of a small sperm whale *Physeter macrocephalus* by the crew of a large canoe. This adds the sperm whale as 16th to the current list of 15 species documented taken in artisanal fisheries, the great majority in drift gillnets and a few in set gillnets and purse-seines (Van Waerebeek and Ofori-Danson, 1999; Debrah, 2000; Ofori-Danson *et al.*, 2003; Van Waerebeek *et al.*, 2009). The catch composition is shown in Table 1. The three most commonly landed cetaceans are: 24.5% Clymene dolphin (*Stenella clymene)*, 13.2% pantropical spotted dolphin *(Stenella attenuata)* and 12.3% common bottlenose dolphin *(Tursiops truncatus).* Also regularly landed are: 10.4% melon-headed whale (*Peponocephala electra*), 9.4% short-finned pilot whale (*Globicephala macrorhynchus*), 9.4% long-beaked common dolphin (*Delphinus capensis).* Occasionally captured are: 6.1% rough-toothed dolphin *(Steno bredanensis)*, 4.7% Risso's dolphin (*Grampus griseus)*, 3.1% kogiids (including *Kogia sima*) and 2.8% spinner dolphin (*Stenella longirostris*). The species that are rarely landed (<2%) include: Atlantic spotted dolphin (*Stenella frontalis*), Fraser's dolphin (*Lagenodelphis hosei)*, false killer whale (*Pseudorca crassidens*) and pygmy killer whale (*Feresa attenuata*). Most cetaceans were netted in wide-mesh drift gillnets which target primarily large pelagic vertebrates, mainly skipjack tuna *(Katsuwomis pelamis)*, yellowfin tuna (*Thunnus albacares*), sailfish (*Istiophorus platypterus)*, blue marlin (*Makaira nigricans)*, swordfish (*Xiphias gladius*), dolphin fish *(Coryphaena hippurus)*, wahoo (*Acanthocybium solanderi*), barracuda (*Sphyraena* sp.), manta ray (*Manta birostris*), blue shark (*Prionace glauca*), and some mustelid sharks. Commercialization of cetaceans and, to a lesser degree, of several species of sea turtles

(Cheloniidae), for food contribute to the economic viability of the gillnet fishery. Cetaceans, originally by-catches, have now become secondary target species. Most cetaceans are landed freshly dead following entanglement, but occasionally if animals are alive when retrieved they are killed, with piercing lance-like metals, cutlasses, hand-harpoons or sticks (Debrah, 2000), further supporting the intentional nature of the exploitation. Both landing and utilization of small cetaceans occurs overtly and is socially accepted. However, in the cities, indications are that most Ghanaians are even unaware of the presence of dolphins in their waters. In the Volta Delta region, traditional taboos against catching dolphins, for instance among the Ewe people, are fast eroding. It is unknown to what extent, and how precisely, cetaceans are used as bait in shark fisheries. Strong demand and high prices for shark fins as an export product to Asian markets constitute a powerful incentive to boost shark fisheries. However prices for cetaceans have steadily increased and, in 2010, roughly equal these for similarly-sized, large billfishes.

Axim

Observed monthly landings for a 23 month period (between Oct 2001-Oct 2003, Table 2) indicate a total of 130 small cetaceans reported landed at the Axim fishing port (mean cpm=5.65 ±SE 1.19, median 4, range 0-20. prorated per annum, 67.8 ±SE 14.28). However, the most intensive and accurate monitoring effort in Axim occurred in the period January-November 2003 when 52 cetaceans were recorded landed in 192 days, or a mean daily landings rate of 0.271 cpd. Prorated per annum gives a 99.0 estimate. Reported landings in August-December 2007 (Table 3) were much reduced, with a mean daily landings rate of 0.087 cpd (prorated per annum: 31.8 cetaceans). However, indications were that some observers spent considerably less time surveying landing beaches even while marking 'on-effort' days and a significant number of cetaceans may have been missed, leading to an underestimate. Monitoring in Axim was interrupted.

Apam

Reported cetacean landings at Apam before 2000 were: in 1995 (n=12), 1996 (n=18), 1997 (n=18), 1998 (n=12), 1999 (n=7), with a monthly mean landings rate of 1.117cpm (±SE 0.23cpm) and no significant variation between years (Kruskal-Wallis, 4.51, df 4, p=0.341). Prorated gives a per annum mean of 13.40 (±SE 2.76) landed cetaceans for the 1995-99 period.

Monthly landings at Apam recorded over 23 months (between October 2001-October 2003) are shown in Table 2. At least 128 small cetaceans were landed in that period, with mean monthly landings of 5.57 cpm ±SE 1.29 (n= 23, median 4, range 1-25); which prorated gives a per annum mean of 66.84 (±SE 15.48) landed cetaceans.

The most detailed record keeping occurred in January-November 2003 when 87 small cetaceans were reported landed on 267 monitoring days, or a daily landings rate of 0.362 cpd, twice as high as the estimated cpd (0.183) for the less intensily surveyed 23months; prorated per annum estimate is 132.22 cetaceans. The cpm in the period 2001-03 increased very significantly compared to 1995-99 (Mann-Whitney U= 325.5; p<0.0001).

Dixcove

The highest catches have been reported consistently from Dixcove. Monthly landings recorded over 25 months (between October 2001-October 2003) show a total of 564 small cetaceans observed landed (Table 2). Mean monthly landings of 22.56 ±SE 3.26 cpm (n=25, median 17, range 6-69) prorated to per annum estimate is 270.72 ±SE 39.12 cetaceans landed. The mean daily landings rate was 0.74 cpd. During the intensive monitoring period of January-November 2003, 174 cetaceans were reported over 241 days (0.722 cpd), practically the same cpd value as for the 2-year period. More recently, in 2009-10, while detailed statistics were not available for this report, daily landings have become the norm, with multiple landings per day common. The highest one-day catch observed exceeded 20 specimens (senior officer Amiah Johnson, *pers.comm*. to KVW, 22 April 2010). In 7 days (17-23 April 2010) of survey effort at Dixcove, we recorded 9 cetaceans: 3 *S. bredanensis*, 2 *T. truncatus*, 1 juvenile *G. macrorhynchus*, and 3 unidentified dolphins sold and butchered before we could reach the landing spot, confirming the thesis that observed landings underestimate true landings.

During 2001-2003, the combined landings at the three studied ports show seasonal peaks in landings during the periods November-January (Figure 1), the reason of which is unclear.

Other ports

A few landings opportunistically recorded during brief visits of other ports (Table 1) cannot reflect the extent of captures there (e.g. 2 *T. truncatus* at Jamestown/1994, 1 *S. clymene* at Winneba/1998; 1 *S. clymene* at Ada-Foah/ 2003), however these serve to remind us that cetacean catches are not limited to the habitually monitored ports. Eventually all Ghanaian ports will need to be surveyed systematically.

DISCUSSION

Catch statistics

No estimates of total cetacean landings in Ghana are available, as (incomplete) data exist only for three ports. An estimated 99 cetaceans were landed at Axim in 2003. The 2007 estimate of 32 animals was thought to be greatly underestimated due to poor effort compliance leading to landed animals being missed. At Apam, mean annual

landings for the earliest recording period 1995-99 were estimated at a mere 13.4 cetaceans. This figure increased tenfold to an estimated 133 cetaceans landed in 2003. Highest catches were seen at Dixcove, with a mean of 270 cetaceans landed per annum in the years 2001-03. Although raw data of most recent years have not yet been analysed, indications are that numbers have sharply increased, daily or even multiple landings have become the norm at Dixcove, and its yearly catches most probably now amount to the higher hundreds, especially taking into account the bias caused by missed landings. Inevitable takes at Tema, Jamestown, Shama, Half-Assini, Winneba, Ada, Kpone and other, smaller, fishing communities remain unassessed, but some of these could also be significant. Finally, bycatches and potential landings by the large-scale, industrial fisheries (e.g. at Tema), including offshore tuna purse-seining, have not been monitored.

Affected species

Small cetaceans are recorded harvested along the Ghanaian coast since at least 1994, but some earlier reports go back to 1956 (Van Waerebeek *et al.*, 2009). Over 97% of cetaceans caught are Delphinidae, the exceptions include a few kogiids (only *K. sima* confirmed) and a single ziphiid. A quarter of catches (24.5%) affected *S. clymene*, with indications that the species is less commonly landed recently. The high take prompted CMS to include the West African population of *S. clymene* on Appendix II in 2008. Second and third most exploited species are, as found before (Ofori-Danson *et* al., 2003), respectively, *S. attenuata* and *T. truncatus*. The latter includes offshore stock individuals (from fishery data) but inshore stock individuals may also be involved. The species that rarely showed up in our sample may either be that, rarely exploited and under no particular threat, or be remnants of once common species in Ghana's waters. The rare appearance of spinner dolphins and Atlantic spotted dolphins are, at least, unexpected. A single killer whale *Orcinus orca* museum record was recognised as possibly derived from a by-catch but no captures are confirmed. Among ziphiids, a single Cuvier's beaked whale was recorded (Ofori-Danson *et al.*, 2003; Van Waerebeek *et al*., 2009). The Atlantic humpback dolphin *Sousa teuszii* has been consistently absent from records since port surveillance started (Ofori-Danson *et al.*, 2003; Van Waerebeek *et al.*, 2003, 2009). A historic population collapse due to by-catches predating monitoring has been suggested (Van Waerebeek *et al.*, 2004). The species' preference for shallow, nearshore and estuarine habitat would render it particularly vulnerable to ubiquitous inshore set gillnets, beach seines and other anthropogenic disturbances. Alternatively, a natural distribution gap may exist off Ghana/Togo related to periodical cool upwelling. Interviews with local residents in the Volta Delta concorded in that inshore-dwelling dolphins have become scarce, and -from behavioural clues- may be bottlenose dolphins. Evidence from Benin and Brass Island, Niger Delta, shows that inshore bottlenose dolphins are present in the Bight of Benin (Uwagbae and Van Waerebeek, 2010).

Variation between ports

About 74% of all recorded catches have originated from Dixcove (Table 2) where a large community of drift gillnet fishers is based. However, the port has also received most attention, has been monitored for longer periods, and its fisheries officer (A. Johnson) has been exceptionally proactive. Lower numbers recorded at Apam are attributable to less intense survey effort, the west-ward migration of gillnet fishers and a greater distance from the port to the continental slope (translating in fewer trips) where many cetaceans forage. Axim harbours a proportionally bigger share of purse-seiners which target small schooling fishes and which infrequently take cetaceans. Landings at Axim are thought to be underestimated due to a negative sampling bias.

Trends and the utilization of cetaceans

While no quantifiable data exist to evaluate the extent cetaceans are used as bait in shark fisheries, most captured animals seem to be landed, butchered on land and sold for human consumption. Salted, smoked or dried, processed cetacean products are 'exported' mainly to the hinterland. Exploitation acquired a commercial character with the increase in demand. Currently prices for dolphins are as high as those for similarly-sized billfishes such as sailfish and marlin. In contrast with neighbouring countries Togo (see Segniagbeto and Van Waerebeek, 2010) and Côte d'Ivoire (A. Johnson, *pers.comm.* to KVW, April 2010) where the overt landing of cetaceans is not permitted, at Ghana ports cetaceans are landed and sold without impediment. This offers the undeniable advantage of allowing catch statistics, the study of trends and provides opportunities for biological studies based on carcass sampling protocols (e.g. morphological variation, growth and reproduction, feeding ecology, stock identification, genetics, parasitology, contaminant loads, and pathology).

Brashares *et al.* (2004) found that fish supply was related negatively to the volume of bushmeat of 41 large mammal species sold in local markets in Ghana. The growing commercialization of small cetacean products for human consumption 1995-2009 has occurred after a gradual decline in Ghana of the per capita fish supply since 1975 (Armah *et al.*, 1996; Brashares *et al.*, 2004) and a decline in reported total catches of aquatic organisms since 1999 (UNEP, 2006). This causal relationship was frequently cited by interviewed fishermen to explain their increasing captures of dolphins and sea turtles. This was predicted with the definition of the term 'marine bushmeat' (Alfaro-Shigueto and Van Waerebeek, 2001; Clapham and Van Waerebeek, 2007). It does not bode well for the future, as the potential exists for a run-away process where annual dolphin catches could rise from the high hundreds into the thousands, with the danger of a collapse in one or more populations, if fish stocks in the region deplete even further.

Status and management issues

The status of exploited species cannot presently be evaluated, as no population estimates for the Gulf of Guinea, nor estimates of total removals are available. The minimum landings at three fishing ports however are sufficiently high to express concern about the sustainability of current, and foreseeable increasing, levels of exploitation of *S. clymene*, *S. attenuata* and *T. truncatus.*

While aquatic mammals are among the first schedule of Ghana's 1971 Wildlife Conservation Regulations (LI. 685), and are protected by law, there are no explicit instructions concerning the use of cetaceans killed in nets. Banning cetacean landings might appear an obvious necessity, however such a measure must be carefully evaluated in the light of local context as, by itself, it would not guarantee an effective protection for cetacean populations. Enforcement of a ban must be both feasible and acceptable by coastal communities. Furthermore, by-catch is largely inevitable as long as gillnets are deployed and will continue to produce dolphin deaths. Also, covert landings may become established and illegal trade (black market) may not be avoidable. If in addition alternative uses for cetacean products are created or strengthen (e.g. use as bait), then cetacean catches may remain as high as in a pre-ban environment, as demonstrated in Peru (Van Waerebeek and Reyes, 1994; Mangel *et al.*, 2010).

To stimulate research and public awareness of aquatic mammals in Ghana and enhance regional collaboration the ngo COREWAM-Ghana (Conservation and Research of West African Aquatic Mammals) was set up.

Further recommended actions include:

- The tallying of cetacean landings be implemented as a standard procedure for fisheries observers at the national level, recognizing that small cetaceans are a *de facto* exploited marine living resource and therefore need to be monitored on a permanent basis.
- Greatly improve information flow to Ghanaian citizens and initiate an informed national debate on the issue of cetacean exploitation. Although cetaceans enjoy some legal protection there is no functional, long-term strategy to effectively manage populations.
- Implement an intensive biological sampling programme based on fresh carcasses, collecting data on morphological variation, reproduction, growth, feeding, stock identification, genetics, migratory habits, etc. Utilize platforms of opportunity for information on distribution, relative abundance and behaviour.
- Training and support of field personnel of Fisheries and Wildlife divisions.

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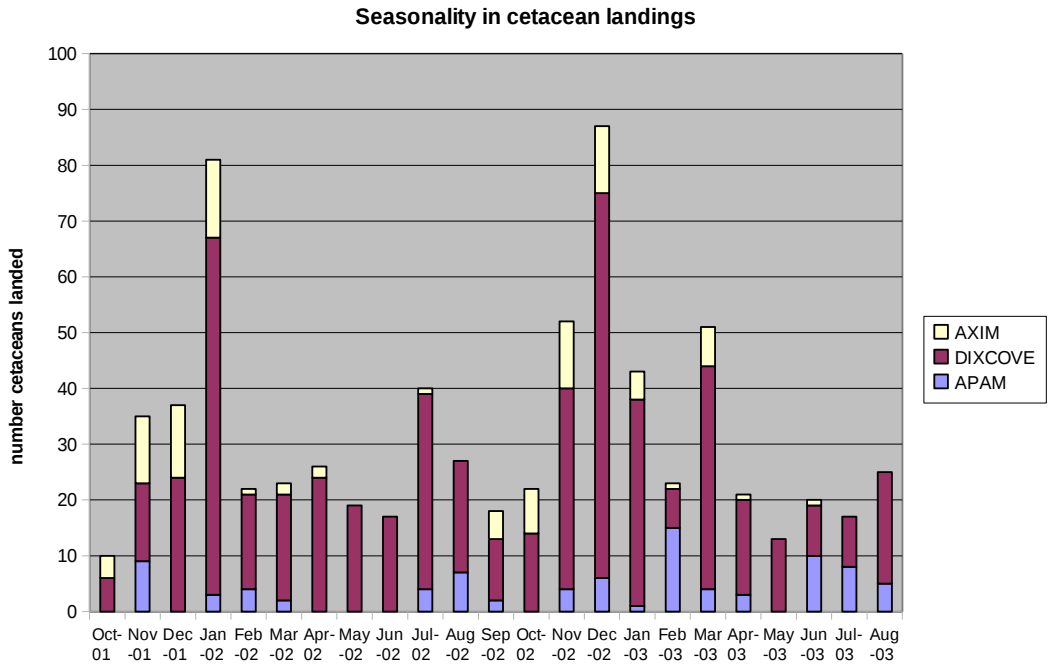

Figure 1. Seasonality in monthly landings of small cetaceans is demonstrated by the pooled samples of three Ghanaian ports (Apam, Axim and Dixcove), as recorded by fisheries observers between October 2001 and August 2003. Peak landings occurred from November till January.

Fishing port →	DIXCOVE											AXIM					APAM								Ghana	
	1999	2000	2001	2002	2003	2005	2007	2008	2010	All yrs Dixcove	%	1994	1995	2000	undated	All yrs Axim	1998	1999	2001	2002	2003	undated	All yrs Apam	%	Jamestown & Shama 1994	all years	%
Species																											
Tursiops truncatus			1	8		3		2	2	14	9.0					0	1				7	2	10	22.7	2	26	12.3
Grampus griseus		2		1	1			2		6	3.8			1		1		1			2		3	6.8		10	4.7
Delphinus capensis	2			3		2	7	5		19	12.2			1		1							0	0.0		20	9.4
Steno bredanensis				4				1	3	5	3.2					0		1		1	6		8	18.2		13	6.1
Lagenodelphis hosei						1				1	0.6			1		1							0	0.0		2	0.9
Stenella clymene				31	7	2		7		47	30.1					0		1			4		5	11.4		52	24.5
Stenella longirostris				4						4	2.6				1	1							0	0.0		6	2.8
Stenella attenuata				3	5	9				17	10.9			1		1	1				9		10	22.7		28	13.2
Stenella frontalis					1					1	0.6					0							0	0.0		1	0.5
Peponocephala electra		3		14	3			1		21	13.5					0					1		1	2.3		22	10.4
Feresa attenuata						1				1	0.6					0							0	0.0		1	0.5
Globicephala macrorhynchus		1		12	1	1		1	1	16	10.3		1			1			1		1		2	4.5	1	20	9.4
Pseudorca crassidens				1						1	0.6					0					3		3	6.8		4	1.9
Kogia sima										0	0.0					0	1						1	2.3		1	0.5
Kogia sp.				3						3	1.9					0					1		1	2.3	1	5	2.4
Ziphius cavirostris										0	0.0	1				1							0	0.0		1	0.5
unidentified		1	1	10	3	1								1							2						
Pooled sample										**156**	100.0					**7**							**44**	100.0	**3**	212	100.0

Table 1. Species composition, stratified by year, of small cetacean landings at Ghana fishing ports. Numbers are subsamples of total landed cetaceans and include only specimens for which identifiable photographs are available. The 19 specimens listed in the “unidentified” category are linked to photographs of substandard quality, some of which are under study but most show only body parts (e.g. tail stocks) that cannot be reliably assigned to species.

YEAR	MONTH	APAM	DIXCOVE	AXIM	TOTAL
2001	October	0	6	4	10
2001	November	9	14	12	35
2001	December	0	24	13	37
2002	January	3	64	14	81
2002	February	4	17	1	22
2002	March	2	19	2	23
2002	April	0	24	2	26
2002	May	-	19	-	19
2002	June	-	17	-	17
2002	July	4	35	1	40
2002	August	7	20	0	27
2002	September	2	11	5	18
2002	October	0	14	8	22
2002	November	4	36	12	52
2002	December	6	69	12	87
2003	January	1	37	5	43
2003	February	15	7	1	8
2003	March	4	40	7	51
2003	April	3	17	1	21
2003	May	0	13	0	13
2003	June	10	9	1	20
2003	July	8	9	0	17
2003	August	5	20	1	26
2003	September	16	10	20	46
2003	October	25	13	8	46
TOTAL		128	564	130	822
%		(15.6)	(68.6)	(15.8)	(100)

Table 2. Monthly landings of small cetaceans, as recorded by fisheries observers for 23 months (Apam and Axim) or 25 months (Dixcove) in the period October 2001- October 2003 at three ports in Western Region, Ghana. Species were pooled because reliable identifications exist only for subsamples (see Table 1).

Axim 2007	# cetaceans landed/ # on-effort days	Mean landings per day	Prorated, cetaceans landed per month
August	4 / 17days	0.235 cpd	7.3
September	3/ 30 days	0.100 cpd	3
October	2/ 31 days	0.064 cpd	2
November	1/ 30 days	0.033 cpd	1
December	2/ 30 days	0.066 cpd	2
Total period	*12/ 138 days*	*0.087 cpd*	

Table 3. Small cetaceans reported landed at Axim port in August-December 2007, as recorded by local fisheries observers. Numbers must be interpreted as minimum numbers taken.